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Sustainable Agroindustry in The Era of Industrial Revolution 4.0

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(ICGAI)

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Grand Inna Malioboro, Yogyakarta, October 22th-23th 2019

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PREFACE

The industrial revolution 4.0 brought many changes with all the consequences. The industry will be more compact and efficient, but there are also risks that might arise, such as reduced human resources because it is replaced by machines or robots. With all the potential that exists we must be active actors who get benefit from the big changes.

It is a must for stakeholders in the agricultural sector to be able to prepare themselves and adapt to changes in the era of the industrial revolution 4.0 to answer the challenges of the future, and turn threats into opportunities.

Improvement of the agricultural sector must be done, and farmers must be strong in technological capabilities. Agro-industry is able to produce environmentally friendly products, substitute non-renewable materials and energy, avoid or minimize the use of toxic chemicals, and minimize emissions. Agro-industry development needs to be directed to integrate the upstream and downstream aspects of the system in a sustainable manner for more prosperous farmers and more advanced agro-industries.

Following the successes of the 1st, 2nd and 3rd International Conference on Green Agro-Industry (ICGAI) were held on 2013, 2015 and 2017 at Yogyakarta, Faculty of Agriculture, Universitas Pembangunan Nasional "Veteran" Yogyakarta, Indonesia in conjunction with its global partner is proudly to announce the 4th ICGAI. The conference will be held on October 22 - 23, 2019, at Yogyakarta, Indonesia. The conference will address problems of primary importance for food security, discussing and proposing a more constructive and progressive approach to ensure future societal sustainability. The meeting will provide a common forum for a wide range of researchers and practitioners specializing in a range of subjects related to the conference themes.

Yogyakarta, March 2020

Editor

DAFTAR ISI

KEYNOTE SPEAKER

PRESENTER SPEAKER

ECONOMICS, SOCIAL AND BUSINESS

AGRICULTURAL ENGINEERING

ANY OTHER TOPICS

CROP AND CROP MANAGEMENT

ENVIRONMENT

SOIL AND WATER MANAGEMENT

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Economic, Social, and Business: Revolution 4.0, Industry VS Agriculture in a Future of Agro-industry Development

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Tarlac Agricultural University, Philippines

Indeed, we are in a rapidly changing world. Who would have thought that we already had three industrial revolutions, which brought significant changes by revolutionizing the production of goods and services and the way people communicate with each other. These industrial revolutions have impacted the technological, socioeconomic, and cultural aspects of people's lives.

A lot of technological breakthroughs emerged during the industrial revolution. New materials (iron and steel) were discovered and new machines were invented (power loom and spinning jenny). Large-scale industries emerged from countries once dominated by agriculture and handicraft. Productivity has further increased due to the introduction of mechanized manufacturing using new machines powered by new sources of energy and the utilization of division of labor which made work in the factory much more efficient. Agriculture also flourished.

Transportation run by steam was introduced and radio and telegraph improved communication. In terms of socioeconomics, the distribution of wealth for a wider section of the population was realized, and workers began to organize to protect themselves. There were also sweeping changes in the culture of the people, particularly in the way they handle things. They were brought to a higher level of productivity by being armed with new skills and the shift from hand tools to machines. This led to the rapid economic expansion of countries in Europe, particularly Great Britain, Belgium, and France, as well as the United States and Japan.

A Glimpse on the First Three Industrial Revolutions

The first industrial revolution was initially seen in Britain in the 18th century (1760 to 1840), with the rapid expansion of industries with the help of skilled workers, who first worked using hand production techniques before transitioning to machines, thus the mechanized factory system was born. New sources of energy were explored and became instrumental in the manufacture of products that were exported around the world. Steam run the mechanized cotton-spinning machine to produce textiles. The carbon rich fuel called coke was preferred in making huge supply of iron.

The first industrial revolution later spread to Belgium and France. Germany, another country in Europe, followed suit. Soon, non-European countries joined the bandwagon like the United States, Japan, and Soviet Union.

The second industrial revolution, which started in 1870 and ended in 1914, was marked by the further economic rise of Britain, Germany, France, Belgium, Italy, Japan, and the United States.

The mass production of steel as a result of the utilization of Bessemer process paved the way for the practical building of railroads, which has tremendously improved and democratized transportation in that era. The railroad transport system has spurred modern business management.

Among the inventions in the second industrial revolution were the paper making machine, chemical in the form of synthetic dye, rubber, bicycle, automobile, fertilizer, machine tool, and the steam turbine.

Electric power came into picture, as well as maritime technology. Telegraph became a major way in which people communicate.

In the late 1950s, we saw the advent of the Third Industrial Revolution. Featuring the widespread use of digital computers, which facilitated record keeping and computing at a rate that has never been imagined, this era of high technology has been aptly termed as Digital Revolution The new breed of super machine also made communication much faster.

With digitalization, a much more efficient technique has been invented to transform analog into its digital format, paving the way for the mass production of the original. Another wonder that digitalization did in communications by using a repeating hardware is being able to spread the signal in a perfect state. With digital technology, the transfer of files between media can be performed seamlessly, and getting and dispensing it can be done anytime and anywhere (en. wikipedia.org).

Game changing inventions were rolled out, which are very popular up to these days. These were the home computer, the video game console, arcade video games in the 1970s; electronic music, automated teller machines, electronic billboards, industrial robots, the first mobile phone, digital camera, and the world wide web were thing of the 80s; first HDTV broadcast, accessible World Wide Web, web browser, online internet banking, text messaging, expansion of the internet in the 90s; widespread use of cell phones, text messaging, internet, HDTV characterized 2000s; increased internet use, cloud computing, use of tablet and smartphones in 2010s.

With all the gadgets developed in the Digital Revolution, the people have been “more connected” and the flow of information unprecedented. Social media became very accessible with the extensive use of smartphones and access to Internet.

The interconnectivity brought about by the World Wide Web has also brought the consumers and the businesses side by side, allowing for more communications and easier transactions. With World Wide Web, companies were also able to reach a wider audience for their products, allowing for more sales and a truly international scope and operations. With the easy access and free flow of information from the consumers from different places, entrepreneurs were the given the convenience of faster and more efficient decision-making.

The Fourth Industrial Revolution

And now, we are facing another era of industrial metamorphosis called the Industrie 4.0, otherwise known as Revolution 4.0, or the Fourth Industrial Revolution.

The Fourth Industrial Revolution, simply put, complements business with digitalization to create smart businesses or factories, capable of capitalizing the information from upstream and downstream partners in creating highly customized products.

To achieve this goal, businesses must focus heavily on interconnectivity, automation, machine learning, and real-time data. Industry 4.0, also sometimes referred to as IoT or smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and supply chain management (https://www.epicor.com>en-ae>resource-center>articles>what-is-indus).

A great feature of the Fourth Industrial Revolution is the required connectivity among business stakeholders to gather information about processes and products for further improvement.

The so-called Internet of Things (IoT), another highlight of the Fourth Industrial Revolution, fulfills the required connectivity. Devices such as sensors and smartphones are connected to automated systems via the Internet, making it possible to gather data that can be further analyzed and later serve as inputs in making important business decisions that can optimize the products and services offered to the customers. This is where machine learning comes using real time data gathered through the Internet.

With all these workings of the IoT, there are conceived benefits. Matthew Evans (2018), the IoT Program Head at techUK, said that IoT offers us the opportunity to be more efficient in how we do things, saving us time, money and often emissions in the process. It allows companies, governments and public authorities to re-think how they deliver services and produce goods (https:/www.wired.co.uk>article>internet-of-things-what-is-explained-iot)

With the interconnectivity requirement of Industrie 4.0 came several issues that need to be addressed for its effective performance. Difficulty in connecting was experienced and seemed to be a problem by several gadgets. If this is the case, then the real time data required for a machine to learn and make important decisions for creating customized products is deemed impossible.

Another problem is the tendency of hacking devices connected to the Internet. The interconnectivity created by the Internet proved to be vulnerable to digital invasion by hackers, especially when there is unsecured connection.

James Clapper (2016), the US Director or National Intelligence said that "In the future, intelligence services might use the [internet of things] for identification, surveillance, monitoring, location tracking, and targeting for recruitment, or to gain access to networks or user credentials" (https:/www.theguardian.com>technology>feb>internet-of-things-smart…).

But in spite of these challenges, the idea of Fourth Industrial Revolution is here to stay and they must be leveraged by business enterprises and other entities for greater benefit.

The question now is, can the Fourth Industrial Revolution possibly democratize its full potential in many countries, developed or developing, more specifically in their private enterprises? Will the Fourth Industrial Revolution work in a developing and at the same time, agricultural country like the Philippines?

These are the serious questions that need to be answered.

Many people are skeptical, casting their doubts due to the possible quagmire it may create, especially in developing countries where technology is not yet developed or, worst, still in the introduction stage.

They worry that countries cannot perform equally in the Fourth Industrial Revolution, as they are not on a level playing field due to the different stages they are in when it comes to technological development and adoption.

Another thing to consider are the businesses. Industrie 4.0 is all about smart factory or digitalizing businesses using the Internet. The businesses must be ready to invest in technology to catch up with the technological requirements of the new Industrial Revolution.

Businesses must also be ready to invest in its people. The right skills must be developed among the workers to cope with the new technology. To survive and to realize the true effect of Industrie 4.0, workers must be equipped with the right technological knowledge to be able to help in operating the smart factory. It is possible that robots might replace people who cannot cope with technology in the workplace. They must secure the necessary skills so they wont be displaced, but instead promoted to higher types of jobs.

The prevailing industries in countries must also be considered. There are industries that require more use of technology, while some requires less, like agriculture. But this does not mean that agriculture cannot be digitalized. Big farms can invest in technologies that will certainly improve and increase their produce, now that we are in the era where population continues to increase at an exponential rate and that many need to eat but the problem is the supply of food. This is true in many developing nations, like those in Southeast Asia, our beloved region.

The governments also play a part. Their policies and beliefs about technology will either make or break the successful staging of the Fourth Industrial Revolution in their countries. A government must have an environment that fully supports the new industrial metamorphosis. Programs must be rolled out that will encourage enterprises to take advantage of technologies that will make them smarter and better. The government must spearhead efforts towards the practical acquisition of technologies needed, so private enterprises will have no reason not to purchase these technologies to improve their operations through digitalization and provide better products and services for the customers, thus ensuring their satisfaction.

With all these issues, let us look at the readiness of my beloved country, the Philippines for the Fourth Industrial Revolution.

The Philippine Economic Structure

The Philippines is a newly industrialized country, as we all know. It has successfully shifted from agriculture to service and manufacturing industries.

The Philippines is now considered as one of the Tiger Cub Economies in Asia, together with Indonesia, Malaysia, Thailand, and Vietnam. It has exhibited aggressiveness when it comes to exporting products and technologies in other countries, leading to enormous increase in its economy.

The major exports that generated the $811.73 billion economy (2016 GDP-PPP) of the Philippines were semiconductor and electronic products, transport equipment, garments, copper products, petroleum products, coconut oil, and fruits, and trading with partners such as the United States, Japan, China, Singapore, South Korea, the Netherlands, Hong Kong, Germany, Taiwan, and Thailand (www.globaltrenders.com).

The Philippines' continuous roar as an important player in the economic scene in Asia can be attributed to past and present administrations of President Benigno Aquino and President Rodrigo Duterte. Clean governance, strong leadership, growing infrastructure and policy endeavors have catapulted the Philippines onto a path of faster growth (www.investopedia.com).

The Philippine Statistics Authority reported in April 2019 that the "The Philippine economy grew by 6.2 percent in 2018, slower than the 6.7 percent growth recorded in 2017. Manufacturing, trade and repair of motor vehicles, motorcycles, personal and household goods, and construction were the main drivers of growth for the year.

Among the major industries, services recorded the fastest growth of 6.8 percent. This was followed by industry with 6.7 percent, and agriculture, hunting, forestry and fishing (AHFF) with 0.9 percent.

Among the sub-industries, five (5) posted faster growth in 2018: Public Administration and Defense; Compulsory Social Security grew by 15.2 percent; Construction, 14.9 percent; Other Services, 7.7 percent; Electricity, Gas and Water Supply, 5.5 percent; and Transport, Storage and Communication, 5.4 percent.

On the other hand, the following sub-industries posted slower growth: Financial Intermediation, 7.2 percent; Trade, 6.0 percent; Manufacturing, 4.9 percent; Real Estate, Renting and Business Activities, 4.7 percent; Mining and Quarrying, 1.3 percent; Agriculture and Forestry, 1.1 percent. Fishing declined by 0.2 percent.

The Philippine Statistics Authority further revealed that in terms of share to the country's total Gross Domestic Product, services accounted for 57.8 percent of the total GDP in 2018. Industry recorded a share of 34.1 percent while AHFF comprised 8.1 percent of the national economy.

Things have improved for the services and industry sectors based on the data gathered from the previous year.

In 2017, services accounted for 57.5 % of the GDP compared to the industry's share of 34.0% and agriculture, hunting, forestry, and fishing's 8.5% of the national economy according to a report from the Philippine Statistics Authority in 2018.

The services sector is also the country's top employer. Data from the same agency declared that 55.4% of the 40 million labor force of the Philippines are working for service businesses, slightly lower than 2016's 56.2%. Less than half that of the services industry or 26.1% are working in the agriculture sector while almost 19% are deployed in the industry.

With the present status of the different sectors of the Philippine economy, the concern now is or should I say the big question is, which among these sectors will be adversely affected by the Fourth Industrial Revolution?

As earlier mentioned, the services sector is a major driver in the Philippine economy, contributing to almost 60% of the GDP, while its manufacturing and industrial sectors remain underdeveloped, generating less than a quarter of the economic output.

With this, let us take a closer look at the two subsectors of the services sector making waves in the economic scene in the Philippines.

First is the OFW subsector.

The Philippines, like many Asian countries, is known for exporting low cost and low skilled labor in countries around the world. This started during the administration of President Ferdinand Marcos, to address the worsening case of unemployment in the country. Mendoza (2015) said that in 2013, 1.8 million temporary migrant workers fanned out to more than 190 countries, each one bearing an employment contract issued and certified by the Philippine government: from factory and domestic workers to engineers and nurses, and a wide range of jobs in foreign labor markets (https://www.worldpoliticsreview.com>articles>human-capital-the-philipp….).

According to World Bank, Filipino OFWs working in the United States, UAE, Saudi Arabia, Qatar, Kuwait, Canada, Malaysia, Japan, Australia and other countries were able to contribute US$28.4 billion or 10% of the Philippine economy in 2015. In 2018, the remittances reached US$31.3 billion, a testament that the OFWs are constant major contributors to the nation's coffers for the country's development.

Second is the IT-BPO Industry

Another cash cow for the country is the IT-BPO industry. The industry is composed of eight sub-sectors, namely, knowledge process outsourcing and back offices, animation, call centers, software development, game development, engineering design, and medical transcription. The IT-BPO industry plays a major role in the country's growth and development (en.wikipedia.org).

The IT-BPO industry has an economic output comparable to the OFW subsector. In 2017, it has generated US$22.1 billion. International financial institution and other organizations are very positive on the nation's IT-BPO industry in the years ahead. By the year 2022, the World Bank and outsourcing advisory firm Tholons have predicted the industry's income to reach US$38.9 billion up to US$48 billion. The contribution of the industry to the GDP is 9%.

The Philippine government is very supportive of the industry's growth, a proof is its inclusion as a priority in the MTPDP (Medium Term Development Plan 2004-2010) to generate 1.5 million jobs a year from 2004-2010. This effort, together with English proficiency, outstanding customer service, and technology has consistently made the Philippines the Call Center Capital of the World.

The Services Sector's Response to the Fourth Industrial Revolution

The Fourth Industrial Revolution has made it imperative for the Philippines to further improve its human capital being sent to other countries. And part of the effort is the enactment of the K to 12 Law and the Philippine Qualifications Network.

The K to 12 Law (RA 10533 or Enhanced Basic Education Act) has increased the taking of the basic education among the students to 12 years (from the previous 10 years) comprising of six years primary education, four years of Junior High School, and two years of Senior High School. In Senior High School, the students are free to choose from the following tracks: 1) Academic; 2) Technical- Vocational and Livelihood; 3) Sports, and 4) Arts and Design. Specifically, the Academic Track includes three strands: Accountancy, Business and Management (ABM); Humanities, Education, Social Sciences (HESS); and Science, Technology, Engineering, Mathematics (STEM). The Technical-Vocational and Livelihood track has the following specialization in Agri-fishery Arts; Information and Communication Technology; Industrial Arts; and Home Economics.

According to TESDA, K to 12 is poised at preparing students for mid-level technical and life skills expected to make them more ready for college life and possible employment, as well as entry to business.

Another effort to make the human capital competitive in the international labor market is the implementation of the Philippine Qualifications Framework. According to TESDA, it describes the levels of educational qualifications and sets the standards for qualifications outcomes. It is a quality-assured national system for the development, recognition, and award of qualifications based on standards of knowledge, skills and values acquired in different ways and methods by learners and workers of a certain country.

With the PQF, Filipinos will now be more qualified to work in other countries as their qualifications are in sync with the international qualifications framework.

The effect of the Fourth Industrial Revolution is more pronounced in the IT-BPO Sector as technology is inherent in its operations. Technology has made it easier and more efficient for the IT-BPO companies to do their daily tasks and there is this threat of possibly substituting human workers with machines, now that these companies have learned the benefits of machine learning, artificial intelligence, and automation. Though technology is expensive, many companies in this sector have seen their costs diving in the long run with the use of technologies. Companies from this sector are now utilizing chat bots and AI, with the former answering the basic questions and concerns of clients and customers. With the advent of FIR, BPO companies became more strict in their recruitment, procuring people who have skills in decision making and critical thinking.

Fortunately, IT-BPO companies have bright prospects for the industry and are taking steps in favor of their employees. Many players in the sector are not seeing an exodus of their workers to other jobs. Benedict Hernandez (2019), the Chairman of the Contact Center of the Philippines (CCAP) said that "technological advances will augment, not replace call center workers". He further added that "workers will be freed from mundane jobs and can move up the value chain" (https://kittelsoncarpo.com>philippine-it-bpo-industry-expected-to-grow-t..).

This upward movement in the career ladder for contact agents, as envisioned by Mr. Hernandez is already materializing. A shift from the call center operations to knowledge-based process outsourcing has been introduced by American IT-BPO companies in the country, making way for call center agents in mid-skill to high-skill jobs in accounting, animation, engineering, fintech, and legal work.

Character also comes into play to spare Filipinos working in the IT-BPO sector from the effects of FIR. The unique characteristic inherent among Filipino call center agents will save them from the threat of technology of the Fourth Industrial Revolution. Filipino call center agents are known the world over for their excellent and unparraleld customer service and the right attitude needed by big companies like Google and Amazon to provide a new customer experience.

The government, thru the Department of Internet Technology, and the academe, are also making actions to support the ever growing demand for workers in the IT-BPO Sector. There are recent improvements in IT services and provision of digital literacy. According to Kittelson and Carpo (2019), a consulting firm, 50 universities have created classes on analytics, internet technology, and service management. In partnership with DepEd, students as young as grades 11 and 12 are already learning the skills for the IT- BPOs of tomorrow. The Philippines already graduates roughly half a million tertiary students each year (https://kittelsoncarpo.com>philippine-it-bpo-industry-expected-to-grow-t..).

The Philippine Agricultural Sector's Response to the Fourth Industrial Revolution

As the Philippines' service industry is bracing for the coming of the Fourth Industrial Revolution, the agriculture sector is also flexing its muscles to cushion against the effects of the new industrial metamorphosis. Although most farmers in the Philippines are not on the use of high technology, the government and other stakeholders, such as private entities and the academe, are strongly advocating the utilization of technology to make our agricultural sector more productive, efficient, and competitive. After all, this is what the Philippines was known for before becoming a newly industrialized country. And it has over one hundred million Filipinos to feed. So technologizing more the agriculture sector is the right thing to do.

As the Fourth Industrial Revolution is geared towards the use of technology, the private sector is inching their way towards this direction to further help the agricultural sector. The Philippine Society of Agricultural and Bio-Systems Engineers (PSABE) is working closely with the ASEAN Cooperation on Agricultural and Bio-Systems Engineering (ACABE) and the ASEAN Universities Consortium on Food and Agro-based Engineering and Technology Education (AUCFA) and is providing avenues for the further dissemination of technologies in the Philippines through forums and trainings. The engineers could help farmers in succesfully linking agriculture with bio-systems engineering through the Internet of Things (IoT) and artificial intelligence. With the efforts of PSABE, more Filipino farmers have realized the benefit of mechanizing their operations. It also hopes to encourage young people to work in agriculture sector, now that farming has been introduced with technologies like AI and robotics.

PSABE's partnership with AUCFA and ACABE seeks to create a regional bond for the agricultural sector to better combat and deal with the challenges of the Fourth Industrial Revolution.

To strengthen the agriculture curriculum of the colleges and universities in the ASEAN Region and to create a single standard, they are evaluated and revised. This effort is expected to produce the same quality graduates and professionals in agriculture and agricultural engineering among the ASEAN countries, making work mobilization and cooperation possible for the effective implementation of Industrie 4.0. PSABE expects that with its affiliation with AUCFA and ACABE, it can raise the bar of competence among the agriculture and bio-systems engineers in the country.

The partnership of PSABE with AUCFA and ACABE also aims to increase the competence of local agriculture and bio-systems engineers with a little help from the state colleges and universities, government and private sectors.

Mr. William DAR, the current acting Secretary of the Department of Agriculture in the Philippines, has conducted studies on farms worldwide before and he observed that almost a quarter of them are on bad state with no or less irrigation and unfit for farming.

In an article written by him in the Manila Times dated April 30, 2019, he pushed for "technologizing agriculture" and proposed 4 approaches such as "producing differently using new techniques; using new technologies to bring food production to consumers; increasing efficiencies in the food chain; and incorporating cross-industry technologies and applications."

Mr. Dar referred to hydroponics, feedstock from algae, desert utilization thru seawater irrigation/farming, and use of bio plastics, genetic modification as the new way of production.

Hydroponics is a water, fertilizer, and space efficient and soil-less technique of growing plants. It is also organic because no pesticides are being applied.

Algae can be explored as alternative for feedstock and feed mill. Agriculture and bio-systems engineers can work together to come up with ways on how to utilize seawater in irrigating arid lands like deserts.

Recyclable bio plastics must be produced extensively to lessen environmental problems.

New technologies include cultured meat and 3D printing. The problem on supply, diseases, and animal welfare can be solved by cultured meat. 3D printing is slowly catching up in food production in the way of additive manufacturing where layers of materials are added up in the printing process using hydrocolloids (gel like substances) and soon to be replaced with natural ingredients like grass, algae, and duckweed.

Food chain efficiency that eliminates post harvest losses can be achieved by technologies such as GPS, cold storage, and internet connectivity.

Meanwhile, drone technology, food sharing and crowd farming, block chain, and nanotechnology and precision agriculture are ways of incorporating cross industry technologies and applications.

Dar said that in the Philippines, drones are being explored as means to apply pesticides in farms and recent experiment by the Philippine Rice Research Institute (PhilRice) showed a reduction of 90% as compared to regular application using traditional means. Drones can also be used in soil and field analysis, planting monitoring, crop progression monitoring, irrigation and health assessment, which are critical steps in the crop cycle.

Zero food wastage has been the discovered benefit of food sharing and crowd farming. Block chain has made it easy to monitor and regulate contaminated food products and inefficiencies in the supply chain.

Nanotechnology can bring precise agrochemical dosage for plants through programmed nanoparticles and farmers can now make precise crop decision making by the use of biosensors.

Dar also advocated the creation of an institution in the country that will oversee the implementation of the Fourth Industrial Revolution in the agriculture sector just like in India through the Consortium of Researches for Disruptive Technologies in Agriculture (CDTA), which is banking on technologies. The aim of CDTA is to help farmers in slowly adopting the new farming technologies, so as not to be overwhelmed. However, the body does not suggest a total sweep of the basic technologies. Rather, the basics should be partnered with the new for the farmers and agri-enterprises to have high productivity and financial returns.

These suggestions by Mr. Dar will definitely make the Philippines' agricultural sector ready for the coming Fourth Industrial Revolution. This will be the future of the country's agro industry.

To end my lecture, let me give you this quotation by Klaus Schwab, Founder and Executive Chairman, World Economic Forum. He said that "We must develop a comprehensive and globally shared view of how technology is affecting our lives and reshaping our economic, social, cultural, and human environments. There has never been a time of greater promise, or greater peril."

Nothing is permanent in this world except change. We must embrace change, for change is not a problem but an opportunity. This Fourth Industrial Revolution must not be a problem for us. It should be treated as an opportunity, which will give us another chance to move forward just like what the past three industrial Revolutions brought and taught us.

But in managing this new industrial transformation, let the lessons of the past not be put into wastes, but rather be included in our arsenal of strategies, ready to be unleashed and complement the new ways of doing things.

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Bottom-Up Rural Development Movements to Support the Industrial Revolution 4.0 in Agro-Industry

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Abstract.

At the age of globalization rural areas seem to be disadvantaged comparing with successful city regions. In order to catch them up, different development programs were implemented in many countries. Top-down approaches in many cases can't improve their situation, on the contrary the dependency rate was growing. At the same time there is an old tradition of "homeopathic", bottom-up movements to mobilize local hidden resources and reach an autonomous development path. Industrial Revolution 4.0 causes new challenges rural regions must face. Experiences of former development programs can constitute a proper background for future steps. In the recent article the institutional background of a European success story (the LEADER program) is examined. With the comparison of the South Korean "Saemaul Undong" some key points can be highlighted that can make future rural agro-industrial programs successful. Nevertheless the diversity of rural areas makes difficult to give one global recipe, accordingly rather general principles than specific program steps can be argued.

1. Introduction

Since population explosion, energy crisis and climate change mean complex global challenges for mankind a multispectral solution must be used. Agro-industry must be suited to the new circumstances as well in order to secure healthy and plentiful nutrition for mankind. Additionally new technologies must be environmentally sensitive and accessible for broad masses of people. The creation of transparent flow of information "from the field to the table" is an integral part, and the active participation of people in this processes is crucial to successfully create Food Citizenship and Food Democracy. (Kinsey, J. 2001; Wilkins, J.R. 2005; Latino, M. – Corallo, A. – Menegoli, M. 2018).

On the one hand the solution is a technical-technological one, but on the other hand economic, social and cultural dimensions must be taken into consideration as well. It might be represented by a multi-level socio-technological regime (Figure 1). Technology, policy, society, science and market conditions are equally relevant in this process.
As experiences of the former agrarian reform movements in the 20th century (Figure 2) (PTD: Participatory Technology Development; FSR: Farming System Research SLA: Sustainable Livelihoods Approach; PRSP: Poverty Reduction Strategy Paper) suggest, rural areas are diverse and the local "non-academic" knowledge must be integrated to the systems of management. (Craig, D.C. – Porter, D. J. 2003; Zahumensky, Y. 2014).

Figure 1: Different parts of a regime of social development (Geels, F. 2011)

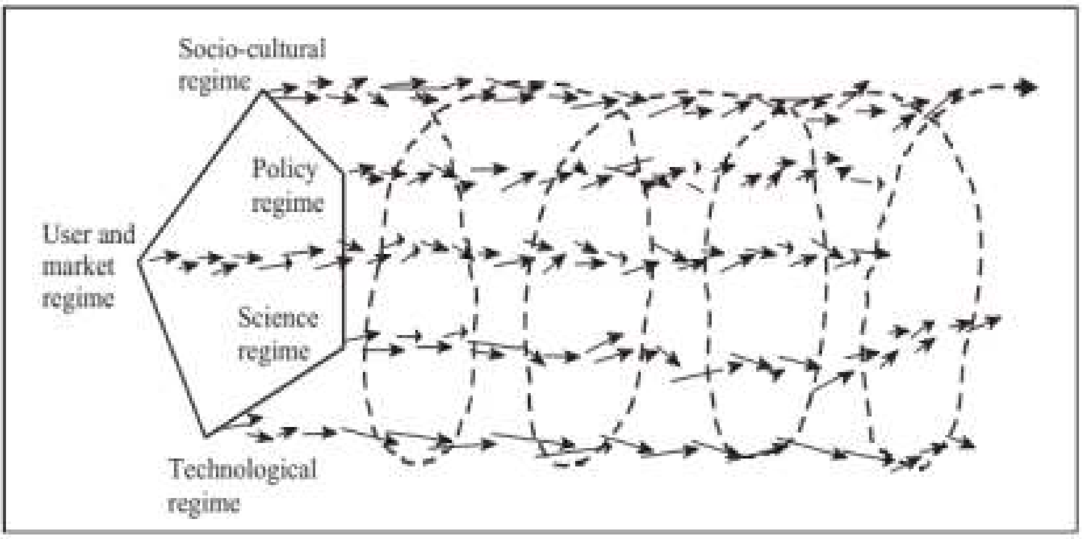
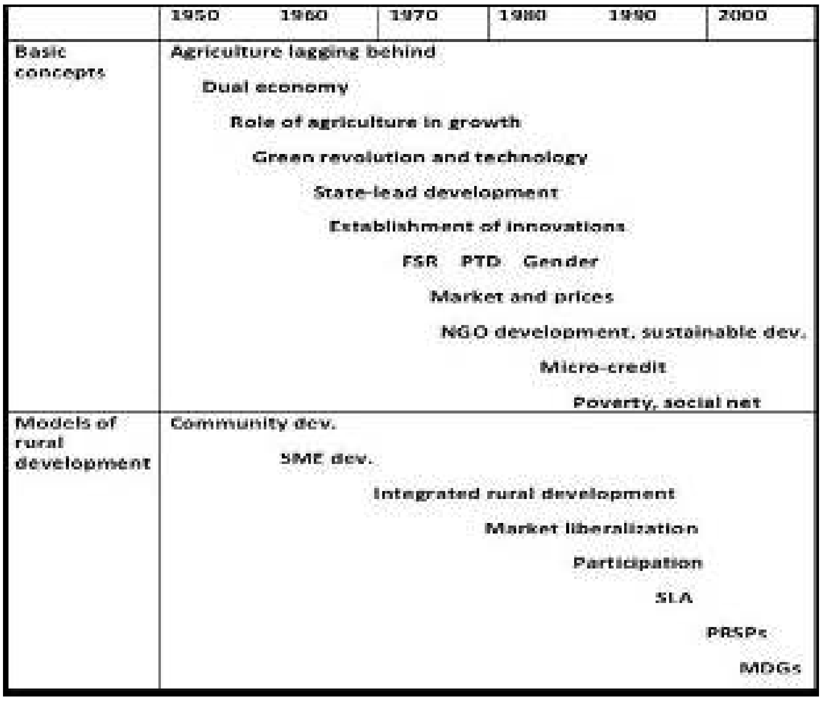


Figure 2: Rural development buzzwords and models from the last decades (PTD: Participatory Technology Development; FSR: Farming System Research SLA: Sustainable Livelihoods Approach; PRSP: Poverty Reduction Strategy Paper MDG: Millennium Development Goal) (Author's edition based on www.fao.org)



Spatial approaches must play decisive role in the success of rural development as it can mobilize additional, sometimes hidden local resources. Even in case of basically agricultural development objectives territorial tools such as growth corridors, clusters, agro-industrial parks and special zones or incubators can be decisive. (Nogales, E.G. – Webber, M. 2017)

A territorially oriented development program can be really successful and sustainable if the local community is involved from the phase of planning to the implementation. Accordingly governance issues are crucial in the form of public-private-partnership (the co-operation of public funds and private ones) or of the broader involvement of local inhabitants. Governance can be described as a shared policy/program/project creation and implementation of different actors belonging to the public (central and local authorities), private (local and multinational enterprises) and civil (non-government organizations) spheres. The certification of a balanced power exercise is an inclusive characteristic of governance too. Governance includes basic principles such as accountability, fairness and transparency. According to literature four governance pillars can be differentiated: accountability, participation, predictability and transparency. (Nogales, E.G. – Webber, M. 2017)

It is hard to overestimate the role of the creation of locally-based governance systems, but as many program experiences prove in practice it is difficult to actively involve huge masses of people. However there are different technics of social engineering to mobilize communities, success is not guaranteed by the mechanic use of them. (Barlow, C. 2016) Active local participation is doubtful unless key local actors ("gatekeepers") are enlisted. (Stanfield, P. 2012) A well-balanced territorial, symbolic and institutional arrangement is needed to help the case, additionally local initiatives should have a well-established role in order to make local initiatives successful. (Paasi, A. 1996)

In our recent article some bottom-up rural development movements will be implemented. The main emphasis will be put on the European LEADER initiative.

Firstly the short history of the movement will be presented in a nutshell, secondly a brief analyses is provided to describe the institutionalization of units implementing the program. The results of a questionnaire research aiming to map governance trends in Europe will be provided.

Additionally a short description will be provided on the Saemaul Undong movement of the Korean Republic in order to find similarities and differences between the European and the Asian programs. Finally a short conclusion will be provided how to use previous experiences to make agro-industrial revolution more successful from a social point of view.

The EU LEADER approach

In the European Union the Common Agricultural Policy (CAP) from the middle of the 1990s is aiming to support a triple system of objectives. Agriculture as one main economic branch is still an important rural activity, but beyond it other economic functions (industries, services and tourism) are relevant too. Additionally agrarian environmental management, the practice of organic crop production and animal husbandry should be spread in vulnerable natural landscapes. (AEIDL, 1997)

In order to set up a fine-tuned rural land use and sustainable socio-economic landscape, the use of local knowledge and the mobilization of local stakeholders is a must. The LEADER (Liaison Entre Actions de Développement de l'Économie Rurale – "Actions for the Development of Rural Economy") initiative was funded at the beginning of the 1990s in order to promote bottom-up development processes in rural areas. At the first stage it was a community initiative as it was co-ordinated and managed by the European Commission. In the first decade of its history only some special rural areas could join the program. After 2000 the scope was broadened to every rural zones of the EU. Statistically rural was defined as municipalities with less than 10.000 inhabitants or with a population density less than 120 cap/km^2. (Fekete, É. 2013)

Table 1: The four phases of the LEADER program in Europe

NAME	LEADER I	LEADER II	LEADER+	LEADER CAP	LEADER /CLLD
Period	1991-1993	1994-1999	2000-2006	2007-2013	2014-2020
Source	1,2 billion Euro	5,37 billion Euro	5,1 billion Euro	8,9 billion Euro	9,4 billion Euro
Recipients	217 LAGs (State, private and mixed organizations)	906 LAGs	1153 LAGs	2416 LAGs (in areas with strong fisheries sector FLAGs)	2600 LAGs
Areas	Objective 1 and 5b areas, 5.000-100.000 cap. population	Objective 1 and 5b areas, 5.000-100.000 cap. population	All rural areas, population 10.000-100.000 cap. population density less than 120 cap/km2	All rural areas, national differences in eligibility	All rural areas, national differences in eligibility

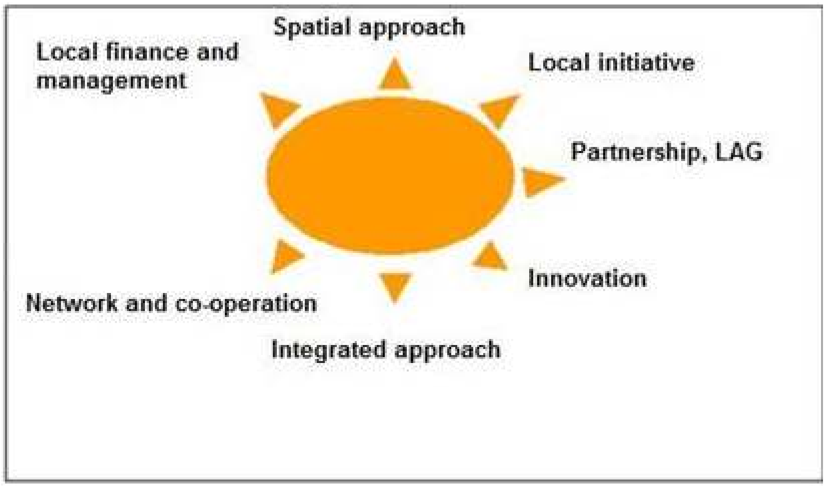
Source: ec.europa.eu

In the period of 2007-2013 it became an integral part of „Rural development" integrated by the EU Common Agriculture Policy. (Table 1) Its main aim was to motivate and help actors of rural development in thinking together and in the realization of a sustainable, integrated and innovative development strategy.

There are different national circumstances and ways of implementation, but the principles (see below!) and the main institutional background are the same everywhere. The LEADER program is based on so called local action groups (LAGs). An LAG is a compound of local municipalities, non-governmental agencies, local enterprises and even inhabitants. Their composition should mirror the composition of the local society. The action group must have a legal form (e.g. association) consequently they owe an assembly where all member may participate and a tighter decision-making body (council) with elected members. In general a LAG bureau or agency exists as well for the implementation of day-to-day administrative tasks. The officially recognized (by the national government and the EU) local action groups will have the right to distribute financial resources originated from the EU and the government to local applicants through locally managed tender scheme. (Lukesch, R. 2007)

The broad framework of the LEADER approach is determined by the EU in the form of seven key principles (Figure 3). The area-based character means the creation of socially cohesive micro regions integrating more villages or small towns. Their boundaries should not coincide with administrative lines, but these should rather be functional. Local partnership must contain actors from different spheres (authority, civil, private) but at decision making institutions none of them can have 50%+ majority. Bottom-up approach is based on the philosophy that local people know their natural and socio-economic environment the best and in a form of participatory democracy they must have the possibility to form their future actively. Local management is based on the virtues of proximity, namely that decentralised management can be more efficient with decreasing transaction costs and faster reacting possibilities. The integrated approach refers to the integration of the objectives of different sectors in the rural development plan of the LAG. Networking is another crucial aspect of the LEADER approach as local action groups should co-operate with different development institutions at the local, regional, national and international level. The innovative character reveals the importance of rediscovering local resources and the harvesting of them in new ways.

Figure 3: Key principles of LEADER-type rural development approach (FVM, 2005)



Some key aspects of the LEADER action groups

As LAGs are spatial units it is important to introduce the geographic and demographic size of them. The official EU and national regulations contain only a minimum and maximum threshold. In reality their size varies to a great extent. (Patkós, Cs. 2013)

To appreciate the size of LAGs is not obvious, since the spatial scope in theory is depending on the population density of the regions. From this point of view Western European countries should have smaller action groups, Nordic and Eastern Central European member states should have bigger ones.

Minor LAGs on the one hand are more transparent and more flexible and resilient, but on the other hand they can lack the so-called critical mass needed to secure own resources and provide lobby for upper authorities.

Local action groups in ideal circumstances are active in many functions. The first activity is planning resulting the elaboration of an integrated rural development plan for medium term (3-7 years). (Lukesch, R. 2007)

Development objectives of LEADER action groups are pending on local circumstances and decision, but some typical areas might be found in different EU member states. (Figure 4 and 5) The support of local farmers in the procurement of sate-of-the-art is a prevailing aim, but the main emphasis in general is put on the diversification of economic activities to non-agricultural branches. Accordingly rural tourism and handicrafts are supported to a great extent. The production and sale of local products and food is relevant in many cases. In the latest years the support of renewable energy harvest and local anti-climate change activities became popular issues among LAGs. (Patkós, Cs. 2013)

Beyond the creation of development concepts a relevant task of the LAG is the facilitation of the local society. A continuous connection building with actors of the local society is urgent in order to find ideas and local resources for development.

Recognized local action groups have the right to issue local project tenders, consider applications and make decisions on who to win financial support. Through these activities local actors can control different financial resources consequently they are empowered. (Lukesch, R. 2007)

Figure 4: The average size of LAGs in the different EU member states in 2007-2013 (Author's edition)

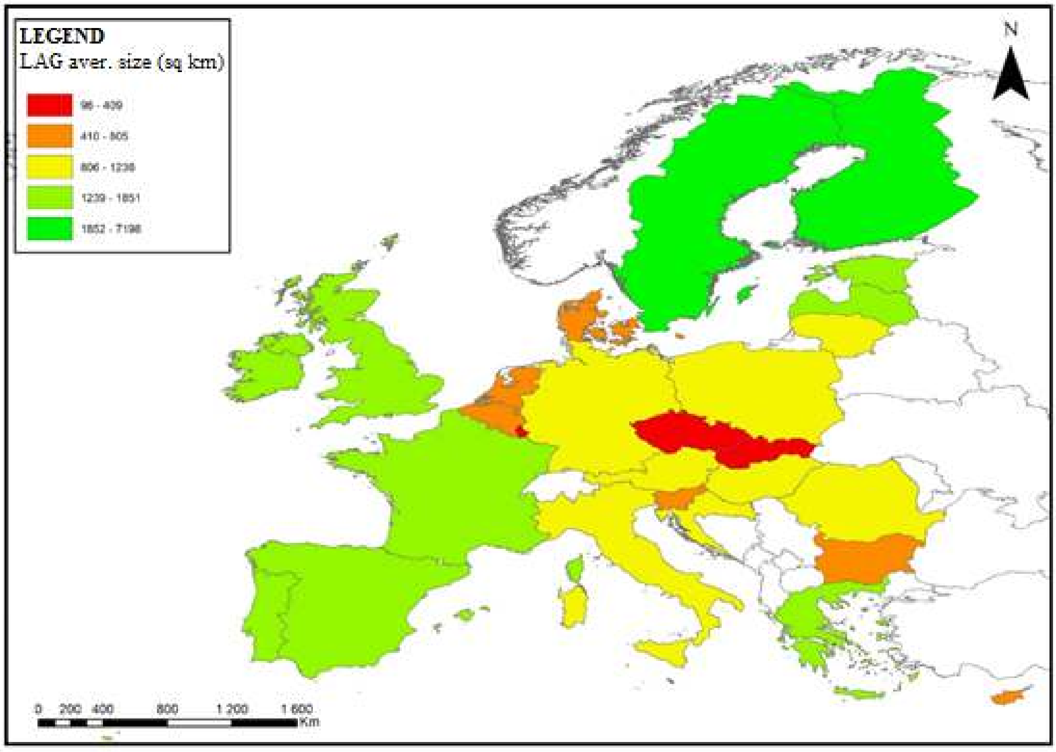
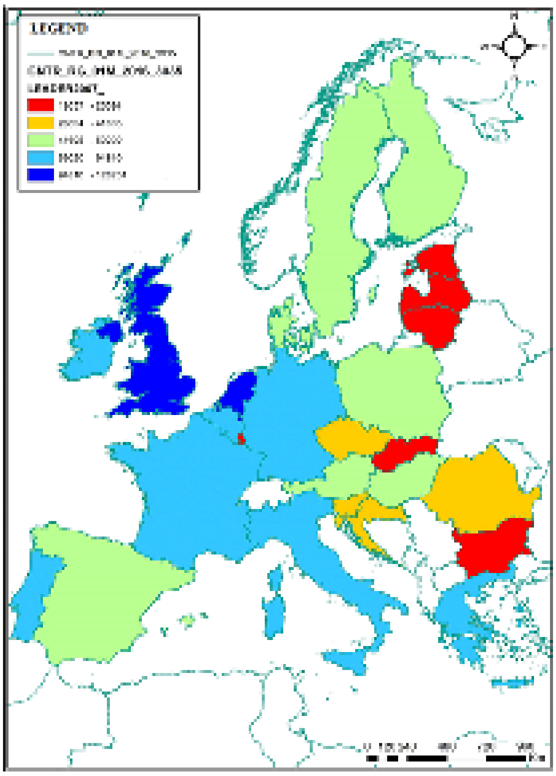


Figure 5: The average population of LAGs in the different EU member states in the 2007-2013 period (Author's edition)



Well-institutionalized and well networked LAGs may raise external (private investment or non-reimbursable subsidies) funding for the micro region as well. As networking is one key principle of the LEADER program, action groups should co-operate with external players. (Finta, I. 2014)

These diversified activities are run by a relatively small administrative body as the average staff number was 2-5 people/LAG. Of course this limited headcount is insufficient to successfully realize these multi-fold tasks. An action group can be really successful and productive in case of active governance circumstances. Governance is a key character of the success of local action groups and it can be positioned in an eight grade scale. (Lukesch, R. 2007) (Table 2)

Table 2: Eight grades of governance

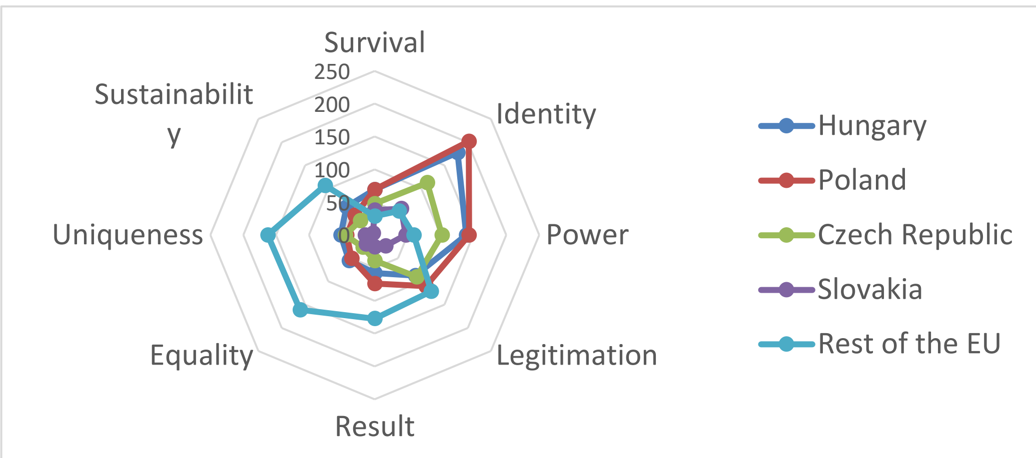
Level	Key word	Form of leadership	Main LAEDER principles
1	Survival	Sustenance	Context not appropriate for LEADER
2	Identity	Allegiance	Area-based approach
3	Power	Charisma	Bottom-up approach
4	Legitimacy	Planning	Partnership
5	Result	Competition	Multi-sectoral integration, innovation
6	Equality	Conciliation	Bottom-up approach, partnership
7	Uniqueness	Strategic vision	Multi-sectoral integration, networking and cooperation
8	Sustainability	Shared responsibility	Networking and cooperation, decentralized management and financing

Source: Lukesch, R. 2007

An on-line questionnaire was sent to a sample of European local action groups active in the 2007-2013 period, containing the "forms-of governance" (FOG) test questions elaborated by Robert Lukesch. Totally 740 questionnaires were sent and 0-60% answer ratio was reached from the different member states. The Central and Eastern European countries (Czech Republic, Hungary, Poland and Slovakia) were examined separately as they have weaker civil society and joined the EU relatively late compared with the majority of EU member states. Consequently their action groups had less time to be formed and to build governance capital.

We may see that the relative latecomer Central European local action groups are at a relative lagging-behind position in the field of governance comparing with the rest of the EU. (Figure 6) It can be explained by the socio-economic backwardness of the region or by the shorter life-span of their LAGs.

Figure 6: Differences between the level of governance among the Central European countries and the rest of the European Union (Author's edition)



Saemaul Undong, an Asian success story

The history of the South Korean "Saemaul Undong" (New Village Movement) is rooted in the 1920s when rural community development initiatives were started by the colonial government (You 1986). In 1927 American YMCA members the 4H Club (Head, Heart, Hand, and Health) aiming to support rural infrastructure and environment. (You, T. 1986)

In 1948 two important national institutes were funded in the Republic of Korea, the National Agricultural Cooperative Federation and the National Fishery Cooperative Federation. These are working nowadays and support financial resources for national agrarian projects. After the Korean War the United Nations helped a pilot program (from 1958) of rural development with more than 2000 joining villages in order to improve agricultural technology and local institutions. Similar programs were generated under the umbrella of the Six-Year Rural Development Plan (1966–1971) in order to rise the income of rural population. (Asian Development Bank, 2012)

At the beginning of the 1970s president Park Chung Hee announced the rural renewal program of the Korean Republic with varied objectives, such as setting up rural democracies, growing incomes of rural households and modernizing agriculture. The whole process was aiming to mobilize hidden resources, such as labour and in this way empower rural communities. The main sources of development were the mobilized local ones, the central government provided only additional financial support. The success of the program was supported by a set of principles, such as diligence, self-help and co-operation, the so-called "Saemaul Spirit". The basic unit of the program were villages (maul: a small settlement with an average 50 households) from them more than 30.000 joined the movement. (Park, S. 2009)

During the program implementation different objectives were realized according to the categories of villages. In order to emphasize the comparative advantages of different natural conditions five types of mauls were specified by geographic position (Asian Development Bank, 2012):

- open-field villages,
- hillside villages,
- mountain villages,
- fishing villages,
- suburban villages.

Different project packages were created to the villages of the above five types, but special local traditions were taken into consideration as well. In each groups thematically various projects were implemented, such as the building of basic infrastructure, environmental improvement (afforestation), agrarian developments (the introduction of new species, mechanized farming), the diversification of economic activities (Saemaul factories).Beyond tangible project results the intangible mental and spiritual benefits were important. In a disadvantaged village environment a "we can do it" spirit was permeating. (Reed, E. P. 2010)

As the movement was a nationally tailored one, the Ministry of Home Affairs of the Republic of Korea took the central control on administrative guidance, technical assistance and monitoring. Locally two institutions were created to managed development processes. While in the general meeting all village members could join, the development committee consisted of 15 members. (Asian Development Bank, 2012)

From an institutional point of view the main achievement of Saemaul Undong was the flourishing of social capital thanks to the introduction of forums and general village meetings. The real success occurred when the activities of local residents met the support of local and central administration, enterprise leaders, the academic sphere, education experts, church members, etc. namely conditions of good governance could evolve. (Yang, Y. 2015)

The program concentrated on the local level, where inhabitants had the right to elect their "Saemaul leader". At the same time applicants had to fit to strict conditions, such as (Asian Development Bank, 2012):

- Their place of birth had to be at the village
- They had to be committed to rural development and democratic way of thinking
- Have vocational school qualification in agriculture or fisheries
- A general habit of "Saemaul Spirit" (co-operation, patience, diligence)
- Have an innovative and creative attitude
- Good physical and health conditions
- Have the ability of self-reliance

The balance of male and female local leaders was a crucial issue to involve members of both genders. Furthermore, among Saemaul leaders, young people were over-represented comparing with the composition of traditional village officers. (Kap-Jin, C. 2012)

The support for local Saemaul communities from the central level was manifold. Beyond administrative and financial support (favourable loans) education in community development and different specialties were frequent. Comparing with the similar European processes Saemaul Undong was unique in supplying villages cement and iron rods for constructing. (Asian Development Bank, 2012)

2. Conclusions

The shift towards agri-industry 4.0 is a rather complex process containing technical, political, social, cultural and economic features. In the previous decades some successful rural development movements were implemented to advance significant changes related to the socio-economic conditions of the countryside. In Europe the LEADER approach was founded a quarter century ago and was able to function in the different EU member states with improving economic conditions, basic infrastructure and the environment. Behind its success the complex – principle-based – institutionalization can be found. Local action groups of the LEADER program work as micro-regional hubs transforming social, financial and natural resources into local development projects, keeping management functions locally. The LEADER approach can realize tangible and non-tangible objectives and projects as well. Local actions groups can be really successful if already existing institutions and spatial units are used as building blocks in their creation.

Some decades earlier in the Republic of Korea the national Saemaul Undong movement was aiming to help rural areas lagging behind. Its success can be explained by similar factors with those of the LEADER. The mobilization of people and the empowerment of local communities helped the achievement of multiple objectives: economic development and diversification, infrastructure building, community organization etc. The vindication of local natural and social conditions during planning and implementation was crucial as well.

A major difference between the two programmes was their territorial scope. On the one hand Saemaul was concentrating on single villages and on the other hand the general LEADER spatial unit contained more settlements. The former one could built on community power of micro communites and the latter one on the bigger mass of resources.

The success of these development approaches is proven by the fact that after the first years both of them were extended to other areas (the LEADER in the form of CLLD to urban areas and to new Central European member states and Saemaul Undong to different emerging and frontier countries. These methods can help in the creation of agro-industrial revolution 4.0 in a sustainable and socially inclusive way.

Acknowledgement

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Industrial Application with Protected Horticulture in Korea

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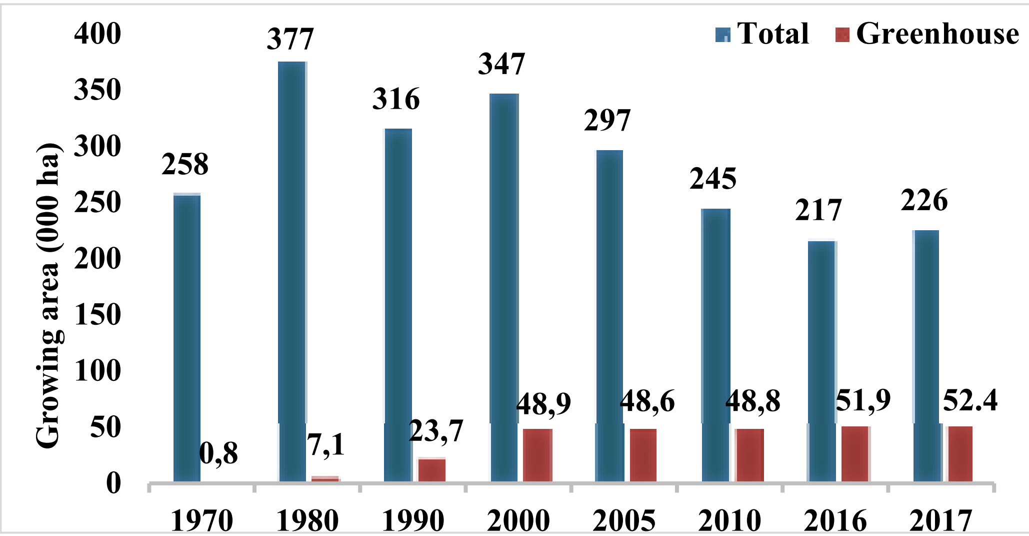
Abstract.

From 1970's protected horticulture industry in Korea has developed rapidly until 2000 with government support and efforts of farmers. Recently, Korean agriculture has faced difficulties both internally and externally but still the area of greenhouse has increased. In order to overcome the challenges surrounding agriculture, rural development of administration (RDA) played a key role in improving agricultural productivity through modernization of greenhouse, development of automation equipment for labor saving, energy saving technology, and development of smart farm using ICT technology with farmers and researchers. This paper will introduce present condition of protected agriculture in Korean and ICT technology from Korea.

Discussion

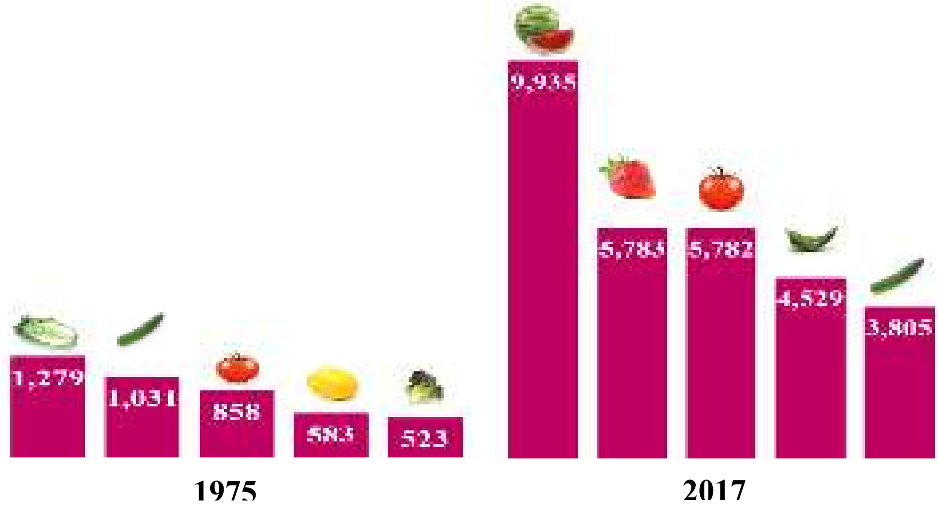
From 1960, through the 'Green revolution' Korean agricultural industry grow rapidly. But at that time still have problem because there are four seasons in Korea. People can grow limited crops that can survive during winter season. After plastic film introduced to Korea in 1970, people tried to apply it agricultural industry and from the middle of 1970's greenhouse area increased rapidly till 2000 (Fig.1).

Fig. 1. Changes total growing & greenhouse area in Korea (MAFRA, 2018).



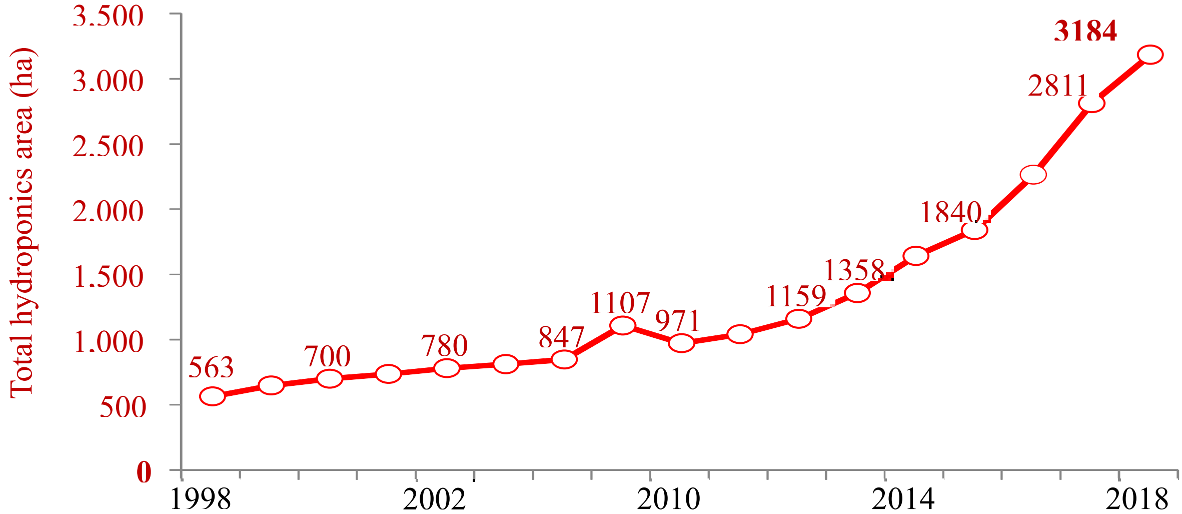
The land covered by plastic houses looks white so people call it 'White revolution' (Seo et al., 2013). During more than two decades trend in greenhouse industry in Korea has changed. For example major crops are substituted from vegetables to fruits (Fig. 2).

Fig. 2. Cultivation area of major greenhouse crops (Kwan, 2018).



People can not only take advantages from greenhouse but also have problems. Under the green house condition, occurrence of disease originated from soil and salt stress have increased. At first people used grafting that one of methods, and it is still popular, people tried to apply hydroponic system to get more safe food (Fig. 3).

Fig. 3. Changes in hydroponic cultivation area of horticultural crops (Kwan, 2018).

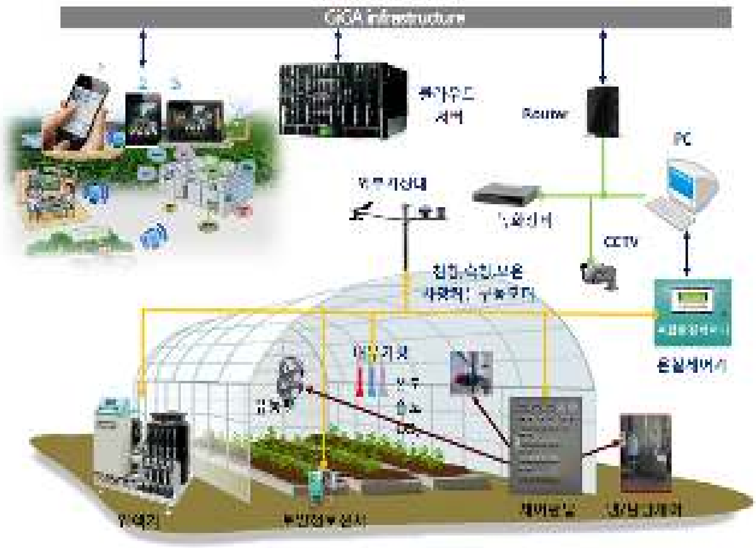


Additionally to overcome various condition like heat, frozen, humid, dry, people adopt heating & cooling system, but mostly the principal of operation derived from foreign country (Fig. 4.)

Fig. 4. Heating & Cooling system in Korea.

Recently, Korean agriculture has faced difficulties both internally and externally problem, like abnormal climate, price competition, high labor fee and cost for agriculture, and so on. So people in Korea try to the concept by small scale in agricultural field with plant factory (Kim, 2010), smart monitoring system (Kang et al., 2010), or environment control system based on deep learning (Shin, 2018), (Fig 5).

Fig. 5. Example of smart farm monitoring system.



On the other hand, try to adopt new light source LED which has long life period and low requirement of electricity (Hong, 2012), (Lee et al., 2014).

Fig. 6. Treatment of day length extension using by conventional incandescent (left) and red LED lighting device (right) in perilla at plastic house (Hong et al., 2012)

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Farming in the Era of Industrial Revolution 4.0: The Environmental Challenges

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Abstract.

The Industrial Revolution 4.0 proposed a cross-cutting impact of information and communication technologies, especially the Internet of Things in various industrial sectors. This revolution supported the development of systems that transfer the advantages of the internet and information systems towards physical systems. In the agricultural industry, the concept of farming in the industrial revolution 4.0 era refers to the increased integration of information and communication technology with farming activities. A smart, networked system, combining various types of data from multiple sources, promised to increase productivity and efficiency. This revolution changes the tools used in agriculture sectors replaces leads to smart farming that must be sustainable agriculture. This paper reviewed the implementation of the industrial revolution concerning smart farming activities and discussed environmental opportunities and challenges raised.

Keywords: industrial revolution 4.0, smart farming, sustainable agriculture, environmental challenges

Introduction

Food demand in the world is continuing to increase. Jelle Bruinsma, in World Agriculture: Towards 2015/2030, stated that the world is facing an enormous challenge. He raised a challenging question, "How to feed 2 billion more mouths in 2030?" But, he also convinced that the world could feed more people (Bruinsma, 2015). As the population increases and revenues increase, demand for food is also growing. He estimates that the total need for agricultural products in 2030 will be around 60% higher than in 2015. At least 85% of this increased demand will be in the developing world.

The population growth has decreased from 1.7% per year for the last 30 years to 1.1% annually to the year 2030. It was expected that the world population would be around 8.3 billion people in 2030. Consequently, the world growing demand for foods is estimated to slow down, from an average of 2.2% per year during the last 30 years to 1.5% annually. In developing countries, it was found a larger decrease in demand from 3.7% per year to around 2% to 2030 (FAO, 2015).

As in the past, agriculture will respond to increasing demand by producing more. But in fact, the FAO expects that with 2030 about 440 million people will still be deficient in chronic nutrition (Bruinsma, 2015). Besides, although the potential to increase production exists, we need to add investment in agricultural development and, in particular, in agricultural research, which is not only to raise the rate of results but also to maintain the level of products. The intensification of agriculture may induce an environmental problem whenever technology is not used correctly. Environmental damage has been found due to pollution caused by excessive application of fertilizers or pesticides, or due to no regulations adequate to protect the natural resources (Gaffney *et al*., 2019). Therefore, we need to introduce adaptable agronomic strategies and rules that consider environmental protection to meet sustainable farming targets.

As environmental problems are becoming an urgent issue, so sustainable agriculture then developed into environmentally sound farming. Agriculture developments tend to automation production and environmentally smart technologies (Lehmann *et al*., 2012). Nowadays, farming required a method that is sustainable in terms of productivity, economic, environmental, and social (Far & Rezaei-Moghaddam, 2018).

The concept of farming in the era of Industrial Revolution 4.0 refers to the increased integration of information and communications technology (ICT) with farming activities. A smart, networked system, combining various types of data from multiple sources, promised to increase productivity and efficiency. This revolution changes the tools used in agriculture sectors replaces leads to smart farming. Smart farming considers both high productivity and sustainability according to environmental safety.

This paper discusses industrial revolution 4.0 and its implementation in agriculture. A brief review will present several definitions and concepts of industrial revolution 4.0 and technologies and implementation of ICT in agriculture. The next part will be a discussion on the challenges and opportunities of farming in the era of industrial revolution 4.0, particularly related to environmental issues. The last part will be an epilogue and a conclusion.

Definition And Concepts

Industrial Revolution 4.0.

It was Professor Schwab, who declared the emergence of the Fourth Industrial Revolution in 2015 (Schwab, 2015). The 4.0 industry then became a topic of general discussion in research, academic, and industrial communities. The main idea is to explore the strengths of new concepts and technologies, including (Rojko, 2017):

• The readiness and application of the Internet and IoT,

• Incorporation of technical and business processes in the enterprise,

• Digital mapping and virtual modeling,

• Smart factories, smart production, and intelligent goods.

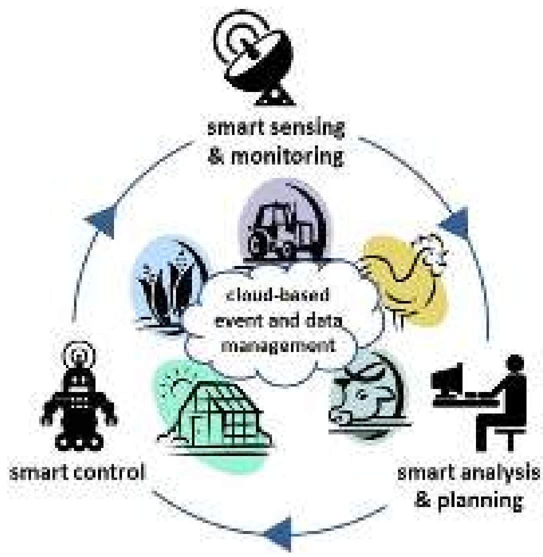
Five years after the first introduction in Germany, the 4.0 industry concept is well-known worldwide. It has also been transferred from its original application field in the manufacturing industry to other engineering and non-engineering (Rojko, 2017). Furthermore, the 4.0 industry is generally adopted as the concept of the 4.0 Industrial Revolution (Rojko, 2017). There have been many experts discussed this concept. However, a universal definition of the Industrial Revolution 4.0 has not yet been confirmed (Lee *et al*., 2018).

Farming in the era of the Industrial Revolution 4.0

The application of the Industrial Revolution 4.0 in agriculture includes three parts. The first part is sensor-based technology for data collection of several parameters related to crops, soil, and weather conditions. The second part is big data analysis resulting requirement of plants regarding water content and fertilizers on appropriate timing. The third part consists of control systems of various farm machinery inputted by database processed from a computerized geographical information system (GIS). The system transformed farming infrastructures into connected tractors and machines, connected farms, and new production equipment. This part will contribute to productivity improvement, environmental protection, and quality assurance of agricultural products.

Figure 1 describes the smart farming concepts. It is the cycle of the cyber-physical system, consists of smart devices connected to the internet and controlling the whole farm system. Intelligent devices, including conventional pieces of equipment (tractors, rain gauge, and computer) completed with autonomous capabilities by sensors, artificial intelligence, capacity for self-operating, and doing remotely. Robots may have an essential function for control. In this cyber-physical cycle, the role of analysis and planning becomes almost autonomous. Machines increasingly assist humans. The system still needs humans with a higher level of intelligence. The humans responsible for the whole process but organizing machines to do execution activities (Wolfert *et al*., 2017).

Fig. 1. The cyber-physical management cycle of Smart Farming enhanced by cloud-based event and data management (Wolfert et al., 2014).



The most related farming activities with industry revolution 4.0 is Smart Farming. Smart farming intelligently manages farming practices, including monitoring, plan, and control of farming activity. This concept needs the implementation of various systems of hardware and software (Kruize *et al*., 2016). The use of unmanned aerial vehicles (UAVs) has been popularly implemented. The technology of GPS and drones with cameras support better decision making and risk management process in agricultural practices (Wolfert *et al*., 2017).

The Industrial Revolution 4.0 created technologies of artificial intelligence (AI) that benefits in decision-making ability and big data, which helps in the analysis of statistical data collected by different techniques. These technologies ease agricultural activities like analysis of soil moisture, the healthiness of crop, prediction of exact harvest time of the plant, and the scheduling of pest control. System termed internet of things (IoT), making it possible to operate farm remotely through mobile devices.

Precision Agriculture

The concept of precision agriculture has evolved since the 1990s and then thoroughly intended to study and manage spatial heterogeneity in agricultural production. The other variability and agriculture-related factors then also to be considered in the concept properly. "Precision Agriculture is a management strategy, including gathering, processing, and analyzing temporal, spatial, and individual data and combines it with other information. It supports management decisions according to estimated variability for improved resource use efficiency, productivity, quality, profitability, and sustainability of agricultural production." (ISPA, 2018)

Precision farming includes a wide range of technology, targeting a more precise agricultural production. These technologies have different acceptance in agricultural practice. Adoption of site-specific seed and fertilizer management continues to lag (Hauser & Wagner, 2018).

Precision agriculture customizes plant and soil management cautiously, considering the land heterogeneity. Plants and soil characteristics on the ground not only vary spatially in horizontal and vertical but also temporal. This heterogeneity issue becomes an important distinction between precision farming and conventional farming. Rapid advances in agricultural technology and applications help increase productivity. Precision farming under agriculture 4.0 is a promising pathway to improve the sustainability of agriculture by increasing farm profitability, reducing manual labor, and reducing environmental impact.

Smart Farming

Smart farming or intelligent agriculture has not yet been popular term as precision farming. As precision farming takes into account variability in the field, intelligent agriculture creates activities based on the field and data. The data was connected with the context and situation and initiated from real-time events (Wolfert *et al*., 2017).

Smart farming has developed in line with the concept of the digitalization of farms (van der Burg *et al*., 2019). The digitization of agriculture presented as a promising technology for a variety of social and technical issues. It could solve problems, such as food supply for the population, reducing farming impacts on the environment, promoting food safety, and increasing public acceptance (Wolfert *et al*., 2017). Smart farming does agricultural activities in such an efficient way. Many types of equipment, like weather satellites, sensors, software algorithms, and robots, are applied together, making agriculture smart. Efficient work can be executed, such as scheduling irrigation, monitoring of plant health based on data collected from the satellites and sensors. Also, all the collected data can be merged and analyzed across the region. Based on more data, the analysis provides even resulted in better information.

Understanding the spatial variability of soil chemical and physical attributes optimizes the profitability of nutrient and water management for crop development. Soil mapping systems with various types of proximal soil sensors provide crop growers with an excellent opportunity to access soil heterogeneity at a sub-meter spatial scale in an efficient and less invasive manner. Studies suggest that sensing information linked to soil pH, electrical conductivity, organic matter content, soil moisture, etc., can be obtained in a relatively cost-effective manner (Huang *et al*., 2018).

Digitalization of farms

The literature about the digitization of agriculture from the perspective of natural or technical is available in various forms. A literature review shows that the future agenda of inter and trans-disciplinary research is urgent for developing the science on precision agriculture, smart farming, digitalization in agriculture, and agriculture 4.0 (Klerkx *et al*., 2019).

Big Data and Smart Farming are both interrelated and may modify the scope and arrangement of agriculture. Research and development activity of both developed fastly. Big data applications far exceed the farm itself but cover the whole cycle of the supply chain. Development of the IoT, connect all kinds of equipment and tools wirelessly in farms and supply chains, generates a lot of new real-time data (Wolfert *et al*., 2017). Concerning Figure 1, management and operation of farming will change to automatic and autonomous processes due to broad access of real-time data, concurrent prediction, types of equipment tracking, and combined with IoT development (Wolfert *et al*., 2017).

ICT in agriculture

Smart farming is a practical application of ICT in agricultural activities. ICT techniques support the efficient process of production (Walter *et al*., 2017). Fast development in ICT technology has motivated practitioners, companies, and scientists to work together in creating innovative technology to support farmer's activities. Implementation of ICT technology in agricultural processes has been beneficial by the utilization of satellite imagery, robotics agriculture, various sensor for data collection, and unmanned aerial vehicles (UAVs) for an aerial photograph. In the European Union countries, cooperation on the future smart digital technology and development of sustainable agriculture in the country and rural areas was declared in April 2019 by the 24 EU member countries (Bacco *et al*., 2019).

ICTs hold the potential contribution to the transition in agriculture sustainability due to their disrupting potential (Bello & Aderbigbe, 2014). According to Wolfert *et al*. (2017), ICT's trends interfere with many platforms, including cloud computing, geo-information, Internet of Things, social media, and connected open data).

ICT and Big Data, including in digital agriculture, is continuing to transform society (El Bilali & Allahyari, 2018). Extension activity will provide better information and services as data was collected and combined from many sources, including satellite imagery, cropping models, and sensors from many locations. Farmers also have the opportunity to improve the learning process during agricultural activities. They can share experiences and ask questions to the extension facilitator during a two-way extension process. ICT makes it possible to provide information directly to farmers using smartphones (Bruce *et al*., 2018).

Innovative urban agriculture (IUA)

Innovative urban farming (IUF) produce food crop using less amount of soil and water than ordinary farming (Rothwell *et al*., 2016). Each agricultural system needs inputs, including planting media, irrigation, fertilizer, and agrochemicals. However, IUF usually practices a circular system. It uses such construction that possible for using alternative planting media other than soil, and automatic types of equipment. Some IUF experiments claim that IUF may increase the efficiency of water and fertilizer use. For example, the application of the aquaponics double-recirculating system (DRAPS) for one cubic meter of water increases

23.6% efficiency of fertilizer higher than conventional hydroponic systems. It produces similar quality and many tomatoes, and additional product 1.5 kg of tilapia per cubic meter of water (Suhl *et al*., 2016).

This effectiveness claim is just based on the single production process. Commonly, IUF practitioners might also apply more amounts of manufactured goods, such as plastics, metals, or chemical fertilizers that could potentially increase a carbon footprint higher than rural agriculture (Sanyé-Mengual *et al*., 2015). Impact of precision agriculture on the environment has been importantly raised from the wrapping and transport of products, an ecological packaging, and preservation (Rothwell *et al*., 2016; Llorach-Massana *et al*., 2016; Abeliotis *et al*., 2016). According to a life cycle analysis, the complete IUF's system for food production systems may require more equipment and energy compared to rural agriculture. Therefore, a full LCA is required before justifying the environmental outlook of the IUF system (Armanda *et al*., 2019).

Challenges And Opportunities

Development of ICT in the era of Industrial Revolution 4.0 boosts farming practices into smart farming that effective and efficient and makes it safe to the human and environment. This type of information requires the recommended dose of fertilizer and specific pest control on site to succeed in agricultural production. Analysis of the digital image of rice leaves can be applied to determine the adequacy of plant nutrients and pest levels. Develop information on recommended fertilizer doses and pest control for a site-specific, in line with the precision of agriculture. Digital image analysis of rice leaf samples can obtain the necessary data to determine the level of nutrient adequacy and pest attack. This research collects technology for combining artificial neural network (ANN) techniques with data communication of digital image techniques to tailor fertilizer needs and pest control recommendations. This application eases the farmers to know the recommendation of fertilizer doses and pest control required for their farmland by simply sending paddy leaves photos using a smartphone application (Partoyo *et al*., 2013).

Technology that uses drones (unmanned aerial vehicles- UAV) to capture images of crops for analyzing big data is beneficial. With the use of drones, farmers can identify which part of the land needed irrigation or fertilizers quickly. Nowadays, this drone used as remotely fertilizing vehicles in farming so that specific areas or individual plants can be accessed easily. This data collected by drone forwarded through ortho-mosaic maps for spatial analysis. Different techniques used to manage the data for agricultural sector development is called Big Data. Big Data denotes processing the massive amount of data collected from information, and communications technologies (ICT) leads to rapid decision-making data for improving crop productivity. Since all data is available from consecutive periods in storage, each farmer may take preventive measures for different weather conditions.

Recently under industrial revolution 4.0, a new technique of machine learning called Artificial Intelligence (AI) increases demands in various activities. This Artificial intelligence (AI) used the previously stored data for decision making and requirement of agricultural sectors with the preparation of the schedule of farming activities. Industrial Revolution 4.0 also results in the utilization of robots in many farming pieces of equipment. This revolution in the agriculture sector may enhance productivity through automation, unmanned farming, and eco-friendly farming.

ICT can facilitate to reduce agricultural inputs (water, fertilizer, pesticides, and energy) as well as reduce environmental costs (Lehmann *et al*., 2012) as described in Table 1. ICT serves as the fundamental for other technology such as geographic information systems (GIS) and global positioning systems (GPS) in precise and specific location farming (El Bilali & Allahyari, 2018). Examples use of ICT in agriculture to improve efficiency is precision agriculture (Balafoutis *et al*., 2017; Allahyari *et al*., 2016; McBratney *et al*., 2005). Precision agriculture is a model of modern agriculture consisting of sensor utilization to optimize water, fertilizers, and pesticides use. The precision farming method relies predominantly on satellite navigation, positioning technology, sensor technology, and the internet of things (El Bilali & Allahyari, 2018).

Table 1. ICT impacts food chain sustainability, especially in environmental aspects.

Expected positive impact
• Increase the efficient use of resources and inputs. • Reduce the cost of the environmental impact of agricultural and food processing (for example, water pollution). • Decrease agricultural sector contributions to the emission of GHG. • Reduce food defeats, and waste.
Potential negative impacts
• Creating electronic waste and dumping of ICT device in agricultural areas

Sources: Adopted from El Bilali & Allahyari (2018)

Precision agricultural technology includes variable-level nutritional applications, variable-level irrigation, variable-level application of pesticides, variable-level of planting, precise weeding technology, autonomous driver engines, permanent traffic-controlled of farming vehicles (Balafoutis *et al*., 2017). In precision agriculture technology, data collected from different sensors allows adjusting the number of inputs to crop needs and various amount to each of the entire area. Reduced use of this input has a positive environment (Balafoutis *et al*., 2017; Hedley, 2015), and economics (Balafoutis *et al*., 2017; Snyder *et al*., 2015) impact. The decision support system based on ICT helps farmers increasing production efficiency, whereas suppressing production expenses and their operating environment footprint (Hedley, 2015). Intelligent irrigation systems based on ICT can reduce the use of water use and energy (Mutchek & Williams, 2010). Generally, precision agriculture may produce lower emissions of GHG due to increased carbon absorption in the soil (European Union, 2014). It may also reduce tillage (Angers & Eriksen-Hamel, 2008), reduce nitrogen rates (Khan *et al*., 2007), reduce inputs use (Mutchek & Williams, 2010), and reduce fuel consumption (Balafoutis *et al*., 2017).

USDA-Natural Resources Conservation Services promoted an efficient irrigation technology as well as protecting water quality. The technology consists of the conversion of furrow irrigation and high-pressure pivot irrigation to low-pressure pivot irrigation and micro-irrigation systems, scheduling irrigation based on weather and sensor data, and planning of soil conservation or fertility management (USDA-NRCS, 2019). Improvements in technology and management of irrigation have improved the efficiency of irrigation and overall water use efficiency (Gaffney *et al*., 2019).

The other opportunity to develop autonomous farming activities is using unmanned aerial systems (UAS). The UAS comprised of components for data acquisition and processing for obtaining field data and processing information provided to the users. Data acquisition conducted by unmanned aerial vehicles (UAVs) and controlling ground stations, comprised of GPS receivers, data capturing sensors, and connection to ground stations with digital storage to save the collected data.

The UAV obtained a mosaic of orthophoto, a three-dimensional model, a digital elevation model (DEM), and a 3D point cloud. An orthophoto provides data for image processing algorithms, consists of DEM provides elevation data from the terrain surface and DSM or

DTM. DSM contains elevation data of features on the ground surface (digital surface model). The DTM contains data of ground elevation (digital terrain models). This model considers a three-dimensional cloud point obtained from the onboard sensor of UAV. The DTM and DSM subtraction resulted in the elevation model consisting of only the above-ground objects called digital-differential-model (DDM), or canopy-height-models (CHM) (Pádua *et al*., 2017).

Atmospheric conditions may interfere application of remote sensing techniques to obtained aerial data. The adverse weather condition in the climatic zone with abundant water vapor in the atmosphere will become constrained to capture a clear image from optical remote sensing instruments. These situations cause difficulties in the interpretation of remote sensing imagery. Radar-based remote sensing may change optical remote sensing implementation. It will be no constraint for obtaining the image according to the case of atmospheric unclear (Liu *et al*., 2019).

Epilogue

Currently, the interest of the young generation to work in the agriculture sector is low. In many countries, agriculture production involves mainly older people. There are opportunities to develop smart farming activity will be interesting for the young generation. They are promoting farming activities that are related to automation, information technology, internet application, using drones. Some farming practices implement high technology. Those are a smart greenhouse, hydroponic techniques, aeroponics technology, and aquaponics technology.

We are Faculty of Agriculture UPNVY promotes a tagline," Bringing knowledge for a better future." It is elevating the interest of students to be sure that with a better understanding of agriculture, it will bring them to a better future. The knowledge provided for the students is modern agriculture, urban farming, aquaponics, tissue culture, GIS, and remote sensing. We have implemented such a curriculum since 2017. We have several students who did their thesis with the topic of sensors for smart greenhouse.

We have the data that the animo of new students to apply for an agro technology program study have increased, and even the entry competition is much thought. It was a significant update that the interest of the young generation to learn agro technology has raised. It might be related to the millennial generation that is interested in modern agriculture.

Conclusion

Farming under the industrial revolution 4.0 era is a promising pathway to increase the sustainability of agriculture by increasing farm profitability, reducing manual labor, and reducing environmental impact. This revolution in the agriculture sector may enhance productivity through automation, unmanned farming, and eco-friendly farming.

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Forecasting Of Chili Prices In The Special Region Of Yogyakarta, Indonesia Based On *Harga Pangan* Applications (Arima Approach)

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Abstract.

The price of chili has characteristics that are unstable and fluctuating, this causes stakeholders difficulty in making decisions about the price of chili. The scarcity of chili production causes demand to increase so that the price of chili also rises. Information is needed regarding the predicted fluctuations in chili price trends so that market demand for chili can be known. The purpose of this research is to create a model and predicted the price of large red chili and curly red chili. This research was conducted using the time series data price of large red chili and curly red chili during 40 periods starting from July 2016 up to October 2019 to predict price red chili and curly red chili for 12 the next periods began November 2019 and ended on October 2020. The data was obtained from *Harga Pangan* (*Pusat Informasi Harga Pangan Strategis*) *Bank Indonesia* application using the price of chili in the Special Region of Yogyakarta. The results of the forecasting model using ARIMA shows that the price of large red chili and curly red chili for 12 periods has increased gradually and forecasting results close to the actual data.

Keywords: ARIMA, chili price, forecasting, *harga pangan* application

1. Introduction

A red chili is a group of vegetable commodities that are commonly cultivated in paddy fields by farmers with traditionally and intensively methods. Compared to other vegetable commodities, red chili has a high economic value but also has a high production risk (Saptana, Daryanto, Daryanto, & Kuntjoro, 2010). High production risk is one of the causes of chili prices to fluctuate. Red chili commodity prices that fluctuate and have high levels of margins lead to inefficient pricing and contribute to inflation (Sativa, Harianto, & Suryana, 2017).

Commonly, the amount of supply and demand for chili become one of the factors affecting the price of chili. If the supply of chili is less than demand so the price increases, otherwise when supply is greater than demand, the price becomes low (the price of chili is elastic to the supply). On religious holidays, for example, nearing Ramadan and *Idul Fitri* 2019, the price of chili rose to 50% because the demand for chili increased by around 10-20%, while supply was seasonal (Makki, 2019). The development of chili prices in the domestic market nationally tends to fluctuate, the price of red chili has a sharper price trend and is more expensive than the price of large and curly red chili. The increase in chili prices the head of the *Idul Fitri* 2019 is expected to occur in some areas but not significant. The increase in chili prices at intervals of 10 days before and after *Idul Fitri* 2019 is caused by farmers not harvesting related to *Idul Fitri* 2019 homecoming (Yanuarti & Afsari, 2016).

The price of chili is influenced by the demand for the amount of chili, while the demand for the amount of chili is influenced by the price of a substitute item (green chili), the price of shallots and one's income (Gusvita & Budaraga, 2015). Demand for red chili will continue to increase along with the increase in population. Producer prices and wholesale prices of red chili commodities contribute greatly to price formation at the consumer level. The maximum profit is obtained by the retail trader when the retail trader applies to collude price as the dominant strategy (Suwarsinah, Harwanti, Hastuti, & Firdaus, 2018).

There are many sources to find out the price of national chili, for example, from the website of the Ministry of Trade, Central Statistics Agency and others. In the era of the industrial revolution 4.0, the use of Android applications makes it easy for people to access various information. There are several android applications that make it easy to access price information on basic commodities in Indonesia, one of which is the food price application. Food prices are the official mobile application of the Bank Indonesia's National Strategic Food Price Information Center which provides official information on the latest national food prices. This application food price data comes from a direct survey in 82 cities/districts of the Consumer Price Index inflation sample that includes price data in traditional markets for 10 food commodities with 21 variants that are quite dominantly consumed by the public and are a commodity that is a source of food inflation. Strategic food commodity prices contained in the National Food Price are rice, granulated sugar, cooking oil, beef, chicken meat, eggs, flour, soybeans, chilies, onions and garlic (Pusat Informasi Harga Pangan, 2019).

Yogyakarta Special Region (DIY) is one of the largest cities in Indonesia which has the highest number of traditional markets, which is ranked thirteenth (13) (Badan Pusat Statistik, 2019). A large number of traditional markets indicate that there are large numbers of consumers who shop at traditional markets to buy food needs. Food needs, one of which is chili, has fluctuating prices and makes it difficult for consumers to predict the price of chili to be purchased. One of the characteristics of chili that has been described is that it has an unstable price and high fluctuations. The instability of the price of chili causes a bad impact on the community so that the chili price forecasting is needed to reduce the adverse effects of chili price fluctuations (Puspatika & Kusumawati, 2018). Based on the background and the problem, the research objective was compiled, which is to find out the forecasting of chili prices in the ARIMA single moving average method. The ARIMA single moving average method is used by utilizing actual past data to get predictive results in the future. (Statistik, 2017)

2. Methods

This research was conducted using time series data on the price of large red chili and curly red chili for 40 periods starting from July 2016 to October 2019. Data for 40 month periods is used to predict the price of big red chili and curly red chili for the next 12 periods starting November 2019 and ending in October 2020. The data source used was obtained from an application owned by Bank Indonesia, namely Harga Pangan (Pusat Informasi Harga Pangan Strategis) Bank Indonesia. The research area is Yogyakarta Special Region which is one of the largest cities in Indonesia which has the highest number of traditional markets, which is ranked thirteenth. Data analysis method to forecast the price of large red chili and curly chili is used ARIMA Single Moving Average analysis.

3. Results and Discussion

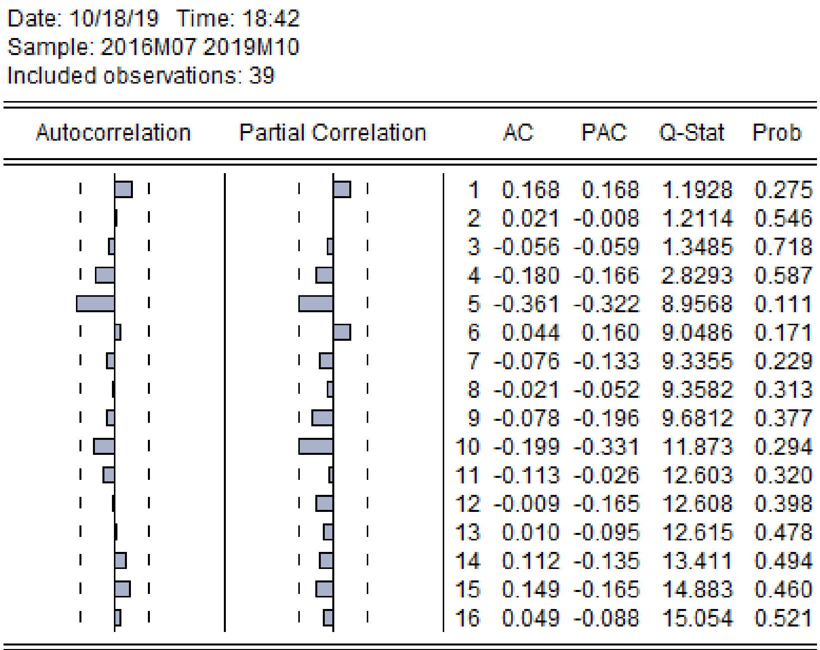
Forecasting prices of large red chili and curly chili are used ARIMA Single Moving Average analysis in which the best ARIMA models are compared. Prior to the ARIMA analysis, the normality of the data presented in table 1 is analyzed first.

Table 1. Normality Test

		t-Statistic	*Prob.**
Augmented Dickey-Fuller test statistic		-5.054363	0.0002
Test critical values:	1% level	-4.297073	
	5% level	-3.212696	
	10% level	-2.747676	

Source: Harga Pangan (modified) (2019)

Figure 1. Big Red Chili Correlogram Table


Date: 10/18/19 Time: 18:42
Sample: 2016M07 2019M10
Included observations: 39

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.168	0.168	1.1928	0.275
		2	0.021	-0.008	1.2114	0.546
		3	-0.056	-0.059	1.3485	0.718
		4	-0.180	-0.166	2.8293	0.587
		5	-0.361	-0.322	8.9568	0.111
		6	0.044	0.160	9.0486	0.171
		7	-0.076	-0.133	9.3355	0.229
		8	-0.021	-0.052	9.3582	0.313
		9	-0.078	-0.196	9.6812	0.377
		10	-0.199	-0.331	11.873	0.294
		11	-0.113	-0.026	12.603	0.320
		12	-0.009	-0.165	12.608	0.398
		13	0.010	-0.095	12.615	0.478
		14	0.112	-0.135	13.411	0.494
		15	0.149	-0.165	14.883	0.460
		16	0.049	-0.088	15.054	0.521

Possible models that can be used to choose the best model. The ARIMA model can be formed in combination as follows:

a. ARIMA c(5,1,4)
b. ARIMA c(8,1,8)
c. ARIMA c(16,1,16)

The predetermined model will be used for the next stage *diagnostic checking* to ensure that the model to be used is free from autocorrelation, homoscedasticity, and normal distribution, *Diagnostic checking* can be seen in the table below.

Table 2. ARIMA Diagnostic Checking Model Price of Big Red Chili

Model	Normality Residual	No Autocorrelation	Homoskedastic
ARIMA c(5,1,4)	-	√	√
ARIMA c(8,1,8)	√	√	√
ARIMA c(16,1,16)	√	√	√

Source: Harga Pangan (modified) (2019)
Information :
√: Assumption accepted

Based on the results of diagnostic checking, it is known that all the selected models are the best models where all models are homoscedastic, free from autocorrelation, and normally distributed. Therefore to choose the best model, consideration of value is needed Adj.R^2, R^2, SE, SIC, and AIC at the table 3.

Tabel 3. Criteria for Choosing the ARIMA Model for Big Red Chili Prices

Model	Adj.R^2	R^2	SIC	AIC	SE
ARIMA c(8,1,8)	-0,01	0,06	0,03	-0,11	0,21
ARIMA c(16,1,16)	0,13	0,20	0,05	-0,14	0,19

Source: Harga Pangan (modified) (2019)

Based on table 3 then the best model among the existing models will be obtained by selecting the highest value of Adj.R2 and R2, and the lowest Akaike Info Criterion (AIC), Schwarz Criterion (SIC), and SE scores. Can be seen in table 3 ARIMA model c (16,1,16) is the best model among the existing models, it is based on the highest Adj.R2 value of 0.13 and the highest R2 of 0.20, and the lowest Akaike Info Criterion (AIC) value is -0.14, the lowest Schwarz Criterion (SIC) is -0.14, and the lowest SE is 0.19, therefore the ARIMA model c(16,1,16) then it used as a model for the forecasting process or prediction prices for curly red chili.

Figure 2. Big Red Chili Price Graph

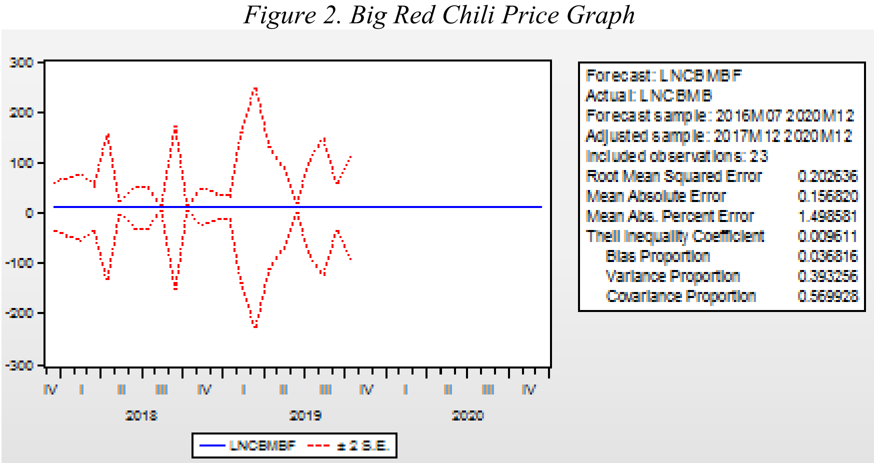


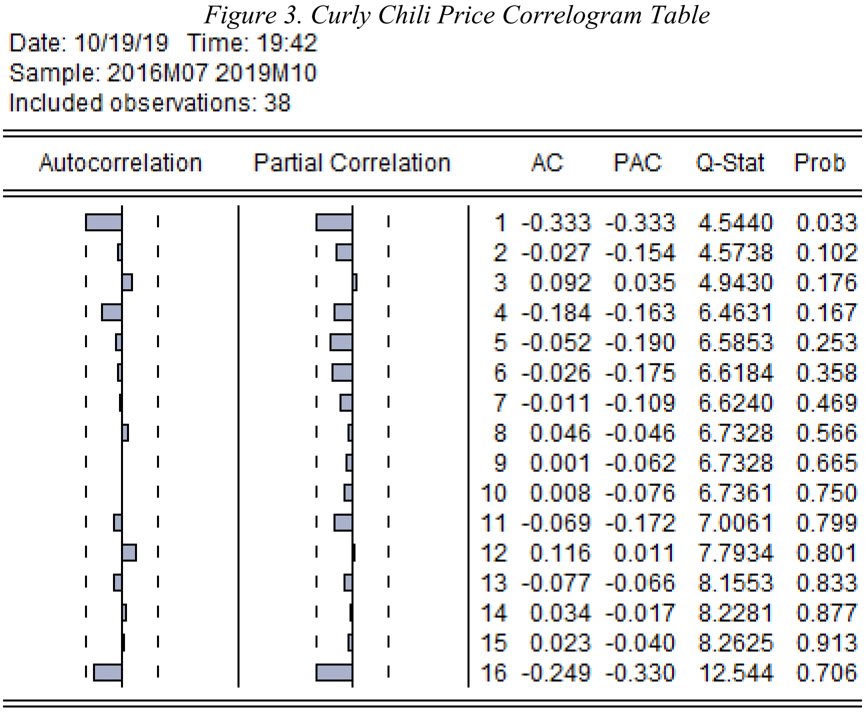
Table 4. Prediction Results of Big Red Chili with ARIMA c (16,1,16) Dynamic Method

Month	Price of Big Red Chili
Jan-18	40.550,00
Feb-18	43.900,00
Mar-18	43.900,00
Apr-18	52.050,00
May-18	38.450,00
Jun-18	34.500,00

Month	Price of Big Red Chili
Jul-18	32.150,00
Aug-18	34.200,00
Sep-18	26.050,00
Oct-18	35.250,00
Nov-18	32.100,00
Dec-18	36.450,00
Jan-19	33.250,00
Feb-19	26.000,00
Mar-19	22.950,00
Apr-19	30.750,00
May-19	36.100,00
Jun-19	44.750,00
Jul-19	58.750,00
Aug-19	61.350,00
Sep-19	40.950,00
Oct-19	36.550,00
Nov-19	42.141,00
Dec-19	41.543,00
Jan-20	44.136,00
Feb-20	42.165,00
Mar-20	41.609,00
Apr-20	41.368,00
May-20	41.964,00
Jun-20	42.988,00
Jul-20	46.231,00
Aug-20	47.889,00
Sep-20	51.530,00
Oct-20	54.834,00
Nov-20	57.712,00
Dec-20	55.063,00

Source : Harga Pangan (modified) (2019)

Figure 3. Curly Chili Price Correlogram Table



Date: 10/19/19 Time: 19:42
Sample: 2016M07 2019M10
Included observations: 38

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.333	-0.333	4.5440	0.033
		2	-0.027	-0.154	4.5738	0.102
		3	0.092	0.035	4.9430	0.176
		4	-0.184	-0.163	6.4631	0.167
		5	-0.052	-0.190	6.5853	0.253
		6	-0.026	-0.175	6.6184	0.358
		7	-0.011	-0.109	6.6240	0.469
		8	0.046	-0.046	6.7328	0.566
		9	0.001	-0.062	6.7328	0.665
		10	0.008	-0.076	6.7361	0.750
		11	-0.069	-0.172	7.0061	0.799
		12	0.116	0.011	7.7934	0.801
		13	-0.077	-0.066	8.1553	0.833
		14	0.034	-0.017	8.2281	0.877
		15	0.023	-0.040	8.2625	0.913
		16	-0.249	-0.330	12.544	0.706

Table 5. Normality Test

		t-Statistic	*Prob.**
Augmented Dickey-Fuller test statistic		-8.434686	0.0000
Test critical values:	1% level	-4.297073	
	5% level	-3.212696	
	10% level	-2.747676	

Source : Harga Pangan (modified) (2019)

Possible models that can be used to choose the best model. The ARIMA model can be formed in combination as follows:

a. ARIMA c(4,2,1)
b. ARIMA c(5,2,5)
c. ARIMA c(5,2,12)
d. ARIMA c(10,2,10)
e. ARIMA c(15,2,15)
f. ARIMA c(16,2,16)

The predetermined model will be used for the next step which is diagnostic checking to ensure that the model to be used is free from autocorrelation, homoscedasticity, and normal distribution. Diagnostic checking can be found in the table.

Table 6. Diagnostic Checking ARIMA Model For Curly Chili Price

Model	Normalitas Residual	No Autocorrelation	Homoskedastic
ARIMA c(4,2,1)	√	√	√
ARIMA c(5,2,5)	√	-	√
ARIMA c(10,2,10)	√	-	√
ARIMA c(15,2,15)	√	-	√
ARIMA c(16,2,16)	√	√	√

Source : Harga Pangan (modified) (2019)
Information :
√: Assumption accepted

Based on the results of diagnostic checking, it is known that all the selected models are the best models where all models are homoscedastic, free from autocorrelation, and normally distributed. Therefore to choose the best model, consideration is needed from the values of Adj.R2, R2, SE, SIC, and AIC as shown in table 7.

Table 7. Criteria for Selection of ARIMA Curly Chili Prices

Model	Adj.R^2	R^2	SIC	AIC	SE
ARIMA c(4,2,1)	0,16	0,23	-4,47	-4,64	0,02
ARIMA c(16,2,16)	0,53	0,57	-4,64	-4,63	0,01

Source: Harga Pangan (modified) (2019)

Based on table 5.6. then the best model among the existing models will be obtained by selecting the highest Adj.R2 and R2 values, and the lowest Akaike Info Criterion (AIC), Schwarz Criterion (SIC), and SE values. Can be seen in table 5.6. ARIMA c model (16,2,16) is the best model among the existing models, it is based on the highest Adj.R2 value of 0.53 and the highest R2 of 0.57, and Akaike Info Criterion value (The lowest AIC) is -4.63, the lowest Schwarz Criterion (SIC) is -4.64, and the lowest SE is 0.1, therefore the ARIMA c (16.2,16) model is then used as a model for the forecasting or prediction process of curly red chili prices.

Figure 4. Curly Red Chili Price Graph

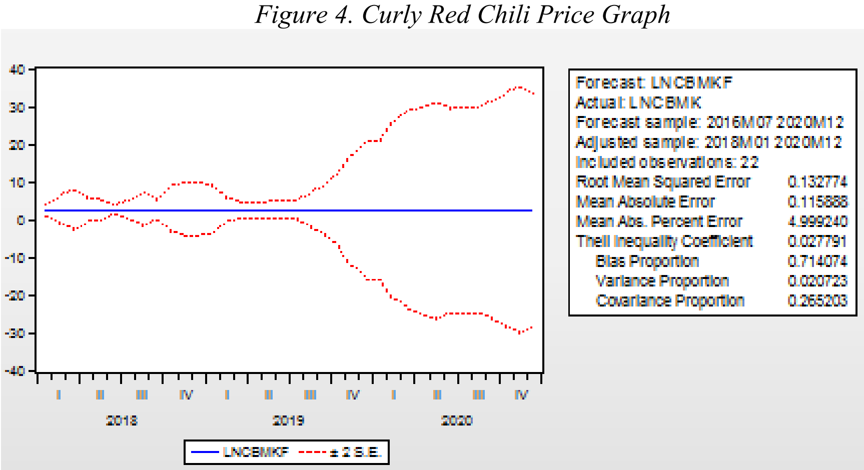


Table 8. Prediction Results of Curly Red Chili Prices with ARIMA c (16,2,16) Dynamic Method

Month	Price of Curly Red Chili (Rupiah)
Jan-18	39.400,00
Feb-18	39.800,00
Mar-18	40.150,00
Apr-18	33.150,00
May-18	27.000,00
Jun-18	26.800,00
Jul-18	26.950,00
Aug-18	25.200,00
Sep-18	20.450,00
Oct-18	30.200,00
Nov-18	25.450,00
Dec-18	24.900,00
Jan-19	23.100,00
Feb-19	18.400,00
Mar-19	17.700,00
Apr-19	18.550,00
May-19	24.850,00
Jun-19	41.100,00
Jul-19	59.050,00
Aug-19	59.850,00
Sep-19	44.900,00
Oct-19	33.650,00
Nov-19	56.507,00
Dec-19	42.938,00
Jan-20	42.636,00
Feb-20	29.169,00
Mar-20	23.577,00
Apr-20	20.647,00
May-20	18.523,00
Jun-20	19.399,00
Jul-20	18.043,00
Aug-20	16.840,00
Sep-20	14.090,00
Oct-20	11.508,00
Nov-20	9.728,00
Dec-20	10.076,00

Source: Harga Pangan (modified) (2019)

4. Conclusion

Forecasting models using ARIMA (Single Moving Average) show that the price of big red chili and curly red chili over the 12 periods has gradually increased and forecast results are close to actual data. The demand for chili trends increase and good planning is needed so that the increase in consumption demand is supported by an increase in production which is predicted to increase higher. Then it is expected that a more stable market price will occur.

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Siem Citrus Commodity Development Strategy in Kerinci Regency, Jambi Province, Indonesia

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Abstract.

This research has the objective of analyzing the revenue generation and strategy development for siem citrus commodity. The study was conducted for eight months from April to November in the two districts in Kerinci Regency, namely Keliling Danau District and Bukit Kerman District. Research data were generated from primary and secondary sources. Primary data were collected using observation, direct interviews, in-depth interviews and Focus Group Discussions (FGD), while secondary data were obtained from related department/agency reports, journals, and other reports related to the research topic. One hundred eighty households served as respondents in the study. The descriptive research design was used with data analyzed using SWOT analysis. The results showed that the average income of siem citrus farmers reached Rp. 64,690,751.55 per year or around Rp. 5,390,895.96 per month. The income obtained by citrus farmers in Kerinci Regency is relatively high compared to other farming income. Based on the SWOT analysis diagram, the development of siem citrus farming is in an aggressive strategy so that the alternative strategy that must be applied is the SO strategy to maintain the quality of products and land fertility by utilizing market opportunities, and take advantage of partner cooperation in the procurement of seeds and yield marketing.

Keywords: aggressive, revenue, siem citrus, strategy, SWOT.

1. Introduction

Citrus plants and tangerines were brought in Indonesia by the Dutch mainly from America and Italy (Anonymous, 2015). One type of citrus growing in Indonesia, particularly in Kerinci Regency in Jambi Province, is *Siem Citrus* (*C. microcarpa L.*). *Siem citrus* is one of the horticultural commodities that has its own added value compared to other commodities, because it is very popular with all levels of society, including children, adolescents, and adult groups.

Siem citrus has the advantage of quite a high production amount, reaching 50-100 kg/tree (Muhammad & Taufik, 2002). This commodity can be easily obtained both from traditional and modern (supermarket and mall) markets. With prices ranging from Rp.10,000 - Rp.12,500 per kilogram, it is very affordable for the middle to lower class groups. In every production process or harvest from 400 trees per hectare and aged 5-10 years, it can generate an income of 120 million/year or around 10 million/month. *Siem citrus* farming is very profitable compared to other crops, but the farmers battle with problems such as limited number of farmers who cultivate the crop, the weak marketing chain, low competitiveness of the commodity both in product development and product quality improvement.

Based on a report from the Jambi Province Department of Food Crop Agriculture in 2015, the three biggest regencies producing *siem citrus* in Jambi Province are Kerinci Regency, Muaro Jambi, and Tanjung Jabung Timur Regency. The districts that have the biggest harvests and total production areas are in Kerinci Regency (Anonymous, 2016). According to the latest data obtained from the Kerinci Regency Department of Food Crop Agriculture, the production centers of *siem citrus* in Kerinci Regency are the districts of Keliling Danau, Danau Kerinci, and Bukit Kerman Districts, with a total production of 981, 1,165 and 1,472 tons, respectively per year (Anonymous, 2015).

According to Kerinci Regency Department of Food Crops and Horticulture (2017) report, the development of *siem citrus* plant in Kerinci district has been running for approximately five years. This research on the analysis of *siem citrus* commodity development strategy aims to generate information and help develop policies, especially agribusiness development policies geared towards the welfare of farmers (Anonymous, 2017). The success of regional development in this sector seems to have given its contribution to the said region under the respective development goals and regional potential. Based on the existing problems in Kerinci Regency, the research objective is to analyze revenues and development strategy of *siem citrus* farming in Kerinci Regency.

2. Method

The study design was *cross-sectional in nature*. The study was conducted in Kerinci Regency and covered two districts namely, Keliling Danau District, and Bukit Kerman District. The research was done in a span of eight calendar months (from April to November) concentrating on research variables such as farming and agribusiness (number of products, quality of products, land area, farmer institutions, and use of rice production infrastructure), institutions and marketing (economic assistance, partnerships, input market access, and output market access), and internal and external variables for the development of the *siem citrus* commodity. Research data came from primary and secondary sources. Primary data were collected using observation, direct interviews, in-*depth interviews* and *Focus Group Discussions* (FGD), while secondary data were obtained from related department/agency reports, journals, and other reports related to the research topic.

The development of the *Siem Citrus* commodity in Kerinci Regency, Jambi Province covers areas that have good agricultural potentials, such as horticulture potential, plantations, food and other agricultural sectors within the Kerinci Regency administrative area. Five district that have potential for horticulture, especially *siem sitrus* are Keliling Danau, Bukit Kerman, Danau Kerinci, Gunung Tujuh, and Kayu Aro District. Using purposive random sampling, the districts of Keliling Danau District and Bukit Kerman District were selected as study areas because they have the highest producers of citrus. Three villages were taken from each district. Utilizing *simple random sampling,* 30 households were selected and served as respondents from each village, for a total of 180 households. Data were analyzed using SWOT approach.

3. Result and Discussion

3.1 Siem Citrus Farming Income and Feasibility

According to Mubyarto (2003), farm income is the revenue reduced by costs incurred in farming and agricultural products marketing. There are three approaches used in income calculation in farming: nominal value, future value, and the present value (Suratiyah, 2011). For the results of this study, the nominal approach was considered. A nominal approach disregards the time *value of money. T*he prevailing price is used so the amount of expenditure and the amount of revenue in a period of the production process can be directly calculated. In this way, farm income can be measured in value by calculating the difference in total revenue and total costs within one year or each cycle of farm production (Soekartawi, 2003).

Data shows that the average income of *siem citrus* farmers reached **Rp. 64,690,751.55** per year or around Rp.5,390,895.96 per month. The income obtained by *siem citrus* farmers in Kerinci Regency is relatively high compared to other farming income (Suandi *et al.*, 2013). Income obtained by citrus farmers in this study area was much higher compared to other citrus farmers, such as the results of Wijaya *et al.* (2015) research with a net income of only Rp.2,422,482.78 per month, Kusumaningrum *et al.* (2018) research with a net income of Rp.2,697,100.75 per month, and Marhawati (2019) research with even smaller income of only Rp 2,345,160.75 per month.

The analysis presented in Table 1 showed that siem citrus farming in Kerinci Regency was very feasible because the R / C ratio > 1. This value indicates that the level of revenue is greater than the cost of managing a siem citrus farm. Other results, where the value of π / C ratio = 25.3 percent. This figure is greater than the current bank interest of 14%, which means that it is feasible. Thus, it can be interpreted that the borrowed capital provides more benefits because the ratio between profits is greater than the total costs incurred during the venture.

The results of this study were in line with research by Wanda & Akbar (2015) which states that farming of siem citrus is very feasible. The results of the calculation of the level of efficiency in Wanda & Akbar research (2015) showed that *siem citrus* farming is very promising with an R / C Ratio of 3.35, which is higher than those from lowland rice farming with an R / C Ratio of just 2.14. Other studies have also shown significant results, such as the one carried out by Zuraida (2012). Citrus farming on tidal land is very feasible as indicated by an R / C Ratio of 3.1, while tidal land paddy farming only has 2.3. The results of this study are further supported by Supriadi's research (2017) stating that farming of siem citrus is very profitable and therefore feasible because it has a profitability value which is higher than bank interest rate of 10.5%.

Table 1: Profitability Analysis of Siem Citrus Farming

No.	Description of Usefulness	Volume	Prices (Rp/unit)	Values (Rp.)
1	Productions	8,982.40	10,000.00	89,824,000.00
2	*Cost incurred*			
	a. Cost of Production Facilities			16,643,785.00
	b. Labor costs			2,856,974.45
	c. Other costs			5,632,489.00
Total Costs				**25,133,248.45**
Net Income (revenues-costs)				**64,690,751.55**
R/C (revenues/costs)(Feasibility)				**3.57**
π/C Ratio				**25.30**

3.2 Strategy for Developing Siem Citrus Commodities

The SWOT approach was used in the strategy development for *siem citrus* commodity in Kerinci Regency. **SWOT** (acronym in English of strengths, weaknesses, opportunities, and threats) is a method of strategic planning used to evaluate the strengths, weaknesses, opportunities, and threats in a project or business speculation (Rangkuti, 2015).

As an analytical tool, SWOT is an important strategic planning tool to help the planner compare internal organizational strengths and weaknesses with the external opportunities and threats (Kurtz: Suandi *et al.* 2019). In other words, the analysis of SWOT needs to be done in company planning to achieve the "fit" between internal resources and external situations of the company. Successful matching will maximize the company's strengths and opportunities and minimize the weaknesses and threats (Pearce & Robinson: Suandi *et al.*, 2019).

Results show that internal and external indicators were closely related. As shown in Table 2 and Table 3, IFAS and EFAS strategies were interrelated. In the IFAS Table (Table 2), it shows that the most significant strengths are the citrus fruit quality and land suitability. Field observations show that the quality of citrus fruits is unique and sweet because *siem citrus* in Kerinci Regency come from good varieties. The quality of the fruit according to the studies of Rahayu (2014) and Nawaz *et al.* (2018) is one of the critical factors that influence consumer patronage, especially when the fruit is suitable to their personal taste. Consumers prefer the distinctive bitter-sweet flavor. The mix of bitter, sweet and fresh flavors is in high demand by the people of Indonesia.

The most notable weaknesses were insufficiency of capital and inability to manage pest and disease attacks. As discovered by Ichsan & Prayuginingsih in their study in 2016, one of the challenges in developing the competitiveness of Indonesia n oranges is the limited capital. Considering the development of siem citrus or horticultural commodities generally have limitations or weaknesses in maintaining fruit quality and added value. This finding is consistent with the results of the research of Kongai *and associates* in 2018 stating that the weakness factors of the supply of siem citrus is quality planting materials, processing for value addition, and establishment of commodity innovation platforms. The overall score for the strength factors is 3.19, while the weaknesses scored an overall weighted rating of 1.70, resulting to a positive axis point of 1.49.

Table 2. Internal Strategic Factor Analysis Summary (IFAS) Matrix on the Development of Siem Citrus Commodities, 2018

No.	Internal factors	Weight	Rating	Weighted Rating
	Strenghts			
1	Citrus fruit quality	0.24	3	0.72
2	Land Suitability	0.23	3	0.69
3	Access to Production Facilities	0.22	2	0.44
4	Prodution center area	0.19	2	0.38
5	Farmers' Institution	0.18	2	0.36
6	Labor Availability	0.18	2	0.36
7	Product Durability	0.12	2	0.24
	Strength Score			**3.19**
	Weaknesses	**Weight**	**Rating**	**Weighted Rating**
1	Capital availability	0.16	3	0.48
2	Land availability	0.16	3	0.32
3	Pest and diseases attack	0.14	3	0.24
4	Post-harvest	0.12	2	0.24
5	Human Resources	0.12	2	0.24
	Weakness Score			**1.70**

Other strength factors that were not so important were in the areas of production centers, farmer institutions, labor availability, and access to production facilities, while human resources and post-harvest were the weakness factors which were given low weights. The results of this study are in line with the research of Usman *et al.* (2018), citrus production in Pakistan's Punjab is limited because it is affected by a lack of human resources.

Apart from internal factors, there were external factors that also influence the citrus farming activities, the weight and rating values of which were shown in the EFAS matrix in Table 3. There were many opportunities for the development and marketing of *siem citrus* in the research area. The interview with the farmers revealed that the foremost opportunities that can be explored for the further development of citrus commodities include price and market availability. These results were in line with research findings of Mutiara & Nurhantanto (2016) and Dien & Dao (2018) declaring that the bright prospects in marketing orange products are price, demand, and market factors. Especially the price factor has an important role as an opportunity factor in the development of siem citrus.

Kerinci's *siem citrus* were not only distributed in the local markets in the area. The products have also been sold in other available regional markets such as Jambi City, Padang, West Sumatra, and even Jakarta. This finding affirms Rahayu's (2014) research result stating that an external factor that can be utilized as an opportunity in marketing horticultural fruits is the opening of significant market. Citrus farmers in Kerinci Regency have many partners both in the procurement of seeds and result marketing. Citrus farmer partners are scattered in Pekan Baru, Padang, and there are even partners in the city of Medan. The results of this study are in line with research by Purnama *et al.* (2014) that the marketing strategy of Indonesian mangoes in the international market, one of which is determined by the factor of collaboration between farmers and entrepreneurs / exporters. Another very promising factor for the development of siem citrus is technology. Although citrus farmers do not have high education, but they have skills in managing the *siem citrus* business. Another opportunity factor that is no less important is the relationship/partner factor.

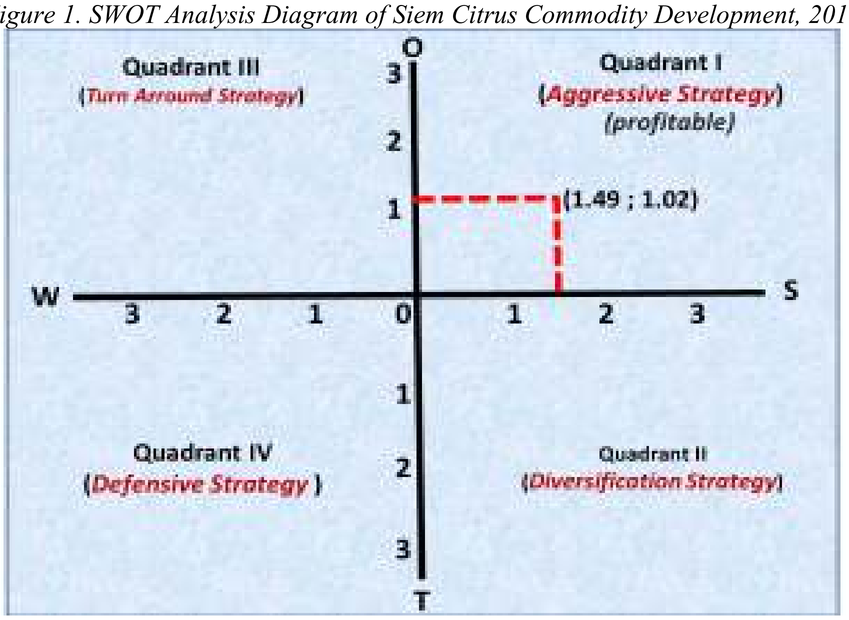
Table 3: External Strategic Factor Analysis Summary (EFAS) Matrix on the Development of Siem Citrus Commodities, 2018

No.	External Factors	Weight	Rating	Weighted Rating
	Opportunities	(1)	(2)	(3)
1	Price	0.22	3	0.66
2	Market availability	0.21	3	0.63
3	Seedling availability	0.21	3	0.42
4	Partner collaboration	0.19	2	0.38
5	Government policy	0.18	2	0.36
6	Technology	0.18	2	0.36
	Opportunity Score			**2.81**
	Threats	**Weight**	**Rating**	**Weighted Rating**
1	Variable cost	0.19	3	0.57
2	Continuity of siem citrus	0.18	2	0.36
3	Agricultural counseling	0.15	2	0.30
4	Climate Change	0.14	2	0.28
5	Competitiveness	0.14	2	0.28
	Threat Score			**1.79**

However, there were various threats in the development of the *siem citrus* commodity in the research locality. Threats are conditions that can interfere with the development and marketing of *siem citrus* in the future. As expressed by farmers, the *main threats so far in the development of siem citrus include the variable cost and continuity of citrus fruit.*. Based on the opportunity and threat factors condition that occurs, the determination of the development and marketing position of *siem citrus* in Kerinci Regency can also take account the weighted value determination of the opportunity and threat factor.

Processed results and data analysis obtained a weighted value of the opportunity factor equivalent to 2.81, the threat factor of 1.79 with a positive axis point of 1.02 (Table 3). Thus, the opportunity factor in the development and marketing of the production of *siem citrus* in Kerinci Regency is more dominant than the existing threats, hence the development and marketing of *siem citrus* is possible in the future. Through the results of the weighted value difference, the position of the development and marketing of siem citrus can be seen described in the SWOT analysis diagram (Figure 1).

Figure 1. SWOT Analysis Diagram of Siem Citrus Commodity Development, 2018



Based on the SWOT analysis diagram (Figure 1), it can be seen that the position of the development and marketing of *siem citrus* in Kerinci Regency is located in Quadrant I, which falls in the area of aggressive strategy. According to Rangkuti (2015) this position is a very favorable situation since the development and marketing of siem citrus have strengths and opportunities that can be utilized. The strategy that can be applied in these conditions is an aggressive growth policy (growth-oriented strategy) or aggressive strategy (aggressive strategy).

Based on the position held, the strategy adopted in the development and marketing of *siem citrus* in Kerinci Regency is aggressive. Based on the SWOT matrix (Table 2 and Table 3), the choice of strategy used is the SO strategy in which this strategy optimizes strength so that the opportunities can be utilized, namely by maintaining the quality of *siem citrus*, flavors, increasing the role of farmer institutions in procurement seeds and marketing results by utilizing available market opportunities. *Siem citrus* found in Kerinci Regency has a unique and specific flavor compared to the other *siem citrus*. With the existence of these advantages, then the flavor of *siem citrus* needs to be maintained so that consumers are satisfied to consume it directly and these advantages can be exploited with the opening of existing market opportunities. The recommendation is in line with Rahayu's (2014) findings that maintaining quality needs to be done to expand market share by utilizing the increasing number of consumers.

The role of farmer institutions is not only in following the seed procurement cooperation activities but also as a provider of production facilities, providers of farming equipment and machinery, providers of capital and also as a marketing unit. This is in line with Anantanyu’s (2011), Fitri's (2013) Astoko’s (2014), Olife’s *et al* (2015) research which recommend that coaching and learning to the Farmers Group Association (*Gapoktan*) to be able to function not only as a production unit, but also as a provider of production facilities, providers of farming equipment and machinery, development of citrus value chain, providers of capital and also as a marketing unit. Another essential strategy is to follow government policies in subsidies on inputs; promoting and facilitating *siem citrus* as alternative livelihoods for rice farmers and cinnamon and coffee farmers (Usman *et al.* 2018). Promotional activities are essential to the progress of farming. As expressed by Riyono (2016), promotion is a product introduction activity to the public (consumers) which aims to increase marketing location and demand. Then, use partner collaboration as a means of providing seeds and marketing results. Kerinci’s typical *siem citrus* has good quality compared to others in Indonesia.

4. Conclusion

The average income of *siem citrus* farmers reached Rp. 64,690,751.55 per year or around Rp. 5,390,895.96 per month. The income obtained by citrus farmers in Kerinci Regency is relatively high compared to other farming income. Based on the results, it was found out that the internal factors which became the strengths in the development of the commodity include the quality of *siem citrus*, access to production facilities, farmer institutions, product durability, and land suitability, while the weaknesses are pests and disease attack, land availability, post-harvest, and capital availability. External factors that became opportunities were market availability, technology, partner cooperation, and prices, while the threats are variable cost and continuity of *siem citrus*. Based on the SWOT analysis diagram, the development of *siem citrus* farming is in an aggressive strategy so that the alternative strategy that must be applied is the SO strategy to maintain the quality of products and land fertility by utilizing market opportunities, and take advantage of partner cooperation in the procurement of seeds and yield marketing.

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Analysis of Clove Agroindustry in Indonesia As an Alternative Green Industry

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Abstract.

Indonesia is one of main clove producers in the world. The majority of Indonesian clove is cultivated by small farmers. For many decades, majority of the clove production is used as main ingredient of the *kretek* cigarette industry. Therefore, the development of clove plant depends on cigarette production. To anticipate the decline in demand of clove in the future caused by the decreasing demand for cigarettes and to keep the Indonesian clove industry alive, there is a need to establish an alternative industry beside cigarette industry. This paper aims to analyze the policies related to clove, as well as the opportunities and challenges of alternative clove industries. This research is based on literature study and policies. The results of the study indicated that in the future, the development of other clove processing industries such as essential oil is very potential. All this time, the policies that related to cloves focus on the needs of clove as raw material of cigarette industries rather than on the need of alternative clove industries. Therefore, the development of other clove processing industries has to receive serious attention from the government both upstream and downstream sectors. The development of processed clove agro-industry is expected to encourage green industry and increase Indonesian clove exports and the clove farmers income.

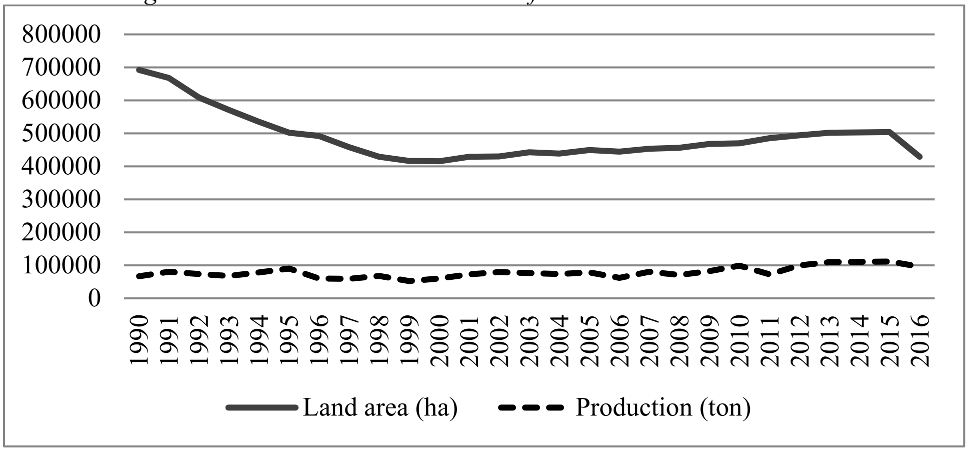
Keywords: clove, agro-industry.

1. Introduction

Indonesia is one of main clove (Syzygium aromaticum, syn Eugenia aromaticum) producers in the world. The main product of the clove plant is the flower that is harvested when it is still in buds. Indonesia usually exports the flowers in dried form. Clove is very important for Indonesian farmers because majority of clove (98%) is cultivated by small farmers [Ditjenbun, 2016]. The major areas of clove production in Indonesia are in Sulawesi, Maluku and a part of Java island.

Since 1996, clove production tend to decline because of the price uncertainty. This is brought about by the farmers' reluctance to maintain their plants, making them susceptible to pests and diseases (Agrofarm, 2013). According to Chief of Directorate General of Estates in Agrofarm (2013), among the problems of clove estate are old plants, spoiled plants, and clove diseases. In addition, the climate change, limited infrastructures, limitation of seed quality, poor quality of human resources, and farmer institutions likewise brought difficulties in increasing clove productivity. The effort to push production such as intentification, diversification and replanting policies in 2007 and also in 2018 not gave significant increase on clove production. Therefore, production of clove tend to be stable for more than two decades. Areas planted with clove also decreased since 1900 and reached at the lowest level in 2000 (Figure 1).

Figure 1. Land area and Production of Clove in Indonesia 1990-2016



Source: Directorate General of Estate (2016)

Clove production has a periodic production cycle of 4 years that is marked by a large harvest, a small harvest, and a big harvest. High production in a particular year will be followed by a decline in production in the next 1-2 years. Therefore, the production or supply of clove fluctuates. This made a big gap in price and profit of cloves in different years such as in North Sulawesi (Sondakh et.al.,2018).

Dried clove is a main ingredient for the Indonesian *kretek* cigarette or clove cigarette. The absorption of these industries reached 80-90%, meanwhile the rest only 10-20% consumed by other industries (*Infotek Perkebunan*, 2012 and *Pusat Data dan Sistem Informasi Pertanian*, 2014). Government revenues from the excise tax of cigarette industries also reached almost 147.72 billion in 2017 (Directorate General of Customs and Excise. 2017). Therefore, the government try to support clove cigarette industry through the policy related to clove. This policy support the availability of cigarette industries included clove as raw material.

One of industry made from raw materials clove product is clove oil. It can be made from the flower, stem, and leaf. Clove oil is one of essential oils that can be obtained from clove plant (Eugenia caryophyllata Thunb). This oil can be utilized by health, food, cosmetics, and waste treatment industries. However, all this time the essential clove oil for domestic consumption is still imported from other countries. Therefore, this agroindustry has a very high potential aside from the cigarette industry.

This research aims to analyze the policies related to clove, as well as the opportunities and challenges of alternative clove industries to be able to develop another Indonesian green-industry in the future such as clove oil industries. The results of this study are useful in describing the performance of Indonesian clove industry in the last decade, hoping to develop policies that will keep the industry alive.

Some researches related to clove oil business as agroindustry have been done by Khozali et.al (2012) in Central Java, and Arizona and Lamusa (2016) in Central Sulawesi. They found out that clove oil agroindustry provided additional income for the farmers. The said oil was sourced out from the leaves and flowers. These researches have also revealed that there was a difference in the production of clove oil between rainy season and dry season. Dry season is more favorable than rainy season in terms of clove oil production.

2. Methodology

This research utilized literatures and studies related to clove's agroindustry, as well as some policies from the last decades. The the results of several studies and the government policies related to clove are expected to illustrate the condition of the clove oil industry in terms of the business feasibility and constrains in Indonesia and find the policy solution.

3. Results and Discussion

3.1. Policies Related to Clove Agroindustry

There are many policies that have been made by the Indonesian government that has already implemented related to clove. But, there were no specific policies made for clove agroindustries.

Table 1. The Policies Related to Clove from 1996 to 2017

No	Rule/ Decision number	Contents
1	Minister of Finance Decree (KMK) 1996-1999	Establish excise tax rates and basic prices of tobacco products
2	Minister of Finance Decree (KMK) 2000-2017	Establish excise tariffs and limits on retail prices of tobacco products domestic
3	Government regulation (PP) No 109 2012	Safeguarding ingredients containing addictive substances such as tobacco products for health
4	Minister of Industry and Trade Decree No 528/ MPP/2002	Import of clove may only be done by licensed importers
5	Minister of Finance Regulation No. 84/PMK.07/2008	Utilization of Tobacco Excise Profit Sharing Funds (DBH-CHT)
6	Regulation of the Minister of Industry No. 117/M-IND/Per/10/2009	Road Map of Clusters Development of Tobacco Product Industry
7	Regulation of the Minister of Industry No. 63/M-IND/Per/8/2015	Revoke Regulation of the Minister of Industry No. 117 of 2009 and establish Road Map for Industrial Production of Tobacco in 2015-2020
8	Rules of trade ministry No. 75/M-DAG/Per/9/2015	Revoke Minister of Industry and Trade Decree No. 528 / MPP / 2002
9	Minister of Finance Regulation No. 6/PMK.010/2017	Establish tobacco import tariffs at five percent
10	Rules of Trade Ministry No. 84/Permendag/2017	Tobacco import provisions, restrictions on tobacco imports, especially Virginia, Burley and Oriental types

Source: Suprihanti et al, 2019

Majority of policies related to tobacco products such as cigarettes industry, which clove included as an ingredient on it (Table 1). Most of the policies related to cigarettes industry are in the form of excise tax, considering the important role of cigarettes in generating excise taxes for state revenues, farmers' welfare, and condition economics. The policies always changed and the amount of excise tax tends to increase every year. This aims to reduce the consumption of cigarette for health concerns. From 2009 to 2017, there were 23 policies related to excise tax for tobacco industry indirectly related to clove. Meanwhile, only 2 (two) policies were directly affecting clove products, and 2 (two) rules of tobacco import.

The policy regarding the importation of clove in 2002 ruled that it can only be carried out by licensed importers approved by the government. In its development this policy was later revoked because it had a serious impact on clove prices on farmers level (Suprihanti, 2019). Such policy made the clove price to go down sharply (Simatupang, 2003), and it also negatively affected the clove farmers' welfare (Suprihanti et.al, 2018a). The importation policy significantly influenced domestic supply of clove, and impact on clove price in the domestic market and the clove price in farmers' level.

3.2. The Opportunities and Challenges of Clove industry

One of the clove agroindustries that has a very high potential is clove oil. Clove oil can be obtained from its flowers and stems. One way to increase the added value of clove from leaf oil is by producing isolates from clove leaf oil, eugenol or its derivatives include iso-eugenol and vanillin (Yuliani, 2007). Eugenol is widely used in the food industry for fragrance and preservatives pharmaceutical industry for dental treatment. The need for eugenol for pharmaceuticals as preparations for dental treatment is still depending on imported products while those from within the country are increasingly rare was found. The quality of clove leaf oil is only slightly lower compared to flower oil or stem oil. Comparison of eugenol levels in clove oil extracted from the parts of clove were presented in Table 2.

Table 2. Comparison of eugenol levels in clove oil based on the parts of the clove plant

The sources of clove oil	Eugenol level
Flower	90 – 95 %
Stem	83 – 95 %
Leaf	82 – 87 %

Source: (Guenther, 1990)

In Indonesia, majority of the dried clove flowers were bought by the players of the cigarette industry and used as material in *kretek* cigarette. The rest of clove (stem and leaf) are sold as the main material for clove oil and can give added value for the farmers. Tropical plant research center stated that Java Island has extensive clove cultivation the area reaches ± 50,000 ha, it is estimated that it has the potential of deciduous clove leaves ± 305 tons per day or equivalent to 4.4 tons of clove leaf oil per day (Yuliani, 2007).

The production of clove oil from the leaves depends on the season. Dry season producing higher volumes of clove oil than the rainy season, thus affecting farmers profits. This is consistent with the result of some researches conducted by Khozali et.al (2012), Ronald et al (2015), and Arizona and Lamusa (2016), which showed that the clove oil agroindustries in dry season were more feasible than in rainy season. This is also in accordance with researchs that have been done in Indonesia that can be seen in Table 3 as follows.

Table 3. Some researches on Clove Oil Feasibility in Indonesia

Years	Location	Results
2016	North Sulawesi	Factory capacity Rp. 863.132.800,-. Investment capital returns in 0,63 year or 7,56 month with Break Even Point (BEP) reached 10.515,2 kg/year. The revenue at the end of the project amount Rp. 13.181.990.610,- Feasibility analysis indicated that NPV (Net Present Value) Rp. 5.353.342.926,- (more than zero), IRR (Interest Rate of Return) more than valid interest rate (18%) about 49.2 % and Benefit/Cost ratio (B/C ratio) was about 1.66 (more than 1). It means that the development of oil destilation project in Nort Sulawesi was feasible

2016	Donggala, central Sulawesi province	The monthy average income of clove leaf oil household industry during 5-month production process in Palau village was about Rp. 5.450.654. Average production of clove oil was about 287,8 kg monthly. In March (dry season), the income reached about Rp.27.253.270 and the lowest income in May (rainy season) Rp.1.675.854.
2012	Sub-District of Sukorejo, Kendal District, Central Java	Income of oil refinery in dry season as much as Rp 182.583,- each process. Meanwhile, in wet season the refiner losed about Rp 38.498,- /unit destilation. In dry season BEP of clove oil production about 16,21 Kg or BEP in rupiah about Rp 78.392,- /kg with gross B/C ratio as much as 1,13 for feasible project. Meanwhile in rainy season, BEP production of clove oil refinery abour 7,75 kg or BEP rupiah as many as Rp 93.264,- /kg and gross B/C ratio about 0,94. Therefore, this project was not feasible in rainy season.
2013	South Sulawesi Province	The highly suitable area or S1 land has a potential net profit Rp 26.841.000/ha, IRR about 30,1%, and B/C about 2,16. The moderately suitable area or S2 created potential profit Rp 16.864.000/ha, IRR as much as 24,0%, and IRR about 1,73. The marginally suitable or S3 has potential profit Rp 2.723.000/ha with IRR as much as 5,9%, and B/C 1,12.
2014	Luwu District, South Sulawesi	Clove oil indutry in interest rate 18% gave B/C 1,26 and IRR 23%
2005	Karanganyar, Central Java	Level profit of clove oil industry as much as 27,67 %. Coefisien variation (CV) about 1,10 and in one processed possible loss as much as Rp 99.457,- per unit refinery . The calue of R/C from the refinery was 1,28 indicated that this refinery was efficient.
2005	Indonesia, *Balitbangtan*	Oil refining industry business at an interest rate of 18% provided B/C 1.26 and IRR of 23%

Some researchs shown in Table 3 indicated that clove oil agroindustry in North and South Sulawesi and Indonesia in general were feasible if viewed from the side feasibility indicators namely NPV, IRR and B/C. Besides, clove oil household industry gave significant additional income especially in dry season for the farmers in Sulawesi and central Java. This oil refining industries were increasingly feasible in areas that have high land suitability for clove and profitable in dry season. It caused by the production of leaves in dry season is higher than wet seasons. Therefore, the production of clove oil will increase significantly.

3.3 Indonesian Clove and the Problems of Clove Agroindustry

Indonesian clove facing problems both upstream and downstream sectors. In upsteam sector, clove productivity in Indonesia is still low because the use of superior plant material is still limited, cultivation technology applied has not followed the advice, the plant is old (over 15 years) and the attack of pests and diseases. If the plant left without maintenance and replanting, it can be feared that the existence of clove in Indonesia will gradually disappear. It will become worse cause Indonesia will lack of domestic supply of clove as raw material of cigarette industry and others. Eventually domestic needs of clove will be met from imports.

Some efforts has been done to repair and maintenance of clove plantations for garden conditions where most plant conditions are still good (minimum 75%). Plant rehabilitation is like an intensification program but only a small part of the plant's condition is still good (minimum 40%) and it is still possible to improve its condition. To support development, it is necessary to pay attention to the land and climate conditions needed by clove plants. Clove development should be directed towards areas that are suitable for growing requirements. Land suitability and climate maps can be used as a guide in direction plants should be developed.

In addition, the effect of season on clove made it worse. This is a major obstacle in the development of cloves in Indonesia. Thus, the government has given subsidies to increase clove production. Plant seeds are also provided to encourage replanting in main areas of clove production with clove seeds that have proven their resistance in the area. Potential locations for clove production in Indonesia must also be identified to increase production of clove and clove oil, and further increase the farmers' and refiners' profits.

In downstream sector, the development of clove-based industry in Indonesia is still constrained by many technical factors and problems, among them are:

1. The processing of clove (or distillation process) depends on the supply of both raw materials and clove itself. In rainy season, it is very hard to collect the raw materials in right amounts and the refinery can only process if the raw materials are sufficient for one process. If the raw materials are enough or more than sufficient, the processing can be done twice a day. The processing will take about 10 hours each. When the raw materials are difficult to find, the refiner has to collect leaves from different locations, making it inefficient.
2. There is a small scale and limited technology for clove oil distillation in the region. This leads to a quality for clove oil below the standard (Widayat, 2013) and affects the price of clove oil.
3. The prices of materials such as stem and leaves are also very low. This significantly affects the desire of the farmers to plant and produce clove and ultimately the sustainability of clove oil in Indonesia. In Java, some farmers have already turned into other plants.

From this condition, we can see clove agro-industry is difficult to develop, although the added value generated is quite high if it applied with good management. There is a lack of development of clove industry because there is no specific policy on clove from upstream to downstream.

The dependency of clove on cigarette industry impacted on the slow development of clove production. If the production of cigarettes will decline in the future, that will affect the demand for clove. Therefore, there is a need to develop other clove agroindustries to reduce dependency on the cigarette industry. In the case of Tanzania, the goverment has committed on developing the clove industry through policy and law reforms. The initiatives included supporting cloves purchase from the farmers, exports and production of essential oils, and increase in production and prices (Suprihanti et al, 2018a).

In the case of Indonesia, the same commitment can be applied in clove agroindustry development from upstream to downstream. The clove policy must take into account clove agroindustry development. The government has to support the development of Indonesian clove products such as essensial oils and preservatives in order to increase the demand in the future. So, the dependency of farmers on the clove cigarette industry can be minimized and the farmers' socio economic status will be further improved.

4. Conclusion

The results of the study indicated that in the future, the development of other clove processing industries such as essential oil is very potential. All this time, the policies that related to cloves focus on the needs of clove as raw material of cigarette industries rather than on the need of alternative clove industries. Therefore, the development of other clove processing industries has to receive serious attention from the government both upstream and downstream sectors. The development of processed clove agro-industry is expected to encourage green industry and increase Indonesian clove exports and the clove farmers income.

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Farmers Adoption on Watermelon Cultivation in Coastal Areas Purworejo District, Central Java

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Abstract.

This research was conducted in Purworejo Regency. Total respondents are 60 people in the Grabag Subdistrict, Ngombol Subdistrict, and Purwodadi Subdistrict. The technique sampling used purposive sampling. The purposes of this research were 1. To determine the characteristics of farmers on watermelon cultivation in coastal areas, Purworejo Regency. 2. To determine the farmer adoption on watermelon cultivation in coastal areas, Purworejo Regency. The results of the research show that the farmer characteristics on watermelon cultivation in the coastal areas, Purworejo Regency that are the age of a farmer was a productive age, farmer education was a junior high school, farmer experience level about 3-16 years, the land cultivation of watermelon farmer about 5000 m2, the status of the ownership of the land was rented, the technique cultivation of watermelon was easy, and the infrastructure facilities for watermelon cultivation was easy. 2. The farmers adoption on watermelon cultivation is low.

Keywords: adoption, watermelon, sandy areas, purworejo, jawa tengah

1. Introduction

The availability of agricultural land decreasing by land function from agricultural sector to non-agricultural sector. One of the efforts to overcome the limitations of agricultural land use an alternative land of coastal sandy Land (Rajiman, 2014). Sandy land is one of the assets that is expected to be developed into a productive agricultural land. Coastal sandy land has advantages, namely: a) expand, B) flat, C) free of flood, d) abundant sunlight, e) shallow ground water, f) soil pH and neutral water and g) easy land processing (Rajiman, 2014).

As well as in the region of Purworejo Regency that the mapping of plant commodities increasingly visible. Paddy fields located in lowland are used to commodity crops such as rice, corn, and soy bean. Then the plateau is used for the types of crops such as teak trees, albasia, mahogany, coconut, clove, chocolate, durian, and some kind of *empon-empon* plants. Then for land in the coastal areas need to be consistently developed vegetable and fruit crops to meet the needs of the regional and outside the area as well as support the mapping of commodities in Purworejo District.

Coastal sandy land that has low productivity due to several limiting factors in the form of supporting and storing low water, high infiltration and evaporation, fertility and very low organic matter and efficiency Low water use (Kertonegoro, 2001; Al-Omran, et al., 2004 in Barus, DKK., 2013).

But the obstacles in the utilization of coastal sand land is the coastal sand land dominated by the sand fraction (> 95%) While the dust fraction and the throw is very low causing coastal sand land has high water power (Istiyanti, et al., 2015).

Watermelon is a type of horticultural crop that is suitable for planting on sandy land in coastal areas. To cultivate watermelon crops also not too difficult. In addition, watermelon plants are a type of fruit that is attracted by consumers both from within and outside Purworejo Regency. These watermelon plants are found in many markets, supermarkets can even be processed products such as syrup, fruit chips, juice packaging, ice cream and food taste. The focus of this research is how farmers adopt the watermelon in the coastal sand of Purworejo Regency. The adoption of innovation is a process by farmers to understand an innovation that will eventually be rejected or applied to such innovations (Mosher, 1978 in Valera, et al., 1987).

According to Leeuwis and Van den Ban (1988), the stage of decision making of the adoption process are:

1. Awareness: knowing/Realizing the existence of an innovation.
2. Interest: Collecting as much information about the innovation as possible.
3. Evaluation: Assessing benefits and Unfortune.
4. Trial/Try: Try the innovation.
5. Adoption/Acceptance: Implementing Innovations.

For the adoption of adopters, it classified into 5 categories namely innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%), and laggards (16%).

The purposes of this research are:

1. To determine of the farmers characteristics on the cultivation of watermelon crops in coastal areas, Purworejo Regency, Central Java.
2. To determine of farmers adoption on watermelon cultivation in coastal areas, Purworejo Regency, Central Java.

2. Research Method

The method of research is descriptive analysis by survey. It can be said that survey research that take samples from one population and use questionnaires as a fundamental data collection. Survey research can be used for the purpose of (1) exploratory research, (2) descriptive, (3) explanatory or confirmatory, namely to explain causal relationship and hypothesis testing, (4) evaluation, (5) predictions or predicting certain events in the future, (6) Operational research, and (7) the development of social indicators (Singarimbun and Effendi, 1989). In this research that used as a staple research is descriptive analysis.

This research is done in the coastal areas, Purworejo Regency, Central Java with the focus on watermelon commodities. Sampling is conducted in three sub-districts in Purworejo District that are Purwodadi Sub-Districts, Ngombol Sub-Districts, and Grabag Sub-Districts.

Total respondents were taken in this study are 60 farmers. Farmers who are taken are farmers who cultivate watermelon comodities in the coastal areas in Purworejo Regency.

The supporting data used is secondary and primary Data. Secondary data in the form of supporting data from libraries, *Badan Pusat Statistik* (BPS), literatures, etc. While, primary data is taken using questionnaires with direct indepth interview with sample.

3. Results And Discussion

3.1. Respondent characteristics

3.1.1. Age

Age is a number of years used to calculate the length of a person's life calculated from birth to now in the unit of years. Age is divided into 3 namely unproductive age, productive age, and non productive age. The unproductive age ranges from 0-14 years old, where the age is age when a person is active in a compulsory period of study. For a productive age ranging from 15-64 years, where the age is a person's productive age. As for age ranged > 64 year is an non productive age.

Table 1. Age Level of Farmer Watermelon Comodities in Coastal Areas, Purworejo Regency

Level of age	Total (population)	Percentage (%)
Non productive (0-14)	0	0
Productive (15-64)	60	100
Unproductive (> 64)	0	0
Total	60	100

Source: Primary Data (2019)

In table 1. shows that the age of farmer was classified as a productive age of 100%. It means that the age of farmers' watermelon in coastal areas, Purworejo Regency, Central Jawa was productive age.

3.1.2. Education level

The level of education is the length of formal education pursued by farmers' watermelon in the coastal areas of Purworejo Regency, Central Java. The level of education is Elementary School, Secondary School, High School, Diploma, and Graduate.

Table 2. The Education Level of Farmers' Watermelon in Coastal Areas, Purworejo Regency

Education level	Total (population)	Persentase (%)
Elementary School	13	13
Secondary School	34	56,67
High School	13	13
Diploma	0	0
Graduate	0	0
Total	60	100

Source: Primary Data (2019)

Based on the table 2. can be known that the majority of the level of Farmers education watermelon in Purworejo Regency, Central Java coastal areas was 56.67% Secondary School, then for the education level of Elementary School and High School were 13% respectively. This shows that the watermelon farmer in the coastal areas of Purworejo Regency, Central Java has been implementing compulsory study for 9 years.

3.1.3. Experience Level

The level of experience shows the skills owned by the watermelon farmer in the coastal areas of Purworejo Regency, Central Java. The longer farmers do their farming in watermelon cultivation in the coastal areas of Purworejo Regency, Central Java there will be more experienced farmers in cultivating crops in the coastal areas of Purworejo Regency, Central java.

Table 3. The Experience Level of Farmer Watermelon Comodities in Coastal Areas, Purworejo Regency

Experience level	Total (Population)	Persentase (%)
3-16	49	81,67
17-30	10	16,67
31-44	1	1,67
Total	60	100,00

Source: Primary Data (2019)

Table 3. Shows that the experience of watermelon farming in the coastal areas of Purworejo Regency ranges from 3-16 years was 81.67%. Then there are also farmers in the coastal areas that has been cultivating a range of 17-30 years, which was 16.67%, the remain was 1.67% with the number of farmers experience very long. This shows that the farmers' watermelon has had sufficient experience in cultivating watermelon crops in the coastal areas of Purworejo Regency, Central Java.

3.1.4. Land Size

The level of experience shows the skills owned by the farmers' watermelon in the coastal areas of Purworejo Regency, Central Java. The longer farmers their farming the longer experienced farmers in cultivating watermelon crops in the coastal areas of Purworejo Regency, Central Java.

Table 4. Land Level of Farmer Watermelon in Coastal Areas, Purworejo Regency

Level of land (ha)	Total (Population)	percentage (%)
0,5	25	41,67
1	23	38,33
1,5	6	10
2	6	10
Total	60	100

Source: Primary Data (2019)

Based on the table 4. Shows that the area of the watermelon farmer in Purworejo Regency was 0.5 ha with the percentage 41.67%. Then followed by 1 Ha land area with the percentage 38.33%, and land area of 1.5 ha with the percentage 10%, and 2 ha of land areas with the percentage 10%.

3.1.5. Land Tenure Status

Table 5. The Land Status of Farmer Watermelon Comodities in Coastal Areas, Purworejo Regency

Land Tenure Status	Total (Population)	percentage (%)
Own Land	19	31,67
Profit Sharing *sakap*	6	10
Rented	35	58,33
Total	60	100

Source: Primary Data (2019)

Based on the table 5. Shows that the status of the ownership of the farmer's land on coastal areas were the status of rented land with the percentage 58.33%, then the status of own land about 31.67%, and the profit sharing or *sakap* was 10%. This shows many farmers who rented sand land and cultivate in coastal for watermelon production are dominant.

3.1.6. Facilities

Table 6. Level of Facilities for Watermelon Farmers in Coastal Areas, Purworejo District

Facilities	Total (Population)	percentage (%)
Easy	59	98,33
Difficult	1	1,67
Total	60	100

Source: Primary Data (2019)

Based on the table 6. The level of infrastructure facilities of watermelon farmers in Purworejo Regency is easy with a percentage of 98.33% and difficult categories with the percentage are 1.67%. This shows that watermelon cultivation used to easy facilities to imcreasing watermelon product and the facilities can be used daily and the other crops.

3.1.7. Cultivation Facilities

Table 7. The Cultivation Level of Watermelon Farmers in Coastal Areas, Purworejo Regency

Cultivation	Total (Population)	percentage (%)
Easy	37	61,67
Difficult	23	38,33
Total	60	100

Source: Primary Data (2019)

Based on the table 7. Show that the ease of cultivation of watermelon plants in the coastal sand of Purworejo Regency is easy with the percentage 61.67%. And difficult cultivation are 38.33%. Difficult cultivation are irrigation that not support for watermelon cultivation.

3.2. Farmers Adoption on Watermelon Cultivation in Coastal Areas, Purworejo District

From the results of the research the adoption of watermelon cultivation in coastal areas, Purworejo Regency as follows.

Table 8. Farmers Adoption on Watermelon Cultivation in Coastal Areas, Purworejo Regency

Statement	Score average	percentage (%)
1. Farmers perform the selection of Superior seeds watermelon (certified).	4,68	9,61
2. Farmers do land processing.	4,38	8,99
3. Farmers do watermelon planting based on field extension instructions.	4,48	9,19
4. Farmers do cultivation of NPK.	4,37	8,97
5. Farmers use compost fertilizer.	4,43	9,09
6. Farmers do eradication of pests according to guidance of field extension.	4,4	9,03
7. Farmers do watermelon crop weeding.	4,3	8,83
8. Farmers conduct disease prevention in the watermelon crop.	4,47	9,18
9. Farmers do irrigation.	4,54	9,32
10. Farmers harvest watermelon crops according to crop age.	4,52	9,28
11. Farmer performs sorting and grading	4,1	8,42
Total	48,71	100,00

Source: Primary Data (2019)

In table 8 above the farmer is known to do a certified seed selection are 9.61%, farmers do a land processing with the percentage 8.99%, farmers do planting according to the counseling that are 9.19%, farmers do the fertilization are 8.97 %, farmers are doing compost with the percentage 9.09%, farmers do the eradication of pests with the percentage 9.03%, farmers do weeding in the plant with the percentage 8.83%, farmers conduct disease prevention in the plant watermelon of 9.18%, farmers do the irrigation of 9.32%, farmers harvest watermelon crops in accordance with the harvest age of 9.28%, and farmers do the sorting and grading of 8.42%. It shown that farmer doing cultivation by habits and need to accompaniment from extension agent.

Table 9. The Farmers Adoption Level in Watermelon Cultivation in Coastal Areas, Purworejo Regency

Categories	Class Interval	Total	Percentage (%)
Low	40-45	23	38,33
Middle	46-51	15	25,00
High	52-57	22	36,67
Total		60	100,00

Source: Primary Data (2019)

Based on the table 9 of farmers adoption level in watermelon cultivation in coastal areas, Purworejo Regency dominant with low category that was 38.33%. This indicated that the farmers' watermelon in the sandy land still used the cultivation habits done by their ancestors.

4. Conclusions

4.1. Farmers characteristic watermelon comodities in coastal areas of Purworejo Regency, Central Java were the age of a farmers was productive age, the average level of education of the farmers was junior high, the average level of experience of farmers ranged from 3-16 years, the area of land in average about 5000 m2, status the ownership of the land is rented, the technique of watermelon cultivation was easy, and the facility of infrastructure for watermelon cultivation was easy.

4.2. The farmers adoption on the watermelon comodities in the coastal areas of Purworejo Regency was relatively low.

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Women Farmers Focus Strategy to Achieve Poverty Alleviation and Sustainable Agriculture

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Abstract.

Report on poverty alleviation program showed that women play significant role in the success of the program, therefore their potential should be empowered to get the maximum achievement. Since the majority (13.10 millions) of poor family are in villages with main occupation as farmers, meaning most poor family are farmers. Therefore a base information for policy on poverty alleviation program for farmers should be collected. Research on poverty alleviation program of farmers family have been conducted in Jember District – East Java in 2019. The data were collected through Rapid Rural Appraisal (RRA) method with respondent consist of farmers family who received poverty alleviation program "*Bedah Kemiskinan Rakyat Sejahtera (Bekerja)*" or Tackle Poverty for People Welfare in 2018 and related institution from all level who participated in the program. Qualitative data analysis were implemented and the results were presented descriptively. The results show that: 1) A lesson learned that the majority of the women (85%) were participated in carrying the implementation of the program instead the -beneficeries target is man.; 2) Women faced on a basic constraint such institutionally that influence their access to participate optimally in the technical assistant. 3) The women participation significantly influence in the success of the poverty alleviation program. A lesson learned could be derived as conclusion is "women had not been taken in to consideration in the planning of the program". The suggested strategy on every poverty alleviation program for farmers is through women empowerment focus strategy.

Keywords: women, focus, poverty alleviation

1. Introduction

1.1. Background

Poverty alleviation through agriculture sector and rural areas is an appropriate strategy for Indonesia, since the number of poor people in the village is currently 13.10 million (60.54%) from the total poor family which is almost twice compare to the number of poor people in the city 6.89 million (BPS, 2018), detail data is presented in Attachment 1. Based on this fact, the Indonesian government had been implemented poverty alleviation programs that directly targeted to poor farmers. There are 9 (nine) out of 38 of poverty alleviation during 1970-2019 (Situmorang, 2018). Two programs that directly related to agriculture and showed positive impact especially for women are the Small Farmers / Fishermen's Income Improvement Project or *Proyek Peningkatan*

Pendapatan Petani Nelayan Kecil (*P4K*) and the National Community Empowerment Program or *Program Nasional Pemberdayaan Masyarakat* (*PNPM*).

The longest Project is the *P4K*, that had been implemented during 1985-2005 (Situmorang, 2018) which initiated from the leadership of President Soeharto (1970-1998) until the beginning of President Susilo Bambang Yudoyono's (SBY) leadership (2004-2014). This long period- of the P4K program is caused by its success, such as: (1) 58,118 groups of small farmers / fishermen (18,197 were women's group), (2) A total of 152,716 joint business plans (RUB) have been prepared and obtained loans from banks with a total value of Rp 1,183.3 billion; (3) A total of 31,859 KPKs have savings in BRI with a total value of 19.4 billion and around 28,100 other KPKs have group savings with a total of Rp 5.9 billion; (4) The formation of a combined 1,066, of which 205 are running savings and loan mechanisms as a forerunner to MFIs, managed and controlled by members of poor families; and (5) The growth of 35 cooperatives originating from the combined KPK. Affandi et al. (2009) reported the hallmark of the success of the P4K Program in Jombang Regency that the majority of women farmers are taking a part, especially by open a new business in the form of a local small industry in accordance with the capacities and capabilities of the recipient.

The *PNPM* program is a scaling up (broader development) from poverty reduction programs, -implemented under the leadership of President SBY in 2004-20014 (Soesanta 2013). The achievements of the *PNPM* program were (1) an increase in per capita consumption of 5% compared to poor households which can increase consumption by 3% more and have the possibility of escaping poverty; (2) treatment group households have a higher chance of getting work and access to health services. Costs incurred for the implementation of *PNPM* in rural areas and the results of activities of *PNPM* in Rural Areas have a high efficiency factor. This can be seen from job opportunities, infrastructure improvements and economic productivity in the village.

The success of PNPM had been reported by some researchers, for example Syahril et al., (2015) found the independent of rural communities in financial assistance and has a significant effect on poverty reduction in Aceh Province. Krisnawati (2010) reported her findings in Tlanak Village, Kedungpring District, Lamongan Regency that: (1) the implementation of *PNPM-M*P in 2009 has been running quite well; (2) successfully raising awareness and activeness of the people (3) *PNPM-MP* physically as well as non-physical activities has succeeded in improving the economy by opening new business-, reducing unemployment rates and increasing people's income and welfare by meeting their daily needs and children's education costs that was handle by women.

The above programs were somehow not continued, according to Nurwati (2008) the poverty alleviation program that has been carried out so far was generally only temporary that it will only run as long as there - still had a budget or funds, after the funds run out then the program - finished.

In 2018 the Ministry of Agriculture implemented Program called "Tackle Poverty for People Welfare" or *Bedah Kemiskinan Rakyat Sejahtera (*Bekerja*). Program Bekerja* is a program of the Ministry of Agriculture to alleviate poverty in 2018, the implementation of the rogram is based on the Government Regulation No. 15 of 2010 concerning the Acceleration of Poverty Reduction and Permentan N0 42 / Permentan / RC.020 / 11 /, and 3) Permentan No. 27 / Permentan / RC.120 / 5/2018 concerning guidelines for the implementation of the program. Located in 10 provinces, covering 100 districts and 1000 villages. The –target of the program is a poor farmer's household based on data from the Ministry of Social Affairs which is diversified by the Ministry of

Agriculture as poor farmer' family or *rumahtangga miskin petani (RTMP)*. The farmers who approved as the RTMP were given a package of farming (livestock, vegetables and annual crops) and technical assistance as well as guidelines (Directorate General of Animal Husbandry and Health, 2018) so that farmers can utilize their field optimally and finally earn income daily, monthly and annually to be a proporous family. *Program Bekerja* will be continued in the 2019 fiscal year, therefore it needs to be studied in order to obtain a lesson learn as a basis information for further improvement of the strategy, specifically for *Program Bekerja* and for other alleviation programs especially for farmers.

1.2. Objectives

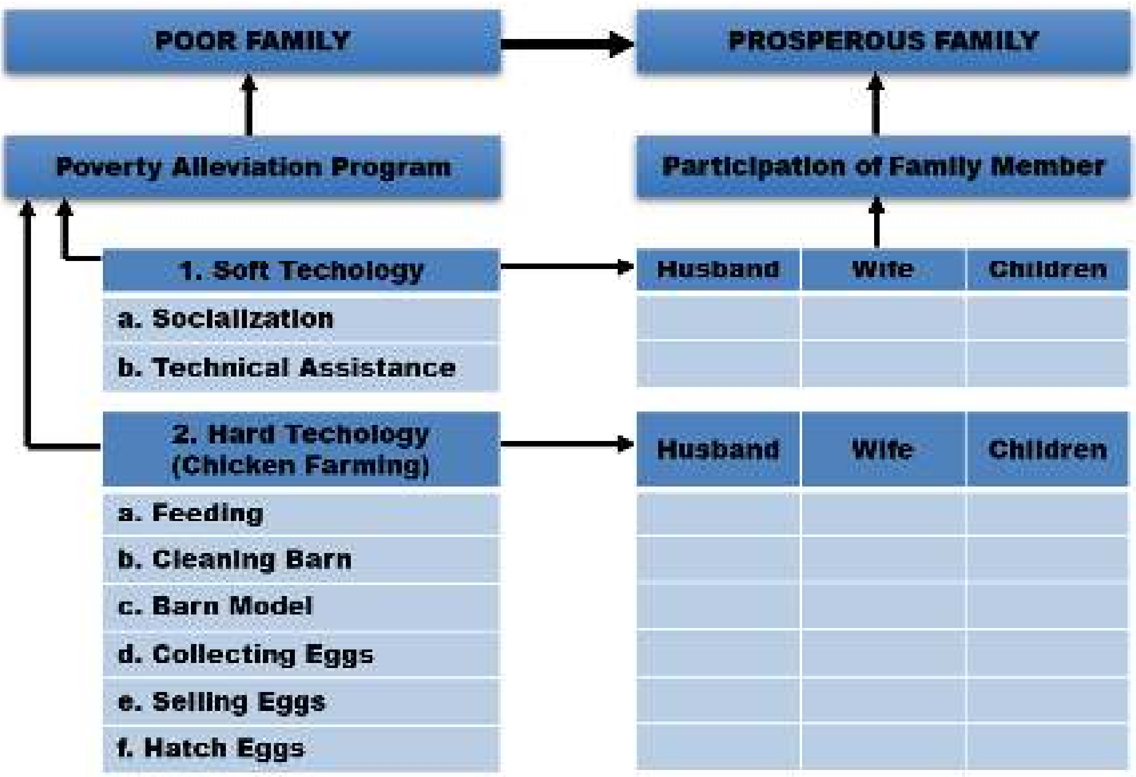
The objectives of this research are: 1) To get a lesson learned from Program Bekerja; 2) Study the women' participation in the implementation of *Program Bekerja* 3.) Analyze the contstrains of women in their participation of the program. 4) To get strategy for the better future of *Program Bekerja* and any poverty alleviation program.

2. Methodology

2.1. Theoretical Framework

The Theoretical Framework of the research is described in Figure 1 that illustrate to achieve a prosperous family need the participation of the family's members in all activities implemented in the program. The implementation was started from the delivery of the soft technology such as socialization and technical assistance and hard technology namely the chiken raising, therefore the participation of women need to be – analyzed.

Figure 1: Figure Description



Source: Tarigan and Wahyuni (2019)

2.2. Locations

The location was selected purposively in a District from- 3 (three) Districts which -received *Program Bekerja*, namely Jember District, East Java Province. There are 3 (Three) Sub-Districts which a village was taken from each district namely Sumber Lesung Village - Sub-district of Ledok Ombo, Karangrejo Village - Sub-district of Gumukmas and Sumber Ketempa Village - Sub-District of Kalisat were selected as the research locations.

2.3. Data

Data consist of secondary and primary, the secondary data were obtain from some report of the Central Bureau of Statistics and related institute of the program at National to village level such as:

- National : Directorate General of Livestock Services and Animal Health (*Dirjen PKH*)
- Province : Regional Planning Agency (*BAPEDA*)
  Agriculture Service (*Dinas Pertanian*)
- District : Food Security and Animal Husbandry Services
- Village : Village Officials

The primary data were collected from the *RTMP of Bekerja Program* , key informant and field observation.

2.4. Analysis

A qualitative analysis applied RRA .Rural Resarch Appraisal (RRA) is a method in collecting information/data by "outsiders" and analyzed by themselves. The implementation of the RRA requires a small multi-disciplinary work team, focused on understanding aspects of research at the local community level combined with scientific knowledge. The principle of implementing RRA is Triangulation: Reviewing secondary data, field observations and key informants (Faturrochman, 2015) and Saputro (2015). The focus of the research is the “Household” therefore information on the participation of the household member in the program were collected, followed by information on the constraint they faced to.

2.5. Results

2.5.1. Lesson learned from *Program Bekerja*

A lesson learned on the implementation of *Program Bekerja* obtained from the Province Level was that the Department of Agriculture of East Java Province has not been involved in Program *Bekerja* in 2018. The reason is that the central government not aware of the variation agencies in the regions, therefore the *Bekerja Program* were not directed appropriately. In Jember District, the Agriculture Department have no authority in the field of animal husbandry, but under the Food Security Department. On the other hand, the companion of the program is the *Penyuluh Pertanian Lapangan (-PPL)* or field agriculture extention Services which is under the District of Agriculture Department who have no authority to allocate insentive for PPL. The consequence is the monitoring and evaluation (monev) was not reported as targeted. To handle the monev activities The Regional Planning Agency (*BAPEDA*) provide an additional incentive of

IDR 500.000/month for 10-month contract to PPL with the task of monev the program then reporting to the district.

The program's location was determined topdown, forgetting that each region has authority over the welfare of their community. To anticipate an undesirable event that might occur to the recipients of the program, Jember Regency did a re-verification of the RTMP that had been determined by the program. The verification team consisted of BABINSA, KAMTIBNAS and the head of the village, call *Tiga Pilar* or three Pillar as the spearhead of the success of every program- that are implemented in the village.

At District Level, as already mentioned the responsible institution is the Food Security and Animal Husbandry Services which have certain goals therefore the program is integrated in overcoming the stunting program. However the program implementer is the Farma Veterinary Center (PUSVETMA) under the Directorate General of Husbandry and Veterinary which has difference goal such as increasing - the chiken population, while the Food Security and Animal Husbandry Services emphasize on food stunting.

The total number from reverification of the RTMPs were 12,660 out of the original verification of 12,698. The program packages include: 1) Jowo Super Chicken (JOPER) aged 4 weeks dropped since September 26, 2018 until the last dropping in November 2018; 2) Feed for 4 months plus vitamins and disinfectants. The package was given to 3 districts namely 12 villages in Kalisat, 10 villages in Ledokombo and 8 villages in Gemukmas with each recipient of the Kalisat District program receiving 5,921 RTMP, 3,770 RTMP, 3,969 RTMP; 3) Barn; 4) Technical Guidance and 5) Assistance from the Sub-District of Social Welfare staff (TKSK) from the Social Service for each sub-district. The difference between planning and implementation at the provincial level also occurs at the district level to the RTMP as stated in Table 1.

Table 1: The design and the implementation and the impact of BEKERJA program in 2018

Aspects	Design	Implementation	Impact
Goal	Increase the chikens population	Overcome stunting	Very low
Institution	Department of agriculture	Food Security and Animal Husbandry Services	Intervention of other institution *(Bappeda)*
Verification	Department of agriculture	Regional Planning Agency (*BAPEDA)*	Reverification
Strategy	Optimation of yard	Chicken development	Not optimal
Socialization target	Extention Service officer	Plus Three Pilar	Better results
Main Package	Integrated, Chicken (C)+Fruit (F)+ vgetable (V)	Only chicken	Not optimal
Supporting Package	C (barn, feed, medical) F (seed + Fertilizer) V ((seed + Fertilizer)	Chicken (cross breed, varies age) Barn: new and still smell he bamboo aroma-not good for chiken. Feed not enough Desinfectant unfamiliar	Chicken (new breed): Farmer unfamiliar, caused most chiken dead
Responsible institution	Various institution	Various institution	Segmented
Dropping	Step by Step, on time	Step by Step behind schedule	Not enough, Feed unaffordable
Receiver *(RTMP)*	Household based on ID	Household based on ID	As planned
Technical	Before distribution	Along with distribution,	Not efficient

assistant		breafly	
Technical assistant Receiver	Head of household (ID)	Household ID, For some reason could be represented	As planned
The cicken mangement	Family (ID)	Mostly women	Unskilled coach
Coach	To be independently	Implementation timing of program	Not sutainable

Source:Primary data, 2019

Information from the Sub-District Level: The program starts with RTMP verification which is carried out by RT and RW. Furthermore, invitation to joint the socialization was held by the Department of Food Security and Animal Husbandry for the village head, BABINSA and KANTIBMAS who expected to deliver their knowledge to the RTMP.

The dropping of the package of chicken were attended by the head of the district, the head of the PUSVETMA and the whole RTMP (the head of the household as in the ID). In this event, socialization about how to raise livestock also explain briefly. Before the chickens were dropped, some requirements such as the barn for the chikens must be ready and 200Kg feed for the chickens already prepared. The chickens' were in a month age, the breed is Joper (*Jowo peranakan*) or crossing between *ayam kampung* and layer chicken that is placed in a box of 50 unsexing chickens, completed with a plastic bottle for watering the chickens as well as some medicine were delivered to RTM. All RTMP who received the programs' package must have an authentic evidence such as photo and ID. Below are photos of 3 (three) RTMPs representing 20% of the total RTMPs who still raised their chicken during the field team visiting (Figure 1).

Figure 1: Representative of the exsisting RTMP

Source: The teams' documents (2019)

The question is, what about the other 80% RTMPs ? The answer is "they have no chicken any more" because the chickens were dead. The following reasons might explain and answer the reasons of the dead chickens.

1. Farmers had not received brochure for the chickens raising, therefore when they faced problem directly report to the Head of Hamlet or *Kepala Dusun* (Kadus) which they consider key person for all matters of in the village meanwhile *Kadus* never received any technical assistance about raising chickens.
2. The age of the chicken were varies, the consequencies are: a) younger chicken has not enough body endurance so it caused dead. b) The life younger chicken need more feed meanwhile the amount of feed provided were in the same amount.
3. Varies of age caused varies in the time to lay eggs (the older chicken lay the egg sooner).
4. The chicken is a new breed which need a special treatment such as raised in a age with feed available in the feeding box at any time, while they used to raise chicken in traditional way, no barn with no special feed.
5. Chicken taste is less tasty compared to Kampung chicken
6. In other Sub-district, reported that level the chicken death-also caused by the differences of chicken ages, especially in the second dropping, chickens were smaller and younger so that most were died when it was dropped during rainy season, and chickens become so week then die gradually in during the first month after dropping and only 50% left.
7. Another factor is that RTMP have no experience on how to raise chickens in a large number, as they usually only have 2 chickens to 5 chickens without any special care from farmers.
8. The unsexing chicken were confusing the farmers, especially related to the decision to sell the cock .

Behind the various problems that have been described, there are found some RTMPs that still have a full number of chikens as the original number “50 chickens” even more, could consume the eggs and the chicken meat, and got additional income for the family. The answer is there was wife/women participation directly in raising chickens farming (Table 2).

Table 2: The Husband and Wife Paticipaton in the Technical Chicken Farming

No	Activities in The Chicken Farming	Family Members Participation (%)	
		Husband	Wife
1	Feeding	10	90
2	Cleaning barn	20	80
3	Health care	10	90
4	Collecting eggs	10	90
5	Selling eggs	10	90
6	Hatch eggs	20	80
	Average	15	85

Source: (primary data, 2019)

However, the above participation was not suported by their access toward the soft technology such as the socialization of the program delivered in the special even during the dropping of the chickens (Table 3). Without participating in the socialization, the wife/woman would not understand the purpose of the livestock package they received, then how it should be implemented. Ask the solution to the husband would not possibly obtained an appropriate answer they faced because the majority of the husband did not quite understand the socialization that was only received in a short time while the information received was mostly new for them.

Table 3: The Husband and Wife Participation in Soft Technology in Chicken Farming

No	Soft Technology	Family Members Participation (%)	
		Husband	**Wife**
1	Socialization of the program	80	20
2	Technical Assistancies	80	20

Source: Primary data, 2019)

Most farmers faced by some constraint in the chickens management, especially women who directly deal with the daily activities as mention in Table 4. How to solve the problem? A success story from RTMPs may help how to overcome inorder to achieve the goals of the program.

In Gumuk Mas sub-district, one of the RTMPs was found to be successful in raising chickens from the *Bekerja* Program package. A family of farmers who experience in native and Bangkok chickens raising. The successful of the raising is through the following management: When the chickens received have shown its sex (around of 3 months age), a number of 28 birds found as cocks, of which 12 are sold for IDR30 000 per head. Money of IDR 360 000 was allocated to buy feed for the needs of all chickens for one month because of the daily feed cost of IDR 20 000 and the supply of medicines if needed any time, namely eye drops, eye warts and nasal drops to threat mucous of the nose.

Table 4: The Womens' Constraints in the Implementation of the Program BEKERJA

Technical Aids	Constraint		Consequency
	Policy	**Technical**	
Breed	Centralistic: Joper/*cross breed*	Not familiar	The management system not appropriate
Feed	Grower, limited, scheduled dropping	Not familiar, unlimited, behind the shedule	Not enough feed, un affortable, production not on time
Barn	Certaint size, to small and new	Crowded, still emits a specific odor of bamboo material	Cannibal, poisoning
Raising system	In the cage	No cage	Natural anemies, diseases
Assistant	Only recipients	No opportunity	Practice traditional system
Medical service	Animal health service	Not enough veterinarian	No solution

Source: (Primary data , 2019)

Information of the medicines was obtained from the companion who was also tasked in providing artificial insemination (AI) services. -Because the family owned 2 cows belong- to the village's head who was being driven. The AI officer was given the additional task in monitoring the development and health of the working chicken program. officer of UPKK is responsible for 100RTM, but there was an UPKK who has to handle 600 RTM so that not all RTMPs are monitored.

From the remaining 16 male chickens, 4 chickens are set aside as the male of the 22 chickens existing female chickens, the rest were sold in stages to maintain the feed needs and successfully consumed as many as 15chickens. From the exsisting 22 chickens, 15 chickens were sold gradually to buy feed and the family's needs, so now there are only have 7 chicken hens that left only 1 cock. From the 7 chicken hens, there was a hen laying eggs, incubating and has just hatched the eggs. One hen produces about 15 eggs, 10 eggs are hatched, the rest was eaten or sold 5 eggs –with IDR 1,500 / egg. After the chicken grow at 3 (three) mounths age, it sold again. This management cycle successfuly achieve the programs goals, increase the consumption of protein and increase the family income.

3. Conclusion

a. There is bias in terms of the design and the implementation of the program. That was start from the institutional aspects, system on the verification of the RTMP, packages, technical guidance targets, and guidance between design and implementation of the program made the program was not optimal in alleviating the poverty.

b. Women participate dominantly in production activities but faced some problems both in the institution and in technical access.

c. Women as the main participant in the implementation of the program, but they have not been considered in the planning of poverty alleviation programs.

4. Policy Implication

Women as the main actors in farming livestock as part of agriculture should be considered in the planning of poverty alleviation programs related to agriculture.

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Attachment 1.

Table 1: The Development of Poor Population in Indonesia March 2014-September 2018

Year	Total of poor population (Millions)			Percentation of The Poor People		
	City (C)	Village (V)	Total (C+V)	City (C)	Village (V)	Total (C+V)
Mar 2014	10.51 (37,16)	17.77 (62,84)	28.28 (100)	8.34	14.17	11.25
Sep 2014	10.36 (37,36)	17.37 (62,64)	27.73 (100)	8.16	13.76	10.96
Mar 2015	10.65 (37,25)	17.94 (62,75)	28.59 (100)	8.29	14.21	11.22
Sep 2015	10.62 (37,25)	17.89 (62,75)	28.51 (100)	8.22	14.09	11.13
Mar 2016	10.34 (36,92)	17.67 (63,08)	28.01 (100)	7.79	14.11	10.86
Sep 2016	10.49 (37,79)	17.28 (62,21)	27.76 (100)	7.73	13.96	10.70
Mar 2017	10.67 (38,42)	17.10 (61,56)	27.77 (100)	7.72	13.93	10.64
Sep 2017	10.27 (38,64)	16.31 (61,36)	26.58 (100)	7.26	13.47	10.12
Mar 2018	10.14 (39,08)	15.81 (60,92)	25.95 (100)	7.07	13.20	9.82
Sep 2018	`10.13 (39,46)	15.54 (60,54)	25.67 (100)	6.89	13.10	9.66

Source: (Author, 2019)

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Marketing Strategy Analysis of Turmeric Tea Products (Case Study at Food Processing Center of Tarlac Agricultural University, Philippines)

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Abstract.

This study aims to (1) analyze external and internal factors related to the marketing of Turmeric Tea products, (2) find out the Food Processing Centers position in the market and the main strategies that can be applied by the Food Processing Center at Tarlac Agricultural University, Philippines in marketing its products, especially Turmeric Tea products. The technique for determining the source is non-probability sampling. Key persons in this study are employees and stakeholders related to the Turmeric Tea products. The research method used a case study. Data sources used are primary and secondary data. Data collection techniques are using observation, interviews, documentation, recording, and questionnaires. Data analysis technique is using the IFE matrix and the EFE matrix. The results of the analysis of the IFE (Internal Factor Evaluation) matrix obtained values 2,480 which showed that the company has internal conditions below average. Analysis of the EFE (External Factor) obtained a value of 2,575 which indicates that the company has a moderate ability (on average) in responding to opportunities owned and overcome the threats faced. The combination of IFE and EFE values can be seen that the company's position is in cell V in the IE (Internal External) matrix, which is the position maintain and maintain (hold and maintain). Strategies that can be applied by companies were market penetration and product development.

Keywords: Marketing Strategy, SWOT, Turmeric Tea

1. Introduction

Tarlac Agricultural University is one of the state universities in the province of Tarlac, Philippines. Tarlac Agricultural University is mandated to provide professional, technical, and instructions for specific purposes and to promote research and extension services progressive leadership in agriculture, agricultural education, home technology, and other related fields. Its main campus is located in Malacampa, Camiling, Tarlac, Philippines. Tarlac Agricultural University offers a Bachelor of Science in Food Technology. By offering a degree program, Tarlac Agricultural University think to establish pilot scale food processing facility that will produce technology in processing agricultural products. The Food Processing Center is a business entity of Tarlac Agricultural University, Philippines. Thus, Processing and Testing Laboratory conceptualized. The facility was established through funding from the Provincial Government of Tarlac, Philippines in April 2006. Management submitted to Tarlac facilities Agricultural University, and managed directly by DFST (Department of Food Science and Technology), College of Agriculture and Forestry. In 2012, Tarlac Agricultural University developing a proposal to establish a Joint Service Facility about Toll Packaging and processing together with DTI (Department of Trade and Industry). Tarlac Agricultural University will provide the infrastructure, while DTI (Department of Trade and Industry) will finance the equipment. Then in 2014, a new building was constructed for the facility. After completion in November 2015, and pending the toll packaging equipment, this being the new Food Processing Center that is managed by DFST (Department of Food Science and Technology). Until 2019, the facility has been processing a wide range of food products, as part of the production function. The resulting product is *Uberind* Candy, Turmeric Tea, Maja Blanca, Candy Tamarind, Turmeric Tea, Chili Garlic Sauce, *Uberind* Candy, Embutido, Tamarind Candy, Creamy *Polvoron*, Peanut Oatmeal Cookies, Nutri Tea, and Chocolate Brownies.

Based on data obtained from the accomplishment Report of the Cash Advance (Food Processing Center, Tarlac Agricultural University), it is known that there are two tea-based beverage product produced by Food Processing Center, the Nutri Tea and Turmeric Tea. Tea Nutri products contributed the most to the revenue, while the products Turmeric Tea contribute the least to the revenue. This indicated a very significant differences between the two products. Both of these products have in common, which is made from tea. Beverage products Nutri Tea and Turmeric Tea are special because it tastes good and also healthy. Nutri Tea beverage products characterized as a refreshing drink that is made from tea, lemongrass (citronella), and rushes. Products Nutri Tea is a beverage product that is different than the other refreshment products in general, because the Nutri Tea has a distinctive flavor. Similarly, Turmeric Tea products that contains turmeric which is believed provides efficacy in the body cause it contain antioxidants, reduce the risk of heart disease, and even believed to cure cancer.

With the advantages possessed by the Turmeric Tea products they can attract consumers to consume. So, the Food Processing Center must have an effective and efficient strategy in marketing their products. Thus, the Tea Turmeric products can be sold more so that manufacturers can obtain the maximum profit.

Formulate a clear strategy can be estimated by concerning the changing environment accurately and concerning aspects of internal and external aspects. In formulating a strategy. It is necessary to know the strengths and weaknesses in order to help identify the company and take advantage of existing opportunities and prevent or deal with threats that may come. Marketing is a dynamic act of applying the principles of excellence and innovation, because it is based on internal and external environments are changing. As such, be aware on external factors and internal factors relating to the marketing of the Turmeric products so that it can be seen an opportunity and a threat to the products.

Indeed, company aims to be to survive and develop, with improving sales through proper and accrate marketing strategy. In formulating a strategy, it is necessary to know the strengths and weaknesses in order to help identify yourself and take advantage of existing opportunities and prevent or deal with threats that may come.

In connection with these problems, this study focuses on the problems of marketing strategy that has been implemented by the Food Processing Center in Tarlac Agricultural University, Philippines in marketing their products. Analysis of the marketing strategy is expected to help the Food Processing Center in determining the marketing strategy for the next period. These can be done by increasing sales and achieving the efficiency and effectiveness of the Food Processing Center in an effort to meet public demand and achieve the maximum profit.

Based on this background, the reseacher was interested in the topic of marketing strategy of Turmeric Tea Products in Food Processing Center of Tarlac Agricultural University, Malacampa, Camiling, Tarlac, Philippines. This study focuses on the problems of marketing strategy that has been implemented by the Food Processing Center in Tarlac Agricultural University, Philippines in marketing their products to consumers. Analysis of the marketing strategy is expected to help the Food Processing Center in determining the marketing strategy for the next period so it can increase the sales and achieved the efficiency and effectiveness of the Food Processing Center in meeting public demand and in achieving the maximum profit.

2. Methods

The basic method of research used in this research was descriptive method. According to Sugiyono (2005), the descriptive method is a method used to describe or analyze the results of the study but not used for make more conclusions. Descriptive research is not used to test specific hypotheses but only to describe the variables, symptoms, and the circumstances existing in the field. The characteristic of this research is comparative, which in this study was not conducted an experiment (the experiment) on the object, but only determine the right strategy for the company in the face of competition.

The method used in this research was case study. According to Bogdan and Bikien in (Asep, 2013) is a case study in detail the testing against the background of a subject or a person or document storage or a particular event. The case study of this research is a phenomenon that occurs in the Food Processing Center at the Agricultural University of Tarlac, Philippines which is a business entity that owned by Agricultural University of Tarlac. In 2016, the Food Processing Center begins operations, so the Food Processing Center has not been sufficiently recognized by consumers. Moreover Food Processing Center still used simple production machines, while competitors use more advanced with a larger capacity. Locations were selected purposively namely in the Food Processing Center at the Agricultural University of Tarlac, Philippines by considering that it is a business entity newly established by the university and not known by many consumers. Food Processing Center determine the price with cheaper products because of the use of simple packaging. Packaging used Food Processing Center is also environmentally friendly. Types and sources of data supported by quantitative data and qualitative data obtained from within the company and the outside in the form of primary data and secondary data. Resource determination technique used in this study was a non-probability samplingthat means that not all elements of the population has an equal chance to be selected as an example. Type of non-probability sampling is purposive sampling, which is a retrieval techniques based on certain criteria. The data type are primary data and secondary data. The primary data obtained directly from the source and conducting studies directly to the company, by interviews, by the relevant authorities. The secondary data were obtained indirectly and sourced from literature, documents, and references relating to the Food Processing Center at the Tarlac Agricultural University, Philippines, include: company history, vision and mission of the company, organizational structure, the production data, product sales data, storage costs, and preparation costs.

2.1 Methods of Collecting Data

Data collection methods are carried out in several ways, including observation, interview, documentation, recording, and questionnaires.

a. Data Analysis Technique

To approach the research objectives, namely analyzing external and internal factors associated with the marketing of Turmeric Tea products, the data analysis technique use the IFE matrix and the EFE matrix.

3. Results And Discussions

The IFE matrix is one tool in the formulation of strategies that is useful for summarizing and evaluating the strengths and weaknesses of companies from various functional fields. In addition, the IFE Matrix also serves to recognize and evaluate the relationship between internal strategic factors that exist in the company. The IFE matrix is prepared after weighting and rating each internal variable including strengths and weaknesses. Results of the IFE matrix calculation can be seen that the main strength of the company was organic products with a good quality with a score amount to 0.356. For the major weakness was the limitation of raw materials products, this factor has a score value the largest was 0.136. The total value of the IFE matrix score was 2,480, which showed that The Food Processing Center of Tarlac Agricultural University has below average internal conditions.

Table 1: IFE (Internal Factor Evaluation) Matrix

Internal Factors	Score 1	Score 2	Score 3	Score 4	Score 5	Score 6	Total
Strength							
1. The strategic location	0,380	0,292	0,354	0,300	0,220	0,344	0,322
2. Good relations with customers	0,292	0,292	0,246	0,273	0,380	0,342	0,293
3. Satisfactory at the customer service	0,344	0,364	0,342	0,300	0,380	0,436	0,352
4. Organic products with the good quality	0,380	0,380	0,327	0,285	0,400	0,420	0,356
5. The comprehensive of cash advance report	0,300	0,327	0,219	0,327	0,246	0,231	0,282
6. Capital belonging to TAU	0,273	0,273	0,369	0,420	0,177	0,150	0,300
Weakness							
1. The simple production machine	0,059	0,091	0,091	0,146	0,100	0,095	0,097
2. The distribution has not yet widespread	0,086	0,082	0,128	0,136	0,100	0,105	0,107
3. The simple packaging	0,109	0,190	0,077	0,095	0,105	0,105	0,115
4. The limited of promotional activities	0,095	0,095	0,190	0,086	0,091	0,182	0,121
5. The raw materials products is limited	0,218	0,105	0,190	0,077	0,118	0,064	0,136
Total							**2,480**

The External Factor Evaluation (EFE) matrix results from weighting and rating based on external factors considered by the company owner as well as research conducted on the company. Based on the results of the EFE matrix analysis obtained the main opportunity for the company is people's confidence in efficacy healthy beverages that have value the biggest score is 0.343, while the main threat is same products from another company with a score of 0.310. The total value of the EFE matrix score is 2,575, this shows that the company has moderate ability (average) in responding to opportunities that exist and overcome the threats.

Table 2: EFE (External Factor Evaluation) Matrix

External Factors	Score 1	Score 2	Score 3	Score 4	Score 5	Score 6	Total
Opportunity							
1. Climate changes that influence health	0,375	0,168	0,501	0,333	0,166	0,228	0,315
2. People's awareness to apply healthy lifestyle	0,375	0,312	0,459	0,278	0,250	0,278	0,338
3. People's confidence in efficacy healthy beverages	0,249	0,360	0,417	0,354	0,354	0,312	0,343
4. Ginger and tea beneficial for health and as medicine	0,249	0,360	0,417	0,354	0,354	0,312	0,279
5. The chances of export markets	0,194	0,236	0,228	0,250	0,112	0,207	0,214
Threats							
6. Same products from another company	0,250	0,438	0,236	0,312	0,250	0,375	0,310
7. The entry of the product from abroad	0,354	0,375	0,208	0,194	0,222	0,194	0,268
8. Expensive cost research to develop products	0,291	0,222	0,249	0,152	0,178	0,264	0,237
9. The buy society still low	0,375	0,375	0,138	0,222	0,236	0,278	0,173
Total							**2,575**

Based on the results of an analysis conducted at the Food Processing Center in its efforts to market Turmeric Tea products, the total value of the IFE matrix score is 2,480 while the EFE matrix is 2,575, placing the company in the position of cell V in the IE matrix. This position is called Hold and Maintain and maintain), and the right strategy used in this position is the market penetration strategy and product development strategy.

Analysis of the company's internal environment can formulate several strengths that companies have, like the strategic location, good relations with customers, satisfactory at the customer service, organic products with the good quality, the comprehensive of cash advance report, and capital belonging to TAU. For the weaknesses owned by Food Processing Center of TAU such as the simple production machine, the distribution has not yet widespread, the simple packaging, the limited of promotional activities, and the raw materials products is limited. Based on an analysis of the external environment towards the company, opportunities that can be exploited companies like climate change that influence health, people's awareness to apply healthy lifestyle, people's confidence in efficacy healthy beverages, ginger and tea are beneficial for health and as medicine, the chances of export markets while threats that must be anticipated by the company is same products from another company, the entry of the product from abroad, expensive cost research to develop products, and the purchasing power of the community is still low.

4. Conclusions

From the results of research can be concluded as follows:

1. The company has internal conditions below average. Analysis of the EFE (External Factor) obtained a value of 2.575 indicated that the company has a moderate ability (on average) in responding their opportunities and in overcoming the threats.
2. The combination of IFE and EFE values can be seen that the company's position is in cell V in the IE (Internal External) matrix, which is the 'hold and maintain' position. Strategies that can be applied by companies is market penetration and product development.

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Comparison of Organic and Conventional Paddy Farming: Study in Two Villages in Malang District, Indonesia

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Abstract.

Practicing organic farming is the way that can be chosen by farmers to realize the sustainable livelihood. However, the practicing of organic farming in Indonesia was only 0.6 percent or 208,042 hectares in 2017. The profit orientation of conventional farmers is the issue in conversion process from practicing conventional to organic farming. The objective of this study is to analyze the profit earned by farmers in conventional and organic paddy farming. Two village in Malang district, namely Sumber Ngepoh and Mulyoarjo, were chosen as study field. There are 32 organic paddy farmers from farmer group of Sumber Makmur 1 in Sumber Ngepoh village and 34 conventional paddy farmers from farmer group of Mulyo 2 in Mulyoarjo village were interviewed. The independent t-test was used to analyze the different of profit earned by those farmers. The mean of total cost in farmer group of Sumber Makmur 1 is 151 percent less than in farmer group of Mulyo 2. Furthermore, the mean of production, revenue, and profit in farmer group of Sumber Makmur 1 are 15, 21, and 66 percent respectively more than in farmer group of Mulyo 2. It is concluded that practicing organic paddy farming in Sumber Ngepoh village is more profit compared to practicing conventional paddy farming in Mulyoarjo village. This conclusion can be a basic for farmers in Mulyoarjo village to do conversion from practicing conventional paddy farming to organic paddy farming by objective to get similar benefit as gotten by farmers in Sumber Ngepoh village.

Keywords: sustainable livelihoods, organic farming, conventional farming, profit

1. Introduction

Doing farming activities is a means for farmers to making a living. Hence, agriculture has a very important role as a livelihood source for the farmers. Livelihood is defined as sufficient supplies and streams of food and money to fulfill basic necessities of life; while sustainable is defined as the preservation or increase of resource productivity on a long-term basis.[1] Based on this definition, farmers must realizes sustainable livelihoods through their farming activities to guarantee sustainability to making a living. Achievement the sustainable livelihoods is only realized if the natural environment is sustainably managed.[2] More specific, organic farming can increase peasant farmers' livelihood.[3]

Organic farming leads to preservation of natural resources, causes minimal negative impact on nature and could be defined as a self-sufficient system.[4] Moreover, organic farming depends on the use of natural resources, and focuses on sustainability, via (among other things) recycling resources and lowering pollution, so that it is a strive that contributes many of the worth and perspectives of ecological economics.[5] However, in 2017, there is only 1.4 percent (69.8 million hectares) of organic agricultural land from total agricultural land in the world.[6] This data indicates that most farmers in the world are still practicing conventional farming.

Conventional farming has been a common practice among farmer in improving productivity to meet the increasing demand.[7] In line to this, conventional farming puts its focus on achieving maximum yields of a specific crop.[8] To realize this achievement, conventional agriculture typically utilize synthetic, chemical inputs.[9] Conventional farming is farming activities, which in its practice use not only synthetic chemical fertilizers, but also synthetic chemical pesticides and synthetic chemical herbicides as well as apply heavy irrigation, intensive tillage, or concentrated monoculture production.[10]

In Indonesia, most farmers are also practicing conventional farming. It is indicated by total organic agricultural land in Indonesia that was only 0.6 percent (208,042 hectares) in 2017.[11] In that year, there were 35,923,886 people working in agricultural sector[1] in Indonesia.[12] Total of smallholders in Indonesia is 93 percent of total farmers and small family farming is generally carried out on modest plots averaging 0.6 hectares.[13] These data show that farming activity in Indonesia has a very important role as a source of livelihoods for the large number of small farmers. By practicing the conventional farming, they are very dependent on the use of chemical agricultural inputs, such as chemical fertilizers, pesticides, insecticides and fungicides.

In Indonesia, there are six sub sectors of agricultural as source of livelihood for the farmers who live in rural area. The subsectors are food crops, horticultural crops, plantation (estate) crops, forestry, livestock and fishery. One of food crops commodity cultivated by the farmers in Indonesia is paddy. This commodity is the source of main foodstuff for Indonesian people and it widely planted in all 34 provinces in this country. In 2017, harvested area for paddy in Indonesia was 15,890,073 Hectare with production was 81,148,594 Ton.[14]

As one of the paddy producing area, East Java province is the second-largest producer of paddy in Indonesia. In 2017, harvested area for paddy in this province was 2,285,232 Hectare with production was 13,060,464 Ton.[15] Two villages as area for planting paddy in this province are Mulyoarjo and Sumber Ngepoh village. In Mulyoarjo village, there are a part of farmers plant paddy conventionally, while in Sumber Ngepoh village, there are a part of farmers plant paddy organically.

Encouragement must be done to the farmers so that they practice organic farming in order to make better the outcome of their livelihoods.[16] The livelihood outcomes are component of sustainable livelihoods.[17] One of the categories of livelihood outcomes is *more income*. Therefore, it is concluded that by doing conversion from practicing conventional farming to practicing organic farming can generate more income, which contribute to sustainable livelihoods. Doing conversion from conventional to organic farming means changing the use of agricultural inputs,

[1] This sector is included agriculture, forestry, hunting and fisheries.

namely from using chemical fertilizers, pesticides, insecticides and fungicides to using natural fertilizers, pesticides, insecticides and fungicides. The conversion of using farming inputs potentially leads to the change of cost of production, rate of production, selling price of the yield, and rate of profit from selling the yield.

Conventional farmers are more profit oriented compared to organic farmers.[18] Therefore, the change of profit as a result of doing a conversion from practicing conventional farming to practicing organic farming encourage every conventional farmers to do a rational thing before they make the decision to convert from conventional to organic farming. In this context, they carry out a comparison analysis about profit, which is earned from conventional farming and from organic farming, deeply and carefully. Certainly, the analysis is intended to avoid the losses as a result getting the lower profit from doing the conversion.

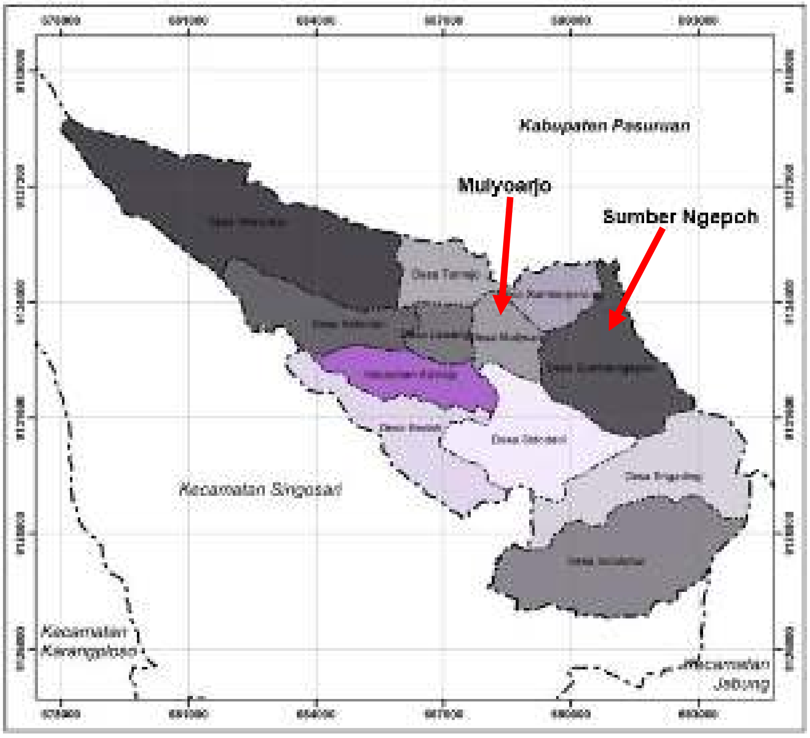
The fact that the farmers in Mulyoarjo village still plant paddy conventionally indicates a reluctance from them to do a conversion from practicing conventional farming to practicing organic farming. However, the consistency of them to plant paddy conventionally could not lead to conclusion that they earn profit from their farming is higher than profit earned by organic paddy farmers in Sumber Ngepoh village. It is needed a comparison of profit earned from conventional paddy farming in Mulyoarjo village and profit earned from organic paddy farming in Sumber Ngepoh village. The comparison must be made base on scientific method by using statistical analysis. This comparison does not carry out on individual level but on a group level. Based on the result of the comparison, a convincing conclusion about the profit earned from conventional paddy farming in Mulyoarjo village and from organic paddy farming in Sumber Ngepoh village could be stated. Therefore, the objective of this study is to analyze the profit earned in conventional paddy farming in Mulyoarjo village and in organic paddy farming in Sumber Ngepoh village where the analysis is based on the cost of paddy production (variable, fixed, and total cost), the total of paddy production, and the revenue from selling the paddy.

2. Materials and Methods

Mulyoarjo and Sumber Ngepoh villages are located in Lawang sub district, Malang district, East Java province, Indonesia. These both areas were selected as the study area because the organic and conventional paddy farmers are available in these villages. Moreover, the villages are adjoining, so that the paddy planting areas in both villages have a similar characteristic, the steps in planting paddy done by farmers in both villages are also similar and the conditions of the farming community are similar.

There are two farmer groups in Mulyoarjo village, namely Mulyo 1 and Mulyo 2, and two farmer groups in Sumber Ngepoh village, namely Sumber Makmur 1 and Sumber Makmur 2. All farmers in two farmer groups in Mulyoarjo village plant paddy conventionally. While, all farmers in farmer group of Sumber Makmur 1 plant paddy organically. A part of farmers in Sumber Makmur 2 plant paddy conventionally and other plant paddy half-organically.

Figure 1: Map of Sumber Ngepoh and Mulyoarjo villages



Source: Damayanti et al. (2017)[19] with modification.

Choosing one farmers group from each villages is intended to create an equality in doing comparison between organic paddy farmers from Sumber Ngepoh village and conventional paddy farmers from Mulyoarjo village. Farmer group of Mulyo 2 is chosen from Mulyoarjo village, and farmer group of Sumber Makmur 1 is chosen from Sumber Ngepoh village. There are 38 paddy farmers in farmer group of Mulyo 2 and 35 paddy farmers in farmer group of Sumber Makmur 1.

To determine the total sample size, this study used the equation to determine the sample size from a known (finite) population.[20] The equation is shown as follow:

$$s = \frac{X^2NP(1-P)}{d^2(N-1)+X^2P(1-P)} \tag{1}$$

where:

s	=	Required sample size
X^2	=	The table value of chi-square for 1 degree of freedom at the desired confidence level (1.960 x 1.960 = 3.841).
N	=	The population size.
P	=	The population proportion (assumed to be 0.50 since this would provide the maximum sample size)
d	=	The degree of accuracy expressed as a proportion (0.05)

By using the formula, the number of sample respondents in this research is 32 organic paddy farmers from farmer group of Sumber Makmur 1 and 34 conventional paddy farmers from farmer group of Mulyo 2. These sample size have fulfilled the requirement for minimum sample size, namely that a minimum sample size for quantitative research which using some form of statistical on data collected is 30.[21] Moreover, generally, sample size greater than 25 or 30 will produce a good approximation.[22]

Collecting data from respondents is done by direct interview to the farmers using structured questionnaire. The data, which were collected from respondents, were tabulated into excel spreadsheet to simplify in the data processing, both using excel or SPSS statistics version 16.0.

Kolmogorov–Smirnov test is used to test whether a sample was from a normally distributed population or not.[23] Therefore, in this study, the normal distribution of data is tested using the Kolmogorov-Smirnov test. The equation of the Kolmogorov-Smirnov test is present as follow[24]:

$$D_{KS} = sup|F_N(x) - F_E(x)| \tag{2}$$

where:
D_{KS} = Kolmogorov-Smirnov test
$F_N(x)$ = The Empirical Cumulative Distribution Function (ECD)
$F_E(x)$ = The Expected Cumulative Distribution Function
x = Random sample
The hypotheses, which are used, in the test are:
H_0 : The data follow a normal distribution if the significant value is more than 0.05 ($p \geq 0.05$).
H_1 : The data do not follow a normal distribution if the significant value is less than 0.05 ($p \leq 0.05$).

"A t-test is a type of statistical test that is used to compare the means of two groups. There is the independent t-test, which can be used when the two groups under comparison are independent of each other".[25] Based on these statements, the independent sample t-test will be used in this research. The formula of the independent sample t-test which will be used in this research is:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \tag{3}$$

where:
t = t-test value
$\bar{x}_1$ = The means for components of economic performance in organic farming
$\bar{x}_2$ = The means for components of economic performance in conventional farming
s_1^2 = Variance for components of economic performance in organic farming:

$$\frac{\sum\left(x_1 - \bar{x}_1\right)^2}{n_1} \tag{4}$$

s_2^2 = Variance for components of economic performance in conventional farming:

$$\frac{\sum\left(x_2 - \bar{x}_2\right)^2}{n_2} \tag{5}$$

n_1 = Number of respondents in organic farming
n_2 = Number of respondents in conventional farming

The hypotheses, which will be used to find out the different of components of economic performance, are:

H_0 : $p \geq 0.05$ means there is no the significant different of the components of economic performance between organic and convention farming.

H_1 : $p \leq 0.05$ means there is the significant different of the components of economic performance between organic and convention farming.

The significance level (α) which is used to accept or to reject the hypothesis is 5 percent (0.05). The hypothesis null (H_0) will be rejected if $t_{calculated} > t_{table}$ and vice versa. The result of the t-test will be used to determine the more profitable farming.

Refer to the objective of this study; this study is to analyze the profit earned in conventional paddy farming in Mulyoarjo village and in organic paddy farming in Sumber Ngepoh village. Therefore, the comparison of mean of variable cost, fixed cost, total cost, production, revenue and profit is done between farmer group of Mulyo 2 and Sumber Makmur 1.

Given that the farming land area owned by each farmer in both villages varies, then this thing causes the use of farming inputs, cost of production, production, selling result and profit are different. Therefore, in doing data processing, data of farming land area in both villages are converted into one Hectare. Thus, data of farming inputs, cost of production, production, selling result and profit in both village varies are also converted equal to one Hectare.

3. Results and Discussion

Test of sample distribution normality by using Kolmogorov-Smirnov test shows that all data are distributed normal. This thing is shown by Significant (Sig.) values for all data is more than 0.05. The results of the Kolmogorov-Smirnov test is presented in the Table 1. Based on this result, the data can be processed by using the parametric inferential statistical test, namely t-test.

The result of data processing by using t-test, as shown in Table 2., shows that all p value are less than 0.05. This means that there is the different the mean of variable cost, fixed cost, total cost, production, revenue and profit between in farmer group of Mulyo 2 and in farmer group of Sumber Makmur 1. The different of the mean states that by practicing the different paddy farming lead to the different using the agricultural inputs, such as fertilizers and pesticides. It influences to the cost of production, which must be spent by the farmers. In turn, it also influence to the profit earned by the farmers.

Table 1: Tests of Normality

The mean of	Kolmogorov-Smirnov		
	Statistic	df	Sig.
Variable Cost Organic	.119	32	.200
Variable Cost Conventional	.116	34	.200
Fixed Cost Organic	.135	32	.147
Fixed Cost Conventional	.066	34	.200
Total Cost Organic	.110	32	.200
Total Cost Conventional	.114	34	.200
Production Organic	.120	32	.200
Production Conventional	.137	34	.103
Revenue Organic	.120	32	.200
Revenue Conventional	.138	34	.101
Profit Organic	.114	32	.200
Profit Conventional	.138	34	. 097

Source: Data processed by authors, 2019

Table 3. present the mean of profit and its components, namely variable cost, fixed cost, total cost, production, selling price, and revenue, both in farmers group of Sumber Makmur1 and Mulyo 2. From the table, it is seen that variable, fixed and total cost which must be spent by the farmers in farmers group of Sumber Makmur 1 to run their organic paddy farming is 153, 81, and 151 percent respectively less than variable cost, which must be spent by the farmers in farmers group of Mulyo 2.

Table 2: T Tests Results

Profit and its components	P(T<=z) two-tail
Variable cost	1.68E-07
Fixed cost	7.11E-07
Total cost	1.44E-07
Production	0,030169
Revenue	0,001046
Profit	3.76974E-18

Source: Data processed by authors, 2019

From Table 3., it can also be seen that production of organic paddy is higher than the conventional paddy. The different of production in both village reach 15 percent. While the selling price of paddy grain for organic paddy is 8 percent higher than conventional paddy. The production and selling price of paddy grain contribute to the revenue of paddy grain. This thing causes that the revenue of paddy grain, which is earned by the farmers in farmers group of Sumber Makmur 1 is 21 percent higher than the farmers in farmers group of Mulyo 2.

From Table 3., it can be seen that profit of organic paddy is higher than the conventional paddy. The different of profit in both village reach 66 percent. This is caused by the low of total cost in organic paddy farming in Sumber Ngepoh village compared to Mulyoarjo village and the high of selling result of paddy grain earned by farmers in Sumber Ngepoh village compared to Mulyoarjo village.

Table 3: The mean of Cost, Production, Price and Profit

Mean of	Unit	Organic	Conventional	Percentage O to C
Variable cost	IDR	7,027,126	17,783,603	(-) 153
Fixed cost	IDR	243,879	442,258	(-) 81
Total cost	IDR	7,271,006	18,225,861	(-) 151
Production	KG	7,119	6,074	15
Price	IDR	5,000	4,612	8
Revenue	IDR	35,596,667	28,005,294	21
Profit	IDR	28,325,661	9,779,433	66

Note: O means Organic; and C means Conventional
Source: data processed by authors, 2019

The low of variable cost to run organic paddy farming in Sumber Ngepoh village compared to variable cost to run conventional paddy farming in Mulyoarjo village is caused by the use of natural farming inputs by farmers in Sumber Ngepoh village, namely the use of animal manure (from cow, goat and buffalo) for fertilizers and some useful plants for pesticides. All farmers in farmer group of Sumber Makmur 1 have livestock as source for animal manure. This thing help them to reduce the cost to procurement of the fertilizer, such as to buy chemical fertilizers. The application of the animal manure to organic paddy plant carried out by the farmers throughout the paddy-planting season. Besides as resource of the animal manure, the livestock also has an important function as a savings for the farmers. They can sell it if they need more money.

To control the rat (*Rattus argentiventer*), the farmers in farmers group of Sumber Makmur 1 use the *gadung KB* (*Dioscorea composita*). This tuber is used only to control the breeding of the rat. While, to control the *sundep* (*Scirpophaga innotata*) the farmers use the *dringu daun* (leaf of *Acorus calamus*) and the *daun sirsak* (leaf of *Annona muricata*).

The variable cost, which must be spent by the farmers in farmers group of Mulyo 2, is to buy the chemical fertilizers and pesticides. The kinds of chemical fertilizers are Urea[2], ZA[3], NPK Phonska[4] and TSP[5]. While, the kinds of the chemical pesticides are Decis[6], Furadan[7] and Ally[8].

The fixed cost, which must be spent by the farmers in farmer group of Sumber Makmur 1, is to pay tax for their farming land and to pay organic certificate. The amount of cost of tax for farming land that must be paid by the farmers in this group is lower than the amount of cost of tax for farming land that must be paid by the farmers in farmer group of Mulyo 2. This thing causes the fixed cost, which must be spent by the farmers in farmer group of Mulyo 2, is higher than the fixed cost, which must be spent by the farmers in farmer group of Sumber Makmur 1.

Meanwhile, the amount of cost, which must be spent by the farmers in farmer group of Sumber Makmur 1, to get the organic certificate is IDR 33 Million. The validity period of the certificate is 3 years. Therefore, each farmers must contribute about IDR 26,191[9] per month to pay the certificate. By paying jointly the cost for the organic certificate are mitigating for the farmers. Moreover, by having the organic certificate give a benefit to increasing the image of their organic paddy to consumers.

The high of total cost, which is spent by farmers in farmers group of Mulyo 2, is caused by the high of variable cost, namely to buy chemical farming inputs. This variable cost is higher compared to the variable cost to pay organic certificate, which is spent by each farmers in farmers group of Sumber Makmur 1.

There are two things, which cause the high production of organic paddy in Sumber Ngepoh village compared to production of conventional paddy in Mulyoarjo village, namely:

(a) the farming land area, which is owned by the farmers in farmers group of Sumber Makmur 1, is more wide compared to the farming land area that is owned by the farmers in farmer group of Mulyo 2,

(b) the *wereng* (*Nilaparvata lugens*), which come into farming land in Mulyoarjo village, also decreased the paddy production in this village.

The different of selling price between organic paddy from Sumber Ngepoh village and conventional paddy from Mulyoarjo village is based on the way to determine the price. The determination of selling price of organic paddy is done by all farmers in farmers group of Sumber Makmur 1. The price is determined in the group meeting which is carried out in every 4 month, namely on 15 April, 15 August and 15 December. Before the meeting take place, the survey of the price of paddy in central

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[2] Urea is known as Nitrogen (N) fertilizer.
[3] ZA is known as Nitrogen (N) with Sulfur (S) fertilizer.
[4] NPK is known as compound (Nitrogen (N), Phosphorus (P), and Potassium (K)) fertilizer.
[5] TSP is the Triple Super Phosphate fertilizer.
[6] Decis is used to eradicate the *wereng* (*Nilaparvata lugens*).
[7] Furadan is used to eradicate the *penggerek batang* (*Tryoiryza innotata*)
[8] Ally is a herbicide.
[9] This IDR 105,000,- is obtained from IDR 33 Million divided by 36 month (3 years to expired time for certificate) is being IDR 916,667. This IDR 916,667 is divided by 35 farmers is being IDR 26,191.

market at Lawang sub district and Malang city is done by two to three of the members of the farmer group. The price, which is gotten from the survey is the price of conventional paddy. Based on this price, the farmers in farmers group of Sumber Makmur 1 determine the selling price for their paddy above of the surveyed price. Meanwhile, the farmers in farmer group of Mulyo 2 sell their paddy is follow on the price for conventional paddy, which is sold in the central market at Lawang sub district and Malang city.

The rate of paddy production and the selling price of paddy in each farmers group contribute to the revenue earned by farmers in each farmer group. The high production and selling price of organic paddy contribute to the higher revenue earned by the farmers in farmer group of Sumber Makmur 1. This revenue, together with the lower of total cost production which spent by the farmers in farmer group of Sumber Makmur 1, contribute to the more profit earned by the farmers in this group. The continuity of high profit earned by the farmers in farmer group of Sumber Makmur 1 is also support by selling of paddy to one of member of the group, namely the head of the farmer group. Therefore, all the farmers only face one trader and the selling process can be controlled directly by them. In contrast, the farmers in farmer group of Mulyo 2 sell their paddy to one of two middleman in Mulyoarjo village, so that they can not control the determine the selling price.

4. Conclusions

The practice of organic paddy farming in Sumber Ngepoh village show many benefit obtained by the farmers in that village. Because, they use the organic farming inputs, which contribute to the higher profit earned by them. Moreover, having the livestock is not only as source of organic fertilizer, but also as savings source for their family. Therefore, this practice to plant organic paddy can also be done by the farmers in Mulyoarjo village, so that they can potentially get the similar benefits as gotten by farmers in Sumber Ngepoh village.

The own the smaller farming land by farmers in farmer group in Mulyo 2 compare to the farmers in farmer group in Sumber Makmur 1 can be one reason for the farmers in Mulyoarjo village to convert their farming practice, namely from conventional to organic. By this, they can reduce the farming variable cost, suppress the *wereng* attack, and increase the paddy yields. They can also imitate the way to determine of selling price for their paddy as similar to the way done by the farmers in farmer group in Sumber Makmur 1.

However, to do the conversion from practicing the conventional paddy to practicing the organic paddy, it is needed the preliminary effort to reduce the dependence to use chemical fertilizers and pesticides. In this issue, the head of the farmers group in Mulyo 2 plays an important role to invite the members of the farmer group to do the conversion. Thus, the strong social tie among the farmers is the central key to achieve this mission.

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Feasibility Analysis of Organic Mangos Business (Case Study at Castro Thomas Farm Camiling, Tarlac, Philippines Republic)

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Abstract.

Castro Thomas Farm is a farm located in Camiling, Tarlac, Philippines. Castro Thomas Farm has a unique organic mango commodity and can be sold to various groups. When running a business there must be faced many obstacles in Business Feasibility This study aims to determine the feasibility of the business in Castro Thomas Farm in terms of the revenue and income, followed with B/C Ratio analysis. Location of the result? The method of data collection is done by observation, interviews, documentation studies, and questionnaires. Data sources used are primary data and secondary data. Data analysis techniques through qualitative and quantitative approacheswhich qualitative data needed for non-financial aspect, and quantitative data for financial aspect. The result of this research showed that the B/C Ratio of Castro Thomas Farm is below 1, which means the business is not feasible enough yet.

Keywords : business feasibility, organic mango, philippines

1. Introduction

Castro Thomas Farm is a farm that was founded in 2016 by Jhunn Castro. Weather Castro Thomas Farm is suitable for the cultivation of mango, where the plantation is located in the lowlands, and has balanced on wet and dry seasons. The land area of Castro Thomas Farm is 5 ha. Castro Thomas Farm has three varieties of mangoes cultivated, namely *Magnolia*, *Catimol*, and *Carabao*. The size of each mango is very large, which is an indicator of fertility garden for mango cultivation. Each mango has a price, taste, and a different production. All the fruit produced by Castro Thomas Farm is organic. Castro Thomas Farm practice environmentally friendly natural farming with various terms such as "organic" or "alternative" and further evolved into organic agriculture as it is today. The resulting fruit also has an optimal taste, and healthy to eat. The economic prospect of the farm is also quite good with the changing pattern of human consumption where they prefer healthy food even though it was expensive.

In the application of organic farming requires high costs, and more complicated than non organic farming (using chemicals). Castro Thomas Farm as executor of organic farming, still expecting a larger production in order to obtain greater income. Castro Thomas Farm using manpower, capital and means of production as a bait to get the expected production. A farm said successful if the farm can meet the obligation to pay interest on capital, tools used, beyond wages and other production facilities (Suratiyah, 2015). The earning has a direct relationship with the results of farm production, while production is determined by an individual's expertise in processing that supports.

The use of production factors such as farm land, labor, capital (cost of seed, fertilizer costs and organic medicines), and management. Castro Thomas Farm must maintain his farm in order to become an efficient farming and able to be thrive better. The purpose of this study was to analyze the financial feasibility of Castro Thomas Farm business especially mango based on the investment criteria namely NPV, Net B / C, and payback period. Financial analysis is useful to provide the information whether the business is financially feasible or notfeasible .

2. Methods

There are two types of data source namely Primary Data and secondary data. Primary data according to Umar (2004) is the data obtained from the first source either from individuals or individuals as a result of interviews or the results of filling the questionnaire is usually done by researchers. The primary data obtained directly to direct interviews with the owners and employees of Castro Farm.. Secondary data by Umar (2004) is the primary data that has been processed further and presented either by the primary data collectors or by other parties. Secondary data were obtained from the literature, documents, or references related to Castro Thomas Farm. This data consists of the company's history, vision, and mission, organizational structure, production data, sales data of products, the cost of storage and preparation.

To obtain the required data, the authors used Data collection methods observation, interview. and documentation.

This study used two basic analysis, revenue analysis and feasibility analysis. To calculate the income of farming can be done by calculating the difference between revenue (TR) and Total Cost (TC). Farm receipts is the multiplication of the production and the selling price of mangos, while the cost is all cash outlay used for the procurement of factors of production, it can be formulated as follows:

π = TR - TC Information :

π = Revenue

TR = Total Revenue (Total Revenue)

TC = Total Cost (Total Cost) Where :

TR = PQ

TC = FC + VC

B / C Ratio

Feasibility is a measure to determine whether a business deserves to be developed. Feasible in the sense that can produce benefits / benefits for farmers. A farm that will be implemented rated to provide benefits or feasible if done feasibility analysis, the feasibility of the approach can be determined by the R / C. R / C stands for Revenue Cost Ratio, known as a comparison (ratio) between the total cost (TR) and total revenue (TC), using the formula:

B / C = TR / TC

Information :

B / C = A comparison between the total revenue with total cost

TR = Total Revenue (total revenue)

TC = Total Cost (total cost)

If the B / C = 1, it means that farming no profit and no loss or break even, then when

B / C <1, indicating that the business is not viable, and if B / C >1, then the farm is worth the effort (Soekartawi, 2002)

3. Result & Discussion

After the conducted research we gain an information that we need for the research. we gain Castro Thomas Farm financial investment per 3 years and the revenue:

Year I

No	Cost	Total
1	Total Operational Cost	Rp. 614.800.000,-
2	Field Tax Cost	Rp. 2.000.000,-
3	Total Variabel Cost	Rp. 56.676.000,-
4	Total Cost in 1st Year	Rp. 673.476.000,-
5	Total Cost in 1st Year/10 Ha	Rp. 6.734.476.000,-

Year II

No	Cost	Total
1	Total Operational Cost	Rp. 51.570.000,-
2	Field Tax Cost	Rp. 2.000.000,-
3	Total Variabel Cost	Rp. 57.976.000,-
4	Total Cost in 2nd Year	Rp. 111.546.000,-
5	Total Cost in 2nd Year/10 Ha	Rp. 1.115.460.000,-

Year III

No	Cost	Total
1	Total Operational Cost	Rp. 4.773.600,-
2	Field Tax Cost	Rp. 2.000.000,-
3	Total Variabel Cost	Rp. 57.976.000,-
4	Total Cost in 3td Year	Rp. 64.749.600,-
5	Total Cost in 3td Year/10 Ha	Rp. 647.496.000,-

Year	Cost
1 (Investment)	Rp. 6.734.760.000,-
2	Rp. 1.115.460.000,-
3	Rp. 647.496.000,-

The total cost for 3 years is Rp 8.497.716.000,- The Revenue of Castro Thomas Farm:

Year	Revenue
1	Rp. 611.700.000,-
2	Rp. 727.500.000,-
3	Rp. 1.090.500.000,-

3.1. Incremental B/C

The Incremental B/C can be formulated :

π = TR - TC Information :

π = Revenue

TR = Total Revenue (Total Revenue) TC = Total Cost (Total Cost)

From the discussion, we get the result of incremental B/C for each years. The B/C for the 1st Year is, - 6.123.060.000. And the B/C 2nd year is - 387.960.000. And finally for 3rd year is 443.004.000. And the Incremental B/C for overall 3 years is -
6.431.016.000.

3.2. B/C Ratio

To find the B/C Ratio can use formula : B / C = TR / TC

Information :

B / C = A comparison between the total revenue with total cost

TR = Total Revenue (total revenue) TC = Total Cost (total cost)

From the discussion, we get the result of B/C Ratio for each years. The B/C Ratio for the 1st Year is, - 0,9091. And the B/C Ratio of 2nd year is - 0,347. And finally the B/C Ratio for 3rd year is 0,684. And th B/C Ratio for overall 3 years is - 0,756.

4. Conclusion

From the result, the B/C Ratio of this business is below 1 (-0,756). Which means, that the business of Castro Thomas Farm is not feasible. But we still conducted some research for the future time, so which means there's a chance in a few years Castro Thomas Farm is feasible enough.

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Farming Analysis of Five New Gogo Rice Varieties In Sub-Optimal Areas in Agrotechno Park (ATP) Area Gunungkidul, Yogyakarta

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Abstract.

This research try to analyze farming business of five new varieties of upland rice in sub-optimal areas in Gunungkidul, Yogyakarta namely Inpago 5, Inpago 8, Inpago 10 Inpari 42 Agrarian GSR, Inpari 43 Agrarian GSR. This research was conducted in the Farmers Group Makaryo, Nglanggeran, Patuk, Gunungkidul , Yogyakarta from February 2018 to June 2018. Five teen days seedlings with one seedling per hill was planted in *tajarwo* 4: 1, spaced of 25 x 12.5 x 50 cm, with 256,000 plant populations. The plot size was 2000 m2. Data were analyzed using t test. The productivity of superior rice varieties of Inpari 42 Agrarian GSR, Inpago 10 and Inpari 43 Agrarian GSR were higher than Inpago 5, Inpago 8 and Ciherang rice varieties. The five new superior varieties were feasible to be developed in Gunungkidul dry land with B/C ratio was 2.02 for Inpari 43, for Agrarian GSR was 2.90 and for Inpari was 42, respectively. Whereas, for the Ciherang rice varity, as a popular variety, only gave B/C ratio of 1.88. The highest incremental B/C ratio to Ciherang (%) was achieved by Inpari 42 GSR (54.25%), followed by Inpago 10 (47.34%), Inpago 5 (44.15%), Inpago 8 (40.42 %) and Inpari 43 GSR (7.45%), respectively. In the future, the superior varieties of Inpari 42 Agrarian GS(R, Inpari 43 Agrarian GSR and Inpago need to be developed in order to increase rice farming in Gunungkidul dry land. The objective of this study was to examine upland rice farming in an effort to accelerate the level of income farmers and support national food security.

Keywords: Gunungkidul, new upland rice, farm studies, superior varieties

1. Introduction

In Yogyakarta, the rice planting area is around 155,457 hectares consisting of 112,083 hectares of rice fields and 43,364 hectares of rainfed land (Dinas Pertanian DIY 2015). According to statistical data, more than 42% of rice needs in the Special Region of Yogyakarta are still supplied from Gunungkidul Regency. Therefore, to support the independence of the program to increase the productivity of upland rice in Gunungkidul District is very important because the upland harvested area of upland rice is about 40,000 - 45,000 ha per year, with peat rice productivity of 4.45 tons ha^{-1} (BPS DIY 2015).

In the Gunungkidul dry land, high yielding upland rice varieties released by the Agency for Agricultural Research and Development have not developed much. Therefore, it is necessary to introduce a variety of Inpago varieties (inbred line rice). In an effort to achieve maximum results from the use of new improved varieties, the right growing environment is needed,so that the results and potential advantages can be realized. In addition to varieties production, support in the form of fertilization technology based on soil testing (PUTK) and planting systems is also important to increase the upland rice productivity potency in Gunungkidul (Suyamto, 2006; Sutaryo et al., 2016).

2. Methodology

The location of the study of the development of superior varieties of Inpago (Inbred upland rice) was in Dry Land Supports IP 200 in Gunungkidul D.I. Yogyakarta, covering an area of about 5 hectares belonging to the "Kumpul Makaryo" Farmers Group, Nglanggeran Village, Patuk Sub District, Gunungkidul Regency. The assessment was conducted on farm research by involving cooperating farmers.

The superior varieties developed were Inpago 5, Inpago 8, and Inpago 10, which are superior varieties with quite high yields from the results of the 2017 assessment. In addition to these three varieties, new superior varieties were developed in Inpari 42 GSR and Inpari 43 GSR which are varieties with amphibious properties (can be planted in dry land or in flooded land). Meanwhile Ciherang rice variety was also planted as comparison variety. The introduction of technology to be developed can be seen in Table 1.

Table 1. Development of upland rice varieties technology

Teknology Componen *)	Inpago 5	Inpago 8	Inpago 10	Inpari 42 GSR	Inpari 43 GSR	Ciherang
1. VUB	V	V	V	V	V	-
2.Labeled Seed	V	V	V	V	V	-
3.Population/ Tajarwo	V	V	V	V	V	V
4.Fertilization according to Soil Test Kits(PuTK)	V	V	V	V	V	V

*Note: *) source: Abdulrachman 2013*

The observed variables were:

a. The yield of the unhusked grain, i.e the weight of the unhulled rice harvested from the development plot was analyzed by the statistical method of the Gomez and Gomez t-Test (1995).

b. To obtain farm income, the following formula can be used (Soekartawi, 2000):
Analysis of farm income: π = TR - TC,
Revenue: TR = P x Q,
Total production: TC = TFC + TVC,
Cost R / C ratio = TR / TC;
B / C value (economic feasibility); and
Incremental B/C ratio), with the following formula:
B/C ratio = Benefit/Total input

Information:
B/C ratio of less than 1 means unprofitable
B/C ratio with a value of more than 1 means profitable

The incremental B / C ratio to comparative varieties was:

$$\frac{\text{B/C ratio of New Superior Varieties - BC ratio of comparable varieties}}{\text{B/C ratio of comparison varieties}} \times 100\%$$

(Soekartawi 1990)

3. Results And Discussion

Grain Results and Inpago Superior Variety Agronomic Characteristics

3.1. Sampling yield, and productivity conversion

In Table 2 we can see the yield of unhulled grain, productivity conversion and productivity conversion minus correction factors. The highest yield was achieved by Inpari 42 Agrarian GSR (6.1 kg), followed by Inpago 10 (5.9 kg), Inpari 43 Agritan GSR (5.9 kg), Inpago 5 (5.8 kg), Inpago 8 (5.7 kg) and Ciherang (4.5 kg). The grain productivity produced increased compared to the results of previous studies conducted in 2016 with Impago varieties 5, 6, and 8 only sampling productions from 3.80 to 4.40 kg (Srihartanto et al., 2016). Thus, the five VUBs can be developed on a broader scale.

Table 2. Sampling yields, productivity conversion, productivity conversion minus correction factors, Nglanggeran, Patuk, Gunungkidul 2018

No	Variety	Sampling yield (kg) GKP	Productivity convertion ha^{-1} (kg) GKP	Productivity convertion ha^{-1} (kg) GKP– correction factor 20% embankment
1.	Inpago 5	5,8	9.280	7.424 *
2.	Inpago 8	5,7	9.120	7.296 *
3.	Inpago 10	5,9	9.440	7.552 *
4.	Inpari 42 GSR	6,1	9.760	7.808 *
5.	Inpari 43 GSR	5,9	9.440	7.552 *
6.	Ciherang	4,5	7.220	5.776 *

*Note : * is a significant difference to Ciherang as a comparison variety in the t test at the 5% level*

In addition to this, the highest productivity conversion results were achieved by Inpari 42 Agrarian GSR (9,760 Kg GKP ha^{-1}), followed by Inpago 10 (9,440 Kg GKP ha^{-1}), Inpari 43 Agrarian GSR (9,440 kg GKP ha^{-1}), followed by Inpago 10 (9,440 Kg GKP ha^{-1}), Inpari 43 Agrarian GSR (9,440 kg GKP ha^{-1}), Inpago 5 (9,440 kg Kg ha^{-1}) 9,280 kg / ha GKP), Inpago 8 (9,120 kg ha^{-1}) and Ciherang (7,220 GKP ha^{-1}).

The results of the conversion of productivity after deducting the correction factor of 20% for the highest furrows were found in Inpari 42 Agrarian GSR (7,808 Kg GKP ha^{-1}), and followed by Inpago 10 (7,552 kg GKP ha $^{-1}$), Inpari 43 GSR (7,552 Kg GKP ha^{-1}), Inpago 5 (7,424 kg GKP ha^{-1}), Inpago 8 (7,296 kg GKP ha^{-1}), and Ciherang (5,776 Kg GKP ha^{-1}) (Table 2).

3.2. Analysis of farm business analysis

In Table 3 it can be seen that the results of the B/C ratio farming analysis showed that the five new superior varieties were feasible to be developed, with the B/C ratio ranges from 2.02 for Inpari 43 of GSR Agritrity to 2.90 for Inpari 42 of Agritrity of

GSR. Whereas, Ciherang rice variety as the popular variety only gave B/C ratio of 1.88. The B/C ratio achieved by these superior varieties provides good benefits; the condition is in accordance with the results of a study by Sularno et al. (2011).

Table 3. Analysis of Inpago superior varieties farming in Nglanggeran, Patuk, Gunungkidul, 2018

Description	Inpago 5	Inpago 8	Inpago 10	Inpari 42 GSR	Inpari 43 GSR	Ciherang
Land area (ha)	1,0	1,0	1,0	1,0	1,0	1,0
Production input (x Rp. 1000)	2.600	2.600	2.600	2.600	2.600	2.300
Labor (x Rp. 1000)	5.200	5.200	5.200	5.200	5.200	3.800
Others (xRp. 1000)	2.200	2.200	2.200	2.200	2.200	1.900
Total (*input*) (x Rp.1000)	10.000	10.000	10.000	10.000	10.000	8.000
Yield of grain (kg)	9.280	9.120	9.440	9.760	7.550	5.770
Selling price (Rp/kg GKP)	4.000	4.000	4.000	4.000	4.000	4.000
Revenue (xRp. 1000)	37.120	36.480	37.760	39.040	30.200	23.080
Benefits (x Rp. 1000)	27.120	26.480	27.760	29.040	20.200	15.080
B/C ratio	2,71	2,64	2,77	2,90	2,02	1,88
Incremental B/C ratio to Ciherang (%)	44,15	40,42	47,34	54,25	7,45	-

Source: primary data analysis, 2018

3. Conclusions And Suggestions

Conclusions

1. Inpari 42 superior varieties GSR, Inpago 10 and Inpari 43 Agrarian GSR provide higher productivity than other varieties.
2. The five new superior varieties were feasible to be developed, with B/C ratio ranging from 2.02 for Inpari 43, Agrarian GSR to 2.90, and for Inpari 42 Agrarian GSR. Whereas Ciherang as the popular variety only gave a B/C ratio of 1.88.
3. The highest Incremental B/C ratio to Ciherang (%) was achieved by Inpari 42 GSR (54.25%), followed by Inpago 10(47.34%), Inpago 5 (44,15%), Inpago 8(40.42%) and Inpari 43 GSR (7.45%), respectively.

Suggestion

In the future, new superior rice varieties of Inpari 42 Agrarian GSR, Inpari 43 Agrarian GSR and Inpago need to be developed more broadly in dry land to support IP 200 in Gunungkidul, and to increase rice yields in Gunungkidul dry land.

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An Analysis of Ecotourism Potency and Its Development in Merapi Mountain Slopes Area (A Study at Deles Indah and Kalitalang Tourism Objects, Kemalang District, Klaten Regency)

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Abstract.

Ecotourism developed in conservation area is "Green and Fair" ecotourism for benefit of the sustainable development and conservation, which is a business activity that is aimed to provide sustainable economic alternatives for the people in conservated areas. The purpose of this research was to analyze the potency of the Natural Resources and Socio-Culture for the development of ecotourism in the southern slope of Mount Merapi, especially in Kemalang District, Klaten Regency. The research method used descriptive and its implementation use case studies at Deles Indah and Kalitalang Tourism Objects. The respondents of this research were the Officials / Heads /Chairpersons of the agencies which are related to this research (Mount Merapi National Park Office, Regional Disaster Management Agency, Youth and Sports Culture Tourism Office, District, Village, and Tourism Awareness Group) , and the visitors. The data needed is primary and secondary data, which are collected by Interviews, Observation and Documentation technique. The data analysis used descriptive analysis. The results showed that (1) Natural Resource Potency in the form of a beautiful natural scenery (Merapi volcano, forest, valley) is very interesting to visit and suitable for photo spots; (2). Tourism Awareness Group (*PokDarWis*) has been formed as the manager of Kalitalang and Deles Tourism Objects; (3) Local Cultural Activities are the attractions that they have been done routinely; (4) Facilities, such as Parking Areas, Toilets, prayer room, Homestay and Trash bin, have been built; (5) Food and Beverage Products, Typical Handicrafts were worthy for sale, (6) Guidance from the Mount Merapi National Park Office, Regional Disaster Management Agency, Youth and Sports Culture Tourism Office, District and Village Government has been established; (7) Visitors tend to increase in 2019 through on line promotion, and informatif location; and (8) needed further investigation for its development strategy, because most of the visitors were not satisfied in the facilities, and there are any obstacles and risks.

Keywords: Ecotourism, Potency and Development, Natural Resources, Socio-Cultural, Mount Merapi Slopes

1. Introduction

Ecotourism is a tourist trip to a remote area that aims to enjoy and learn about nature, history and culture in an area, where its tourism patterns help the local economy and support the natural conservation. Mount Merapi slope is one of a tourist area which started to get attention from tourists both domestic and non-domestic. This region has a unique natural resources as a series of products from the activities of Mount Merapi.

Mount Merapi grows above the point of intersection between Ungaran volcanic alignment - Telomoyo - Merbabu - Merapi and Lawu volcanic straightness - Merapi - Sumbing - Sindoro – Slamet. The Ungaran-Merapi volcanic alignment is a concave horizontal fault that reaches to the west, and gradually develops its volcanic activity along the horizontal fault from north to south. Therefore, it mentioned that Mount Merapi located at the intersection of two Quaternary faults, the North-South-oriented Semarang Fault and the East-west-oriented Solo Fault. With this such volcanic conditions make the location around the slopes also danger during the eruption.

Another problem was the result of the eruption raises the capacity of the soil and the stability of the slope on the eruption deposits. The rocks and their constituents consist of lava, pyroclastic rocks and lava depositsmake problems such as landslides, limited capacity and the threat of eruptions of Mount Merapi that occur periodically, as well as lava threats. Along with population growth and the progress of the world of tourism, the development of natural tourism areas was needed in order to improve its quality as an interesting attraction. So with such natural conditions the specific development strategy was needed.

The master plan for regional tourism development in Central Java Province according to Governor Regulation Number 10 of 2012, concerning the Central Java Tourism Development Master Plan for 2012-2027. The research area based on the Governor Regulation includes Borobudur - Dieng DPP and its surroundings, which is included in the KSPP Merapi-Gray and surrounding areas (Perda No 6 Tahun 2015)

In Klaten Regency, there are development of two tourism objects namely: Deles Indah, Sidorejo Village area, and Kalitalang in Balerante Village, Kemalang District. Deles Indah is a tourist attraction located on the eastern slope at the foot of Mount Merapi, about 25 km from downtown of Klaten, with elevations between 800 - 1300m. This location located in the form of natural mountain views. Few interesting places can be visited are historical relics and special recreational areas such as: Raja Paku Buwono X Site, Tombs, cave, *Sendang* and Parks. Deles Indah which was cultivated before 2000 was the largest source of regional income from the tourism sector.The problem of it location is at this tourist spot is the water source facilities are difficult. So this location is rather quiet visitors so it make business people reluctant to open the business opportunities in this place. The condition of Deles Indah after the eruption of Merapi tend to untreated and it causes the tourism potency not attractive forthe visitors (Dinas Pariwisata Kabupaten Klaten, 2004). Kalitalang tourism object is located on the border of Cangkringan District, Sleman Regency, Yogyakarta Special Region and Klaten Regency, Central Java Province. This new tourism object opened in September 2016. At this tourist locationwe can enjoy the fresh air, the landscapes and very large rivers, artistic bamboo for photo selfie spots, and provided mountain bike trails (Downhill) (Dinas Pariwisata Kabupaten Klaten, 2004).

Conservation areas, both natural conservation areas and conservation forest areas, are interesting destinations for the tourists. They have a diversity of flora and fauna, beautiful natural phenomena, cultural and historical objects and unique local community life. The whole tourist attraction object is a resource that has high economic value educated and environmental preservation. Utilization of natural resources and the environment as concern of community in conservation areas is in line with the vision of development of ecotourism, namely the conservation of biodiversity , its ecosystem, and the empowerment of local communities (Fandelli, 2000).

In order to prevent forest destruction getting worse, many countries use many ways to preserve their forests. One of the efforts is developing ecotourism as a source of livelihood to reduce forests damage.

Based on the previous description, the purpose of this study was to analyze the potential of Natural Resources and Socio-Cultural Resources for the development of ecotourism of the southern slopes of Mount Merapi, especially in Kemalang District, Klaten Regency.

2. Research Methods

The basic research method used descriptive and its implementation used case study. Respondents in this study were Officials / Heads / Chairpersons of agencies related to this research (Mount Merapi National Park Office, Regional Disaster Management Agency, Youth and Sports Culture Tourism Office, District, Village, and Tourism Awareness Group). Other respondents were visitors at Kalitalang and Deles Indah Tourism Objects who metting and willing to be interviewed for the past two months. The data were primary and secondary data, collected by interviews, observations, and documentation technique. Data analysis used descriptive analysis.

3. Results And Discussion

3.1. Ecotourism Potency and Conditions

Based on the data collected, an analysis was carried out. Description of the potency and conditions of the Kemalang District ecotourism obtained and can be seen in Table 1.

Table 1. Ecotourism Potency and Conditions in Kemalang District Klaten Regency in 2019

No.	Aspects	Deles Indah	Kalitalang
1.	Ecotourism Location	Hamlet Deles and Hamlet Mbangan Sidorejo Village, Kemalang District and part of TNGM (Gunung Merapi National Park) in the utilization zone	Hamlet Kalitalang Balerante Village Kemalang District, residents' land and part of the TNGM Non-utilization Zone.
2.	Tourism Management Group / Managers	Counselor : Village Head Person in charge: Village Secretary Chairperson, Public Relations Section, Culture Section, Outbound Section, Horticulture Section, Facilitator Section (Tracking, Hiking and Camping) 28 people Meeting: Routine every Monday	Counselor: Village Head Person in charge: Head of Planning Chairperson, Secretary, Treasurer, Sections 20 people: Meeting: Routine on the 1st of every month

		Wage at the place of the leader Tourism Management Group	
3.	Destinations	1.Beautiful view of Mount Merapi and the Valley 2. Facilitator / guide (10 people): -Outbond -Tracking 3.Camping 4 location points; 2 locations at the pesanggrahan, 2 points at the TNGM location 4. Japanese Cave 5. Kalireno Spring 6. Mountain Bike Path (Downhill) 7. Resting on Paku Buwono X 8. Culture: Karawitan, Ketoprak, Jatilan (Kuda lumping) 9. Grave of Kyai Mloyopati 10. Horticulture: Short distance guide and horticultural plant education 10. Education of Disaster Mitigation Services 11 Food Stalls: Deles Coffee (Petruk coffee), *Wedang* herbs, chips, *otokowok*, *jambal*, pondoh corn	1. Beautiful view of Mount Merapi and the Valley 2. Special Interest Sports: -Camping, Mountain Bike Path (Downhill 3. Tomb of Kyai Ageng Kalitalang 4. Typical Merapi Plants (Anggrek) 5. Museum and House of Balerante Batik 6. Food stalls: Balerante Robusta Coffee, Lemper
4.	Visitor Services	Every day	Saturday - Sunday And National Holiday
5.	Entrance ticket	Monday-Friday: IDR 6,000 (Insurance IDR 1,000) Saturday-Sunday and National Holidays): IDR 8,500 (Insurance IDR 1,000)	(Monday-Friday): TNGM IRD 6,000 (Insurance IRD 1,000) and Pokdarwis IDR 2,000 Saturday-Sunday and National Holidays: TNGM IDR .8,000 (Insurance IDR 1,000) and Pokdarwis IDR 2,000
6.	Fauna	Partridges, deer, long-tailed macaques, pleci birds, starlings, finches, pentet, curls, derkuku, betet, trotokan, Javanese eagle	Partridges and, long-tailed macaques,
7.	Flora	Pine, Bintari pine, acacia dekuren, roso molo, puspa, bamboo	Acacia, Bamboo, Aren, Kaspo (just starting to plant)
8.	Culture as an attraction (once a year)	a. Mertideso / cultural parade / ogoh-ogoh every 14 Ruwah (Sya'ban) b. Clean Hamlet(*Bersih Dusun*) c. Grooming times (*Dandan Kali*)	Mertideso
9.	Facilities	1. Parking Bike: IDR 2,000. Car: IDR 5,000 2. Toilets (6 pieces): 2 pieces each in Nature Tourism, Pesanggrahan and Circuit 3. Musholla 4. Trash Can 5. Lodging / Homestay	1.Parking: Locations of residents' land -Bike: IDR 5,000 - Car: IDR 10,000 2. Toilets (2 pieces) near the parking lot and food stalls 3. Musholla 4. Trash Can 5. Lodging / Homestay
10.	Activity of Chairperson	Volunteer	Teacher
11.	Others	- Directions are quite informative - Road conditions are not good - The risk of an eruption is large	Directions are informative - Road is in good condition - The risk of an eruption is large

	enough - Promotion has been carried out online	enough - Promotion has been carried out online

Based on Table 1, it can be concluded that the potency of ecotourism in the Merapi Mountain Slope area, especially on the south and east (Kemalang District) is quite large, in the form of Natural Tourism supported by Natural, Social and Cultural Resources to be developed. These supported by the formation of the Tourism Awareness Group (Pokdarwis) as a manager of Tourism Objects, Guidance from the Mount Merapi National Park Office, Regional Disaster Management Agency, Department of Culture Tourism Youth and Sports, District and Village Governments. In the development, Deles Indah was initiated earlier, Pokdarwis was more active, compact and experienced. The location in the utilization zone, more diverse destinations, and more complete facilities cause it better known and visited by more tourists. In August and September 2019 Deles Indah was visited by tourists from Japan. In 2019 the number of tourists in both tourism objects tend to increase (Table 2).

Kalitalang Tourism Object visitors only open every Saturday and Sunday and the number of visitors range between 25-75 people which less than Deles Indah.

Table 2. Development of Deles Indah Visitors, Kemalang District in May - August 2019

Month	Number of Visitors (people)		
	Domestic Tourist	Foreign Tourist	Amount
May	73	-	73
June	888	-	888
July	280	-	280
August	37*)	20	57
	1,278	20	1,298

Source: Deles Indah Administration, 2019
**) only date of 1-4 August 2019*

3.2. Tourist Satisfaction and Expectations

In general, visitors in Deles Indah and Kalitalang are young people who has adventurous spirit, like challenges and always want to capture all the conditions and the atmosphere they see. Foreign tourists, especially from Japan interested in the beauty of mountains and the valleys on the slopes of Merapi. Both domestic and foreign tourists interested to visit again and hope that there were improvements on the facilities.

Table 3. Deles Indah Tourist Satisfaction, Kemalang District, Klaten Regency

No	Aspect	Score Average	Score Maximum	%
1	Natural Resources	3.10	4	77.50
2	Infrastructure	2.54	4	63.46
3	Accessibility	1.60	4	40.00
4	Hospitality and Cultural Resources	2.87	4	71.75
5	Marketing Mix	2.63	4	65.83

6	Enchanting Seven/Sapta Pesona	3.50	4	87.50
7	Education	3.00	4	75.00
8	Principal Tourism	3.25	4	81.25
Total		22.49	32	
Average		2.81	4	70.29

Score : 1 = Not Satisfied; 2 = Not Satisfied; 3 = Satisfied; 4 = Very Satisfied
Please make some prolog sentences to the next Table

In general, tourists were not satisfied with the accessibility in Deles Indah. It caused by poor condition the road, from the Klaten Yogya highway about 10 km. While tourists are satisfied with Sapta Pesona, the principle of ecotourism and natural resources.

Table 4. Kalitalang Tourist Satisfaction, Kemalang District, Klaten Regency

No	Aspect	Score Average	Score Maximum	%
1	Natural Resources	3.50	4	87.50
2	Infrastructure	2.75	4	68.75
3	Accessibility	2.25	4	56.25
4	Hospitality and Cultural Resources	2.50	4	62.50
5	Marketing Mix	2.63	4	65.83
6	Enchanting Sapta/Sapta Pesona	3.25	4	81.25
7	Education	2.00	4	75.00
8	Principal Ecotourism	3.05	4	76.25
	Total	21.93	32	
	Average	2.74	4	68.53

Score : 1 = Not Satisfied; 2 = Not Satisfied; 3 = Satisfied; 4 = Very Satisfied

Tourists both who visit Kalitalang and who visit Deles Indah satisfied with beautiful scenery, enchantments and the principle of ecotourism. , But, they less satisfied with the existing education.

3.3. Expectations of Management and Stakeholders

Mentoring and supporting of stakeholders to the management is shown by several activities, including:

a. In August, 2019 mentoring was held by the Mount Merapi National Park Office (BTNGM) to the Management of Kalitalang tourism object and the Balerante Village Community.

b. At the end of August, 2019 a Focus Group Discussion (FGD) was held with the theme "Ecotourism Development Strategy in Kemalang District, Klaten Regency". As the speakers were Klaten Regency Youth and Sports Culture and Tourism Office (*Disbudpora*), the Regional Disaster Management Agency (BPBD) of Klaten Regency and BTNGM. Participants consisted of the management / Pokdarwis, Community Leaders, Kemalang District Head, Sidorejo and Balerante Village Officials, Kemalang District Extension Officers, Sub-District and Village Supporters, and Research Teams from UPN "Veteran" Yogyakarta.

c. In September 2019, the Klaten District Tour Guide Training was held by the Youth and Sports Culture Office.

The results of the Management and Stakeholder assessment of both tourism objects in Kemalang District were presented in Table 5 and Table 6.

The assessment of managers and stakeholders on the tourism objects of Deles Indah and Kalitalang werethe same, which they lackof management. Therefore management training is needed to fix it, and do comparative studies with the similar tourist objects that have been advanced.

To develop ecotourism in Kemalang District, intensive mentoring from stakeholders and open communication between the tourism object management and stakeholders were needed.

Table 5. Assessment of Managers and Stakeholders of Deles Indah Tourism Object

No	Aspect	Score Average	Score Maximum	%
1	Natural Resources	3.03	4	75.75
2	Infrastructure	2.32	4	58.10
3	Accessibility	2.28	4	55.88
4	Hospitality and Cultural Resources	2.71	4	67.68
5	Tourist Services	2.68	4	67.10
6	Marketing Mix	2.54	4	63.54
7	Ecotourism Management Institution	2.63	4	65.79
8	The involvement of parties outside the ecotourism management organization	2.85	4	70.38
9	Management of Ecotourism	1.33	4	33.33
	Total	22.37	36	
	Average	2.48	4	62.00

Score: 1 = Bad; 2 = Less; 3 = good; 4 = Very Good

Table 6. Assessment of Managers and Stakeholders of Kalitalang Tourism Object

No	Aspect	Score Average	Score Maximum	%
1	Natural Resources	2.99	4	74.82
2	Infrastructure	2.37	4	59.31
3	Accessibility	2.92	4	73.00
4	Hospitality and Cultural Resources	2.67	4	66.71
5	Tourist Services	2.51	4	62.9
6	Marketing Mix	2.85	4	71.25
7	Ecotourism Management Institution	2.08	4	52.00
8	The involvement of parties outside the ecotourism management organization	2.11	4	52.75
9	Management of Ecotourism	1.26	4	31.15
	Total	2.,76	36	
	Average	2.41	4	60.25

Score: 1 = Bad; 2 = Less; 3 = good; 4 = Very Good

4. Conclusions And Suggestions

4.1. Conclusions

Based on data analysis and the discussion, it can be concluded as follows:

1) Natural Resource Potency in the form of a beautiful natural scenery (Merapi volcano, forest, valley) was very interesting to visit and asobject of photo spots;
2) (2). Tourism Awareness Group (*PokDarWis*) has been formed as the management of Kalitalang and Deles Indah Tourism Objects;
3) Local Cultural Activities were the attractions and what they have been routinely carried out; (4) Facilities, such as Parking Areas, Toilets, *Mushollas*, Homestay and Trash, have been built;
4) (5) Food and Beverage Products, Typical Handicrafts are worthy of sale,
5) (6) Guidance from the Mount Merapi National Park Office, Regional Disaster Management Agency, Youth and Sports Culture Tourism Office, District and Village Government has been established;
6) (7) Visitors tend to increase in 2019 because they on line promotion, and the location directions are quite informative.

4.2. Suggestion

Need further investigation for the development strategy that must be carried out in developing both of tourism objects. It caused by most of visitors have not satisfied and want to management improve their facilities, and there were many obstacles and risks.

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Competence of Small Holder Farmers in Implementing Palm Oil Replanting in Rokan Hulu Regency

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Abstract.

Competence of palm oil farmers in global trading competition depends on implementing 4 of 7 Indonesia Sustainable Palm Oil (ISPO) standards that was set by the government. The aims of this research were to : 1) Study the Role of farmer's extension in guiding the farmers to implement the standards, and 2) Analyze farmer's competence in implementing standards set by the government. This research used survey method held from January to June 2019. Multi stage approcah was used in site selection (district and village). Sampling respondent consist of 91 palm oil farmers that came from 3 villages representative. Analysis used descriptive statistics (percentage, and Likerts scale). Result of this research showed that farmer profile was dominated by male with high school education, had 4 family members, Javanese who have 10-20 years farming experience, and had farming as the main livelihood. It has an impact on less capable of small holder farmers in fulfilling the 4 standards (legality of land ownership, farmers organization and farm management, enviromental management, and developing a sustainable agribusiness). The goverment was expected to sinergize with farmers and private sectors (coorporation) in improving farmers empowerment and independence during palm oil management according to the set up standards so the farmers could compete globally.

Keywords : palm oil, ISPO, competence

1. Introduction

The plantation sector in Riau Province through palm oil commodities is one of a contributor to the country's revenue. There is about 50 million Indonesians dependent their livelihood on palm oil. Statistical Data on oil palm plantations in 2017 showed that the area of oil palm plantations in Riau Province was 2.260.941 Ha (18,38 percent), with production 7.722.564 tons (22,40 percent) and productivity of 3.989kg / ha (10,93 percent) of those produced by Indonesia (Dirjen Perkebunan, 2017). Palm oil with above average Indonesian productivity only achieved by large state plantations, while the productivity of smallholder plantations was still below average caused by various constraints such as age of oil palm plants that are above 15 years and the productivity below to 10 tons / ha due to the use of uncertified seeds.

International trade in palm oil requires management of oil palm plantations to be managed sustainably (socially, economically, and environmentally) through standard operating procedures that must be obeyed by producing countries known as the Roundtable Sustainable Palm Oil (RSPO). Indonesia sets a management standard called Indonesian Sustainable Palm Oil (ISPO). The government obliged the Smallholder Plantations to implement 4 of the 7 standards that must be implemented by smallholders. The smallholders are expected to be able to implement 4 standards set by the government, such as : (1) legality of plantations, (2) management of plantations, (3) environmental monitoring, and (4) sustainable business improvement. The condition of independent smallholder farms (which age more than 15 years) wich has low productivity required plantations replanting, but the farmers' ability to carry out replanting according to standards faced obstacles caused by their inability. This condition makes most of the independent smallholders do not replanting according to the standard, so the replanting target expected by the government has not been achieved as expected. The problems and constraints need to be assessed. Based on this problem, research about the profile and ability of independent smallholders in replanting is carried out. Therefore This paper describes the profile and ability of independent smallholders in replanting palm oil in Rokan Hulu Regency.

2. Methods

This research was conducted in Rokan Hulu Regency with the Survey method. The Study starts from October 2018 to June 2019. Sampling was done by using Multi Stage Sampling (district, sub-district and village) involved 3 villages in 3 sub-districts. The population in the study was independent farmers whose has plant age over 15 years and the productivity of oil palm produced below 10 tons / ha. Sample respondent consisted of 91 people from 3 selected villages (Rambah Samo, Rambah Hilir, and Kepenuhan Hulu). Primary data that were collected included : farmer profiles, legality of plantation, management of plantation, environmental monitoring, and business management. Secondary data were included: area, production and productivity of palm oil in Rokan Hulu Regency. Data analysis was performed using descriptive statistics and Likert scale. Likert scale analysis was used in assessing the ability of farmers for replanting according to 4 ISPO standards for independent smallholders. Scale analysis was carried out to measure farmers' perceptions of farmers' ability to carry out replanting with scale range 1 as the lowest value and 2 as the highest value.. The perception of farmers' level of ability was presented in the Table. 1.

Tabel 1: The ability of farmers for replanting in Rokan Hulu Regency

Perception	Scale	Score	Category
1. Good	2	1,49 – 2	Competent
2.Not good	1	1 - < 1,49	Not competent

3. Result

The success of independent smallholders in increasing the competitiveness of the palm oil market was related to the quality of farmers' human resources and the ability of farmers to implement 4 of ISPO standards set by the Government through Regulation No. 11 / Permentan / OT.140 / 3/2015. The Smallholders Plantation

Business which is managed by independent smallholders was expected to be able to implement 4 of standards in replanting their palm oil plantations in accordance with government expectations. Factors that determined the success of farmers in replanting accordance with the government's standards could be seen from : (1) Farmer profiles, (2) Plantation Conditions, (3) Farmer institutions in supporting farm management, and (4) Farmers' abilities in applying 4 standards that have been set. Each factor was described below.

3.1. Farmers Profile

The limitation of farmer's human resources could be seen from the internal and external profiles of independent smallholders which also determined by the ability of farmers in replanting. Profiles of independent smallholders were presented in Table 2.

Tabel 2: The percentage of the profile of independent smallholders in Rokan Hulu Regency in 2018

No	Farmer Profile	Number (person)	Maximum average (%)
1	Internal Profile		
	a. Aged (33 – 43) year	37	40,66
	b. Male sex	88	96,70
	c. Senior high school education	31	34,07
	d. Farming experience 10 – 19 years	39	42,88
	e. The main income as farmers	77	84,62
	f. The side income as farmers	14	15,38
2.	External Profile		
	a. Javanese ethnic	49	53,85
	b. Family member consist of 4 person	31	34,07
	c. Palm oil plantations area 1-2 ha	37	40,66
	d. Rubber plantations area 1-2 ha	30	32,97

Internal profile in Table 2 showed that most of palm oil farmers had palm oil farming as the main income and rubber farming as the side income. Farming experience in palm oil business range from 10 to 19 years. Educational level in supporting business development was senior high school level.

The external profile of independent smallholders showed that the majority of these farmers came from the Javanese ethnic which were known for their diligent, patient and conscientious culture in running their businesses, and were very serious in their works. The average cultivated land area for both oil palm and rubber, ranges from 1 to 2 hectares. Farmers had 4 family members to support. Profile of the farmers showed that they had a good educational level with and enough farming business experience, so it was estimated that they can support 4 family members.

The Plantation's condition owned by smallholder also determined the success of farmers in managing their palm oil plantations. The plantation's condition in this study could be seen from: land certificate, farm's location that was not in the protected forest area, suitability of the farm's location with the spatial layout, and the availability of the Cultivation Certificate (STDB). Others factors that could describe the condition of independent smallholders' plantations consist of : plant access to the collecting place, transportation system in maintaining the quality of the palm oil fruits (TBS) produced, the distance of the farm, and the travel time to the Palm Oil Mill (PKS). Table 3 illustrated the conditions of independent smallholder plantations.

Tabel 3: The largest percentage of independent smallholders seen from the plantations condition in Rokan Hulu Regency in 2018

No	Plantation's Condition	Number (Person)	%
1.	Land certificate	39	42,86
2.	Suitability of the farm's location with the spatial layout	55	60,43
3.	Farm's location in the protected forest/ country area	0	0,00
4.	Availability of Cultivation Certificate	2	2,20
5.	Plant access to the collecting place (maintain palm fruits)	55	60,44
6.	Transportation system in maintaining the quality of palm fruits	34	37,36
	Distance form plantation to mill (1 – 10 km)		
7.	Travel time from plantation to mill (1 – 2 hours)	59	64,84
8.		87	95,60

Table 3 showed that the ability of farmers (above 60 percent) which plantation that meet the set up standards such as : suitability of the farm's location with the spatial layout, farm's location that is not in the forest area, access of farm's location to the colleting place TBS, farm distance to the factory location under 10 km, and travel time under 2 hours (relatively short). However, there were more than 50 farmers who experiencing problems in improving their ability to meet the standards, such as : not able to meet proof of ownership (only SKT), cultivation certificate availability, and transportation systems in maintaining palm oil fruits quality

The institutionalization of farmers as planters was also one of the factors that will support the ability of farmers to manage the plantations. Farmer institutions that was well functioned will increase the ability of farmers to manage the farm, because the institutions played role as a learning forum, a collaboration unit, and a production unit, so that agricultural business activities will succeed if farmers have sufficient capacity. To be able to achieve optimal productivity and efficiency, farmers must conduct a collective business (Anantanyu, 2011). Farmers' capacity building could be done if farmers as group members use the group as a institution to improve themselves (improving quality) by making the group as a place for learning. The farmers institution situation (farmers' organizations) was presented in Table 4.

Tabel 4: Institutional smallholder farmers in supporting the ability to meet ISPO standards that must be implemented in Rokan Hulu Regency

No	Farmers institution	Number (Person)	%
1.	Farmers as the members of the farmers group	51	56,04
2.	The role of groups in raising farmer awareness	36	39,56
3.	Availability of the planters activity reports, groups or cooperatives	21	23,07
4.	The role of groups in improving the quality of palm oil products	31	34,06
5.	The role of groups in reducing greenhouse gas emissions	18	19,78

The smallholders institution showed that most farmers (more than 50%) join the farmers group but only small percentage of farmers (under 50%) who aware the role of group in improving the ability to make the activity reports, improving quality of palm oil products and reducing green house emission.

The ability of farmers to manage their farm will show how farmers could apply cultivation according to the expected ISPO standards in managing their farms. The ability of farmers to manage their farms was illustrated in Table 5.

Tabel 5: The greatest percentage of farmers' ability to manage palm oil plantations in Rokan Hulu Regency

No	Farmer Farm Management	Number (Person)	%
1.	Sprouts / seeds used (Marihat brand)	71	78,02
2.	Dominant type purchased (seedlings)	65	71,43
3.	High quality seeds	25	27,47
4.	Fertilization frequency 2 times	56	61,54
5.	Weed control frequency	52	57,14
6.	Hatching frequency	67	73,63
7.	Mill Productivity (1 – 2 ton/ha/th)	44	48,35
8.	Mill Selling price (IDR 1.000 – IDR 1.200 / kg)	56	61,54
9.	Net income palm oil farming IDR Million / year (5 - 25)	47	51,64

In managing oil palm plantations, the role of the institution will largely determine the capacity of farmers in managing the oil palm plantations they are cultivating. One of the institutional roles through the education process will be to increase the capacity of farmers. The group is expected to play a role as a forum for farmers to learn. This was in accordance with the results of the study (Prawiranegara, 2016), that the importance of the role of institutions in strengthening the capabilities of farmers. Table 5, shows that in managing a dominant farm the farmer uses seedlings rather than sprouts with the Marihat trademark and the superior seeds purchased by farmers are not the type of seed that has a certified label. Maintenance is carried out by fertilizing, transferring weeds, and cutting, which is the highest frequency 2 times a year. However, almost half of the farmers get the lowest productivity that can only be reached 1 to 2 tons / year from the productivity range of 1-40 tons / ha / year, with the lowest selling price in the group 2 ranging from IDR. 800.00 to IDR. 1,500.00. The management system carried out is only able to provide net income that is in the second lowest group of the income range below IDR. 5 million/ year to above IDR. 88 million / year. The condition of plantation management that is able to be achieved is still far from expectations because only half of the farmers are joined in the group and are still below 40 percent of farmers who are aware of the role of the group so that the group has not been able to increase the productivity and quality of the results obtained. In order for farmers to be able to improve their capabilities, it is necessary to increase their institutional role, because enhancing the capability of farmers to manage innovation can be done; first, improvement of the institutional role of farmers; second, improving the characteristics of the capabilities of farmers to manage innovation; third, improvement of information quality and fourth, increase in support of external institutions (Darojat, 2016).

3.2. Competence of smallholders farmers in implementing ISPO standards of palm oil replanting

Certification is one of the prerequisites that palm oil farmers must fulfill in Indonesia in the management of the palm oil plantation, known as Indonesia Sustainability Palm Oil (ISPO). ISPO aims to allow farmers to manage their plant sustainably in social, economic and environmental.

Regulation of the Kementrian Pertanian No. 11/Permentan/OT. 140/3/2015 on Sustainable Palm oil certification for smallholders plantations was set to do 4 standards namely (1) the legality of non-governmental plantations, (2) Farmers Organization and management of non-governmental plantations, (3) environmental management and monitoring, and (4) continuous business improvement. The competence of smallholders farmer in applying 4 ISPO principles was presented in Table 6.

The ability of farmers in fulfilling the 4 standards set by the Government in accordance with the Peraturan Mentri Pertanian No. 11/2015 was still inadequate in the legality farm, plantation management, environmental monitoring, and the sustainable business improvement. This finding appropriate with results of the study from Dharmawan Arya H, stated that small-scale palm farmers were not ready to implement ISPO certification (Dharmawan, 2019).

Table 6: The competence of smallholders farmer in applying 4 ISPO principles of palm oil replanting

No	Farmers competence	Number	Percentage	Score	Category
1	Legality of plantation :				
	2 = Competence	41	45,05	1,45	Not
	1 = Not competence	50	54,95		competence
2	Farm Management				
	2 = Competence	27	29,67	1,30	Not
	1 = Not competence	64	70,32		competence
3	Environmental Management and Monitoring				
	2 = Competence	7	7,69	1,07	Not
	1 = Not competence	84	92,31		competence
4	Continuous Business Improvement				
	2 = Competence	6	6,59	1,06	Not
	1 = Not competence	85	93,41		competence

Farm legality was a proof of ownership of the farm as standard number 1 that must be met, only 54.95 percent of farmers who were able to have proof of ownership both ownership (SHM) and usage right (SKGR) while the rest of them only have other evidence that does not comply with predefined proof of ownership. Although it had limitation in proof of ownership but the farm land was not located in the protected forest area and state land. Other problems were those who had had proof of ownership only 60.44 percent of them that was suitable with the spatial planning and the certificate of ownership was in the Bank so that it cannot be used as a legal proof of farm legality ownership.

The standard of farm organization and management as standard number 2 could not be met by farmers, that was because only 56.04 percent of farmers were joined in farmer group. The farmer's institution had not been well-administered because only 49.45 percent was able to demonstrate the management document. The group's role in raising new farmers awareness was able to be perceived by 39.56 percent of the members, only 34.06 percent of the members who felt the group's roles/benefits in improving the quality of palm oil yield, and only 19.78 percent of the group members could reduce greenhouse gases.

In the farm management, 78.02 percent of farmers have used certified superior seeds with a trademark, but the authenticity of the seeds was still doubtful because there were no label in the certificate of the seed used. The frequency of fertilization and pest control had been well done by the farmer, where 61.53 percent and 57.14 percent have been fertilizing and controlling weeds with frequency 2 times a year. Good cultivation process that has been done by the farmers has not given the best results that farmers want because 61.54 percent of farmers got the lowest price ranging from IDR 1.000.00 to IDR 1,200.00 per kg (the 2nd lowest price group from 4 group price), And 51.65 percent were only able to obtain revenues of IDR 5 million to

IDR 25 million/year (the 2nd lowest income from 6 group income). The inability of farmers in getting a decent price showed lower farmer's bargaining position and lower farmer's competitiveness in business development.

The third standard of environmental management and monitoring was not able to met by the farmers. It could be seen that 95.60 percent of farmers did not have environmental permits in accordance with letter of environmental management and monitoring (SPPL), 86.81 percent had not implemented the same joint fire prevention and countermeasures, and 95.60 percent had no record of rare animals and plants around the farm.

The ability of farmers to meet the fourth standards, sustainable business improvement business sustainably still felt under privileged. This condition because 95.60 percent of farmers did not have a record of improvement results made as a results of evaluation from various institutions or related agencies and 91.21 percent did not follow up on the repair process according to Group or Cooperative agreement.

4. Conclusion And Recommendation

1. Profile of the smallholders palm oil determine the participation of farmers in implementing the 4 standards (the legality of farm, farm organization and management, environmental management and monitoring, and continuous business improvement) ISPO certification in Peraturan Mentri Pertanian Republic of Indonesia No. 11/Permentan/OT. 140/3/2015. The Government's role in improving farmer profile quality was expected.
2. The ability of smallholder farmers in implementing ISPO standards set by the Government is still less perceived. The lowest standard that farmers can apply primarily in sustainable business improvement and environmental management and monitoring. It takes government and private attention to improve people's farmers ' ability to apply the 4 standards so that farmers have the competitiveness in managing the palm oil business.

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Readiness of Soybean in Tidal Land Facing The Agriculture Industry 4.0

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Abstract.

The potential of sub-optimal land is tidal land that estimated at 20.13 million ha, spread in Sumatra, Kalimantan, Papua and Sulawesi, 9.53 million ha suitable for agriculture. The tidal land is very important resource in order to meet national food needs in line with an increase population and land conversion of paddy fields, especially in Java. This paper presents the contribution of tidal land use to support food sustainability and its strategy from the aspect for the national soybean commodity. If mapped, the position of soybean agro-industry strength in tidal land is in quadrant I, which is the growth phase area. In this quadrant the strength factor dealing with the opportunity factor with a higher chance factor value. That is, the development of soybean agro-industry for tidal land is easier if properly managed. There are four strategies, namely: (1) Provision of permanent soybean planting areas; (2) Soil amelioration actions; (3) Increasing national soybean competitiveness; and (4) technology dissemination and promotion of domestic soybean use. Implementation of the strategy is to apply a model of corporate-based soybean agro-industry area. By using this agro-industry model the opportunities for modern agricultural technology use can be implemented.

Keywords: Readiness, Soybean, tidal land, industry 4.0

1. Introduction

The potential of tidal swamps is very wide, estimated at 20.13 million ha, spread on the Sumatra, Kalimantan, Papua and Sulawesi, including 9.53 million ha suitable for agriculture (BBSDLP 2006). This tidal land is a very important resource in order to meet national food needs in line with an increase in population and land conversion of paddy fields, especially in Java. According to Suwanda and Muhammad Noor (2014) in the use of tidal swamp land to support national food sovereignty, several strategic steps need to be taken including strengthening technological innovation through research and development activities; strengthening cooperation in harmony, synergistically and in participatory way between the parties concerned; regulation of tidal swamp development; zoning of development areas and commodity zoning; development of supporting infrastructure; strengthening the distribution and marketing of agricultural products.

Indonesia's obsession is not only food self-sufficiency but but also sustainability and sovereignty in food procurement. F food sovereignty is the right of every country and the right of every people to have the ability to produce and market basic needs independently (Bobjen, 2014). Ffor example sovereign soybeans, a country is able to determine its policies by producing local (domestic) soybeans for its own needs, guarantee the availability of land, water, seeds, including to finance farming and prohibit trade by dumping. The policy means that the independent farmers in the business, starting from producing, distribution and others so that food sovereignty is in the farmers not by entrepreneurs (importers).

Agriculture cannot possibly meet the needs of a growing population without technology. The Ministry of Agriculture (2019) took the initiative to accelerate agricultural productivity by launching the Industrial 4.0 in agriculture to answer the challenges. Through the implementation of Industry 4.0 in the agriculture sector, it is expected that farming processes will become more efficient, productive, and competitivenesscompetitive. How is the readiness of our national soybean commodity facing the era of the industrial revolution 4.0. The Ministry of Agriculture continues to make breakthrough policies and programs to transform traditional agriculture into modern and improve the quality of human resources. The spirit of agriculture 4.0 must be accompanied with the readiness of human resources and the paradigm shift of thinking to move forward to develop the agricultural sector as driving of the people's economy and the economic backbone of Indonesian society.

The Ministry of Agriculture (2019) has prepared many programs. One of them is the optimization of swamps which are quite extensive in Indonesia. Furthermore, the agriculture ministry described the potential of swamps in Indonesia reaching 33.4 million ha consisting of tidal land covering 20.1 million ha and swamps land covering 13.3 million ha. This is a great potential that cannot be maximized yet.

With some of the above considerations, efforts to utilize and optimize in this case tidal land as an area for developing soybean production are expected to support the sustainability of national food. This paper presents the contribution of tidal swamp land use to support food sustainability and its strategy for meeting the needs of national soybean.

1.1. Development of the Soybean Tidal Land Area

Profile of Soybean Farmers in Tidal Land

Historically, soybean farming in tidal land was brought by migrants from Java. These migrants are pioneer in the use of tidal land for agricultural cultivation. They open the land with simple technology independently, namely making drainage related to the river. The tidal land that was cleared at decades ago is now diverse, from it has been remains a bush, swamp to what has arranged into rice fields. Technically, tidal land is feasible and suitable to be developed for agriculture with an integrated farming system based on food crops, industrial crops (coconut) and livestock. For the natural conditions, water is always available both from rainfall and from tidal currents. It can be said, water from tides and rivers that already natural and it become an important resource to agro-industrial systems sustainable on tidal land.

The community who has already live in tidal land are workers as a human resources, although at the beginning it is necessary to been improved the quality of their human resources from unskilled to skilled workers who have expertise in agriculture. Focus attention is land management must be carried out properly and carefully before the land is used for an agricultural business system. Tidal land farming system seen from the typology aspect of land overflowing type and wide land and available technology is quite promising. (Sianturi, 2011).

Agricultural Research and Development Agency in the last 15 years has conducted a series of research activities in the tidal land and has found various tidal land agricultural technologies. Various alternative technologies have been produced including: land management and water management, cropping patterns, superior varieties of tidal rice, soil amelioration, fertilization, pest and disease control, farming tools and machinery and farming systems. The alternative technology has been studied and developed in various tidal farmers' fields called FSTA (Farming System Technology Adaptation) in South Sumatra, Jambi, Riau and West Kalimantan.

Farmer's Response to Soybean Technology

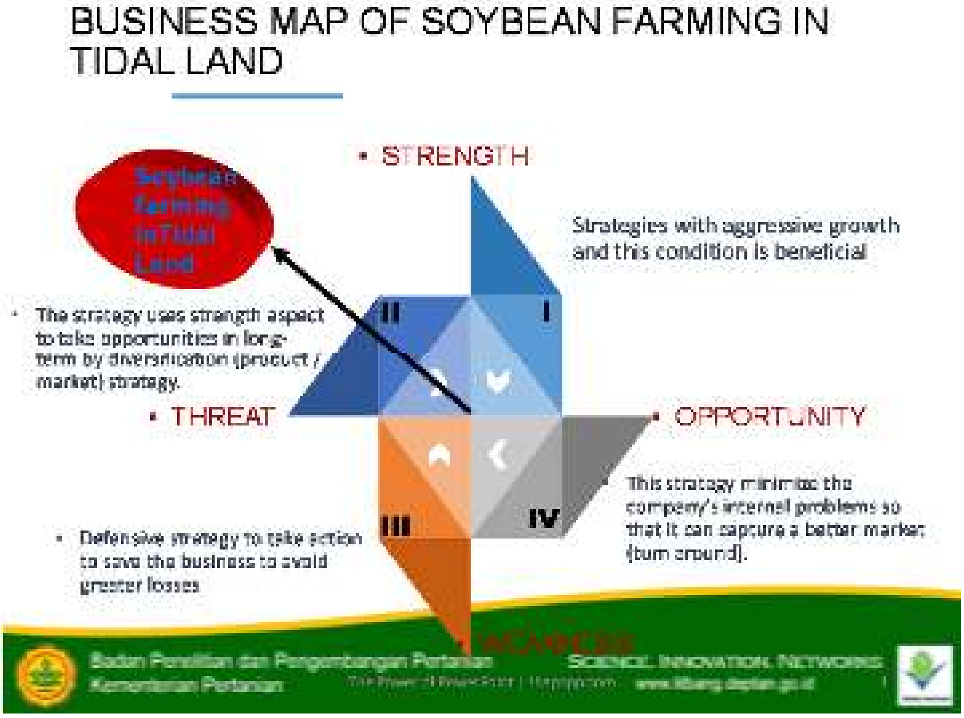
The Indonesian Agency for Agricultural Research and Development, in this case the Indonesian Legumes and Tuber Crops Institutes (ILETRI), has conducted a series of soybean Integrated Crop Management (ICM) activities in the Tanjung Jabung Jambi sub-district in the past year. One of the studies of these activities is the problem of farmers' behavior in cultivating soybean ICM technology that has been introduced in the field. Behavioral patterns are social aspects seen from the response of cooperator farmers (farmers who are directly involved in research activity) and non-cooperators (not directly involved limited in knowing the existency of research) on ICM technology. It is suspected that there are some characteristics of a person who influences a lot of behavior to make choices. In this case the choice of accepting, rejecting or partially accepting from soybean technology. The main characteristics were (1) the status of a farmer he is a cooperator or non-cooperator in carrying out testing / experimental activities, (2) The level of formal education they have, (3) the long experience in soybean farming which is also a lot related to the age and (4) total area of cultivation in producing soybeans.

Farmers' response to the soybean technology component as the main consideration of farmers for technical aspects are variety and lime application to the land (amelioration). So, supporting factors of adoption technology for social aspects are education and direct involvement in technology assembly activities or farmer participation. The higher the formal education, the higher the farmer will adopt soybean new technology. The opportunities for adoption of this educational factor was range from 38-50% and farmers' participation was 21-35%. (Rozi et al 2013)

Position of Soybean Business in Tidal Land

The development of agro-industry at the agricultural industrialization is right strategy, because it being able to create conditions of mutual support between advanced industrial and agriculture. (Hanani et.al , 2003), Likewise, how the ability of soybean agroindustry in tidal land in the era of agricultural industrialization 4.0 needs to know the condition of its strength map. Based on SWOT analysis (Rangkuti 2005). the development of soybean agro-industry in tidal land is currently in quadrant II area. Where, this wasbusiness area by facing various threats, although the condition of this business still has strength from an internal factor. The threat from external factors (environmental) of the soybean commodity development is the over supply of imported soybeans which are always a competitor to local (domestic) soybeans, so that comparative advantage of local soybeans is low and other threats are limited soil fertility in tidal land (Heriyanto and Fachrur Rozi, 2011).

Figure ,1: Business Map of Soybean Farming in Tidal Land (Heriyanto and Fachrur Rozi 2011).



The strategy that must be applied is use strength factor to take advantage opportunity factor in long-term for facing of threats, namely by diversifying strategies (products / markets). In the short term the strategy to be carried out of this diversification strategy is the permanent soybean planting areas with new technologies application. The implementation of the strategies are (1) Opening of new soybean land areas with the development of soybean plantations by a plasma-core pattern of at least 2000-2500 hectares, and (2) Establishing policies to increase productivity of Imperata grassland by using new technology, namely cultivation techniques and seeds of soybean new superior varieties (Taufiq A, Marwoto, F. Rozi, and M. Jana Mejaya, 2009).

Readiness of Soybean New Technology Support

Efforts to manage tidal swamps need to be supported by suitable cultivation technology because generally tidal swamps have several obstacles in the fertility of the land. Effort to increase productivity in tidal land by technology support is very important. The success of soybean development in tidal land is largely determined by the regulation of water management, land amelioration, and fertilization (Balitkabi, 2013; Taufiq et al 2009). One of the limitations of labor and human resources can be overcome by using agricultural equipment and machinery, including land processing machinery, soybean thresher and dryer (Umar et al 2002), planting equipment, as well as harvesting and postharvest equipment (Sawiyo et al., 2000).

The good condition of soybean farming in the tidal land is also strengthened by the results of research of the using of feasibility of new technology and economically (Jumakir, and Abdullah Taufiq. 2010). The technological innovations to support increased soybean productivity have been available by using technology packages such new superior varieties with a potential yield of more than 2 ton / ha. Fertilizing 50 kg / ha Urea, 75 kg / ha SP36 and 50 kg / ha KCl, dolomite 300 kg / ha and 1000 kg / ha manure.

Increasing of soybean productivity needs to be supported by other technological components such as micro water management, pest / disease control, harvest and post-harvest (Jumakir and Endrizal, 2015). Some new superior varieties (VUB) of soybeans that accordance with the agroecological conditions of tidal land have high yield potential and large seed with same as imported soybeans was Dega 1, as reported by Balitkabi (2018). The others variety in the tidal land Barito Kuala Regency, South Kalimantan were Anjasmoro, Panderman, Dega 1, and Demas that can grow well at the 30% Al saturation, and give same results with plants that grow at 20% Al saturation. Furthermore, the results of the four varieties were Anjasmoro has 2.35−2.52 ton / ha, Panderman has 2.01−2.29 ton/ha, Dega-1 has 2.53−2.72 ton / ha, and Demas has 1.78−1.95 ton / ha of yields farming.

Policy Implementation

Agriculture 4.0 is a certainty that must be faced so that readiness and acceleration of adaptation to users (farmer) is needed. The national soybean problem has not been resolved until now. The great opportunity solve the problem is produce soybeans on tidal land in outside Java. Land use competition in tides is not as heavy as the condition of land in Java. Such as the problem of land conversion and also land use competition for soybean farming. According to Satria (2019) agriculture 4.0 will be characterized by precision farming, starting with producing superior seeds based on bioinformatics, intelligent integrated pest control with artificial intelligence such as identification of plant diseases with smart phones, precision fertilizing, using of smart tractors, seeding seed with robots. Plant factory is now also increasingly popular.

Agricultural objectives 4.0 related to the national soybean problem can be realized with optimizing land in tidal areas by increasing yields (quality and quantity) and efficient use of available resources. Strategy of policy implementation as fallows: (1) Provision of permanent soybean planting areas (soybean estate) based of regional with a corporate model by using new technology. The application of new technology and modernization of agriculture is done easier in one area. Using of Labor is scarce in tidal land, especially outside Java, also by relatively large ownership of land area and will be easier to consolidate for the application of modern agricultural tools. The farmer corporation model is an institutional model of farmer group economic cooperation with an agribusiness orientation through land consolidation into one area, but by guaranteeing the ownership of each farmer's land. By farmer corporations, resource management can be optimized because it is carried out in a more integrated, consistent and sustainable manner so that more efficient, effective and high quality standards are formed that encourage economic growth in rural areas. The area development approach is designed to be able to increase the effectiveness of farming activities, encourage financial efficiency, and support the sustainability of soybean farming in tidal especially in the outside Java regions.

(2) Increase the productivity by using an application of soybean new technology. The use of soybean new technology to reduce yield gaps at the farm level. Using of soybean seeds with new varieties, namely: Dega-1, Devon, Dena. Cultivation techniques by using the soil amelioration and fertilizing recommendations. From many soybean new varieties, the Agency for Agricultural Research and Development produces varieties of soybean is soybean Devon-1. The Devon 1 variety of soybean can support acceleration of soybean production increase due to high yield. Devon 1 of soybean variety was capable of producing 3.09 ton / ha by using new cultivation techniques that are amelioration land and fertilization. The yield is higher than soybean productivity at the farm level, which currently only reaches 1.3 t / ha. This yield jumps in soybean productivity is very likely increase national soybean production in meeting the increasing needs of soybean for community.

(3) Education to community. Education to public in the form of dissemination or socialization the importance of consuming local soybeans or healthy products (non-GMO). The product can counteract free radicals and in a long time formed in our body. Selectivity for soybean commodities needs to be socialized through various media massively so that public opinion can be formed. For example Devon 1 variety of soybeans contain isoflavones (2,220 µg / g) that is higher than Wilis variety (1,854 µg / g) or Anjasmoro variety (1,457 µg / g) which both are widely planted by farmers now, moreover for imported soybean isoflavones far below it. (Adie M.M, 2015). Isoflavones are nutrients contained in soybean. According to health experts isoflavone compounds in soybean beneficial to prevent several diseases such as cardiovascular, osteoporosis, reduce cholesterol levels and can prevent cancer (Křížová L et al , 2019; Wu X C, 2008).

In the international world, soybean commodity is not merely placed as food, but has improved its function by being positioned as a healthy food source and becoming a highly prospective functional food source. The global community faces many and experiences a variety of degenerative diseases due to various negative impacts of development and lifestyle, so food selectivity by the community needs to be done to anticipate free radicals that cause many health problems. The promotion to Increase of Local Soybean will have an impact to growing love of domestic soybean (fanaticism) and market demand increase will cause farmer's good will plant soybean increase also and resulting in a multiplier effect.

Conclusion

- There are some problems must be solved for domestic soybean in facing the agricultural era 4.0 which is still great hope to be solved.
- Development of soybean farming in tidal land is prospective to rebuild domestic soybean in the agricultural 4.0 era
- By using of model soybean farming that based of regional and a corporate.
- By applying a new technology can develop tidal land to support agriculture revolution 4.0.

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Micro and Small Entreprise (Mse) Development by Using SWOT and Analytical Hierarcy Process Methods Approach (Ahp)
(Study Case In Tarlac Agricultural University (Tau) Mushroom Production, Malacamp, Tarlac, Phillipines)

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Abstract.

This research is aimed to identify the competitive advantage of Tarlac Agricultural University (TAU) Mushroom production by using SWOT methods approach and than making a decision by using the Analytical Hierarcy Process (AHP) method Approach. Based on the result of the SWOT, the strategy was formulated is the SO (Strength and Oportunities) Strategy, which its mean that TAU mushroom need to maximalized their strength to reach the industrial opportunites. Based on the AHP result, the fourth alternative strategy has a highest weight, so its mean that to reach the business main goals, business need to (1) proposing to the stakeholder, not only to provide the capital assistance, but also to improve the ability of of the workforce to use existing technology (0,353), (2) establishing a cooperation with partners not only in field of training, but also cooperating in the field of production and marketing (0,223), (3) Innovating the product, in order to expands the range of product marketing (0,216) and (4) Improving the quality of mushroom produces, by switching to using the adequarate technology or moving to semi-modren system (0,208).

1. Introduction

As one of the best performing campuses in the Philippines, Tarlac Agriculuture University in the city of Tarlac also plays an active role in conducting SMEs activities in the country. In carrying out the activities of SMEs on campus, TAU established several building units that were designated as the center of the SMEs in the campus, including Food Laboratory unit 1 which produced Nutri tea, Turmeric Tea, Brownies, Tamaryn Candy, Oat cookies and chile garlic. Then Sweet Potato Production which produces sweet potatoes brownies, sweet potatoes buchi, polvoron sweet potatoes, cookies, etc., and also establishes organic oyster mushroom production centers under the auspices of the campus faculty of agriculture.

The oyster mushroom production center business carried out by Tarlac Agriculuture University is still classified as a micro category (MSMED Council measured) because it only has an income of less than 3 million pesos per month and has only 4 employees. The mushrooms produced have all applied an organic system but are still classified as conventional because the production system applied is still manual. The mushroom produced is entirely managed by TAU Mushroom Production starting from the preparation of the planting media to the sales process. In its production, TAU Mushroom Production not only sells fresh mushrooms but also sells mushroom growing media at a price of around Php. 100 and the selling price of mushrooms applied at TAU Mushroom Production is around PhP.200 with a margin of around 50-60%.

TAU Mushroom Production in running its business activities does not always run smoothly, this business is often visited by many problems, both large and small scale problems. Like some time ago when the Philippines held elections for the 2019 senator election, capital and financial problems became a problem that slowed company performance, because this business was under the auspices of the government department, of course political uncertainty would have a real impact on the business, which would certainly cause business funding will go down slowly, moreover this business in carrying out its business activities always hold training (short training) which is done to farmers and the general public to motivate them about mushroom business activities such as mushroom production training, mushroom marketing and others, of course this will be a separate threat to the business, because with the training held this business also helps create new competitors, so the biggest risk if there are many businesses engaged in similar fields will have an impact on business competition, both in terms of business standards, products or prices will all experience competition. On the other hand, Mushrrom Production TAU's business has weaknesses in the field of technology. Where with the development of technology that is increasingly developing at this time in the Philippines, it makes it very difficult for businesses to develop, due to the inability of businesses to respond to any technological developments that exist today. So this will be feared as a threat to the business because there will be many competitors of similar businesses that emerge precisely with capabilities far superior to those of TAU Mushroom Production. In addition, technology issues also have an impact on many business problems, both in terms of financial management, marketing and others which have a major influence on the business.

As a result, the formulation of strategies that have been designed by the business, not in accordance with the capabilities of the business, so that businesses often have to be in an unfavorable condition even often experience substantial losses. Therefore, the TAU Mushroom Production needs to improve its current strategy, which not only improves the short-term strategy but also the long-term one, by reformulating alternative strategies that are in line with the business vision, and can be taken into consideration in developing TAU Mushroom Production business. Therefore this research was conducted with the aim to help companies find alternative business development strategies that are in line with the main objectives of the business. Where this research was conducted with data analysis techniques in the form of SWOT analysis (Strength, Weakness, Oportunities and Treat) and Analytical Hierarchy Process (AHP), which was given the title "SME's (Small and Medium Entreprises Development Strategy) Using SWOT Method and Analytical Hierarcy Process (AHP) ".

2. Literature review

This study uses a grand theory of management strategy. According to David (2011) strategy management is the art and knowledge of formulating, implementing, and evaluating cross-functional decisions that enable an organization to achieve its goals. Strategy management focuses on efforts to integrate management, marketing, finance, production, research and development, and computer information systems to achieve organizational success.

Strategy management is the process and approach to determine organizational goals, develop program policies and paradigms and plan to achieve the goals of a company, and allocate resources to implement policies, programs, paradigms and plans. or in other words, strategic management can be seen as managing the combined components of the three stages of the strategy process namely, strategy development, strategy implementation and strategy evaluation. As represented in Figure 2.1 below

The main objective of the organization is to maximize long-term profitability and sustainable development of competitive advantages over competitive competitors in the external market. The industry-perspective organization (I / O) is the basis of this theory because it views the organization of external market positioning as an important factor for achieving and maintaining profitability, or in other words, the traditional I / O perspective offers a systematic strategic management model for assessing competition in an industry. the same with the economic philosophy of business goals. On the other hand, the competitive advantage of company resources lies in their internal resources, in contrast to their position in the external environment. It is not just evaluating the opportunities and environmental threats of doing business; competitive advantage depends on the unique resources and capabilities of the company. (Omalaja and Eroula, 2011)

3. Discussion

TAU Mushroom Production is a business that was founded in 2010 which was established by the TAU Collage of Agriculture. Tarlac Agricultural University (TAU).

1. Business vision and missions
   a. Business Vision
   Becoming one of the advanced businesses in the field of mushroom processing in the Philippines and becoming a place of learning for the community regarding mushrooms.
   b. Business Mission
      1) Increasing the quality of mushroom production in every year
      2) Increasing the quantity of mushroom production in every year
      3) Conducted the Community Training about mushroom production
      4) Expanding the business marketing segmentation
      5) Improve the collaboration quality with the business partners
2. SWOT analyze of TAU mushroom production

Table 1. Result of SWOT analysis in TAU Mushroom Production

STRATEGI S-O	STRATEGI W-O
Improving the Quality of Fungus in production, by switching to using appropriate technologies or turning towards semi-modren. Doing product innovation, in order to expand the reach of business marketing. Collaborating with business partners, not only in the field of training, but also in cooperation in the field of	. Promoting on the basis of the use of social media Start switching by implementing a technology-based financial system Creating a Marketing Gallery that is outside the campus area, or which is easier for the public to access Reducing Marketing Costs by maximizing the use

production and marketing. Propose to stakeholders not only to provide capital assistance but also training to improve the ability of the workforce, especially in terms of the use of existing mushroom production technology.	of technology, such as reducing promotion costs and others
STRATEGI S-T Start doing Product Innovations on the basis of doing product innovations regularly Increasing the capacity of human resources at any time regarding the activities of the oyster mushroom cultivation Improving the quality and quantity of products produced in order to anticipate the threat of new entrants Improve the quality of cooperation with business partners, with the aim of anticipating government policy uncertainty	STRATEGI S-OS-O STRATEGY Maximizing conventional production processes in terms of minimizing production risk Maximizing the use of the existing financial system to overcome unstable production costs

Based on table above, the alternative order of the SWOT strategy, that the Strength-Opportunity (S-O) strategy produces the highest weight, which is a strategy that utilizes all the power to seize and make the most of opportunities. Based on the SWOT matrix tables that have been analyzed, the S-O strategies are:

a. Improving the Quality of Mushrooms in production, by switching to using appropriate technologies or turning towards semi-modren
b. Doing product innovation, in order to expand marketing reach.
c. Collaborating with business partners, not only in the field of training, but also in the fields of production and marketing
d. Propose to stakeholders to not only provide capital assistance but also training to improve the ability of the workforce in using existing technology, such as the use of technology, financial systems, etc.

After establishing the SO strategy as the highest weighting strategy on the results of the mushroom production TAU marketing strategy analysis, it is necessary to determine the strategic priorities of the four Strength-Opportunity (SO) policy strategies produced through SWOT analysis in this study using The Analytical Hierarchie Process (AHP).

3. Analitical Hierarcy Process

Table 2 : AHP result of TAU Mushroom Productions

	S1	S2	S3	W1	W2	W3	O1	O2	O3	T1	T2	T3	Prioritas
	0,031	0,077	0,019	0,105	0,132	0,083	0,092	0,073	0,116	0,080	0,063	0,100	Global
Strategi 1	0,198	0.239	0,159	0,317	0,177	0,132	0,110	0,207	0,140	0,099	0,138	0,125	0,208
Strategy 2	0,240	0,168	0,239	0,124	0,195	0,190	0,230	0,295	0,330	0,121	0,070	0,217	0,216
Strategy 3	0,209	0,198	0,292	0,134	0,195	0,165	0,302	0,295	0,200	0,259	0,187	0,230	0,223
Strategy 4	0,345	0,395	0,311	0,226	0,434	0,295	0,358	0,207	0,330	0,521	0,606	0,429	0,353
CR	0,07	0,02	0,09	0,02	0,01	0,01	0,02	0,05	0,02	0,08	0,06	0,07	

Globally, the first priority of the TAU Mushroom Production business development strategy lies in the alternative of the fourth (S4) strategy, namely proposing to stakeholders not only to provide capital assistance but also training to Improve Workers' Ability in using existing technology, such as the use of technology, financial system, etc. with a weight (0.353) then followed by an alternative third strategy (S3) namely Establishing Cooperation with business partners, not only in the field of training, but also conducting cooperation in the field of production and marketing with a weight (0.223), followed by an alternative of the second strategy (S2) i.e. To innovate products, in order to expand the range of marketing products with weights (0.216) and finally is the first alternative strategy (S1), namely Improving the Quality of Fungi in production, by switching to using appropriate technologies or switching to semi-modren with weight (0.208). As shown in table above it was decided that the alternative strategy S4 was the strategy chosen.

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The Stakeholders Analysis In The Farmers' Empowerment

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Abstract.

The empowerment of Mekar farming group is conducted to establish solidarity and independence. In agribusiness, the farmers are not only solid and independent in the capital-providing but also in the cultivation techniques, post-harvest handling, distribution, institutional, and business diversity. Therefore, they need supports from the stakeholders in accordance to their necessities. The results of the research show that the stakeholders' supports come from their primary duties, so that they need an instrument to unify them. Therefore, the farmers should have the major strength which is to integrate the stakeholders dynamically. The group dynamic is seen in the reorganizing process of the organizational structure in order to adjust the form of support given by the stakeholders. It is done to develop human resources for increasing the farmers' welfare.

Keywords: empowerment, stakeholders, welfare

1. Introduction

The majority of Indonesian farmers live under the poverty belt, as characterized by their daily life. Small farmers have the tendency of unwilling to take any risk (Scott, 1983) due to the skill limitation in developing their farms. Therefore, there needs to establish strategies to advance and develop the paradigm and working patterns of farmers in order to become independent and competitive.

The strategy applied is by executing the society-centered development to intensify the ability in management and to encourage the resources available around them. In other words, the society-centered development is an empowerment which leads to the independence. Thus, the empowerment must develop the farmers' ability and confidence to support independence (Suharto, 2006).

The farmers'empowerment needs the stakeholders' support because not only they work in the farming process, but also in field of all the farming process, top to bottom. Therefore, the member of Mekar farming group should gain as much support from the stakeholders. In accordance, their goal is to shape the farmers' skill in problem solving and fulfilling the need of farming in order to achieve welfare. This research focuses on the implemented strategies used to integrate the stakeholders in the empowerment.

2. Methods

The participant of this research were small scale farmers whose grouped in rice Mekar Ngalian, Widodomartani village, Ngemplak distric, Sleman Regency. This research was conducted from March 2019 - August 201.9 This research used descriptive qualitative approach on case studies. The subjects in this study were the administrators and the members of the farmers group. The methods of the data collection were observation, interviews, and Focus Group Discussion (FGD). The data collected were tested their validity with triangular sources and methods. The analysis techniques using Miles and Hubermen models.

The Stakeholders Analysis

The stakeholder analysis is a systematic process of gathering and analyzing qualitative information to determine whose matters must be counted when developing and/or applying the policy or program (Schmeer, 1999). The analysis is beneficial in identifying the most influenced community or social group in the developing process (Race and Millar, 2006). An activity can give benefit for particular society but it can also create disadvantage against others. Therefore, the analysis of the stakeholders is related to several elements such as the existence of social group, the impact, and the consequence occurred from the implementation of the development programs.

Start and Hovland (2004) underline that the analysis can be implemented to identify all sides involved in activities: the policymakers, the executor, and the mediator. It will help the farmers to determine the way to attract the stakeholders' attention so that the impact of the policy can be thoroughly optimized. Furthermore, Start and Hovland (2004) formulate 3 substantial aspects in the analysis of the stakeholders. They are:

a) Establishing all stakeholders related to the issues, which could consist of: organization, group, department, structure, network, individual, *et cetera* which related to problems or issues,

b) Grouping of the stakeholders based on their significance and strength in performing activities,

c) Developing a strategy to find the most appropriate way to connectthe farmers with the stakeholders.

3. Results

The Stakeholders

The process of the farmers' empowerment has begun since 2012 when Mekar Farming Group, accompanied by Balai Pengkajian Teknologi Pertanian (BPTP) Yogyakarta, holds the rice quality improvement by refining the products management system. The improvement is done by implementing the Standard Procedure Operation/Good Agricultural Practice (SPO/GAP). The SPO/GAP activities consist of the land and seed preparations, embroidery, pruning and thinning of the the young plants, fertilization, irrigation, pollination, pest control, harvest, and post-harvest. The activities of Good Handling Practice (GHP) consist of the post-harvest activities until the distribution.

However, the farming does not only require capital, but also cultivating technique, post-harvest, distribution, institutional, and business diversity. Therefore, the farmers need supports both from the government and private stakeholders. The government and other stakeholders are BPTP Yogyakarta and Dinas Pertanian, Pangan dan Perikanan Kabupaten Sleman. The roles of those stakeholders can be identified in Table 1.

Table.1 the Main Tasks and Roles

No.	Stakeholder	Main Task Based on Group's Vision and Mission	Role
1.	Dinas Pertanian, Pangan dan Perikanan, Kabupaten Sleman	Implementing the agricultural development and improvement	Supporting the organizational development and improvement to strengthen and autonome the group
2.	Balai Pengkajian Teknologi Pertanian (BPTP) Yogyakarta	Implementing the appropriate technology assessment, assembly, and improvement in specified locations	Supporting rice cultivation technique through the management system refinement using SPO/GAP to obtain the high-quality

Source: Primary data analysis

Table 1 shows that the roles of the stakeholders are implemented in order to fulfill the responsibilities and functions based on the organization's visions and missions. It is something understandable in regards with the fact that he government and the private stakeholders, especially the Organisasi Perangkat Daerah (OPD), are still bounded with their main tasks and functions.

The Classification of the Stakeholders

According to the significance and the power in this farmers' empowerment activity, the stakeholders can be classified into the main matter, the supporting matter, and the key matter stakeholders (Crosby, 1992). The stakeholders of Mekar Farming Group are:

a. The key stakeholders

They have strong and significance influence related to the problem, necessity, attention of the success of the farmers activities. In this case, the key stakeholders of Mekar Farming Group are **BPTP Yogyakarta.**

b. The supporting stakeholders

They are the mediums who help to announce the activities. In several activities, they have formal and informal significance. In Mekar Farming Group empowerment, the supporting stakeholders are **Dinas Pertanian, Pangan dan Perikanan Kabupaten Sleman.**

The classification of the stakeholders has a strong relationship with the farmer's empowerment process. Start and Hovland (2004) argue that these type of stakeholders are so-called the 'keep informed' type, marked by their attention towards the empowerment process. Besides, this type is also characterized by the stakeholders' limitation in supporting the empowerment program. Due to the limitation, though possessing influential significance, they have to be informed because they have strong significance in the process. However, they can establish the base or the coalition of the stakeholders which can lobby to create changes. Thus, the Mekar Farming Group uses this condition in the empowerment process for its members.

The Strategy of the Farming Group

The characteristic of the stakeholders in the empowerment rely on their own functions and tasks. It causes the partial support in farmers' empowerment due to the fact that the stakeholders cannot collectively support one single activity. This condition results in the farming group adjusting to the role of each stakeholder.

In other words, the group must plan an appropriate strategy in the empowerment process if they need support from the stakeholders. The strategy implemented here is done by changing the group's organizational structure. With the support of the stakeholders, the group adds and expands job decription of a division in the group. In other words, they perform a structural dynamism to integrate the stakeholders in the empowerment activity.

The dynamism of the farming groups' structure is implemented so that the farmers' activities will work properly with the support of the stakeholders. The strategy and the dynamism results of the organizational structure with the support of the stakeholders are shown in Table 2.

No	Stakeholder	Strategy	Result of Dynamism
1.	Balai Pengkajian Teknologi Pertanian (BPTP) Yogyakarta	Adding a task of the rice division by establishing the rice cultivation task force through SPO/GAP to achieve rice certificate	The farmers and the group receive the rice certification in 2018.
3.	Dinas Pertanian, Pangan dan Perikanan Kabupaten Sleman	Forming a task force to prepare the group qualification	Beginner: 2005 Advanced: 2011.

Source: Primary data

Table 2 shows that the farming group has done the dynamism in its organizational structure to adapt the role of the stakeholders. It means that the major strength of the relation between the stakeholders situated in the farming group can integrate the stakeholders by establishing divisions directly correlated to the stakeholders. To put it simply, the relation between the structural changes in the group and the stakeholders in the empowerment process can be imagined as a propeller with the group is the axis of the propeller, while the stakeholders are the blades of the propeller. It will work properly if all components work based on their tasks and functions.

Table 2 also points out that the implemented strategy has succeeded significantly to improve the welfare. It can be seen through these aspects:

1. The rice certification which is safe to eat leading to the rice.
2. The group has improvement of the group's classificationfrom beginners to advance farmers.
3. The establishment of tourism village which gives the farmers income warranty so that they are independent and able to manage the business.

4. Analysis and Discussion

The empowerment of Mekar Farming Group has been done by the support of many stakeholders. The characteristics of the stakeholders in empowering the farmers take roles suited to their tasks and functions. Thus, they cannot decide which strategies will be applied for the beneficiaries. The reason behind this is that the government and the private stakeholders, especially the Organisasi Perangkat Daerah (OPD), are still attached to their main tasks and functions whether stakeholders from the government or the private sector. In other hands, the research of Katharina (et. all 2012) shows the difference; in the company, the policymakers and the managers are not only concerned with the legitimacy, but also with the strategic purpose-taking. This is understandable because the stakeholders are the implementer of the policy so that they cannot apply the strategy freely in the field.

The characteristics of the stakeholders above have influenced the group's activities within the empowerment process who cannot collectively perform activities. In addition, these activities are partially to them. Based on this situation, they must be united in one way or another within the empowerment activities. Mekar Farming Group understands that in this period, the dynamic interaction is unavoidable. As a result, therelationship between stakeholders and the farmers are a necessity. The existence of the group will always affect the stakeholders the stakeholders and vice versa (Zadek, 2006).

The ability to unite and mobilize the stakeholders is within the hands of farming group; especially their initiative to create changes. Alcock and Craig (1998) argue that the local authority, in this case, Mekar Farming Group, cannot omit or significantly decrease the local poverty without establishing cooperation with the related parties. In consequences, the farming group plays a role as the unifier of the stakeholders by performing group dynamism. It is supported by the argument of Sajogja (1978) which states that the success of the empowerment could occur if the dynamic process happened on the group. Although this change will decrease the group's role, as a whole, the farming group has a role in improving its human resources in Dusun Ngalian to achieve the farmers' welfare.

The change that the farming group has done, realized or not, faces a certain degree risk. The process needs a great commitment from all member to establish a strong long-term relationship. It is simply said that every member thoroughly understands others' need. However, for the group, it does not require a long time and great commitment because the group still prefers to use apply the social culture rather than the economic culture; the farmers prioritize social values than the economic values (Soemardjan, 2002).

In correspondence with this condition, Boeke and Tideman (1974) argue that the community develops socially rather that economically whose values and attitudes are characterized as 'limited needs' or 'oriental miticism'. It means that they are satisfied; they feel peaceful without forcing their wills out of their reach. Scott (1983) points out that the farmers prioritize their safety. However, due to the abundant amount of the farmers who are actually involved in subsistent as well as capital economy, they determine their rationality to improve the economy and are able to take risks (Popkin, 1979). This farmers' rationality is a stepping point leading to their welfare.

5. Conclusion

The success of the farmers' empowerment required the key and the supporting stakeholders' supports and cooperation. The farmers and the group have to initiate this movement. They need to adjust themselves to the stakeholders' characteristics because the success of the empowerment can be achieved through the group's dynamism. It is required to develop the human resources for achieving welfare.

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A Review of The National Programs and Research on Chili Commodity Development Strategy in Indonesia

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Abstract.

Chili has a significant contribution in inflation, therefore government continue implementing various programs and conducting researches on chili to obtain maximum production (2.33 million tons in 2020). This paper aims to generate information as the base of the policy for chili development by reviewing the previous national program and conducting three years of research from 2016 to 2018. The 2016 research observed the chili resiliency to drought climate at East Java and West Nusa Tenggara, in 2017 examined the access of chili to export market at West Java and North Sumatra, and in 2018 traced the chili supply chain of Toko Tani Indonesia (TTI) Program at Central Java and West Java. The results informed that from the six national programs, there were three programs that result good impact on the chili development, namely Climate Field School (SLI: *Sekolah Lapang Iklim*), Annual Water Allocation Forecast (RAAT: *Rencana Alokasi Air Tahunan*), and Water Rescue Partnership Movement (*GNKPA: Gerakan Nasional Kemitraan Penyelamatan Air*). The farmers' resilience index on drought was 62-67%, meaning farmers could solve the drought problem. The access of chili to export market constrained by high production input. The TTI program significantly shortened the chili supply chain. The proposed strategy to achieve chili development is through good farming practice by integrating the *SLI, RAAT* and *GNKPA* supported with the marketing system. Through these efforts the quantity and quality are guaranteed so that they can penetrate the export market.

Keywords: chili, national program, strategy

1. Introduction

1.1 Background

The production of chili in Indonesia in 2016 is 1.929.831 tons, meanwhile the target of consumption is 1.998.762 tons, therefore additional of 689.31 tons (3.45%) are needed (SUSENAS, 2016). This fact caused that during the year 2010-2016 the value of chili exports decreased as 0.19% and the volume of import increase at 0.25%. At the same time the price of chili was increased both in the domestic market and the world market proxied from the implicit price of Indonesian chili exports to the world market of around 0.05%/year (Kustiari et al., 2017).

A focus effort should be done for the solution, therefore the long-term plan for chili development in Indonesia has been compiled in a road map document until 2045 (PUSDATIN, 2016). The focus of the development of chili commodities is directed to: (1) meet domestic consumption needs; (2) import substitution; and (3) filling export market opportunities (Kementerian Pertanian Republik Indonesia, 2017). Until 2019 the program of chili development in Indonesia will be directed at efforts to stabilize supply and prices. During 2016 - 2019 the program includes improvements in the intensification and extensification of technological innovations and machinery, supply and distribution chains, pricing policies, institutions and human resource capacity building. While in 2020 - 2024 the development will be directed towards achieving self-sufficiency and competitiveness through efforts to provide seeds for the mobile cold storage industry in the diversification of the second market products, market information industry partnerships and foreign diplomacy. Achievement of self-sufficiency and exports is targeted to be achieved in the period of 2025 - 2034 through efforts to use satellite farming, export institutions, as well as trade diplomacy and foreign market expansion. In 2035 - 2045 Indonesia is targeting to become the main exporter of chilies in ASEAN, that would be done by maintaining competitiveness and expansion of the production.

This paper focus on chili development in Indonesia directed at efforts to stabilize supply and prices in the period of 2016 to 2019 that includes improvements in intensification and extensification through internal and external factors. The internal factors included such as managing the chili cropping pattern/production that targeted 2.33 million tons in 2020 (SUSENAS,2016) through national programs on chili development that had been implemented while the external factors were from the research reports on factors to reach maximum production such as climate change, export market opportunity and supply chain of chili.

1.2 Objective

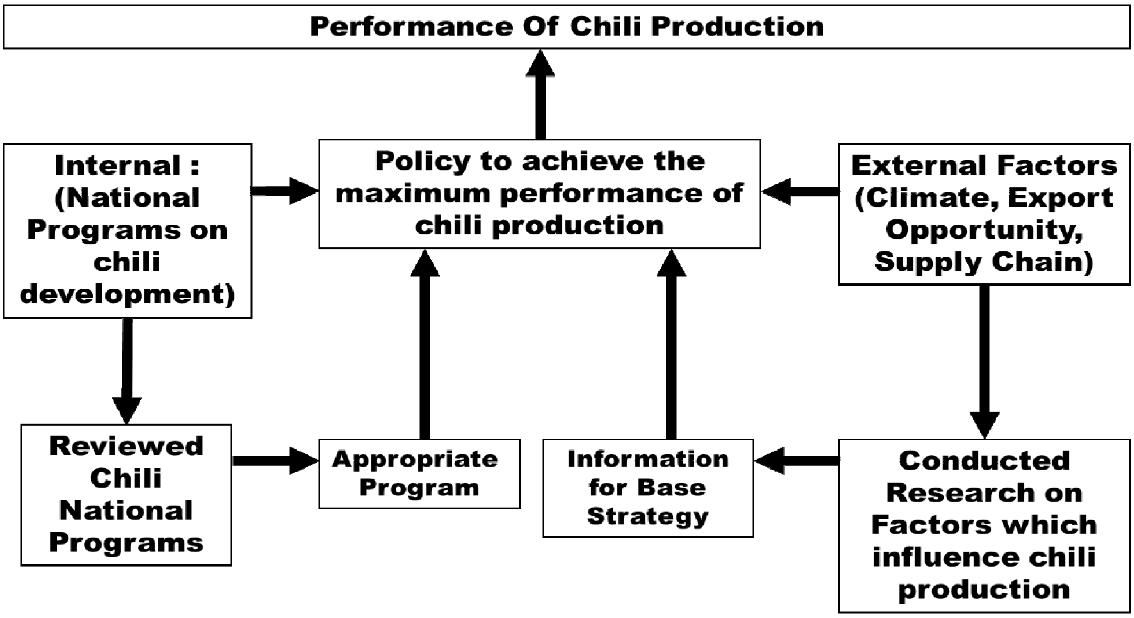
This paper generate a base strategy for policy on chili production development by reviewing the previous national programs on chili development that have been implemented and identify external factors, namely climate change, export markets and value chain of chili that have been reported from some research to get the appropriate strategy to be implemented.

2. Methodology

2.1.Theoretical Framework

To achieve the maximum performance of chili production, a policy should be developed based on the factors that influence the performance of chili production. There are internal factors such as National Programs on chili development and external factors such as climate, export market opportunity and the chili supply chain. To get the appropriate program, the implemented Chili national programs should be reviewed and research on external factors such as climate, export market opportunity and supply chain should be conducted (Figure 1).

Figure 1: Theoretical Framework for Policy on Performance of Chili



Source: (Author, 2019)

2.2 Location

The research location was selected purposively, in the center of chili production. The observation on chili resilience to drought climate, was conducted in 2016 at Kediri - East Java and West Lombok - West Nusa Tenggara by Sayaka et al.,(2016) and information on access of chili to export market were refered from report of Kustiari et al., (2017) research conducted in Pengalengan-Bandung-West Java and Karo - North Sumatra while the information on Chili supply chain in Indonesian Farmers or Toko Tani Indoensia (TTI) were traced from Anugerah et al.,(2018) research at Magelang - Central Java and Lembang - West Java.

2.3 Data

The secondary data were obtained from the related institution of each location. The primary data were collected from the farmers through interviwed based on a structured quesioner done by the researchers team, where the author was one of the member' team (Table 1).

Table 1: The Data Source of Each Research

No.	Source	Climate Change		Chili access to export		Chili supply chain		Total
1	Secondary	East Java	West Nusa Tenggara	West Java	North Sumatra	Central Java	West Java	
	Related Intitution	10	9	7	7	8	8	49
2	Primary	36	35	27	27	4	8	137
Total Each province		46	44	34	34	12	16	186
Total sample		90		64		28		

Sources: 1) Bambang, S., et.al.(2016); 2) Kustiari, R., et.al., (2017) ; 3) Setiajie, I.A., et.al, (2018)

2.4 Analysis

a. The appropriate national programs on chili were analized qualitatively and presented descriptively.

b. Farmers Resilience: Analyzed by Vulnerability index refer to Nelson et al., (2005) such as:1) The human resources. 2) Social aspects. 3)Natural 4)The physical condition 5) The farmers' income. The total variables are 17 and each variable scored 1 to 100, the higher the score means the better resilience.

c. Opportunity on Export Market: in order to find out farmer's access to the market, the important information will be presented includes: 1) The mapping of export opportunities for farmers 2) The charachteristic of the chili products and demands. 3) The performance of chili export market and 4) The factors that influence farmers' access to the export market .

d. The Supply Chain were analized qualitatively and presented descriptively by comparing the supply chain of the TTI supply chain to the exsisting marketing chain, ferered to (Anantan and Ellitan, 2008).

2.5 Results

2.5.1. Performance and Impact of Chili National Program

There were six famous Chili National Program that had been implemented namely

1) Shallow-well pump or *g*overnment's aid in the short term to deal with drought was shallow-well pump with the depth up to 15 meters. Only few farmers' groups got water pumps aid utilized it due to very deep ground water level or distant water sources during drought (*Balai Besar Wilayah Sungai Nusa Tenggara* I, 2015[a]).

2) Information of precipitation forecast The Meteorological, Climatological, and Geophysical Agency (*BMKG: Badan Meteorologi, Klimatologi dan Geofisika*) offers forecast data on rainfall to anticipate water supply for cropping seasons annually, especially for rain-fed lowland (*Balai Besar Wilayah Sungai Nusa Tenggara I. (2014)* and *Balai Besar Wilayah Sungai Nusa Tenggara* I., 2016).

3) *BMKG* also implemented Climate Field School or *Sekolah Lapang Iklim* (*SLI*) intended to improve farmers' awareness on climate change impacts. The farmers are expected to be capable gradually to adapt with extreme climate including drought. This such program was very useful for long term policy (Boer, 2009)

4) Planting Chili Movement on Dry Season or introduced by Directorate General of Horticulture had relatively limited impact. The area size of demonstration farm was relatively narrow and technology introduced was not good enough to deal with drought affecting most chili farmers significantly.

5) Brantas River Area Office in East Java and River Area Office in South East Nusa Tenggara (NTB) I in NTB always conduct Annual Water Allocation Forecast (*RAAT*) based on rainfall forecast conducted by *BMKG*. *RAAT* is very useful to determine cropping calendar including crops to be planted by farmers in accordance with irrigation water supply (*Balai Besar Wilayah Sungai Brantas*, 2015[b]).

6) Water Rescue Partnership Movement or *Gerakan Nasional Kemitraan Penyelamatan Air* (*GNKPA*) was also conducted in East Java and NTB provinces. *GNKPA* involve all stakeholders to conserve river basement such that water sources are sustained and erosion and its impacts are controllable (*Balai Besar Wilayah Sungai Brantas*, 2015).

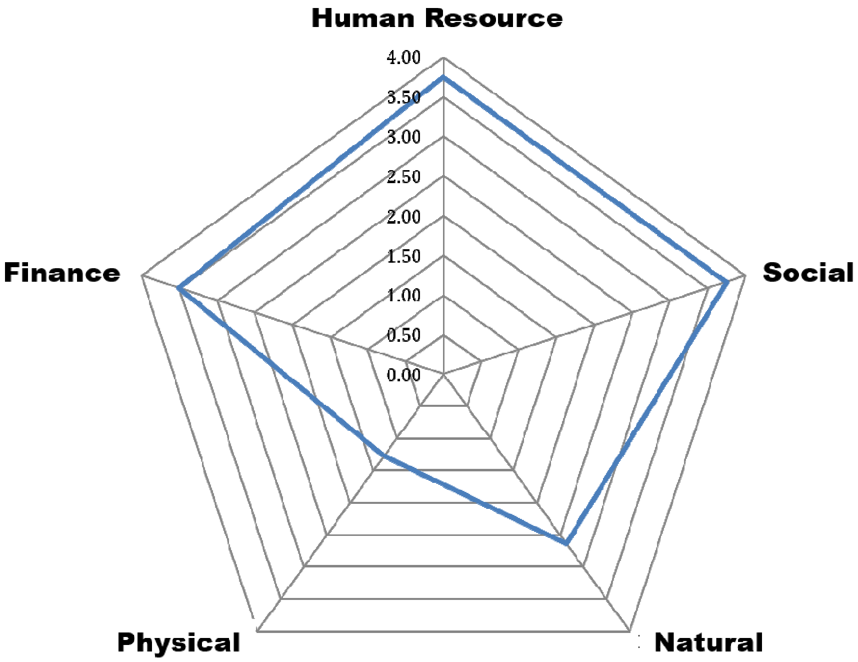
2.5.2. The Resilience Index

Resilience is the capacity of people, communities, countries and global institutions to anticipate, prepare, for cope with, and recover from the shock and not only bounce back to where they were before the shocks occurred but becomes better-off (Department for Intrenational Development,2012). To overcome the drought situation, some of the chili farmers tried their best to overcome the lack of water during drought. Individually or in groups chili farmers tried to overcome drought that affects their agricultural land. Some farmers left their agricultural land fallow, planting drought-resistance crops, or delayed to plant crop until the early wet season **(**Rahayu, 2011)**.**

To tackle climate change, a practical book has been published by the Ministry of Environment (Kementerian Lingkungan Hidup, 2014) while a guidelines for the Prevention of Disaster Impacts in Agriculture have also been established by the Ministry of Agriculture of the Republic of Indonesia (Kementerian Pertanian Republik Indonesia, 2007). However, the success in overcoming drought depends on the sufficient water supply for irrigation even though the water volume was limited. Despite its expensive cost, irrigation water could be supplied from distant water sources. Chili yield exposed to drought was lower, however to some extent, more expensive chili price during drought compensated the relatively lower yield therefore the benefit from the chili farming was no significant difference (Sayaka et al., 2016).

Based on indicators compounding the indicators of resilience index such as: 1)The human resources namely the education level of the husband and wife; 2) The social capitals include access on internet, mobile phone, the participation in farmers' group and water association; 3) The natural resources such as the farmers' unplanted land, unirrigated land during dry seasons and the unirrigated area; 4) Physical conditions namely the land holding, area of the irrigated land, farmers who have access on irrigation, the rainfed area, numbers of farmers who have rainfed land and 5) Finance condition include cash income, income from onfarm, nonfarm and various source of income generating. Each indicator of the resilience was scored from 0 to 100, the higher score means the better resilience. It was reported that the chili farmers in Kediri Regency, East Java Province had a resilience index value of 62.86 (Figure 1). The higher farmers' resilience index was achieved by chili farmers in East Lombok Regency, NTB Province, i.e. 67.49 (Figure 2). Meaning that both provinces have high resilience and could overcome the drought conditions.

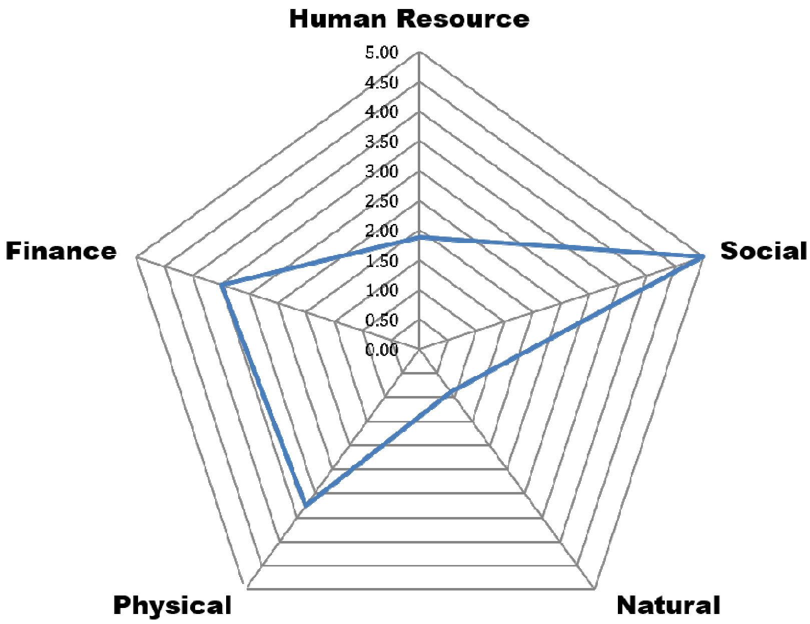
Figure 2: Multi-dimensional Degree of Farmer's Resilience in East Java



Source: (Sayaka et al.,, 2016:40)

Farmer's resilience index on drought at East Java is 62,8%

Figure 3: Multi dimensional Degree of Farmer's Resilience in West Nusa Tenggara



Source: (Sayaka et al., 2016:)

Farmer's resilience index on drought at West Nusa Tenggara is 67%

2.5.3. Export Market Opportunity

The mapping of export opportunities showed that world chili market was dynamic, as in 2016, the main supplier of chili in the world market were Mexico, Spain, Canada, USA, and Marocco. During 2010–2015, the Netherland was counted in the ten main supplier of chili to the world market, but not in 2016. Indonesia, however also considered as small chili export in a relatively limited volume. The export even decreased in the average of 0.19%/yearof value and 0.25%/year of volume during 2010-2016 (UN Comtrade,2016). The increasing trend of domestic price of chili has influenced the volume of export during the past few years and that would not be competitive in the world market as the price of Indonesia's chili is higher than that of world market (Darwis,2011). During March 2018 to March 2019, Central Bureau of Statistics (Badan Pusat Statistik, 2019) reported that the price of chili were decreased about 20-28%. Similar trend also reported by Farid and Subekti (2012).

On chili demand, the largest world importer of chili that imports as high as 1 (one) million tons in 2016 (US$ 1.6 billion) was the USA. The second to five largest were, respectively Germany, England, France, and Canada. These five countries have shared about 87% of the total import volume of the world market (UN Comtrade, 2016).

The characteristic of the chili products for export market needs standard and certificate as an important reference to measure the quality of product and or services in trade activities. The application of the quality standard is intended for Indonesia's agricultural product in its attempt to be listed in the prime and export market-oriented products and at the same time to list the specific products of Indonesia to be considered in the strategic position of products within the global market. Codex, ISO, and HACCP are among the international quality standards that directed to be met by the local products for export. The products that meet the national and international standard should be well accepted and globally acknowledged for international markets (Kementerian Perdagangan, 2017). This idea is in accordance with IFAD (2003), that it is very important to promoting market access for the rural poor in order to achieve the millennium development goals.

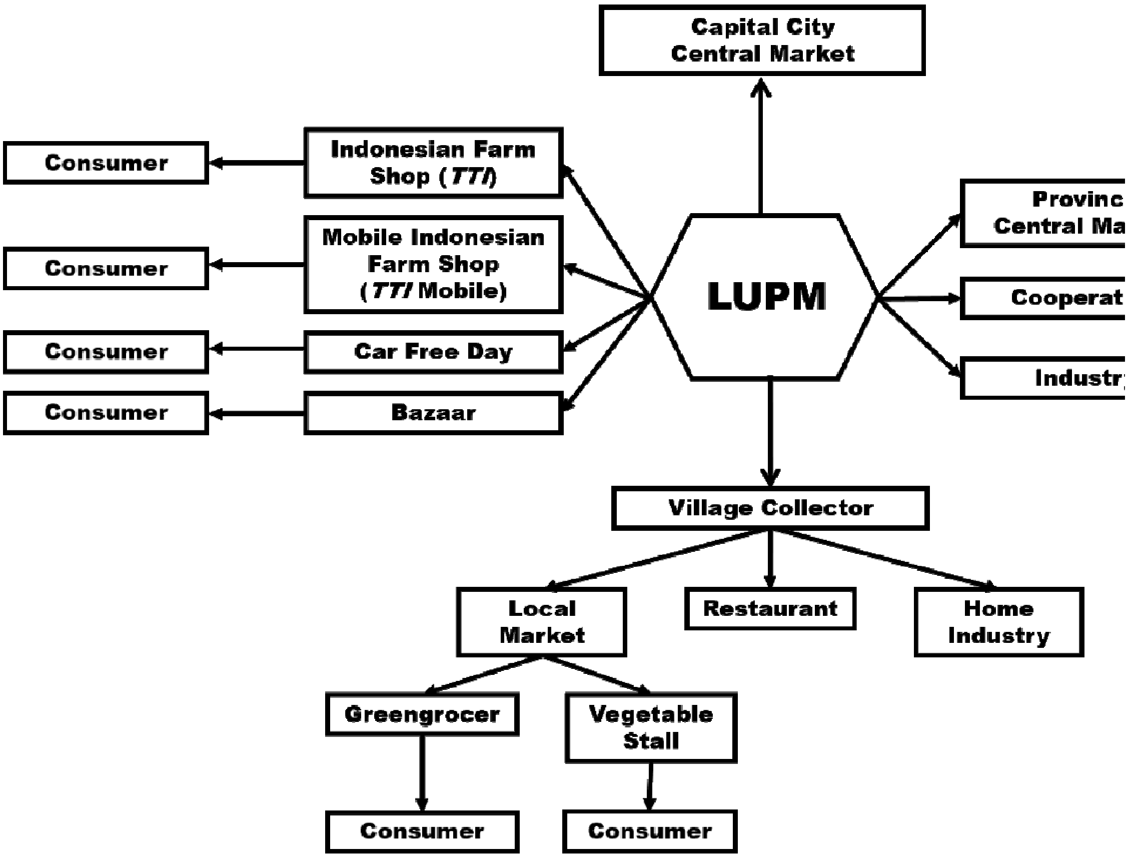
According to Balgah and Buchenrieder (2011) the access to international market is significantly influenced by the constraints faced by the farmers such as uncertain price, unqualified in getting the standard certification, difficulties in implementing the contract, as well as physical aspect such as infrastructure. The performance of chili farmers in Indonesia (Kustiari et al., 2017) could be illustrated in three factors such as technical, economic and social. Technically farmers had not implement yet the recommended technology of Good Farming Practices. Moreover, farmers were not fully meet technical requirements in respect to product characteristics as conditions applied by the importer countries. From the economic point of view, farmers still face problems in making available farm working capital. Farmers are heavily depending on the government's subsidies and capital loan from traders/ production input shop with the consequence of high interest rate. Socially, farmers have a lot of difficulties to access international markets due to uncompetitive price leading to selling the products at local/rural level with local traders and or large traders as their trade partners.

2.5.4. Chili Supply Chain

One of the Indonesian government efforts to achieve the community food security (Kementerian Pertanian Republik Indonesia, 2016)) is the Community Food Business Development (*PUPM: Pengembangan Usaha Pangan Masyarakat*) through the Indonesian Farmers Shop (*TTI : Toko Tani Indonesia*). One of the objectives of the *TTI* is sorthening the chili supply chain by directly buy the chili production from the farmers with higher price and sell to *TTI* which 10% lower than the market price with detail guideline outlined in Agricultural Ministry (Kementerian Pertanian Republik Indonesia, 2017). This effort is carried out because shortening the structure of the supply chain will increase the efficiency of the activities of the farming (Rasoki, 2016) while Ahmadullah (2013) stated that forces of collaboration in supply chain should be done directly with farmers or the *LUPM*.

The existence of *TTI* is very helpful for consumers from the economic aspect because of the lower price and the ease of getting good quality of chili at *TTI* which in 2019 there were 1,562 TTIs spread in 34 provinces (Sulaiman et al., 2018). There are also *TTI* mobile available in certain area, bazaar and car free day. To reach consumers through *TTI* program only need 2 (two) chain from Farmer's Group and *TTI* (Figure 4) compare to other chain such as from *LUPM* to village collectors then local markets and greengrocer or vegetable stall. While the price of TTI product were lower than the market price (Darwis,2011).

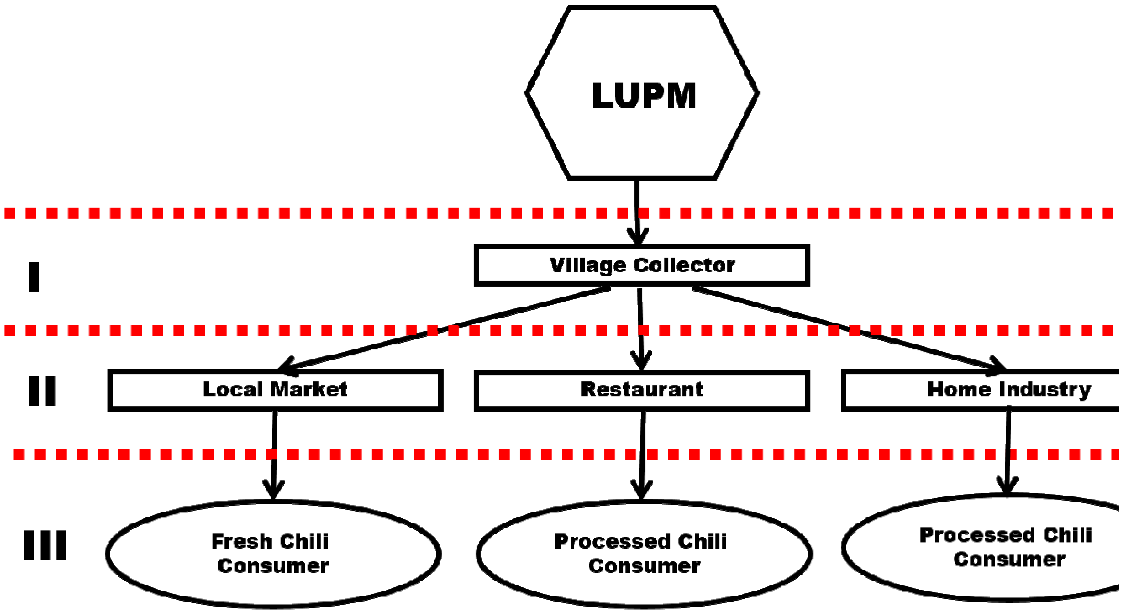
Figure 4: The Exsistance of TTI in the Traditional Chili Supply Chain in entral Jawa



Source: (Primary data, 2017)

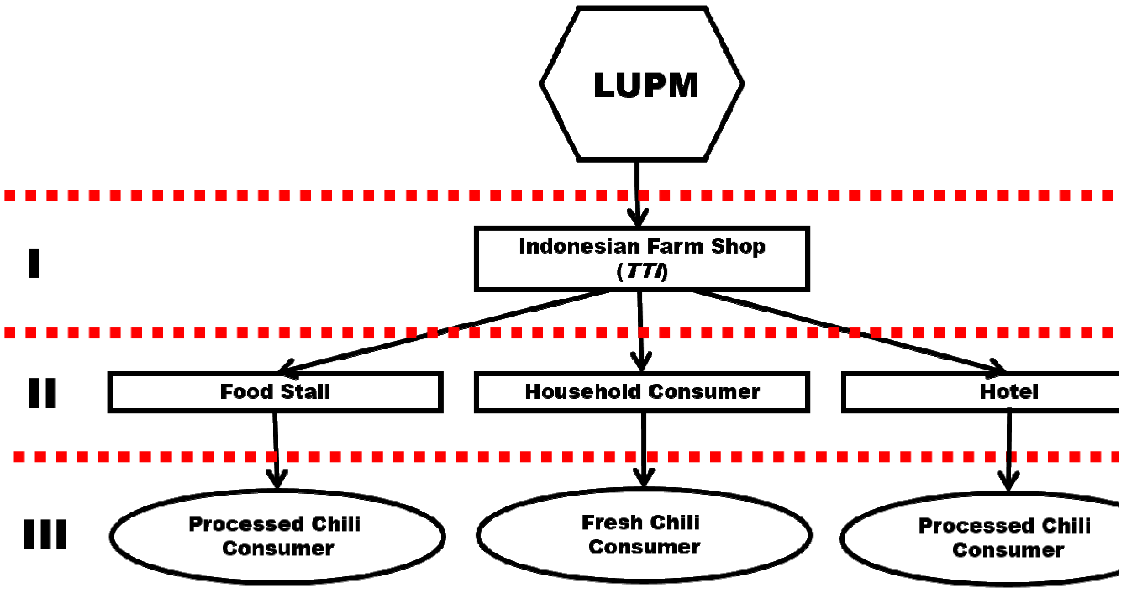
The benefit for the farmers from the existence of TTI is to provide more marketing channels so that avoid losses due to unsold chilies. This benefit also recognized by rice farmers' who get LUPM program (Anugerah and Wahyuni,2019). This means that government policy to increase the farmers' welfare had successful. The variation of the chili supply chain in different *PUPM* were found as (Figure 5), which need at least three chains for the consumers to get the chili. There will be more chain when the consumers by chili to *warung* or peddle shop. The supply chain from *TTI* illustrate in (Figure 6), its only needs maximum of two supply chain to reach fresh as well as processed chili.

Figure 5: Chili Supply Chain from to TTI and Consumer



Source: (Anugerah et al., 2018)

Figure 6: Chili Supply Chain from POKTAN to Indonesian Farm Shop



Source: (Anugerah et al., 2018)

3. Conclusion

From the six national programs, there are three programs that resulted good impact on the chili development, namely Climate Field School (SLI), Annual Water Allocation Forecast (RAAT) and Water Rescue Partnership Movement (GNKPA).

Access of chili to export market constrained by high production input, especially for irigation and other factors includes thecnical, economic and social factors.

The TTI program significantly shorten the supply chain that help farmers and consumers suround the TTI, therefore the program should be continued and implemented in orther area, especially in areas where the people are less well of or under the poverty line.

4. Policy Implication

Efforts to increase market access to international/foreign market should be continued. The strategy to achieve chlli development is implementing, a good farming practice that is integrating the *SLI*, *RRAT* and *GNKPA* supported with the marketing system. Through these efforts the quantity and quality are guaranteed so that they can penetrate the export market.

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Utilization of Bambara Bean (*Vigna subterranea* L.) Flour As a Substitution of Wheat Flour in Making Cookies

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Abstract.

Bambara (*Vigna subterranea* L.) has a fairly good carbohydrate and protein content of 56.61% carbohydrates and 20.6% protein. The purpose of this study was to determine the proximate content of adding Bambara bean flour in making cookies and panelists' acceptance of bambara bean cookies. The experimental design used was Completely Randomized Design (CRD) with 3 treatments and 3 replications. The treatment given are : P1 (75% of Bambara flour: 25% wheat flour), P2 (50% of Bambara flour: 50% wheat flour), P3 (25% of Bambara flour : 75% wheat flour). Bambara bean flour and Bambara bean cookies are tested proximate content and hedonic tests. Bambara bean flour contains of 7.13% water content, 22.64% protein, 8.09% fat, 3.75% ash and 58.46% carbohydrate. The addition of Bambara bean flour to cookies significantly affected the water content, ash, fat, protein and carbohydrates in cookies. The addition of Bambara bean flour to cookies significantly affected the aroma and flavour but did not affect the color and crispness of the cookies. P1 treatment cookies are preferably by the panelists of the aroma and flavour parameters. P1 treatment contains of 3.49 % water content, 2.07 % ash, 24.42 % fat, 11.21 % protein and 59.08 % carbohydrates.

1. Introductions

Bambara beans are bean original plant from West Africa (Wicaksana et al., 2013). Bambara beans are often referred to as Bogor beans in Indonesia and many are processed into snacks such as boiled beans and fried beans. Bambara beans are easily obtained because there are quite a lot available in several regions, especially on the islands of Java such as Bandung, Garut, Sumedang, Gersik, Lamongan and Majalengka (Kuswanto et al., 2012 in Adhi, 2018). Bambara beans have high nutritional content and source of important nutrients especially protein for the body. Bambara beans contain 20.6% protein, 6.6% fat, 6.3% fiber, 3.25% ash, and 56.61% carbohydrate in 100 grams of material (Adhi, 2018).

Types of legumes can be used as flour to substitute wheat flour in the manufacture of food preparations. Bambara beans can be used as flour because they contain high levels of carbohydrates. Bambara bean flour can be used as a substitute for making cookies. The use of Bambara bean flour can reduce the needs for flour and flavor enhancers in making cookies. Cookies are one of the food products that are almost in great demand by various groups ranging from children to adults, both from the lower economic community to the upper economy. Cookies are a type of biscuits made from soft dough, high in fat, relatively crispy and when broken the cross-section of the cutter is less dense textured. Cookies are baking products with high sugar and fat content relative to flour and less water (SNI, 1992; Faridi 1994). The addition of Bambara flour in making cookies can be an alternative diversification of cookies products.

2. Methodology

2.1. Material and Tools

Ingredients used in making Bambara bean cookies were Bambara flour, wheat flour, vanilla, salt, cooking oil, cornstarch, refined sugar, and egg yolks. The tools used in making Bambara bean cookies were digital scales, spoons, plates, pans, blenders, spatulas, sieves, basins, small plastic cups, pans, cookie molds, wooden rolls, brushes, and oven.

2.2. Experimental design

The experimental design used was a completely randomized design (CRD) with 3 treatments and 3 replications as follows:
P1: 75% Bambara bean flour: 25% Wheat flour.
P2: 50% Bambara bean flour: 50% Wheat flour.
P3: 25% Bambara bean flour: 75% Wheat flour.
There are 9 samples for proximate analysis and 29 panelist for organoleptic test.

2.3. Data Analysis

The cookies' contents of water, fat, protein, carbohydrate, and ash were measured by proximate analysis. The organoleptic testing (preferred level) used the hedonic method with the parameter tested were color, aroma, flavor, and crispness of cookies. The results of the panelist preference level assessment range using a Likert scale with the following criteria :

Tabel 1. Level of respondent statement

Interval	Level of respondent statement
1,0 – 1,8	Dislike very much
1,9 – 2,6	Dislike moderately
2,7 – 3,4	Neither like
3,5 – 4,2	Like moderately
4,3 – 5,0	Like very much

Source : Suryono & Ningrum, 2018

The data obtained was analyzed using ANOVA and if it shows a real effect it proceed with the Duncan test.

3. Results and Discussion

3.1. Nutritional content of Bambara flour

Bambara bean flour has the same physical characteristics as wheat flour in general, has a white color and powder type. Bambara bean flour with characteristics similar to SNI flour used as food ingredients can be used as local ingredients to substitute wheat flour in the process of making cookies. The results of the proximate analysis of the Bambara bean flour used in making cookies were as follows:

Table 2. Nutritional content of Bambara bean flour

Nutritional Contain	Total (%)
Water content	7.13
Ash	3.70
Protein	22.64
Fat	8.09
Carbohydrate	58.46

* 5 g of flour samples

Bambara bean flour contains 7.13% water content, 3.70% ash content, 22.64% protein, 8.08% fat and 58.46% carbohydrate. This is in accordance with the opinion of Sobari & Wicaksana (2017) who stated that Bambara beans in 100 grams contain nutrients, namely 20.6% protein, 6.6% fat, 6.3% fiber, 3.25% ash and 56.61 % carbohydrates (Adhi, 2018). Each dried seed has 16-21% protein, 50-60% carbohydrate and 4.5-6.5% fat (Sobari & Wicaksana, 2017).

3.2. Nutritional Content of Cookies

The nutritional content of cookies based on the results of the proximate analysis are shown in Table 3.

Tabel 3. Nutritional content of 100 g cookies

Nutritional Contain	Cookies (%)		
	P1	P2	P3
Water Content	3.49c	2.82a	3.07b
Ash content	2.07a	2.10b	2.14b
Fat	24.41c	23.31b	21.38a
Protein	11.21b	10.01a	8.07c
Carbohydrate	59.08b	57.11a	64.71c

Note:
P1: 75% Bambara flour: 25% Wheat flour; P2: 50% Bambara bean flour: 50% Wheat flour;
P3: 25% Bambara bean flour: 75% Wheat flour.

Water content

Based on the results of a proximate analysis conducted from each treatment, it was found that the treatment of Bambara flour gave a significant affect of water content of the cookies (P <0.05). P1 has the highest water content of 3.49%. The water content of P1 cookies is still in accordance with the Cookies Quality Requirements (SNI No. 01-2973-1992) a maximum of 5%. Adding 75% of Bambara flour will affect the water content of cookies. Proximate analysis results show that the Bambara bean flour contains as much as 7.12% water content per 100 g of material.

Ash Levels

Ash content describes the mineral contained in an analyzed product. The addition of Bambara bean flour to cookies has a significant effect on the ash content. The highest ash content was found in P3 of 2.14%. The amount of ash in food products depends on the amount of mineral content of the material used. It's believed that ash level roughly describes the mineral content of a food ingredient (Nisar et al. 2018).

Fat

The given treatment had a significant effect on the level of fat produced (P <0.05). The highest fat content produced by P1 was 24.41% and the lowest was P3 of 2.14%. The more additions of Bambara bean flour cause higher levels of fat in cookies. The Bambara flour used has a fat content of 8.08% per 100 g of material. This statement accordance with the opinion of Ratnasari and Yunianta (2015) who stated that the fat content in cookies increases with the higher proportion of pumpkin flour in the cookies produced.

Protein

It was found that the treatment of Bambara bean flour added to cookies has a significant effect on the protein contained in cookies (p <0.05%). P1 has the highest protein content of 11.21%. This is due to the amount of the addition of Bambara flour as much as 75% in the treatment of P1, thereby increasing the levels of protein cookies in P1. The more additions to Bambara bean flour cause a higher protein content of the cookies.

Carbohydrate

The treatment of adding Bambara flour to cookies has a significant effect on the carbohydrate content of cookies. The highest carbohydrate content is in the P3 treatment. The more additions to the Bambara bean flour the less wheat flour is added to cookies. The proportion of added flour will affect the carbohydrate content of cookies. Wheat flour contains a lot of starch which produced from wheat seeds. Wheat seeds have a high nutritional content, including carbohydrates 60-80% (Sramkovaa et al. 2009).

Hedonic Test

The hedonic test is the most widely used test to measure the degree of preference for food products. The hedonic test results can be seen in Table 3.

Tabel 4. Hedonic test

Sample	Parameters			
	Color	Aroma	Flavor	Cripness
P1	3.55a	3.72b	3.83b	3.52a
P2	3.21a	3.28ab	3.38a	3.48a
P3	3.52a	3.45a	3.45a	3.83a

Note: 1.0-1.8 (Dislike very much); 1.9-2.6 (Dislike moderately);
2.7-3.4 (Neither like). 3,5-4,2 (Like moderately). 4.3-5.0 (Like very much).

Color

Color has the most important role in the selection of a product, because if the color of the food is not attractive it will reduce consumer acceptance on the product (Mustika, 2016). Based on the results of the hedonic test, it was found that the treatment did not have a significant effect on the color of the cookies produced (P <0.05). Bambara bean flour has almost the same color as wheat flour so that there are no color differences in the cookies produced.

Aroma

It was found that the treatment of adding Bambara bean flour to cookies gave a significant effect of the aroma produced by cookies (P <0.05). P1 was preferred by the panelists with an average value of 3.72 (like moderately). The aroma in Bambara beans cookies can be influenced by the fat content in Bambara beans. According to Pertiwi & Khasanah~~,~~ (2018), the aroma that comes out of cookies can be caused by the reaction of fat in the cookie dough when baking.

Flavor

Based on the results of hedonic tests, the treatment of adding Bambara bean flour significantly affected the flavor parameters (P <0.05). The highest taste score found in treatment P1 is 3.83 (like moderately). Taste is one of the factors that determine a product can be accepted or not by consumers. The taste of food is a mixture of taste and odor responses, where the determination of taste using the taste buds. According to Putri (2018), the taste can be influenced by several factors including chemical compounds, concentration, temperature and interactions with other taste components. The addition of Bambara bean flour adds the flavor of the cookies produced.

Crispness

The treatment of adding Bambara flour to cookies did not significantly affect the crispness parameters produced (P <0.05). Judging from the average value produced, P3 has a higher level of preference than other treatments. Giving more flour will provide a high content of amylopectin. The crispness of cookies can be influenced by differences in the composition of the basic ingredients, especially in the amylopectin (Lestari & Yusuf, 2018).

4. Conclusions

The addition of bambara bean flour to cookies gave a significant effect to the content of water, ash, fat, protein and carbohydrates in the cookies. The addition of Bambara bean flour to cookies give a significant effect of the aroma and flavour but did not affect the color and crispness of the cookies. P1 treatment cookies (75% Bambara bean flour: 25% wheat flour) were preferred by the panelists from the aroma and taste parameters. P1 treatment cookies contained water content (3.49%), ash content (2.07%), fat (24.41%), protein (11.21%) and carbohydrates (59.08%).

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Effect of Storage Rice Bran on Antioxidant Activity Hydrophilic Extract

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Abstract.

The utilization of rice bran on the rice mills in Java, in general, is not taken immediately after coming out of the mill. This study aims to determine the effect of storage time of bran to the yield, total phenol and antioxidant activity of the extract hydrophilic. Total phenolic content of hydrophilic bran extracts analyzed using the Folin-Ciocalteu method while testing the antioxidant activity using DPPH free radical fishing methods (2.2 diphenyl-1-picrylhydrazyl). Storage time in this study conducted over four weeks. Each sample was extracted with ethanol hydrophilic components. The hydrophilic extract was analyzed yield, total phenol, and antioxidant activity. The results showed that in the first week of storage bran has the highest total phenol (498.8467 EAG mg / g) and the highest antioxidant activity (80.7825%). While in the fourth week of storage has the highest yield (11.2575%). The higher the value of total phenols hydrophilic extract of bran in the first week, the higher the ability to inhibit free radicals.

Keywords: antioxidant activity, bran, hydrophilic extracts, storage, total phenol, yield

1. Introduction

Rice bran is known is a byproduct of rice milling. Bran consists of layers of the rice grains are aleurone/rice husk and endosperm fraction. In the rice milling process in Indonesia bran produced in the milling process both [1]. Sukoharjo district including rice granary areas in Central Java, so the amount of bran production in line with the amount of rice production. Production of rice in 2016 as many as 391 675 tonnes of a grain of harvest area of 54 339 ha and 392 587 tonne increase in 2017, or an increase of 2.48 quintal/ha (CBS, 2017). The grain production if milled rice will yield about 55% or 215 412 tons of rice. Bran produced about 10-15% of rice or reaching around 21 541 tonnes. The rice bran has a huge potential to be developed so as to increase the added value.

During this time the majority of bran in Sukoharjo district used as animal feed. Astawan, states that the nutrients and functional characteristics possessed bran potential to be used as a functional food and food ingredient. The main problem in the use of bran is easy to rancidity due to reactions that lead to rancidity hydrolytic and oxidative rancidity. Bran stabilization efforts can be made through the inactivation of lipase and lipoxygenase, such as by adjusting the pH, dry heat, steam heating, the use of microwave energy, the use of ethanol vapor, to the use of antioxidants.

The results of the study have revealed that bran is known to contain high bioactive components [2]. Hartati [3] declare that several varieties of rice bran extract showed that total phenolic content ranged from 60.61 to 2794.28 ± 2280.00 ± 181.83 pg Error Acid Equivalent (EAG) / g bran. The antioxidant activity of the ward (scavenging) free radical (DPPH) high of 41.28 ± 0.60%. The extraction is done using known toxic methanol. Required solvent cheaper, safer and friendlier to the environment, namely ethanol. Sukoharjo district is also known to have the ethanol industry center in the District of Mojolaban. Ethanol results of the domestic industry and SMEs (small and medium micro enterprises) need to be developed in a positive direction to avoid misuse of ethanol. One such use is used as a solvent. The use of ethanol as a solvent requires optimization to extract the bioactive components of rice bran. Therefore we need this study. Extracts obtained still require further testing includes testing the content of bioactive components and antioxidant activity. Extract in vivo testing using experimental animals is also required.

Objective To determine the effect of storage time of bran to the yield, total phenol and antioxidant activity of the extract hydrophilic.

2. Materials and Methods

2.1. Materials and Equipments

The main material used in this study is the bran varieties of IR 64. The materials used for the extraction and analysis covering the 96% ethanol, DPPH solution (2.2 diphenyl-1-picrylhydrazyl), Folin-Ciocalteu solution, Na_2CO_3 7.5%.

Equipment used for the extraction of bran includes Duran bottle, flask, funnel, filter paper, test tubes, test tube rack, aluminum foil UV-Vis spectrophotometer, water bath.

2.2. Research methods

Analysis procedures

1. Yield Analysis Procedure

Determination% yield taking into account the extraction and bran samples used in the extraction. To calculate the% yield using the following formula:

$$\text{The yield (\%)} = berat\ total\ terekstraksi / \ berat\ bekatul\ awal \text{ x } 100\%$$

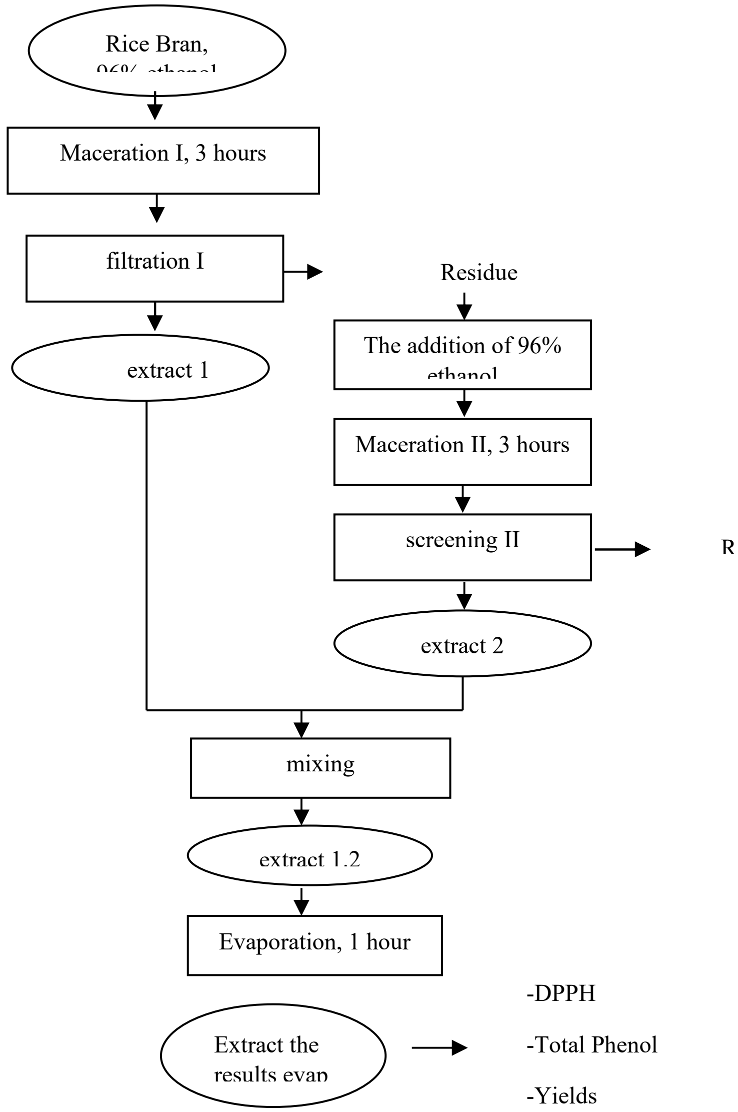
2. Test Procedure Total Phenol with TPC [4]
   a. Taking 1 ml of bran extract, diluted in 10 ml flask, of dilution of 1 (P1) was taken 1 ml diluted again in the flask 10 ml to dilution 2 (P2), up to dilution 3 (P3).
   b. Each dilution was tested in total phenol with the TPC method in duplicate.
   c. Taking 0.12 ml samples of each dilution.
   d. Add 0.6 ml of Folin-Ciocalteu, then adding 0.96 ml of Na_2CO_3 7.5% (75g / L).
   e. Vortex, then heated in a water bath temperature of 50 C for 5 minutes.

   f. Measure the UV-Vis spectrophotometer at a wavelength of 750 nm.
3. DPPH Test Analysis Procedure (2.2 diphenyl-1- picrylhydrazyl) (Sompong et al., 2011):
   a. Taking 1 ml of bran extract, diluted in 10 ml flask, of dilution of 1 (P1) was taken 1 ml diluted again in the flask 10 ml to dilution 2 (P2), up to dilution 3 (P3)
   b. From each dilution tested by Duplo DPPH
   c. 0.3 ml of extract plus 1.5 ml of DPPH 0,16nm then vortex and antioxidant activity observed using UV-Vis spectrophotometer at a wavelength of 515 nm
   d. Noting the results of the absorbance of each sample.

2.3. Stages Research

The Stages of the research conducted are making rice bran the extracts is then followed by the analysis of yield, total phenol, and antioxidant activity. Extraction is done by maceration terraced rice bran by using ethanol solvent. Ethanol is used as a solvent able to extract more good antioxidant compounds in the form of antioxidants polar and non-polar. Furthermore, bran added solvent ethanol (1: 6) was then performed story maceration for 3 hours. Once macerated samples were filtered and the solvent evaporated with a rotary vacuum evaporator until the solvent does not drip. Flow diagram of the stages of research can be seen in Figure 1.

Figure 1. Stages Research



2.4. Data analysis

The data were the yield, total phenol and antioxidant activity were analyzed using analysis of variance completely randomized design (CRD). Data processing includes the analysis of variance (ANOVA). Data processing is done by using SPSS version 21. To see the difference among the treatments carried out a further test using the Duncan test at a 5% level.

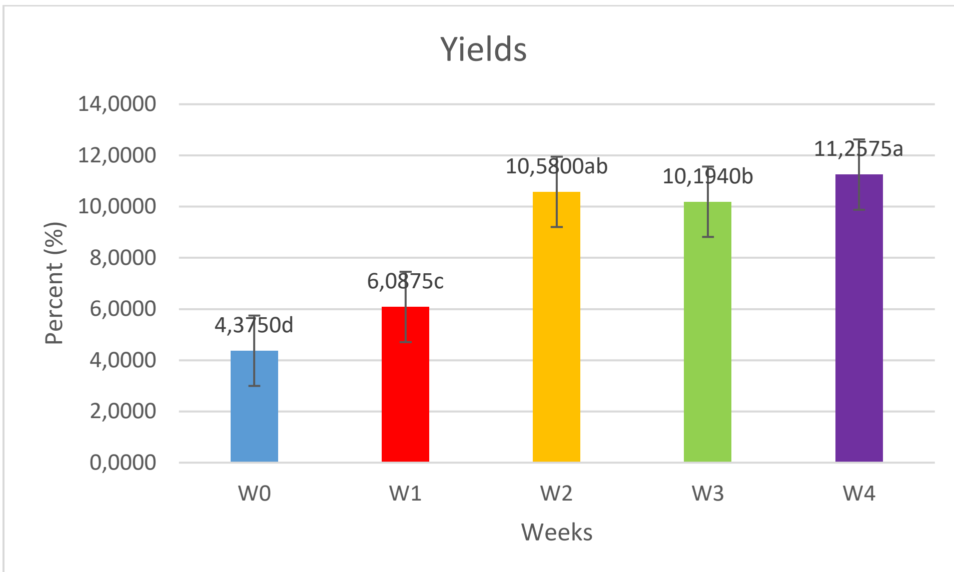
3. Results and Discussion

Bran extract obtained from the extraction process using ethanol tested yield value and chemical characteristics which include total phenol and antioxidant activity of the extract hydrophilic.

3.1. The yield

Statistical analysis of the effect of rice bran storage to yield hydrophilic extracts show that the week four significantly different from the other except at week two was not significantly different. In the fourth week of storage has the highest yield (11.2575%), then successively in week two (10.5800%), at week three (10.1940%), the first week (6.0875%) and to zero (4.3750%). Results of statistical analysis yield a hydrophilic extract of bran that can be seen in Figure 2.

Figure 2. Results of Hydrophilic Bran Extract Yield Analysis After Storage At Week Four



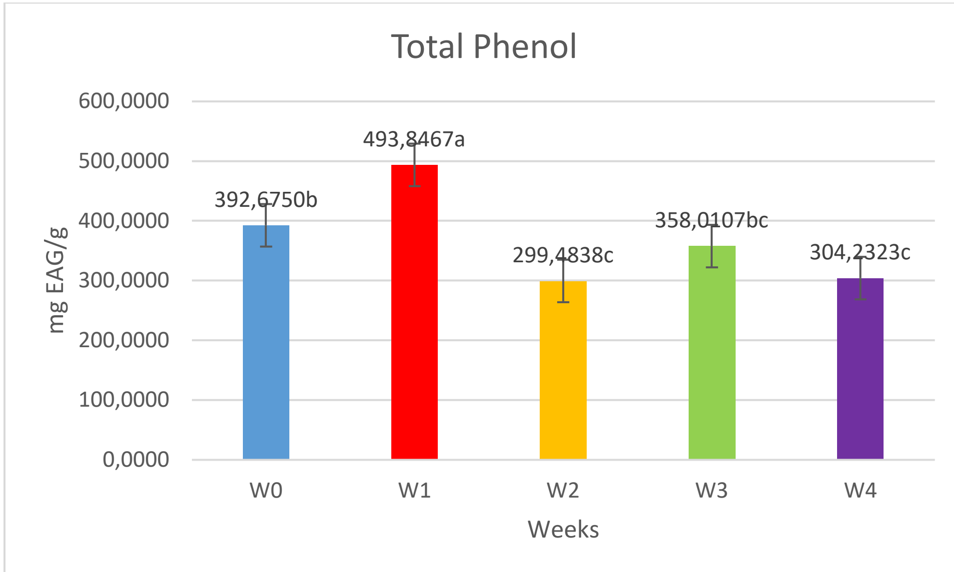
Description: W0: Week to zero; W1: the first week; W2: second week; W3: Sunday to three; W4: week four

Based on the results of the analysis of hydrophilic bran extract yield value resulting in saving of up to four weeks to have a lower value than the study 37.79 ± 3.89% [5]. Differences in yield value can be caused by several factors, including the method of extraction, the type of solvent, temperature and time of extraction, and the extracted sample size [6]. Bran extract yield value according to some previous studies ranged from 9-24% [7]. High yield value in the sample is likely due to less optimal evaporation process so that there is still residual solvent contained in the extract and take calculated as weight extract.

3.2. Total phenol

The content of total phenols hydrophilic bran extracts analyzed using the Folin-Ciocalteu method. Statistical analysis showed that the total phenol storage bran extract in the first week was significantly different from the results in the other week. Total phenol at week the zeroes significantly different from week to two and four. Storage in the first week has a total phenol highest (498.8467 mg EAG / g), and then successively at week zero (392.6750 mg EAG / g), the third week (358.0107 mg EAG / g), week four (304.2323 mg EAG / g) and second (299.4838 EAG mg / g). Results of the statistical analysis of total phenols hydrophilic bran extracts can be seen in Figure 3.

Figure 3. Results of Analysis of Total Phenol extract Hydrophilic Bekatul After Storage At Week Four



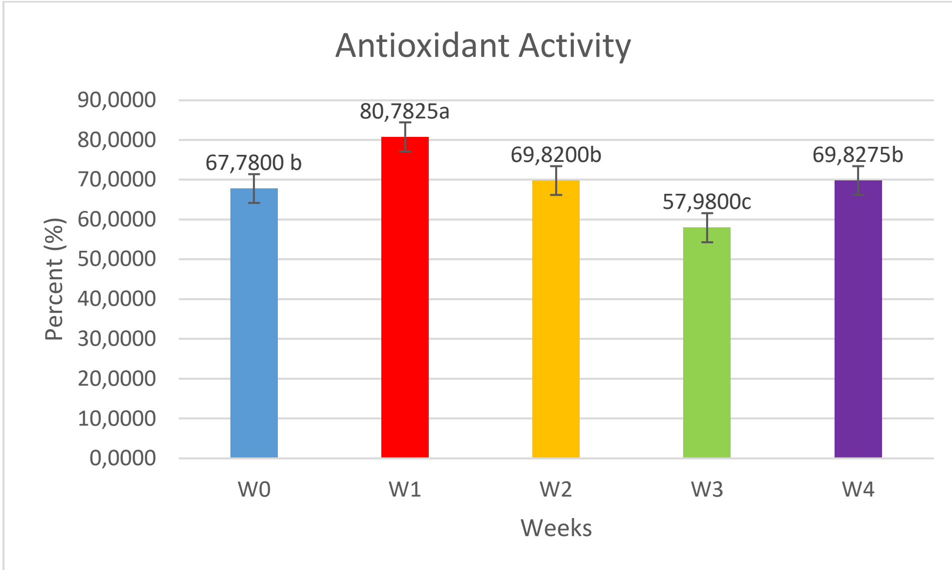
Description: W0: Week to zero; W1: the first week; W2: second week; W3: Sunday to three; W4: week four

The total value of phenol extract rice bran lower hydrophilic rather than literature can be caused by several things including the quality of rice bran and rice bran rice varieties which were obtained. Phenol compound is one of the secondary metabolites, which occur due to environmental conditions that do not support such a strong light, low temperature, infectious diseases, and pests, as well as nutritional deficiencies [8]. Phenol compounds are more soluble in polar solvents [9] so that the presence of polar groups in ethanol led to many phenolic compounds dissolved in the extract participate. According to research Zaidel [7] bran is extracted with the solvent ethanol that has a higher total phenol than n-hexane or methanol. And Hartati [9]stated that the methanol extract some varieties of rice bran showed that total phenolic content ranged from 2280.

3.3. The antioxidant activity

Testing hydrophilic antioxidant activity of extracts of rice bran performed using fishing methods DPPH free radical (2.2 diphenyl-1-picrylhydrazyl). Statistical analysis showed that the antioxidant activity of the extracted storage hydrophilic bran weeks zero, two and four are not significantly different, but significantly different from the yield in the first and third the weeks. Storage in the first week has the highest yield (80.7825%), followed by consecutive week four (69.8275%), week two (69.8200%), week to zero (67.7800%) and third (57.9800%). Statistical analysis hydrophilic antioxidant activity of rice bran extracts can be seen in Figure 4.

Figure 4. Results of Analysis Extract Hydrophilic Antioxidant Activity Bekatul After Storage At Week Four



Description: W0: Week to zero; W1: the first week; W2: second week; W3: Sunday to three; W4: week four

The antioxidant activity of the extract of bran analysis showed a high value, which reached 90.47%. It's not much different from the research conducted by Zaidel [7] which states that the value of rice bran extract antioxidant activity was 92.96%. The antioxidant value obtained from this study is higher than some other studies show that the antioxidant activity of rice bran extract ranged between 49-57%[9]. The high antioxidant activity of the extracts of bran because many brans the extracts contains antioxidant compounds such as tocopherol, tocotrienol, γ-oryzanol, and the phenol compound. According to Xu [10] phenol antioxidant activity four times higher than the γ-oryzanol, while γ-oryzanol has antioxidant activity ten times higher than the tocopherol. Inside there is also a bran extract tocotrienol antioxidant activity of compounds 40-60 times higher than the tocopherol [11]. Their combination of several antioxidant compounds that causes the value of rice bran extract antioxidant activity is very high. According to Hartati[3] stated that the methanol extract some varieties of rice bran showed that the antioxidant activity ward (scavenging) free radical (DPPH) high of 41.28 ± 0.60%.

4. Conclusion

The longer the storage increase the yield. Morever, the content of total phenol antioxidant activity affects the hydrophilic extract of rice bran. The lower the value of total phenols hydrophilic extract of bran, the higher the ability to inhibit free radicals. Phenol content and antioxidant activity of bran hydrophilic extract the highest in the first week of storage then decreased.

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The Use Indigofera Plants As Natural Dyes For Batik

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Abstract.

Yogyakarta,as the center of batik, most of the batik industry uses chemical dyes for its coloring material. However, since there is a prohibitation using chemical dyes, especially from azzo species in the Netherland, Japan, and Germany, it opens the opportunity to replace chemical dyes to natural dyes this research was aimed to inform the advantage of using the Indigofera plant (*Indogofera tinctoria*) as natural coloring agents for coloring batik cloth which has a prospective future supporting the eco–fashions. By extracing the leaves will produce blue color paste that can be used for batik coloring. Observation was cunducted at Triharjo village in August 2019 by following the process from collecting the Indigo leaves, making paste until applying it to coloring the batik cloth It is proven the batik at Indigofera plants as natural dyes has an advantage over the chemical dyes, that the waste does not pollute the enviroment.

Keywords: batik, indigofera, natural dyes

1. Introduction

Indigofera plant is one type of plant where the leaves can be used as natural coloring agents for coloring batik cloth which has a prospective future. Yogyakarta as the center of batik most of the batik industry for its coloring material uses chemical dyes. The advantage of this chemical textile dye is that it is inexpensive and has a high stability compared to natural dyes, in addition to the diversity of colors available and the continuity of the guaranteed material so that it is preferred by consumers. However since there is a prohibition on using chemical dyes, especially from azo species in the Netherlands, Japan and Germany, it provides an opportunity to find a substitute for chemical batik colors using natural batik dyes.

Dyestuff-producing plants grow in Indonesia, more than 150 types of plants that produce dyes that can be extracted from roots, stems, flowers, bark and others. Among these types of plants producing color is Indigofera. The leaves of this plant can be extracted which can give a blue color.

Indigofera plants are relatively easy in their cultivation and do not require fertile land requirements, so that the marginal land of these plants can be cultivated. Indigofera plants are resistant to pruning, so at the age of 4 months the leaves can be utilized to be processed into indigo paste that produces blue color (tom). In its life cycle that can reach 2 years, plants can be taken as many as 6 times pruning. Indigo leaf processing can be done by extracting this plant with the following steps: the leaves are immersed in a soaking tub and then the immersion water is oxidized, the result is a settling paste. This paste is then drained to reduce the water content. Indigo paste produced can be used for natural batik dyes.

Indigofera plant is one type of plant where the leaves can be used as natural dyes for coloring batik cloth which has a prospective future since there is a prohibition on using chemical dyes, especially from azo species in the Netherlands, Japan and Germany, according to Septia and Dian Widiawati, (2013) indigofera leaves can also be used as a craft coloring craft. The advantage of this chemical textile dye is that it is inexpensive and has a high stability compared to natural dyes, in addition to the diversity of colors available and the continuity of the guaranteed material so that consumers . However, since there isa prohibitation on usprefer it.

Dyestuff-producing plants grow in Indonesia, more than 150 types of plants that produce dyes that can be extracted from roots, stems, flowers, bark and others. The resulting colors include combination colors such as green, orange, brown, indigo and the basic colors of red, yellow and blue (Heyne 1987 in Kasmudjo et al). Among these types of plants producing color is Indigofera. The leaves of this plant can be extracted which can give a blue color.

In the Special Region of Yogyakarta, especially in the area of batik centers, namely in Wukirsari Imogiri Bantul, Lendah kulon progo in the last decade the development of the batik industry experienced significant development, interestingly the use of synthetic dyes slowly began to be replaced with natural dyes. This was suspected because batik with natural dyes had a higher price besides the waste does not pollute the environment, but the problem that arises is that these batik craftsmen get a supply of natural dyes from outside the Yogyakarta area. One of the natural dyes that produce blue (tom) is derived from the leaf extract of the indigo fera plant. Some areas of Bantul, especially in the Triharjo Pandak area, have cultivated these plants as raw material for making indigo paste. These indigofera plants are relatively easy in their cultivation and do not require fertile land requirements, so that marginal land in these plants can be cultivated. Indigofera plants are resistant to pruning, so at the age of 4 months the leaves can be utilized to be processed into indigo paste which produces blue color (tom). In its life cycle that can reach 2 years, plants can be taken as many as 6 times pruning. Indigo leaf processing can be done by extracting this plant with the following steps: the leaves are immersed in a soaking tub then this immersion water is oxidized, the result is a settling paste. This paste is then drained to reduce the water content. Indigo paste produced can be used for natural batik dyes.

2. Material and Methods

The research method used to obtain data by observation and question and answer at the place of business making natural blue extract with the raw material of Indigo plant leaves, in the village of Triharjo Pandand subdistrict of Bantul Regency.

Materials used include: indigo leaves, lime, water while the tools used are: soaking tubs, aeration tubs , water pumps, pasta filters.

3. Discussion

Indigo leaf extraction becomes coloring through several main processes namely fermentation, aeration and reduction. Following is an explanation of each stage and the method of making it.

3. 1. Collection of Indigo Leaves

Indigo plants that are more or less 4 months old can be harvested leaves. Picking leaves usually by including a little twig. The time of indigo leaf harvesting is very influential on the quality of the extracted color quality. The best time to harvest indigo leaves is before sunrise (based on the experience of farmers in the Wonosobo area).

Figure 1. Leaves of Indigo plants ready for harvest

3. 2. Fermentation

Indigofera plants contain indicative glucosides. This indication needs to be fermented enzymatically hydrolyzed so that it turns into indoxyl and glucose. Fermentation is generally done by soaking the leaves in water. When fermentation will arise froth foam on the surface of immersion water. Fermentation can be stopped if a lot of foam has formed. This process takes approximately 1-2 days.

• Leaf weight ratio: water volume = 1:10 (kg: liters)

• Because the leaves are very light so the leaves can be submerged, weights are needed that are placed on the leaves (all leaves must be submerged)

• Immersion results are blue liquid must be separated from the leaves.

• Separation of leaves is done by filtering with a filter cloth. The result of filtering is a yellowish blue liquid. Furthermore, this liquid is dissolved (aeration).

Before being ground or aerated, the lime solution is added with lime water which is made by dissolving active lime in water. Active lime marks can be checked by dissolving them in water. If there are bubbles, they are still active.

Figure 2. Indigo leaf fermentation process

The weight range of lime used is 2-3% of the weight of leaves soaked, then dissolved in 1-3 liters of water. This lime solution is left to sit for at least 1 day before pouring it in an indigo marinade solution. Adding lime will make the solution alkaline where the dyes are more soluble in this atmosphere. Adding less lime will result in the dye not being taken completely, and if there is too much lime, then the paste will contain lime which can affect the coloration (fading).

After adding lime, the color of the solution will turn yellowish green. A solution that is too brown indicates too much lime is used

3. 3. Aeration (Blurring)

Indoxyl produced from the fermentation process needs to be oxidized to become indigotin (blue dye). The oxidation process is done by blurring (it can also be called aeration or contact with oxygen in the air) During the blurring process white foam or foam will form. Blurring continues until the foam disappears. The time range depends on the liquid in contact with air. If done manually with a dipper spray, 1 medium size bucket (20 liters) can last for 0.5 - 1 hour. In larger scales, bubble-producing spargers (such as those used in fish ponds or shrimp ponds) can be used.

Figure 3. Aeration process (aeration)

After the froth in the solution is gone, the paste will begin to settle to the bottom. The deposition process can be waited for 3-4 hours. The surface of the water will become clear greenish and below will appear blue deposits. The strip can be removed and the precipitate filtered with cloth. Filtering paste can be done by hanging in a filter cloth.

Pasta that is formed is not too durable or easily rot if exposed to air. Therefore, the paste must be stored in a tightly closed container. With good storage, it can last up to 1 year. In order to prolong the storage process, the paste can be dried by being dried in the sun to dry and become powder. In powder form it can last several years.

3. 4. Reduction

Indigo paste containing indigotin can already be used for dyeing batik cloth. However, this compound is not soluble in water so it cannot be attached to the fabric just like that. Reduction process is needed so that the blue color can be attached to the fabric. Indigotin needs to be reduced to indigo leuco in order to dissolve and adhere to the fabric. There are several types of reducing agents that can be used, both chemical and natural. The chemical commonly used is sodium hydrosulfite (commonly called hydro) while natural ingredients such as reducing sugar. Reducing sugar is sugar that can reduce, for example, fructose. Generally found in palm sugar but not in granulated sugar. So that even though they are the same sweet and called sugar, not all can be used as reducing sugar.

Figure 4. Indigo Paste

3. 5. Dyeing

Cloth that has been dyed with indigo needs to be air-dried to contact air. Oxygen in the air will change the greenish brown color of the fabric to bright blue. This indicates that the Leuco indigo compound that attaches to the fabric slowly becomes indigotin again. The dyeing process can be carried out several times until the desired color is achieved. Usually ranges from 3 to 5 times.

4. Conclussions

From the results of observations made it can be concluded how to make indigo paste through several stages, namely:

1. Preparation stages of indigofera plant leaf material, soaking, fermentation, aeration and reduction.
2. The paste obtained can be used as a natural coloring agent in blue.

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Spudy Agrihorti Is A High Yielding Potato Variety Suitable For Chipping Industry

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Abstract.

The demand for potato in the domestic chips industry is very high and most of it is still imported. Small and medium industries that process chips generally find it difficult to get raw materials because they are unable to import while domestic raw materials are almost unavailable. Therefore a breakthrough is needed to get new superior varieties of processed potato chips that are suitable for industrial raw materials both large, medium and small industries. The purpose of this study was to obtain a candidate for a new superior variety of processed potato chips. The output of this activity is to get at least one potential potato variety suitable for the raw material for the domestic chip industry. The study was conducted in Cikandang Village, Cikajang District (1300 m asl), Garut Regency. The experimental design used Randomized Complete Block Design (RCBD), the number of replications was 4 times, the treatment consisted of six genotypes namely Spudy Agrihorti, clones 12.20, clones 14.5.1 and three comparative varieties namely Atlantic, Medians, and Granola. Plant population 80 plants / plot. Observations were made on the qualitative character, quantitative character, chemical analysis of potato and consumer preferences. The results showed that Spudi Agrohorti was the variety that has the highest yield reaching 40.8 tons/ha compared to other varieties. Spudy Agrihorty also displays supporting data of a highly qualified processed quality to be used as raw material for the chips industry. This is indicated by the high carbohydrate content of 14.77%, a high specific gravity of 1.093 m3 with very low reducing sugar content of 0.03%. The quality results of Spudy agrihorti chips are preferred by consumer respondents because they have a yellow chip color compared to white chips produced from chipping varieties of Atlantic and Medians.

Keywords: chip industry, consumer preference, high-yield variety, potato chips, spudy agrihorti

1. Introduction

Large industries that process potato chips in Indonesia are still very rare and all of them use imported raw materials. The variety used for the processed chip industry is Atlantic which is imported from Canada, Australia, and Scotland. The Atlantic variety is suitable as a raw material for potato chips, because it tastes good, with a high SG (specific gravity) characteristic of 1.078 – 1.087 (Basuki et al. 2005), thus giving a high yield of chips. However, according to growers, the varieties are less favored, because yields are lower than Granola, very susceptible to late blight (Phytophthora infestans), susceptible bacterial wilt (Ralstonia solanacearum) and the degeneration period is very fast (Kusmana and Basuki, 2004).

Efforts to obtain the genotype of processed potato chips have been carried out since 2004 at the Vegetable Crops Research Institute (IVEGRI) through a cross method by using one of the parents of Atlantic processed potato varieties with a collection of germplasm of IVEGRI potatoes (Kusmana and Sofiari, 2007; Kusmana, 2012). Crosses with target resistance to Late blight (P.infestans) and high carbohydrate content produce 21 combinations of cross yields (Handayani et al., 2015). Breeding stages carried out on potato plants include early generation selection at the tuber family stage, selection of plant architecture, tuber shape selection, tuber skin selection, tuber depth selection, and plant uniformity, then evaluating the yield and quality of Sg tubers, starch, sugar content (Brown and Dale, 1998; Love et al., 1997). Spudy Agrihorti is the result of a cross between variety of Atlantic and Repita's. Spudy Agrihorti is very adaptive to be cultivated in the potato production center in Garut Regency, West Java.

2. Material and Methods

2. 1 Planting Material

Total potato genotypes planting was six they were Spudy Agrihorti, Clone PB 12.8, Clone 14.5.1 and three comparative varieties of Atlantic, Granola and Medians.

2. 2 Location and Time

The research was carried out at the Agricultural Technology Park, located in Cikandang Village, Cikajang District, Garut Regency, West Java Province (1300 m asl). The research was held from September 2017 to January 2018

2. 3 Method

The research was arranged using a Randomized Complete Block Design (RCBD) with a total of 4 replications. Out of 80 plant populations/plots, 11 plants were randomly sampled. Plants are planted using beds covered with black plastic mulch, according to local farmers' habits when growing industrial potatoes. Plot size 1.2 m wide and 14 m length, with a plant spacing of 60 x 35 cm (double row). Plant population / plot of 80 plants.

One week before closing the plastic mulch was given 20 tons of chicken manure, 500 kg of NPK 16:16:16 and 40 kg of nematicide for each hectare. The maintenance of the plants including irrigation, NPK supplementary fertilizer application at the age of 30 days after planting was as much as 500 kg / ha. Pest and disease pest control was carried out twice a week. The chemicals used for disease pests was the Mancozeb type while for pest pests of the Prefenofos type the dosage was used in accordance with the manufacturer's recommendations.

This study observed both following qualitative and quantitative characters: 1) Plant height is measured from the ground level to the highest part of the plant, when the plant is 70 by using a ruler; 2) The yield of tubers / plants is calculated from a total of 11 sample plants; 3) The number of sweet potatoes per plant is calculated from the number of samples / plots of 11 random sample plants: 4) Tuber yield / plot is weighed from the tuber weight produced/plot; 5) Tuber weight / ha is calculated by weighing the tuber / plot and then converted to hectares with 80% land efficiency; 6) Quality of tubers such as, specific gravity, reducing sugars and carbohydrates were observed at the post-harvest laboratory services. Qualitative data observed included: leaf color, leaf shape, flower corolla color, tuber skin color, tuber flesh color and taste (observed at harvest and after harvest). Observation of colors using the RHS (Royal Horticulture Society) color chart. Quantitative data not analyzed statistically is also carried out on consumer preferences through questionnaire from 30 respondences. Score is 1–5, where 1 = not liked; 2 = rather like; 3 = preferred; 4 = preferred; 5 = very liked.

2. 4 Data Analysis

Quantitative data were analyzed using statistic computer of PKBT STAT 2.01 software.

3. Result and Discussion

3. 1. Qualitative Observations

Observation of morphological characteristics of plants and tubers is intended to compile a description of the variety in addition to getting a special identifier of the variety. In general, the overall leaf shape of six genotypes is oval, whereas leaf colors of all genotypes, which are almost the same, namely green 137 A and 137B Green Group RHS.

The flower corolla of the Spudy Agrihort is white (155C White Group RHS), while Atlantic and Medians was purple (84B Violet Group RHS) (Figure 2). The flower corolla is a unique character because it is different from the comparative varieties of Atlantic and Medians. Spudy Agrihorti has a pale yellow flesh color (163C Greyed Orange Group RHS) which is different from the comparative varieties of Atlantic and Medians which are white (155B and 155 A RHS White Group). The tuber shape of all genotypes were oval (Figure 3).

Fig.1. Leaf shape. (a) Clone PB 12.20, (b) Spudi Agrihorti, (c) Clone 14.5.1, (d) Atlantic, (e) Medians, (f) Granola.

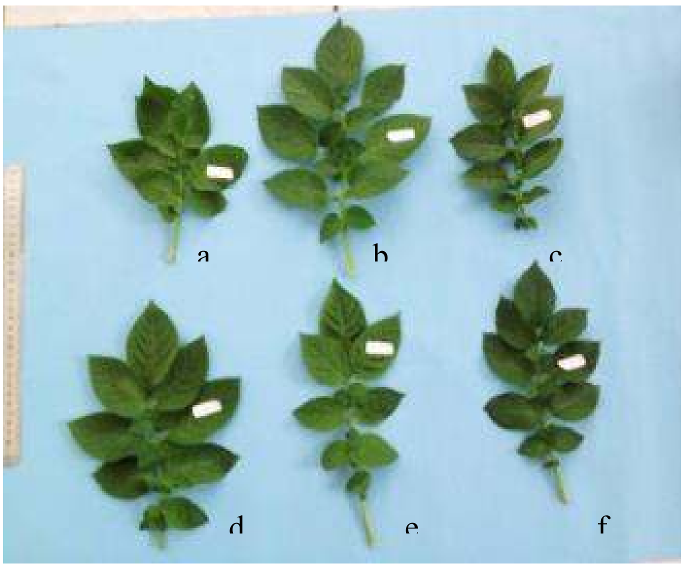


Fig. 2. Inflorescence. (a) Clone 14.5.1, (b) Spudy Agrihorti, (c) Atlantic, (d) Medians

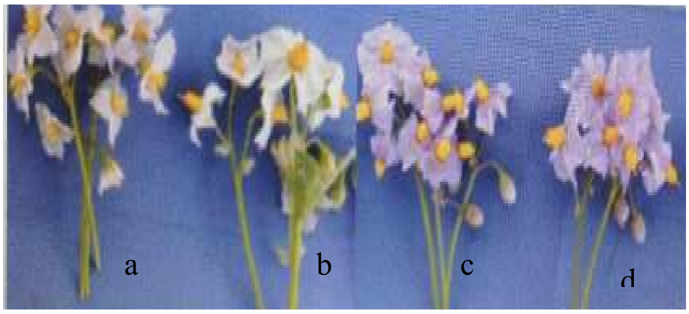
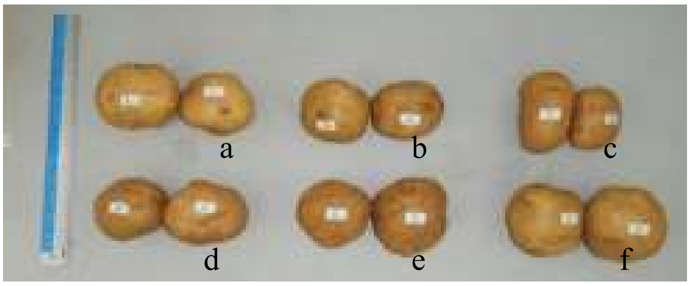


Fig.3. Tuber shape. : (a) Clone PB 12.20, (b) Spudi Agrihorti, (c) Clone 14.5.1, (d) Atlantic, (e) Medians, (f) Granola.



The yellow tuber flesh is the favored color of consumers both of vegetable potatoes and processed potato chips. Tuber skin characteristics, almost all genotypes display light yellow skin color, except for Granola varieties with slightly different tuber skin color is pale yellow (163C Greyed Orange Group RHS).

Table 1.Chemical composition of six potato genotipes

Genotypes	Starch (%)	Reduction sugar (%)	Specific gravity (M3)
PB.12.20.	15.69	0.34	1.069
Spudy Agrihorti	14.77	0.03	1.083
Klon 14.5.1	9.60	0.21	1.076
Atlantic	10.97	0.05	1.078
Medians	12.22	0.03	1.080
Granola	10.85	0.12	1.067

Observation of potato chips based on three main characters e.g. taste, crispness and color of chips. Spudy Agrihorti showed the level of crispness and taste that equals to processing potato variety of Atlantic. Even the yellow Spudy agrihorti chips were preferred by consumers over Atlantic and Median varieties. Total reduction sugar which tolerant for processing potato is 0,28 – 0,50% (Kumar et al., 2004). The use of raw materials with high Spesific gravity (Sg), has an impact on the efficiency because it gives a high value of chips and is more efficient in the use of cooking oil. Spudy Agrihorti showed the most superior quality attributes of raw materials, namely high carbohydrate content, low reducing sugar and the highest Sg compared to other genotipes (Table 1). In the United State chips industries preferred round white flesh cultivars with high Sg more than 1.076 and scored frying 2.5 (Douches, et al, 1996). In China potato can be processed to several products such as strach, noodle, french fries, chips and dehydrate potato (Jansky, et al, 2009).

Table 2.Consumers preferences for taste, crispiness, colour of 6 potato chips

Genotypes	Taste	Crispiness	Colour
PB.12.20.	3,42	3,92	3,92
Spudy Agrihorti	3,95	4,00	4,25
Klon 14.5.1	3,42	3,08	2,75
Atlantic	3,98	4,08	3,95
Medians	3,92	3,98	3,50
Granola	3,83	2,92	2,75

Score 1= not like; 3 = like; 5 = very like

3. 2. Quantitative Characters

Spudy Agrihorti performed as the tallest plants and more vigorous even though it was not significantly different from the comparative varieties of Atlantic, Granola and Medians. The number of tubers produced by the Spudy Agrihorti is very high > 20 tubers / plants equal to Clone 14.5.1 and very significantly different from the three comparison varieties (Table 3). The large number of tubers per plant makes it easy for farmers to get seeds in the following season. Besides the high number of tubers, the tuber yield of Spudy Agrihorti is also very high, reaching 1,314 kg / plant which is significantly higher than the comparative varieties of Atlantic and Granola. Likewise productivity per hectare of Spudy Agrihorti ranks at the top of 31.44 tons / ha significantly higher than processed potato of Atlantic varieties which are only 18.46 tons / ha (Table 3). High yields obtained of Spudy Agrihorti variety as a result of the heterosis effect, which are derived from the results of a cross between Atlantic and Repita that have a considerable long genetic distance (Kristianto, *et al*, 2019)

Tuber bulking of potato crop is strongly influenced by the occurrence of carbohydrate and metabolism resulting from synthetic starch and sucrose translocation from leaf to stolon and tuber induction from leaf to stolon is influenced by the balance between the stimulus element tuberization and the inhibitor tuberization element (Fischer *et al*, 2008). The tuber yield in potato plants is controlled by genes that work additively and its expression is strongly influenced by the environment (Brown, 1985).

Table 3.Plant height, tuber number and tuber yield six potato genotipes for processing

Genotypes	Plant height (cm)	Tuber number (#)	Tuber yield/plant (g)	Tuber yield/plot (kg)	Tuber yield ton/ha (ton)
PB.12.20.	72.4 b	14.25 b	821b	35.25bc	20.77b
Spudy Agrihorti	91.87a	20,50 a	1,314a	53.25a	31.44a
Klon 14.5.1	74.13ab	22.5a	865b	43.50abc	25.52ab
Atlantic	81.27ab	6.00b	955b	31.50c	18.46b
Medians	82.47ab	10.25 b	1,049 ab	50.75ab	28.40ab
Granola	79.33ab	8.75b	869b	46.00abc	26.99ab
CV	8.05	22.95	15.19	17.36	17,93

4. Conclussions

Spudy Agrihorti has a unique characteristic of the white flower corolla and the yellow tuber. It productivity reached 31.44 tons/ha, the highest among other varieties in this research. The chips of Spudy Agrihorti are very popular among consumers because they have great taste, crispy, and good color.

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Motivation and changes in business behavior of laying hens (Case Study in Laying Hens Association of Kedu Region)

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Abstract.

The purposes of this study was to: 1) determine the motivation of farmers in developing a business of laying hens, 2) analyze- the relationship between farmer motivation and behavior change. This research was conducted in the association of laying hens in - Kedu region which includes Purworejo Regency, Magelang Regency, Kebumen Regency, and Wonosobo Regency. Sampling was carried out randomly from a group of 25 farmers. This research was designed as a correlational descriptive study. Analysis of the data used - descriptive statistical analysis and correlational analysis using the Spearman rank test - The results showed the motivation of farmers in raising chickens laying - good category and behavior changes either -. The Spearman rank correlation test - between motivation and behavior change showed significant results.

Keywords: behavior change, laying hens, motivation

1. Introduction

The chicken eggs are an important livestock commodity in Indonesia. The integrity of animal protein is largely contributed from eggs. The availability of eggs is easier and faster than the availability of meat. Large and fast egg production can be done from commercial laying hens.

Laying hens are mostly raised by farmers as a side business. The existence of a community allows increased motivation. Laying chicken associations in the Kedu region consist of *Berkah Telur Makmur*, *Kenzo* and - *Komunitas Petelur Kebumen* (KPK), which are a laying hens association -in the region of Purworejo, Kebumen, Magelang and Wonosobo districts. This association provides guidance and motivation to its members.

Motivation comes from the Latin word *movere* which means drive or driving force [1]. The concept of motivation is an important concept in the study of individual performance [2]. Motivation is the first step in increasing work productivity which will ultimately have an impact on the achievement of livestock business goals, and the benefits will be felt by the breeders themselves. The purpose of this study was to determine the motivation of farmers in raising laying hens and to analyze the relationship between motivation and behavior change in the association of laying hens in the Kedu region.

The purpose of this study was to determine the motivation and behavior changes of farmers to improve laying hens in the association of laying hens in the Kedu region and analyze the relationship between motivation and behavior change.

2. Materials and Methods

This research was conducted on breeders who are members of the laying hens association in the Kedu region including Blessing the Eggs *Makmur, Kenzo* and the *Kebumen Laying Community (KPK*). This research was conducted for four weeks, in September-October 2019. The study population was members of the laying hens association in the Kedu region including Blessing the Eggs Makmur, Kenzo and the Kebumen Laying Community (KPK). The sample in this study amounted to 25 breeders. This research is a descriptive correlational study. The independent variable is the motivation factor and the dependent variable is the change in behavior in raising laying hens. Primary data needed such as the general condition of research location, farmer characteristics, farmer identity, farmer experience, farmer activities, and other data contained in the questionnaire. The instrument used in this study was a questionnaire containing questions for respondents divided into three questions, namely: Part 1 contains questions to find out the identity of the respondent. Part 2 contains questions to find out the motivation for raising laying hens. Section 3 contains questions to find out the behavioral changes in raising laying hens. Instrument reliability refers to understanding whether an instrument can measure something that is measured consistently over time. Data analysis to answer the problem and research objectives that have been formulated. Data collection was performed using a Likert scale questionnaire to layer farmers. Data is processed and analyzed using Linear Regression with SPSS. Data were analyzed with descriptive statistics in the form of frequency, percentage, median, average score, and total average score. Relationship data between variables analyzed using tests: Spearman rank correlation [3].

3. Results and Discussion

3.1 General research location statement

Kedu is an area that includes Purworejo, Kebumen, Magelang, and Wonosobo. In the Kedu area, laying chicken farm is being started. The development of laying hens encourages the formation of laying hens associations. The formation of this association will be driven by the need for Day Old Chickens (DOC), feed, livestock facilities and infrastructure, and for discussions between farmers. There are 3 laying hens associations in the Kedu region, namely "Berkah Telur Makmur" in Purworejo Regency, "Kenzo" in Magelang and Wonosobo Districts and "Kebumen Laying Community" located in Kebumen. "Berkah Telur Makmur" - established since- 2016 with 67 members of the breeder. "Kenzo" - establishedsince 2014 with 14 breeders. While, "Komunitas Petelur Kebumen" established in 2017 which has 30 farmer members.

3.2 Characteristic respondent

The characteristics of the respondents described in this study are age, education, occupation, livestock experience. Data on the characteristics of respondents are listed in Table 1.

Table 1: Characteristic of respondents

Parameter	Category	Scale	%
Age	<29	7	28
	30-49	11	42
	50>	7	28
Gender	Male	15	60
	Female	10	40
Education	Elementary	1	4
	Middle School	6	24
	High school	14	56
	Diploma	3	12
	Bachelor	1	4
Occupation	The main job	8	32
	odd jobs	17	68
length of breeding (years)	0,5	1	4
	1	8	32
	2	13	52
	3	3	12
	6	1	4
	9	1	4
	12	1	4
ownership status	one's own	21	84
	someone else's	4	16

Age of laying hens on average by 42 % aged 30-40 years. whereas those aged 29 years and below and 50 years and above represent 28 % each. Thus, the breeders in "Berkah telur makmur" are still very potential considering that most of the farmers are relatively young. The sex of the respondents - most of them are men, which is 60% while women account for 40%. In terms of education, - the majority of respondents were high school, amounting to 56 %. The high number of breeders with secondary school education can encourage them to improve their ability to develop in the business of raising laying hens. Most of the correspondent work in laying hens (68%) - is a side job, - - and only 32% of them run laying hens as their main occupation. Most of the experience of raising laying hens for 2 years is 52%. This shows the laying business is a new business that was initiated in the association "Berkah telur Makmur".

3.3 Motivation factors for raising laying hens.

Motivation of breeders is the power that exists in your breeders that encourages raising livestock. The motivation of farmers in "Blessing the Eggs Makmur" is very important because it relates to the motivation, distribution and motivation of supporting farmers who want to work hard to achieve optimal results. Motivated breeders always want to develop and have a strong drive to succeed and improve breeders. The motivating factor for raising laying hens is supported by the basic need to raise livestock, social motivation will motivate status and motivation. education level, farming experience, ease of marketing are significantly related to farmer's motivation [4].

Basic needs are important needs of farmers who give great meaning to the needs of farm families. Meeting the basic needs of breeders -rises because breeders are needed from the results of business laying hens that are able to meet the primary needs, secondary needs, tertiary needs, and inventory. Average scores for meeting basic needs can be seen in Table 2.

Table 2: Average Score of Fulfilling Basic Needs of raising laying hens

Indicator	Score	Average	TCR	Category*
Meet primary needs	88	3.52	70.4	good
Meet secondary needs	87	3.48	69.6	good
Meet tertiary needs	87	3.48	69.6	good
Investment	77	3.08	61.6	average

Description: score 85-100 is very good, 66-84 is good, average is 51-65, 36-50 is not good, 0-55 is not good

Table 2 shows good motivation for farmers to develop laying hens. motivation to meet primary, secondary and tertiary needs shows good results. while the motivation for raising laying hens investment is considered sufficient. This shows that the business of raising laying hens is considered important because it can meet the needs of life to the level of tertiary needs. To increase the motivation of layer farmers so that can be used for inventory, it is necessary to increase the number of livestock. Motivation for social status- is the need of farmers to obtain social needs and the need for prestige (status). Means the compliance score for social status is in Table 3. The needs of the farmer's social status in the group indicate value on average, as well as the social status in the community which shows the average value. This shows that raising laying hens get enough social status because it has not shown very tangible results. To improve social status within groups and in community, breeders need to increase the number of laying hens -. The need for farmer appreciation in the community shows good grades. This shows that the community gave a good appreciation for the business of raising livestock despite the average social status

Table 3: Average Scores Fulfillment of the social status of raising laying hens

Indicator	Score	Average	TCR	Category
Social status in groups increases	78	3.12	62.4	Average
Social status in the community increases	76	3.04	60.8	Average
appreciation in the community	85	3.4	68.0	good

Description: score 85-100 is very good, 66-84 is good, average is 51-65, 36-50 is not good, 0-55 is not good

Business development is the ability in a person to develop, be creative and active in the business of raising laying hens. Business development is related to increasing farmer's work productivity and increasing business in laying hens. Developing a laying hens business can improve breeders' knowledge and scale of laying hens. motivation to develop a business for raising laying hens in Table 4.

Table 4: Average Score of Fulfilling Basic Needs of raising laying hens

Indicator	Score	Average	TCR	Category
Improving breeding ability	85	3.4	68	good
Increase the number of livestock	88	3.52	70.4	good
Transfer skills to others	87	3.48	69.6	good

Description : score 85-100 is very good, 66-84 is good, average is 51-65, 36-50 is not good, 0-55 is not good

The results of this study show the fact that breeders in developing a business of laying hens can be obtained properly. This is because breeding laying hens are still new in Kedu region which includes Purworejo, Magelang, Kebumen, and Wonosobo so that was not many competitors. In addition, this area is mostly located in the mountains that are not suitable for growing rice can be used for raising laying hens.

Motivation raising laying hens

According to the Indonesian dictionary, changes can be interpreted as a changing state. So we can define it that change is the transition of the previous state, the change is not only in the form of conditions but can be in the form of a change in mindset, and behavior of a society. Behavior is an individual's response or reaction to stimuli or the environment. Changes in the behavior of raising laying hens are changes after getting conditions that cause changes. This behavior change consists of basic needs, social status and a desire to develop.

Changes in behavior in raising laying hens. Behavioral changes will be made in a moment laying hens are shown in Table 5. Changes can be identified by looking at breeding businesses that focus on livestock, not sharing with other work, paying attention to livestock, improving livestock status in relationships.

Table 5: Average Score of behavior change in raising laying hens

Indicator	Score	Average	TCR	Category
focus on animal husbandry	82	3.28	65.6	average
not sharing with other jobs	84	3.36	67.2	good
attention to livestock	100	4	80	good
raising livestock status in associations	81	3.24	64.8	average

Description : score 85-100 is very good, 66-84 is good, average is 51-65, 36-50 is not good, 0-55 is not good

Changes in behavior in this study indicate that the average category focuses on animal husbandry. A good category in this research is not sharing with other work, paying attention to livestock, improving livestock status in the association of laying hens breeders. This change is because farmers understand the benefits of raising broiler chickens so they care deeply about their business.

Changes in behavior in social status are shown in Table 6. Indicators of changes in social status used by social status indicators have increased, valued by other farmers and competing for progress

Table 6: Average scores of behavioral changes in the social status of laying hens

Indicator	Score	Average	TCR	Category
Improving breeding ability	85	3.4	68	good
Increase the number of livestock	88	3.52	70.4	good
Transfer skills to others	87	3.48	69.6	good

Description : score 85-100 is very good, 66-84 is good, average is 51-65, 36-50 is not good, 0-55 is not good

Changes in social status behavior in this study indicate that the average category of social status has increased while being valued by other farmers and competing for progress shows a good category. These results address the increase in social change.

Behavioral change for the development of indicators used: motivated to be large, motivated by the increased number of laying hens, motivated knowledge transfer.

Changes in mindset motivate farmers to become more powerful showing average results. Efforts to increase the number of laying hens showed good results. The knowledge transfer effort shows a good category. This shows that the efforts of laying hens are motivated to be better in the number of farm animals and in the development of knowledge transfer to other farmers.

Table 7: The average score of change in business development behavior of raising laying hens

Indicator	Score	Average	TCR	Category
motivated to be great	81	3.24	64.8	average
motivated the number of laying hens is increasing	88	3.48	69.6	good
motivated transfer of knowledge	83	3.32	66.4	good

Description : score 85-100 is very good, 66-84 is good, average is 51-65, 36-50 is not good, 0-55 is not good

3.4 The relationship of motivational factors with the behavior of raising laying hens

Analysis of the relationship between motivation and maintenance of laying hens is processed using Spearman ranking analysis. Spearman's tolerance analysis results shows in Table 8.

Table 8: Correlation Coefficient Motivation for raising laying hens and behavioral changes

Indicator	Changing basic needs	Changes in social behavior	Changes in business behavior
basic needs	.572**	.646**	.736**
social behavior	.555**	.651**	.796**
business behavior	.457*	.801**	.784**

** = Significantly related to the significant level α = 0.05*
*** = Significantly related to the significant level α = 0.01*

The results of this study indicated that basic needs -will show positive changes in basic needs, changes in social status and changes in business development. The motivation for social status determined positive change will require a basis, changes in social status and changes in business development. Motivation to develop business also shows positive changes in basic needs, changes in social status and changes in business development.

4. Conclusion

Breeders in the laying hens association in the Kedu region have high motivation and change in efforts to raise laying hens. There was a difference between positive and changes in raising laying hens.

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Challenges, Opportunities and Prospects of Swine Industry in Vietnam

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Abstract.

In the gross output of agriculture sector, livestock contributes about 19% and is important income for farmers, especially small-farmers in Vietnam. Small-scale farms accounted for 85% in livestock scale of Vietnam. The swine sector is the most important livestock sector in Vietnam because of its contribution to the people's nutritional requirements annually, about 70-76% of total meat production. This paper reviews the Vietnamese swine trading sector. Starting with an overview of Vietnam's natural conditions of swine industry, including a description of prevalent swine production systems, the value chain of swine trading, the paper then takes a systematic view of opportunities, challenges and prospects of swine product marketing. Besides, the government implemented strategies for strengthening swine industry, keeping pork price stable and balancing swine herd. The opportunities offered by swine farming to improve livelihoods, enhance their standard living and alleviate poverty. However, swine producers mostly face with the challenges of knowledge gap in best practice in husbandry and management of farms as businesses. Other challenges are low quality-high cost feeds, inability to service quantity and quality demands of the market. Among the emerging problems are majority of swine farmers are limited in market power, and in 2019, African Swine Fever (ASF) emerged in Vietnam and rapidly spread to whole country which led to the decrease of swine herd. This paper also assessed likely changes in the next 5 years based on past trends and future scenarios, and evaluated growth potential, viability, and the sustainability of smallholder swine systems in Vietnam.

Keywords: value chain, swine industry, Vietnam.

1. Introduction

The swine industry in Vietnam, which has continued to expand from 2010 to 2019, has played a major role in Vietnam's economy. The industry brings more income for the Vietnamese people, creates new jobs and new products for the market, and meets the demands of Vietnamese people in industrialization period. Pork makes up a high ratio in the total meat production in Vietnam, and is the most widely eaten animal food source, about 24.7 kg/capita/year (Nga et al., 2015). Because of swine price crisis in 2016, the swine ratio had a steady decrease, about 78% (GSO, 2016). The declining price of swine puts smallholder farmers into difficult situations, the state of low price had lasted which led to the decrease and change in the herd in many small-farmers. In 2017, the whole Vietnam had 29 million live swine with more than 2.1 million tones of pork, according to the General Statistics Office (2016). On February 19th, 2019, Vietnam confirmed its first ASF outbreak with the announcement of detections in Thai Binh and Hung Yen provinces, which are located southeast of the capital Hanoi, approximately 160 km away from the Chinese border. Since the Ministry of Agriculture and Rural Development (MARD) confirmed the first ASF outbreak, a total of 63 provinces/cities reported outbreaks and more than 4,500,000 swine have been culled (FAO, 2019). Normally, most of the farmers sell their swine through middlemen who collect, buy finisher swine from the farm/house holders, sell them in slaughter houses, and then sells them to the market. This is the reason why Vietnam faced a very difficult situation in preventing the spread of ASF.

About 80% of swine raisers are identified as smallholders, and the development of the swine sector in the South and North of Vietnam is very important for improving income and creating livelihood (Lapar, 2014). Pork always accounts for the highest proportion in the consumption structure of Vietnamese people with the proportion of over 70%. The proportion will gradually decrease due to diversifying structure and category of food (predicting 2020: 68- 69%, 2025: 62-63% and from 2030: around 60%). In the future, pork scarcity in Vietnam is urgent problem, not only for Vietnam swine industry, but also for Vietnam's economy. Besides, the price of pork and swine will increase rapidly beyond consumers' affordability, which leads to the challenges of swine production. For this reason, the Vietnamese government now implements some strategies such as importing pork from the other countries in order to balance the price of pork, and also to meet the demand of the customers. Prioritizing the restructuring of the swine industry bases on enterprises to create commodity production, hi-tech investment, chain production, linking production with processing and trade promotion, connecting markets. By doing so, the swine industry can increase its production efficiency, can decrease the price, strengthen its competitiveness, and export to other countries.

2. Methods

The study was an exploratory research, with data based from secondary literature from the reports of the General Statistics Office, the Food and Agricultural organization, International Trade Centre, Food and Agriculture Organization in United Nations and Government policy documents. The second data on swine production for the period 2010 - 2018 is provided in Vietnam. The forecasting for the five coming years was analyzed by the SPSS application.

3. Results and discussion

3.1. Vietnam swine value chain.

3.1.1. Swine production

Swine production is socially and economically indispensable in Vietnam where three-quarters of meat consumed is pork and pork products. In Asian countries, Vietnam ranked second in pork meat produced in 2013 after China - the largest pork producer (Lapar, 2014) and ranked seventh in the world. Swine are typically reared in intensive systems, most of people in Vietnam raise swine in small-scale. Besides that, a large proportion of rural areas in Vietnam keeps and rears swine which derive income for farmers, about 80% (Lapar, 2014). This is a reason why the Ministry of Agriculture and Rural Development (MARD) plans to restructure swine production to solve the current problems in Vietnam like reduced arable land, limited genetic resources, and polluted ecological environment.

Table 1: Vietnam's volume of swine, cow and buffalo production 2010 – 2018 (thousand heads)

Criteria	Volume of swine, cow and buffalo production (thousand heads)								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
Swine	27373.3	27056	26494	26264.4	26761.4	27750.7	29075.3	27406.7	28151.9
Cows	5808.3	5436.6	5194.2	5156.7	5234.3	5367.2	5498.6	5654.9	5802.9
Buffalos	2877	2712	2627.8	2559.5	2521.4	2524	2519.4	2491.7	2425.1

Source: Livestock production department, MARD – Vietnam (2018).

This is swine production trend from 2010 to 2018 compared with other livestock species. When we compare swine performance with other livestock such as cows or buffalos about 5808.3 thousand heads and 2877 thousand heads in 2010 respectively, the number of swine is more dominant and larger, reaching a peak in 2016 with 29075.3 thousand heads. Swine price crisis led to decrease swine production and resulted in significant contraction in the swine industry (30% of small farm gone out of business) (Coyne et al., 2019). In early 2018, swine production increased again with 28151.9 thousand heads.

Table 2: Vietnam's swine production by areas 2010 – 2018

Areas	Vietnam's swine production (thousand heads)				
	2010	2015	2016	2017	2018
Red river delta	7301,0	7061,2	7414,4	7085,5	7157,6
Northern midlands and mountain areas	6602,1	6841,5	7175,5	6786,8	7120,2
North Central and Central coastal areas	5552,9	5367,9	5420,6	4978,0	5153,4
Central Highlands	1633,1	1797,4	1903,3	1806,2	1841,6
South East	2485,3	3093,6	3358,5	3245,4	3422,8
Mekong River Delta	3798,9	3589,1	3803,0	3504,9	3456,4

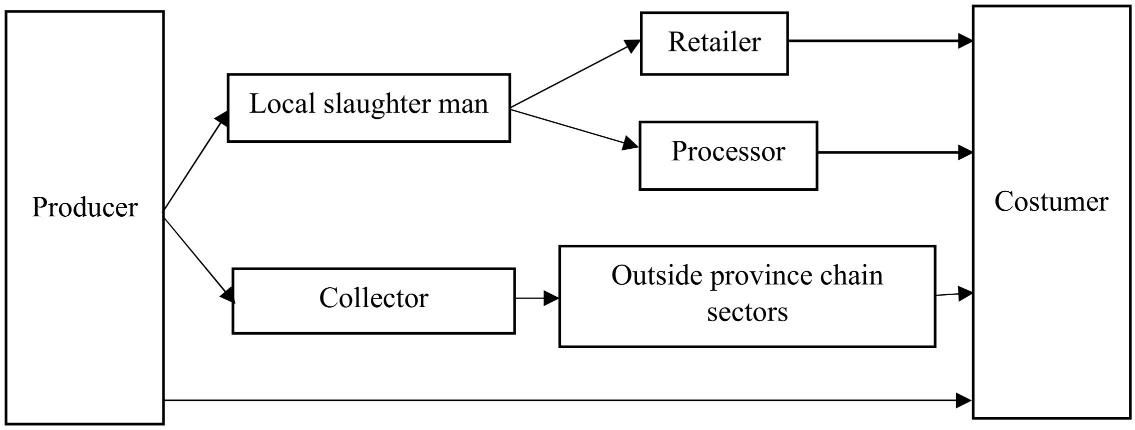
Source: Livestock production department, MARD – Vietnam (2018).

Swine performance is different and depends on the areas. In Vietnam, the structure of swine industry is small and medium commercial production, and swine production focuses mainly on Red river delta, the number of swine in the North is more than other areas in the period of 2010 to 2018, about 7157,6 – 7301,0 thousand heads. However, for farming scale, there is more intensive and larger swine scale production in the South of Vietnam when compared with scale production in the North of Vietnam (Coyne et al., 2019). The figure 2 showed that swine production trend in Vietnam is not stable, especially in 2017, the number of swine decreased in all of areas.

3.1.2. Swine marketing system

Intensive large-scale commercial farms, small-scale commercial farms, and the traditional free-range system is the three swine production systems which have been available in Vietnam and depending on hygiene. Currently, Vietnam has four types of swine production encompassing (1) small-scale with low hygiene; (2) small-scale commercial farms with standard hygiene and combined with VAC (rearing swine combines with growing plant and raising fish); (3) intensive large-scale commercial farms with high level hygiene; and (4) collaboration farm with medium level hygiene.

Figure 1: Mapping of basic local swine value chain of smallholders in Vietnam, 2015



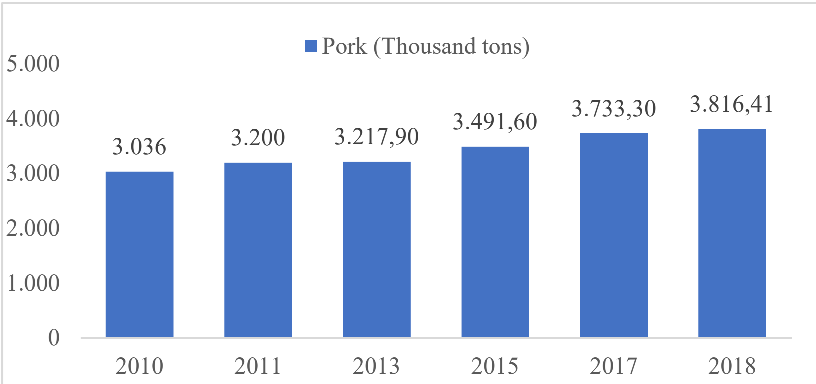
Source: Nga (2015).

Swine products in Vietnam have to pass through many intermediaries prior to reaching the final customer. The swine marketing system in Vietnam have to assemble a large number of swine from farmers with small-scale and poor infrastructure. This is the reason why transaction costs in swine marketing is high. The most common channel in marketing system: sale to assemblers or middleman and sale to slaughterhouses. Middleman usually collects fattened swine from farmers and then they will sell them to bigger middleman or slaughterhouses. Following this channel, slaughterhouses in Vietnam will sell carcass to three categories such as slaughterhouses selling to both wholesale and retail (70%), slaughterhouse exclusively for wholesale (24%), and slaughterhouses only selling to end consumers (6%) (Tung el at., 2005). There is small number of farmers who sells their products to the slaughterhouse or the market without middleman. In addition, the market in Vietnam is mainly traditional markets, also known as wet market or public markets which dominate traditional retailers accounting for 94% of sales in this food retail channel (Vo, 2017). Traditional markets in Vietnam are ideal for purchasing small-quantity food.

3.1.3. Pork consumption

In Vietnam, pork is very important and is the most consumed meat, providing livelihoods and income for more than 4 million small farmers (Nga et al. 2015). Depending on the area, there are many places where people may purchase pork. In the countryside, 93.3% of the people tend to purchase pork in the small market. This problem led to only 13.2% of pork has quality-controlled stamp (Nguyen & Thuy, 2014). In the cities, people pay more attention to higher pork quality. They buy pork in the supermarkets and do not mind to pay for more. There are also people who care about their health and are overly concerned with food safety. They are much more likely to purchase their meat from modern retail outlets rather than traditional wet markets (Tisdell et al., 2010; Stark – Ewing & Saskia, 2018).

Figure 2: Graph of volume of pork in Vietnam during 2010 – 2018



Source: Livestock production department, MARD – Vietnam (2018)

From 2010 to 2018, pork consumption in Vietnam has a steady increase, about 3036 thousand tons in 2010 to 3816,41 thousand tons in 2018. Although affected by swine price crisis in 2017, the number of swine herb in Vietnam decreased, the amount of pork consumption has not changed. However, there is a change in meat consumption ratio in Vietnam, that is the decrease of pork consumption ratio and increase of other kinds of meat ratio such as chicken, beef, buffalo. Particularly, in 2017, the ratio of pork consumption is 71.8%, falling down nearly 4% when compared with ratio of pork consumption in 2010.

3.2. Challenges Facing in Swine Industry

As compared with other countries, farm size in Vietnam is much smaller and more spontaneous, with farms having 1 to 4 swine occupied 71.63 % (GSO, 2011), the majority of swine herd is less than 100 swine while Thailand is less than 500 swine for their small swine farm production (Dang et al., 2013). This problem caused the difficulty in controlling and managing swine herb and also in controlling the price of swine and pork. The supply exceeded the demand and strict policy in exporting of China leading to swine price crisis in 2017. Another challenge in the swine industry in Vietnam is the price of animal feeds. Almost all of the farmers are buying mixed animal feeds from the agents around their house, and there are small number of farmers who are directly buying animal feeds from companies (Nguyen & Thuy, 2014). Besides that, swine industry consumed a lot of industrial feeds per year, around 70% of the total of 14.4 million tons (MARD, 2015) and the price of materials depends on importation, and that led to the change in the price of animal feeds. The price of swine and pork has not increased but the feed and its materials have steadily increased. Since early 2017, Vietnam has experienced falling swine prices, which has resulted in significant contraction in the swine industry (30% of smaller farms have gone out of business) (Coyne et al., 2019).

Because of small and spontaneous scale, the government and government agents faced a difficult situation to control the diseases of swine. Particularly, foot and mouth disease (FMD) struck Vietnam and caused economic losses. Recently, Vietnam was affected by African swine fever disease and this disease spread to whole country after several months. In February 2019, the African swine fever has caused serious damage to the swine herd in Vietnam and more than 4,500,000 swine have been culled (FAO, 2019) and still continue to spread to other areas.

3.3. Opportunities and Prospects in Swine Industry

3.3.1. Opportunities

Vietnam has a mass of opportunities that could help develop the economy, including the swine industry. First, Vietnam is now one of the most dynamic emerging countries in East Asia region and it has transformed from one of the poorest in the world into a lower middle-income country (World Bank, 2019). Besides, population in Vietnam is large, around 93 million, half of which are under 30, which is a key reason behind the strong surge in food and beverage products consumption. Furthermore, an average population in Vietnam is growing of 1% per year which means that every year, new potential consumers and customers nearly 1 million are born, making Vietnam extremely attractive to food retailers (Vo, 2017). Additionally, people show more concern about where their food comes from and how it is processed and the food industry is moving towards the same direction to meet the needs of their newly enlightened consumers (Park et al., 2017).

Nowadays, pork still makes up high proportion of meat consumption in Vietnam. Although this proportion will gradually decrease due to diversification of structure and category of food consumption, gradual shift to consuming fast food and processed foods, Vietnam ranked seventh in the world in terms of pork consumption (after China, Europe, America, Russia, Brazin and Japan) (Lapar, 2014). In addition, the demand for pork is still high in Asian countries, and this is an opportunity for Vietnam to improve swine herd and pork quality to export to Asian countries.

The fact that Vietnamese consumers, like many other cultures, prefer fresh meat is an advantage to internal pork producers. Despite the demand for fresh, local pork, the government has expressed its intention to increase the pork export quantities dramatically. The Vietnamese government also implements some strategies to improve swine industry such as improving quality of swine herd, decreasing the price of pork, attracting investment from large companies to enhance swine industry forward high technologies and closed-chain. In 2018, Vietnam signed in EU Free Trade Agreement (FTA), it is a great opportunity for Vietnam to improve exporting commodities.

3.3.2. Prospects

Livestock is one of the most important and fastest growing sectors in Vietnam's agriculture and economy. In the recent years, the livestock industry in Vietnam has experienced a lot of changes. Especially, livestock population has been growing fast but the number of households raising animals has gone down. Small-scale swine production in Vietnam decreased and disappeared mostly in 2017 because of swine price crisis. However, swine farming has quickly recovered, especially in the last months of 2018 due to an increase of the market prices and the producer's earnings (MARD, 2018). Facing African swine fever in the first months of 2019, Vietnam will again wrestle with pork scarcity in the future. Following information from MARD, August 2019, the total volume of swine in Vietnam has decreased by 18.5% when compared to the total swine population in the same period of 2018. In the coming years, Vietnam may have to import pork from other countries to meet the demand for consumption and make up for the pork (Nga Bui, 2019). By 2025, some industry experts predict that the modern food retail will account for 20 percent of sales in Vietnam (Vo, 2017).

Figure 3: Prediction of swine production in Vietnam in coming years.

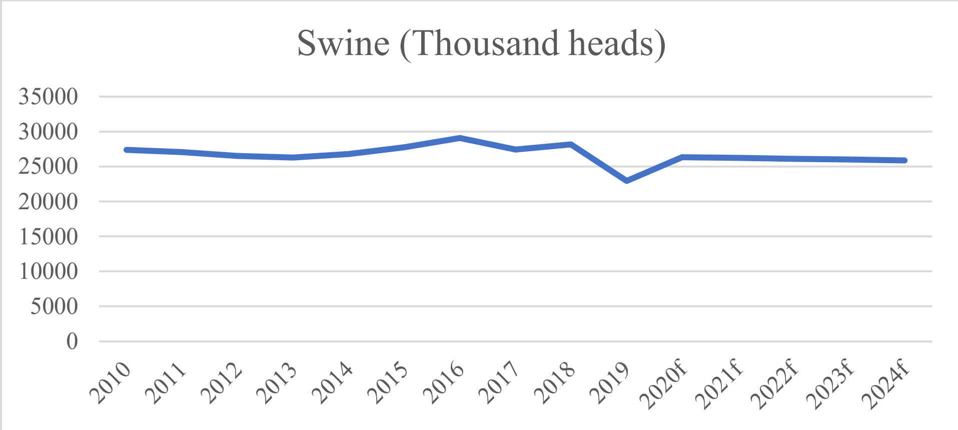


Figure 5 shows that in the next five years, swine production will be stagnant. Not only swine production will be stable in coming years but also the price of pork will be adjusted. Besides that, swine industry in Vietnam will be more systematic than the last ten years with large commercial scale production, good hygiene and more competitiveness in the market. Moreover, Vietnam's government will control the consumption of pork to balance meat consumption and keep the pork consumption around 60%.

4. Conclusions

The swine industry in Vietnam is developing and expanding. The swine production is still on small scale and the price of swine products are not stable. Besides, the farmers are not that receptive in adopting new technologies and knowledge on disease management in Vietnam is still low. Stabilizing the price of swine products, reproducing, improving swine herb, and controlling diseases are currently the urgent problems in Vietnam. Although facing lots of challenges, the swine industry in Vietnam has many growth opportunities in the future. Vietnam is one of the countries in Asia with the fastest economic growth, has a young population, and has an increase in consumption index over the years that will surely help develop the swine industry in the future. The swine production in Vietnam will change from a small-scale to a much modernized and advanced, thereby improving productivity and quality, and thus more ready for export markets.

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Agronomic Characters Evaluation of Garlic (*Allium sativum* L.) Bulbils

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Abstract.

Garlic production is practiced vegetatively through cloves/bulbs. However, naturally garlic also produce bulbils in stem or scape (topset). The agronomic characters of this tiny bulb-like form has been rarely discussed despite its potential for soil borne disease free seed production. This research carried out in March 2019 was aimed to evaluate some of plant morphological characters from garlic bulblets. These bulbils were harvested from Indonesia garlic variety known as Lumbu Hijau. Completely Randomized Block Design was applied throughout 4 treatment combinations e.g immersion duration and dose of growth hormone with 3 replications. Seedling percentage, plant height, number of leaf, fresh weight, dry weight, bulb height, number of clove and number of bulbils were evaluated. Although the result showed that all treatments were not significant for all characters, they showed fairly high percentage of seedling. Plant height (75 DAP) ranged between 26.99 – 30.75 cm with 3-4 number of leaves. Plants were harvested on 120 DAP where fresh weight ranged 55.90 - 68.46 gram/plant. After two months wind dried, bulb diameter range 20.40 – 21.60 cm and bulb height range 15.31 – 16.18 cm were then recorded. This results indicated that more agronomy studies need to be done for improving quality of bublets as a promising alternative in garlic production.

Keywords : agronomic character, bulbils, evaluation, garlic, propagation

1. Introduction

Among all Allium species, garlic (*Allium sativum* L.) is the most important crop after onion or shallot. It consists the main economic organ, bulb, which contain many or few of cloves, and bear leaves, pseudostem and topset which are also edible (Fritsch and Friesen 2002). Like most of Allium species, garlic is propagated asexually through axillary bulb cloves and also bulbils in stem or topset (Kamenetsky and Rabinowitch, 2006). In garlic, bulbils can form on a flower bud that has the same function as a clove bulb, so that it can also be used as a "seed". Bulbil phenomena exists in some plants e.g. when the flowering process is aborted and developmental changes produce new plantlets or bulbils instead of floral organ and seeds, but often form together with seeds in a flower bud (Asker, 2015; Ceplitis and Bengtson 2004). The mature bulbils can be separated physiologically from the parent plant and grow on its own, but sometimes it remains attached to the parent plant (Callaghan *et al.*, 1997). A bulbil consists of one small bud, with one short stem that has fleshy scales (Bell, 2008) and also can appear along pseudostems of plants which are also known as aerial bulbils (Walck *et al.* 2010). Because its lackness of anatomical structure of seeds e.g. protective layer for food reserve, bulbils tend to be more vulnerable against the environment (Dormann *et al*. 2002). However, bulbils may have higher adaptability after generations in the certain harsh environments (Callaghan *et al*., 1992). Bulbils are commonly produced from plants in higher elevation assuming that in these area as well as arid areas, extrem environmental harsness could trigger plant survival mechanisms (Abraham-Juarez *et al*., 2015).

So far, 95% Indonesian garlic consumption has been imported from China. Our garlic local production is still far below domestic demand. Bulbils which is biologically ‘younger’ cloves can also be an alternative approach in the production of garlic which is economical and free from soil-borne diseases and free from nematode infection or other disease-mosaic virus in particular (Etoh and Nakamura, 1988; Kamentsky, 1997). Moreover, Mathew *et al.* (2005) concluded that within 2 years, garlic propagation through aerial bulbils would result multiplication rate 45 times higher than conventional cloves. Despite its potential utilization as an alternative in garlic production, however, there have not been plenty literatures about garlic bulbils especially their agronomic characters on field. This research was aimed to evaluate agronomic characters of garlic grown from bulbils.

2. Methods

The research was started from March until September 2019 on IVEGRI Margahayu Experimental Field, Lembang, West Java. Bulbils evaluated in this study were harvested from Indonesia garlic variety e.g. Lumbu Hijau in 2018 and had reached its maturity (stored for at least 4 months after harvested). Bulbils were treated in 4 (four) combinations with 3 (three) replications between Dose of Atonik^{TM} immersion e.g. 3 ml/l (D1) and 6 ml/l (D2) and Duration of immersion e.g. 4 hours (P1) and 8 hours (P2). After air dried, treated bulbils were planted on March and harvested on July 2019. Harvested plants were air dried for two months for dry weight observation. Evaluation included percentage of emergence (%), plant height (cm), number of leaves, fresh weight (g), dry weight (g), bulb diameter (mm), bulb height (mm) and number of bulbils.

Fig 1. Bulbils from Lumbu Hijau variety (left); Bulbils in Atonik treatments (right)

3. Results

3.1. Vegetative Growth of Plants

Percentage of germination was recorded two weeks after bulbils planted into seedbed. In average, our study showed relative high percentage of germination (69.33-78.67%; data was not shown). In the previous work, Ceplitis and Bengtson (2004) concluded that bulbils seemingly have higher germination rate than seed. Based on the results of the analysis of variance on plant height showed that the immersion of Atonik growth regulators did not significantly affect the growth of garlic plant height at ages 30, 45, 60 and 75 DAP. The average height of garlic plants aged 30, 45, 60 and 75 DAP is presented in Table 1.

Table 1. Plant height in 30, 45, 60 and 75 Days After Planting (DAP)

Treatments		Plant Height (cm)							
		30 DAP		45 DAP		60 DAP		75 DAP	
D1P1	Immersion with 3 ml/l Atonik for 4 hours	12,72	A	17,25	A	24,83	A	30,75	A
D1P2	Immersion with 3 ml/l Atonik for 8 hours	12,48	A	16,37	A	24,13	A	28,25	A
D2P1	Immersion with 6 ml/l Atonik for 4 hours	12,43	A	15,84	A	23,58	A	27,06	A
D2P2	Immersion with 6 ml/l Atonik for 8 hours	11,40	A	15,50	A	22,55	A	26,99	A

Treatments with same letter within a row are not significantly different

The difference in plant height has not been seen at the beginning of planting (30 DAP). The significant difference also of plant height seen at the age of 30 HST and 75 HST. Based on the results of the statistical tests in our study, D1P1 (3 ml/liter soaked for 4 hours) had the best effect on the height of the garlic plants, even though the figures produced were still not significantly different from D2P1 (6 ml/liter). This shows that giving Atonik at the right concentration can actively stimulate all plant tissues so that it can accelerate the process of plant metabolism in forming vegetative organs so that at the right dose can cause optimum growth. Previous trials using bulbils and cloves of garlic bulbs showed that plants derived from bulbils were shorter (Mhazo *et al*. 2014)

Table 2. Number of leaves in 30, 45, 60 and 75 Days After Planting (DAP)

Treatments		Number of leaves							
		30 DAP		45 DAP		60 DAP		75 DAP	
D1P1	Immersion with 3 ml/l Atonik for 4 hours	2,40	A	3,13	A	3,96	A	4,00	A
D1P2	Immersion with 3 ml/l Atonik for 8 hours	2,33	A	3,10	A	3,43	AB	3,97	A
D2P1	Immersion with 6 ml/l Atonik for 4 hours	2,30	A	3,03	A	3,26	AB	3,83	A
D2P2	Immersion with 6 ml/l Atonik for 8 hours	2,13	A	3,03	A	3,10	A	3,43	A

Treatments with same letter within a row are not significantly different

The results of statistical analysis on the number of leaves are in table 2. The results of the analysis show that the effect of giving the application of Atonik growth regulators was significantly different at the age of 30 HST and 60 HST, although not significantly. Where the D1P1 treatment showed the highest number of leaves at 4.00 leaves and the lowest at D2P2 was 3.43 leaves per plant.

3.2. Crop Production

In this research, plants were harvested at 120 days after planting (DAP), which is longer than usual Lumbu Hijau harvest time. This agreed with previous studies that showed bulbils require a longer growth period than normal tubers (Kajimura *et al*. 2002). The results of statistical analysis showed that the weight per sample, non-sample weight and total weight in Table 3 had no significant differences for all treatments. However, based on the average value, the D1P1 treatment (3 ml/liter soaked for 4 hours) had the highest weight compared to other treatments, namely 3.13 gr for sample weights, 65.33 gr for non-sample weights, and 68, 46 for total weight. There is a tendency that garlic bulbils immersion using Atonik growth regulators get a good response from garlic plants, especially for the addition of tuber weights per plant, although not significantly proven.

Table 3. Fresh weight harvested from bulbils derived plants

Treatments		Fresh Weight (g)					
		Sample		Non Sample		Total	
D1P1	Immersion with 3 ml/l Atonik for 4 hours	3,13	A	65,33	A	68,46	A
D1P2	Immersion with 3 ml/l Atonik for 8 hours	2,93	A	57,33	A	60,26	A
D2P1	Immersion with 6 ml/l Atonik for 4 hours	2,93	A	56,33	A	59,26	A
D2P2	Immersion with 6 ml/l Atonik for 8 hours	2,90	A	53,00	A	55,90	A

Treatments with same letter within a row are not significantly different

The immersion treatment using Atonik growth regulators did not have a significant effect on the diameter of the garlic bulbs (Table 4). In table 4, it can be seen that the D1P1 treatment (3 ml/liter soaked for 4 hours) has the largest tuber diameter of 21.60 mm compared to the D2P2 treatment (6 ml/liter soaked for 8 hours) which is 20.40 mm although not differ significantly. This shows that the immersion treatment using Atonik growth regulators at low concentrations will give a pretty good effect. This because Atonik is one of the growing substances that works at low concentrations, if the Atonik concentration in the plant is still high enough it will act as an inhibitor that inhibits the metabolic process. Thus to obtain maximum plant growth and development, the use of Atonik must be at the right concentration. This opinion is supported by Wiwit (2003) which states that auxin functions to regulate growth and other physiological functions in the body of plants outside the tissue where auxin is formed and auxin is an active ingredient in very low amounts.

Table 4. Bulb diameter and height

Treatments		Bulb Diameter (mm)		Bulb Height (mm)		Dry Weight (g)	
D1P1	Immersion with 3 ml/l Atonik for 4 hours	21,60	A	16,18	A	2,400	A
D1P2	Immersion with 3 ml/l Atonik for 8 hours	21,34	A	15,61	A	2,000	A
D2P1	Immersion with 6 ml/l Atonik for 4 hours	21,31	A	15,45	A	1,933	A

D2P2	Immersion with 6 ml/l Atonik for 8 hours	20,40	A	15,31	A	1,900	A

Treatments with same letter within a row are not significantly different

From the analysis of variance analysis, it can be seen that the immersion treatment using Atonik growth regulators has no significant effect on the dry weight of garlic bulbs. It appears that the D1P1 treatment (3 ml/liter soaked for 4 hours) gives the best effect on increasing the dry weight of garlic bulbs. This shows that soaking using Atonik must be at the right concentration so that it can improve the development of plant roots which will support the physiological processes of plants. Increased dry weight can occur if the results of photosynthesis are greater than respiration. Immersion in Atonik is thought to increase cell wall permeability which will enhance and accelerate the absorption of nutrient elements that play a role in the formation of chlorophyll to increase the dry weight of the tuber. The immersion treatment using Atonik growth regulators also had no significant effect on the formation and amount of bulbils of garlic bulbs (Table 5).

Table 5. Number of bulbils formed (observation of bulbils-to-bulbils cycle)

Treatments		Number of Bulbils	
D1P1	Immersion with 3 ml/l Atonik for 4 hours	0,67	A
D1P2	Immersion with 3 ml/l Atonik for 8 hours	0,40	A
D2P1	Immersion with 6 ml/l Atonik for 4 hours	0,33	A
D2P2	Immersion with 6 ml/l Atonik for 8 hours	0,30	A

Treatments with same letter within a row are not significantly different

Bulbil plants in our study resulted bulb and cloves smaller than normal cloves of Lumbu Hijau variety. This finding is similar to Mhazo *et al.* (2014) mentioning that it needs several years of bulbil derived-plants planting to gain good sized bulbs. Moreover, those bulbil derived-cloves have stronger purple color on their skin than normal cloves. We noticed not only cloves derived from bulbil plants, but also the second generation bulbils indicating bulbil-to-bulbils cycle (Figure 2c). However, in this research the second generation produced smaller bulbils than their 'parent' or previous bulbils showed in Fig.1. Another study on tuberose plants concluded that small sized bulbs produced smaller bulbils due to less availability of photosynthates (Ahmad *et al.* 2009)

Fig 2. a.Bulbils derived- plants performance on testing field; b.harvested plants; c. bulbils derived-cloves (left) versus normal cloves (right); sample cloves (left) versus bulbils produced in stem (aerial) of sample plants indicating bulbil-to-bulbils cycle (right)

4. Conclusion

The Atonik immersion with various dosage treatments given the results is not significantly different. The recommended immersion treatment using Atonik is following the D1P1 treatment (3 ml/liter soaked for 4 hours). The highest harvest production of garlic produced by the treatment of D1P1 (3 ml/liter soaked for 4 hours) has the highest weight of 3.13 gr for sample weight, 65.33 gr for non-sample weight, and 68.46 for the total weight.

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The Effectiveness of Plant Growth Regulators on Shallot Cultivation in Polybag

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Abstract.

Shallot plants are currently being cultivated in polybags and placed in residential yards. The purpose of this kind of cultivation is not to get crops to be traded, but merely as a cultivation activity for the use of limited time and space. Shallots itself is including herbs and or medicinal plants which are needed every day even though in small amounts. This is a factorial experiment of shallots that uses a growth regulator called Oligo Chitosan, which is sprayed like leaf fertilizer, carried out on plants periodically in various concentrations of solution. Factor 1 is the frequency of the provision of Oligo Chitosan at the age of plants reaching the age of 15 dap and 45 dap (F1); age 15 dap, 30 dap, 45 dap (F2); age 15 dap, 25 dap, 35 dap, 45 dap (F3). Factor 2 is the various concentrations of Oligo Chitosan solution, which is 1 ‰ (K1); 2 ‰ (K2) and 3 ‰ (K3). Nine treatment combinations are formed, and for control as a comparison are zero treatment combinations. The experiment was carried out using the Complete Randomized Block Design Method with an accuracy level of 95%. To determine the effect of treatment on the growth and yield of shallot bulbs, analysis of variance was performed. From observations of plant height, number of leaves and number of tillers until the plant age of 50 days after planting, it has not shown any significant effect from the treatment applied, but it can be expected that the F2K2 treatment will provide the most tuber yields.

Keywords: Oligo Chitosan Level, Frequency Of Oligo Chitosan Spraying, Cultivation In Polybags

1. Introduction

Shallots are included in the family Liliaceae, genus Allium which has more than 500 species, which are more widely known and needed by the community are types of shallots (*Allium cepa* L. or *Allium ascalonicum* L). Shallot is one type of annual plant in the form of grass, grows upright with a height of about 15-20 cm and shaped like a clump. This horticultural crop is a concern of the community as a superior crop to be fulfilled in the needs of its cultivation technology. According to the Directorate of Horticultural Production Development (2006), shallots are one of the top priorities in the development of national rank horticultural production, especially for export. The development of the export value of shallots has increased periodically from 2003 to 2006, which was exported at 5,514 tons, 6,745 tons, 6,874 tons and 7,254 tons. Horticulture Research and Development Center (2005), establishes technologies that can increase the yield of shallots, one of which is planting superior varieties that are resistant to pests and / or diseases and have broad adaptability; application of technology for controlling plant-disturbing organisms with biological agents; and productivity enhancing technology with the use of new types of supplements. BATAN (National Atomic Energy Agency) is a government agency that has succeeded in innovating new products, in conducting research, development and utilization for the welfare of the community in the form of Oligo Chitosan or Chitosan Irradiation or Oligo Chitosan which functions as a supplement to plants. Oligo Chitosan is the result of Chitosan products, and Chitosan is an organic material produced from shrimp shells / shrimp waste. Oligo Chitosan is a derivative of chitin with the molecular formula D-glucosamine. Oligo Chitosan is mostly obtained from crustacean shells, molds, squid, etc., through the deproteination process using NaOH; demineralization using HCl; and deacetylation with 50% NaOH. Oligo Chitosan is in the form of white amorphous solids. Properties of Oligo Chitosan is soluble in organic acid solutions. At a pH of around 4.0, Oligo Chitosan is soluble, but insoluble at a pH greater than 6.5, insoluble in water, alcohol, and acetone solvents. According to Knorr (1984), a good and commonly used Oligo Chitosan solvent is acetic acid with a concentration of 1-2%.

2. Research methods

The research method was field trials using planting media in polybags in the form of a mixture of regosol soil and manure in a balanced ratio. The factorial experiment pattern is the Randomized Complete Block Design (RCBD) (Gomes and Gomez, 1983). In this experiment, the first factor for the experiment was the frequency of administering Oligo Chitosan, by spray in three levels, namely in aged plants: 15 dap (days after plant) and 45 dap (F1); 15 dap, 30 dap, 45 dap (F2); 15 dap, 25 dap, 35 dap, 45 dap (F3), while the second factor was Oligo Chitosan concentration in four levels namely 0 ‰ (K0) as a control, 1 ‰ (K1), 2 ‰ (K2) and 3 ‰ (K3). For planting material is the tuber seedlings of shallots Variety Tajuk originating from Nganjuk, East Java. While the supplement used as leaf fertilizer (Darmawan, 2016 and Rinsema, 1993) is Oligo Chitosan which has been packaged as a trade item with an official brand. In its implementation, as many as 20 polybags were prepared for each combination of treatment and control in one group, which was then repeated three times to form three groups, to meet the factorial experimental design. To determine the effect of treatment on the quality of growth of onion plants, analysis of variance was carried out at 95% accuracy level for the three parameters observed were plant height, number of leaves, number of tillers in the observation period of 10 days, since the plants were 20 days after planting to age 50 days after planting. If it shows a real effect, then further tests are carried out by DMRT (Duncan's Multiple Range Test) at 5% significance level and orthogonal contrast test to test the real difference between the control and factorial treatments that were tried.

3. Results and Discussion

Observations that have been made during the vegetative growth of plants are plant height, number of leaves and number of tillers at the age of the plant 20 days after planting (dap) until the age of the plant is 50 days after planting. From these observations, it can be seen the development of growth in each observation period of 10 days. In analysis of the three growth parameters, it shows the real effect of the treatment combination applied compared to the control treatment. Before getting the results of observations of the growth of onion plants, it can be informed that the growth of tubers from the seed tested showed satisfactory results, because 100% can grow well, and tubers that are soaked by oligo chitosan before planting show better vigority, in terms of morphological appearance and plant growth performance.

Based on the variance in all observed parameters, all treatment combinations tried and between treatment factors, the interaction was not real. The effect of each treatment factor can be known in Table 1., up to Table 3.

Table 1. The average height of shallot plants at the age of 20 dap to age 50 dap (cm)

Treatment	Age 20 dap	Age 30 dap	Age 40 dap	Age 50 dap
Spraying Frequency 2x (F1)	30,07 p	35,83 p	40,70 p	41,02 q
Spraying Frequency 3x (F2)	31,15 p	37,78 p	42,26 p	43,75 p
Spraying Frequency 4x (F3)	29,44 p	36,49 p	40,56 p	41,62 pq
Average	30,22 x	36,70 x	41,17 x	42,13 x
Oligocitosan 1 ‰ concentration (K1)	30,21 a	37,41 a	42,20 a	42,95 a
Oligocitosan 2 ‰ concentration (K2)	29,35 a	35,47 a	39,80 a	41,08 a
Oligocitosan 3 ‰concentration (K3)	31,09 a	37,11 a	41,52 a	42,36 a
Average	30,22 x	36,70 x	41,17 x	42,13 x
Control (Without Oligocytosan) (F0K0)	27,96 x	31.55 y	36,51 y	39,63 y

Note: The average number in the column followed by the same letter, shows no significant difference between treatments based on the 5% level DMRT

In Table 1 shows, there is no interaction between the treatment, the frequency of spraying with the concentration of Oligo Chitosan, and its effect on plant height. Observation at the age of 20 dap until age 50 dap, the frequency of spraying did not show any real effect, but observations at age 50 dap, the F2 treatment showed better results than the F1 treatment, although the two treatments were not significantly different from the F3 treatment. By the treatment of Oligo Chitosan concentration, observations at the age of 20 dap, up to the age of 50 dap, did not show any real effect, so that the treatment between Oligo Chitosan concentrations was relatively the same. Furthermore, it can be explained, that the tubers treated with oligo chitosan, observations at the age of 30 dap, 40 dap and 50 dap showed better results than those not treated. That means the role of oligo chitosan is quite good in improving the quality of plant growth. According to Darmawan (2016), oligo chitosan has an important role in plant elicitor (plant vaccine) and as a plant growth regulator. Therefore, this plant can show an active role in promoting better growth, rather than not using oligo chitosan.

Table 2. The average number of leaves of shallot plants at the age of 20 dap to age 50 dap (strands)

Treatment	Age 20 dap	Age 30 dap	Age 40 dap	Age 50 dap
Spraying Frequency 2x (F1)	22,44 p	29,47 p	40,39 p	43,50 q
Spraying Frequency 3x (F2)	22,69 p	33,47 p	43,47 p	47,14 p
Spraying Frequency 4x (F3)	22,97 p	32,67 p	39,05 p	43,06 q
Average	19,33 x	31,87 x	40,97 x	44,57 x
Oligocitosan 1 ‰ concentration (K1)	23,00 a	32,00 a	42,33 a	44,78 a
Oligocitosan 2 ‰ concentration (K2)	22,72 a	31,08 a	40,00 a	44,94 a
Oligocitosan 3 ‰concentration (K3)	22,39 a	32,53 a	40,58 a	43,97 a
Average	19,33 x	31,87 x	40,93 x	44,16 x
Control (Without Oligocytosan) (F0K0)	22,70 x	24,50 y	37,75 y	38,67 y

Note: The average number in the column followed by the same letter, shows no significant difference between treatments based on the 5% level DMRT

Table 2., shows no interaction between the frequency of spraying with the concentration of oligo chitosan, and its effect on the number of leaves. Observations

on plants aged 20 dap until age 40 dap, the frequency of spraying did not show any real effect, but observations at 50 dap F2 treatments showed better results than F1 and F3 treatments. By the treatment factor of the concentration of oligo chitosan, observations on plants aged 20 dap to age 50 dap, whereas the vegetative growth period, did not show any real effect on the number of leaves, meaning that the treatment of oligo-chitosan concentration was the same or not significantly different. It can be further explained, that the plants treated with chitosan oligo spray, in the observation period from the age of 30 dap to the age of 50 dap, showed better results than those not treated (control). Means the role of oligocytosan is quite good in improving the quality of plant growth. In accordance with Darmawan's statement (2016), oligo chitosan has an important role in plant elicitor (plant vaccine) and as a plant growth regulator. Therefore in this plant, it can be said that oligo chitosan has a role in promoting better growth.

Table 3. The average number of tillers of shallot plants at the age of 20 dap to age 50 dap

Treatment	Age 20 dap	Age 30 dap	Age 40 dap	Age 50 dap
Spraying Frequency 2x (F1)	5,19 p	5,94 p	5,94 p	9,30 p
Spraying Frequency 3x (F2)	5,06 p	5,90 p	5,94 p	9,75 p
Spraying Frequency 4x (F3)	4,94 p	5,89 p	5,89 p	9,47 p
Average	5,06 x	5,93 x	5,92 x	9,51 x
Oligocitosan 1 ‰ concentration (K1)	5,03 a	5,83 a	6,04 a	9,51 a
Oligocitosan 2 ‰ concentration (K2)	4,94 a	5,83 a	5,83 a	9,47 a
Oligocitosan 3 ‰concentration (K3)	5,22 a	5,92 a	6,11 a	9,54 a
Average	5,06 x	5,93 x	6,00 x	9,50 x
Control (Without Oligocytosan) (F0K0)	22,70 x	5,50 x	5,93 y	8,57 y

Note: The average number in the column followed by the same letter, shows no significant difference between treatments based on the 5% level DMRT

In Table 3., there is no interaction between the treatment factors, the frequency of spraying with the concentration of oligo chitosan, also no effect on the number of tillers. In observations of plants aged 20 dap until age 50 dap, the frequency of spraying did not show any real effect, thus between treatments the frequency of spraying was not significantly different at age 20 dap until the age of 50 dap. In the treatment of chitosan oligo concentrations, observations from the beginning to the end of vegetative growth did not show any real effect on the number of tillers, so the treatment between chitosan oligo concentrations did not differ significantly. It can be further explained that plants treated with oligo chitosan spray, observations on plants aged 40 dap and aged 50 dap, showed better results than those not treated (control). This means that the role of oligo chitosan is quite good in improving the quality of plant growth. According to Darmawan (2016), oligo chitosan has an important role in plant elicitor (plant vaccine) and as a plant growth regulator. Therefore, this plant shows a role in promoting growth better than those not given oligo chitosan.

4. Conclusion

From the observations and analysis of variance, plant height parameters and number of leaf parameters, onion plants showed a tendency to increase rapidly from the age of 20 dap to 40 dap, subsequently the increase was low. In the parameter number of tillers there is a low increase from the age of 20 dap to age 30 dap, and from age 30 dap to age 40 dap increase in the number of tillers is very low, but then there is an increase in the number of tillers very high up to age 50 hst, most in the combination of F2K1 treatment . The number of tillers of the onion plant illustrates the number of tubers formed, because the onion tubers are the base of the pseudo stem of the shallot plant. Thus oligo chitosan can improve the quality of growth of onion plants before the tubers can be harvested. Limited to this experiment, which was carried out within the time and parameters of observations that had only reached the stage of vegetative growth and had not yet reached tuber yields, it can be concluded as follows: the quality of the growth of shallots. The treatment of chitosan oligo frequency spraying three times at the age of 15, 30 and 45 dap, has the potential to improve the quality of plant growth, and even means to improve the quality of the onion bulbs in the end. The lowest concentration of chitosan oligo chitosan treatment factor, which is one permil (1 ‰), is good enough to influence the improvement of the quality of plant growth, which turns out to be the same as the higher concentration treatment, which is 2 ‰ and 3 ‰.

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The Repellency of Guava Shoots Extract to The Asian Citrus Psyllid (*Diaphorina citri)*

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Abstract.

CVPD or greening disease is the most devastating disease on citrus production in Indonesia and in the world. It is vectored by Asian citrus psyllid (Diaphorina citri). Guava leave extract is a prospective control means for reducing psyllid population. Research was conducted to investigate the repellent effect of guava shoots to psyllids. Repellent effect of grinded dried upper shoot (leaf number 1 and 2 from the top) of 50ºC and 80ºC of red, white, and non-seed guava shoots to ten adult psyllids of mixed gender were determined in Y-tube olfactometer. The result shows that guava shoots has repellence effect to psyllids adult. The effect is reduced as the increase of drying temperature. Highest repellence effect is found from red guava shoots, followed by non-seed guava and white guava. It is suggested that the highest repellent properties is in red guava shoots and the ability will increase in line with the increasing of drying temperature. However the effect of extraction temperature on psyllids attractiveness should be proved further.

Keywords: *Diaphorina citri,* guava, CVPD, disease vector, drying temperature

1. Introduction

Mandarin (*Citrus reticulata*) are widely grown in Indonesia. They are located mostly in North Sumatra and East Java. Production growth in 2011-2015 is decline in locations of outside Java but showed an increase in Java. Production of mandarin in Indonesia mostly comes from North Sumatra and East Java. Citrus production in Indonesia in 2020 is estimated 3.25 million tons, with the average increase 4.93% per year. Citrus consumption by household in 2016 was 3.41 kg/cap/year or 882,689 tons for Indonesian population. The demand of citrus fruit for households are projected to increase over the next five years (2016-2020) with an average of 3.73% [1].

The most serious problem in citrus production is the widespread of Citrus vein phloem degeneration (CVPD) or Huanglongbing or Greening disease. Besides impacting on the high mortality rate, CVPD also shortens the productive life of the citrus plants as well as decreases the productivity and product quality which in turn will weaken the competitiveness and fulfill the product needs [2]. The impact of CVPD is marked by a decrease in Indonesian citrus production from 2,467,632 tons in 2008 to 1,611,768 tons in 2012, and increased imports of citrus fruits from 138,000 tons with a value of USD117 million in 2008 to 256,000 tons with a value of USD247 million in 2012 [1].

The pathogen causes of CVPD are Gram-negative bacteria *'Candidatus Liberibacter asiaticus'* and *'Candidatus Liberibacter africanus'* for Asian and African types and *'Candidatus Liberibacter americanus'* for American type [3], [4]. Only the imago psylids and the 4-5 instar nymph are capable of transmitting the disease [5], [6]. Insect vector is able to transmit disease throughout its life [7], [8]. The control of CVPD is implemented through the application of four major components [9], namely (1) the use of disease-free seeds, (2) elimination of infected plants in the field, (3) vector insect control, and (4) quarantine. Control of CVPD disease vector insects (*D. citri*) still focuses on the use of synthetic insecticides that require a high enough cost to keep infected plants in production [10]. Alternative substitute for synthetic insecticides is the use of mineral oil [11], but the availability is still low and it is expensive. The presence of guava plants in citrus plantations was able to reduce the population of psylids and the incidence of CVPD disease [12], [13], but the capability variation among the varieties of guava plants have not been investigated.

2. Methods

2.1 Psyllid cultures

Culture of psyllids were obtained from Citrus and Subtropical Plants Research Station and were maintained on the ornamental orange jasmine plants (*Murraya paniculata* L.) in nylon mesh cages (600 mm long, 600 mm wide, 1000 mm high) in a greenhouse at 26±4°C and 60-80% relative humidity.

2.2 Leaf extract

Citrus (*Citrus reticulate*) shoots with 2 (two) fully open leave, and guava leave from the upper shoots (leaf number 1-2 from the top) were collected and then dried in oven at 50^0C for 24 h and 80^0C for 48 h. The dried leave were ground to powder with an electric grinder and then sieved to avoid unwanted granules from the powder. The leave powder was stored in airtight containers.

2.3 Olfactometer responses

Y-tube olfactometer was constructed from a 10.0 mm diameter (internal), 300 mm long, transparent glass tube, connected by a 5.0 mm diameter (internal) silicone tube to a sucking machine that was used to suck air into the olfactometer at 141 mL min-1, as measured with a flow meter (Model N 112-02G, Cole-Parmer Instrument Company, Illinois, USA). Each arm of Y-tube was connected to one of the two odour sources with silicone tubing. Air entering each olfactometer was filtered through activated charcoal and humidified by passing it through distilled water before it was passed through a transparent plastic container (50 mm diameter × 40 mm high) housing the odour source (treatment). Each odour source was 25 mg dried leave extract. Responses of adult psyllids of mixed gender were determined for the paired treatment comparisons listed in Table 1. Adult psyllids were collected in specimen tubes (31.5 mm internal diameter and 50 mm long). The specimen tubes were open at one end and covered by fine mesh at the other. The open end was immediately sealed with rubber plug after the psyllids were collected. The psyllids were then starved for 60 min before they were released into the distal end of the olfactometer used for the first of two tests (Table 1).

Table 1. Y-tube olfactometer comparisons: for each comparison, responses of 10 adult D. citri per replicate (n = 15) to odour from sources of leave extracts (1:1 w/w) dried at 50ºC for 24 h (50) and dried at 80ºC for 48 h (80) listed in the left hand and right hand column were recorded over 30 min intervals

Comparison	Odour sources		
I	Citrus + Red guava upper shoot (50)	Vs	Citrus + Non seed guava upper shoot (50)
II	Citrus + Red guava upper shoot (50)	Vs	Citrus + White guava upper shoot (50)
III	Citrus + Non seed guava upper shoot (50)	Vs	Citrus + White guava upper shoot (50)
IV	Citrus + Red guava upper shoot (50)	Vs	Citrus + Red guava upper shoot (80)
V	Citrus + Non seed guava upper shoot (50)	Vs	Citrus + Non seed guava upper shoot (80)
VI	Citrus + White guava upper shoot (50)	Vs	Citrus + White guava upper shoot (80)

The adults were left within this olfactometer for 30 min, then removed, kept within a covered specimen tube for 30 min and then released into a second olfactometer for 30 min for the second test. Ten adult psyllids were used for each replicate (n = 15 for each paired treatment). Responses to the volatile aroma sources were recorded as the proportion of adults

3. Result And Discussion

The results of the olfactometer experiments are shown in Fig. 1 up to 3. Variant response of adult psylids to the mixture of plant volatiles odour sources of citrus leave and guava leave extract (1:1 w/w) is observed in every set of Y-tube olfactory tests. It is also obviously seen that some adult psylids do not move to both of odour sources. Those phenomenon prove repellence effect of guava leave prevent adult psylids to choose citrus leave extract volatile as cue to their host plant (citrus). Barman and Zeng [14], [15] also found the same repellence effect of guava leave extract when sprayed on citrus leave. The presence of guava shoot odour are able to reduce adult psyllids population in citrus leave [16], [17]. Significantly less adult psylids move to the citrus dried leave with the addition of upper shoots of red guava dried leave than non-seed upper shoots guava dried leave which was dried at 50ºC for 24 h (*P*< 0.0001). The number of psylids move to citrus leave extract with the addition of upper shoots leave extract of red guava and non-seed guava is 2.53±0.22 and 3.80±0.31 respectively. The number of psyllids move to non-seed guava upper shoots are same with the number of the not moved psyllids.

Mixture of red guava dried upper shoot and citrus dried leave is also less attractive for psylids than mixture of white guava dried upper shoot and citrus dried leave (*P*< 0.0001). The number of psylids move is 2.60±0.13 and 5.47±0.22 for red guava and white guava odour sources respectively.

Psylids move in paired comparison test to the mixture of non-seed guava dried upper shoot and citrus dried leave is lower than mixture of white guava dried upper shoot and citrus dried leave. Repellent effect of non-seed guava dried upper shoot is significantly higher than white guava dried upper shoot (*P*< 0.0001). The number of psylids move is 2.63±0.32 and 4.80±0.23 for non-seed guava and white guava upper shoot odour sources respectively.

Based on the comparison responses of psyllids to the guava dried shoots (Fig 1, 2, and 3) drying at 50ºC for 24 h and 80ºC for 48 h, it can be stated that upper shoot (leave number 1 and 2 from the top) dried at 50ºC for 24 h has higher repellence effect (*P*< 0.0001) to psyllids adult than upper shoot dried at 80ºC for 48 h. The number of psyllids move to upper shoot dried at 50ºC for 24 h and at 80ºC for 48 h is 2.53±0.22 and 1.33±0.16, 3.80±0.31 and 2.07±0.18, and 5.47± 0.22 and 2.80± 0.11, for red, non-seed, and white guava respectively. It also suggest that the repellency is dose dependent [14] and higher repellence properties is in upper shoots of guava. It seem that the temperature and duration for drying of guava leave has a significant effect to the attractiveness of psyllids. However it should be proved further that the higher repellence effect is not caused by the lack of specific compound volatile from citrus leave as a cue for determining the host.

Based on the comparison of red, non-seed, and white guava dried upper shoot, it is suggested that aroma of red guava has highest repellent effect to psyllids adult, followed by non-seed guava, and white guava. Psyllid uses volatile compounds of specific species and intensities as a cue to determine the location of their host plants, and finds parts of plants that are still free of other competing insects [13], [18].

Fig 1. Mean (±SE) of psyllids adults that not moved (NM) or moved towards volatiles entering Y-tube olfactometers: response to leave extract of citrus + red guava upper shoots (CT + RGUS) and of citrus + non-seed guava upper shoots (CT + NSGMS), dried at 50ºC for 24 h (50) and at 80ºC for 48 h (80).

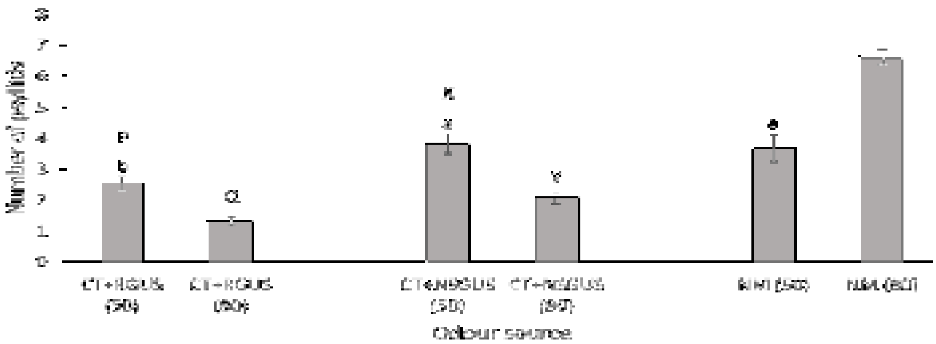


Fig 2. Mean (±SE) of psyllids adults that not moved (NM) or moved towards volatiles entering Y-tube olfactometers: response to leave extract of citrus + red guava upper shoots (CT + RGUS) and of citrus + white guava upper shoots (CT + WGMS), dried at 50ºC for 24 h (50) and at 80ºC for 48 h (80).

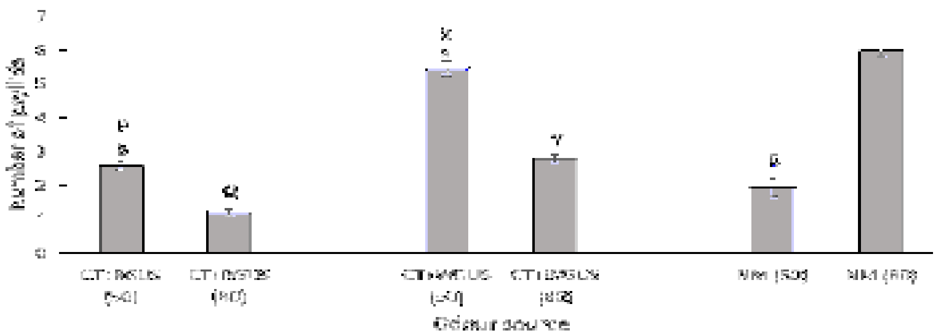
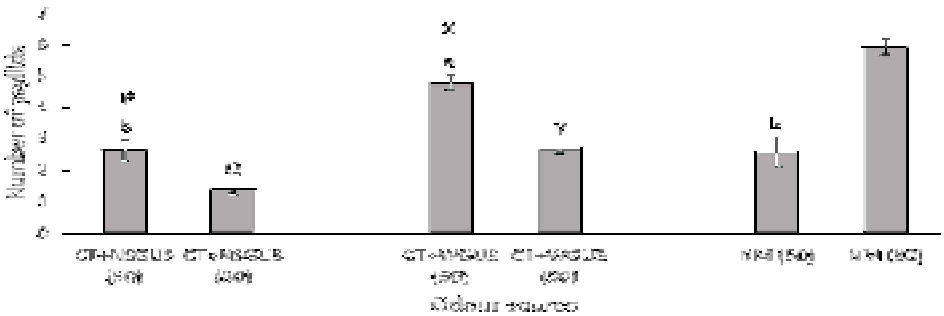


Fig 3. Mean (±SE) of psyllids adults that not moved (NM) or moved towards volatiles entering Y-tube olfactometers: response to leave extract of citrus + non-seed guava upper shoots (CT + NSGUS) and of citrus + white guava upper shoots (CT + WGMS), dried at 50ºC for 24 h (50) and at 80ºC for 48 h (80).



4. Conclusion

Guava leave has repellent effect to psyllids adult. Highest repellent effect is found from red guava leave, followed by non-seed guava and white guava. The repellent effect is also depended on the drying methods.

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The Effect of Various Fertilizer Application and Soil Humidity on Quality of Tomato

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Abstract.

This research aimed to study the quality of tomato grew under different fertilizer applications and soil moisture levels. The green house experiment was set in a Randomized Completely Block Design. The treatments were various types of fertilizers (Liquid Organic Fertilizer/LOF, inorganic fertilizer/AB Mix, LOF+AB Mix) and different soil moisture levels (30%, 45%, 60%, 75%). Tomatoes were planted in polybags in a green house and treated according to the experimental design; each treatment was replicated three times. The results showed that there was an interaction between type of fertilizers and soil moisture in affecting fruit sugar content and fruit diameter. Sugar content of tomatoes harvested from plant treated with AB Mix and grew under 30% soil moisture level was not significantly different from tomatoes grew under 45% soil moisture level and treated with AB Mix or LOF, but the sugar content was significantly higher than those grew under 60% or 75% soil moisture level treated with different type of fertilizer. Tomato plants treated with LOF and grew under 30% soil moisture level significantly produced smaller fruits than those treated with AB Mix only or AB Mix+LOF grew under 45%, 60% or 75% soil moisture except those treated with AB Mix+LOF grew under 45% soil moisture. The percentage of tomatoes infested by fruit rot was not significantly affected by type of fertilizers and but affected by soil moisture. The lowest fruit rot intensity occurred on plant grew under 30% soil moisture level.

Keywords: inorganic fertilizer, liquid organic fertilizer, quality, soil moisture, tomato

1. Introduction

Tomato is widely grown in various regions in Indonesia. Indonesian tomato production in 2016 was 883,233 tons of the harvested area of 57,688 ha with a productivity of 15.31 tons /ha, in 2017 the harvested area drop to 55,623 ha with a production of 962,845 tons, resulting in an increase in production of 9.01 tons and an increase in productivity to 13.06 tons/ha (RI Ministry of Agriculture, 2019). Tomatoes are one of the favorite vegetables consumed by the people of Indonesia. Tomato consumption per person per week was 0.080 kg in 2015 and increased to 0.085 kg in 2016, so the estimated national tomato consumption in 2015 was 1,045,620 tons and in 2016 amounted to 1,149,160 tons (Central Bureau of Statistic, 2017). By comparing the production and consumption data of tomatoes in 2016 it is estimated that there is a shortage of tomato supply to meet domestic needs. With the trend of increasing tomato demand from year to year, it is necessary to increase national tomato production.

Increasing tomato production can be done by increasing the area of land and intensification on existing land. In conventional tomato cultivation, farmers rely on the use of inorganic fertilizers to provide nutrients for plants. The use of inorganic fertilizers continuously without being balanced with the use of organic matters will cause a decrease in soil quality in the form of a decrease in soil fertility and micro nutrients content, in addition to that the soil becomes hard and decreases its porosity (Zhang *et al*., 2008).

Organic fertilizers besides contain macro nutrients also contain micro nutrients, whereas inorganic fertilizers only provide certain macro nutrients. Research shows that soil fertility increases after long-term use of organic fertilizer (Granstedt & Kjellenberg, 1997; Lazcano *et al*., 2013). The results of plants that were given organic fertilizer were not significantly different from plants that were given inorganic fertilizers. Red onions fertilized with chicken manure, goat manure or cow manure at a dose of 20 tons/ha or 40 tons/ha gave yield not significantly different from plants that were given inorganic fertilizer (Abdelrazzag, 2002; Yoldas *et al*., 2011).

Moisture content of the soil also affects the vegetative growth of plants. In tomato plants drought stress affects the vegetative growth of tomato plants. Tomato planted in drought stress (reduction in soil moisture) 75% resulted in vegetative growth (plant height, number of leaves, wet weight and dry weight of plants) lower than tomato planted in drought stress 50% or 25%. Tomato planted at 75% drought stress also absorbed the lowest N nutrients compared to tomato planted at 50% or 25% drought stress (Hara & Saha, 2000). In beans plants soil moisture affected plant height, but did not affect the number of leaves and number of stem segments (Bierhuizen & Vos, 1959). Given that plant responses to fertilizer application and soil moisture conditions vary, a comprehensive study needs to be carried out. This study aimed to examine the effect of applying various types of fertilizers (inorganic and organic) and various levels of soil moisture on the quality of tomato.

2. Materials and Methods

The study was conducted in a greenhouse in Karangnongko Hamlet, Maguwoharjo Village, Depok District, Sleman Regency. The experiment was arranged in a Randomized Completely Block Design (RCBD) with two factors and replicated 3 times. As a treatment, the first factor is the type of fertilizer, i.e., liquid organic fertilizer (LOF), inorganic fertilizer (AB Mix), LOF + AB Mix; the second factor is the soil moisture level, i.e., 30%, 45%, 60%, 75%. Liquid organic fertilizer was formulated by the researchers from fermented fruits waste.

Tomatoes planted were hybrid variety Liontin F1. Seedlings were planted in 35 cm-sized polybags filled with soil from Gunung Kidul mixed with compost in a ratio of 2: 1. Fertilizers, according to treatment, were given once a week starting at 2 weeks after planting (WAP) up to 6 weeks after planting. Plant watering was set according to soil moisture treatment. Soil moisture control was done automatically with sensors that utilized information technology. Pest and disease control was not carried out.

Tomato fruits were harvested at full maturity shown by the reddish orange of fruit skin color. Observation for tomato quality was conducted on sugar content (Brix number), fruit weight, fruit diameter, and fruit rot intensity (%). Harvested fruits were kept in room temperature (27 ±2°C) then the sugar content was measured at 13 days, 15 days, and 17 days after storage. The observed data were subjected to Analysis of

Variance (ANOVA, α = 5%) and followed by Duncan's Multiple Range Test using SPSS for Windows version 15 (α = 5%).

3. Results and Discussion

Sugar content in tomato fruit was shown in brix number (total soluble solids). The results showed that there was an interaction between type of fertilizers and soil moisture in affecting tomato sugar content. Tomato treated with AB MIX with 30% soil moisture or treated with LOF or AB MIX with 45% soil moisture produced fruit with the highest sugar content in comparison to other treatments. Liquid Organic fertilizer (LOF) and AB MIX provide sufficient nutrients to support sugar formation in tomato (Table 1).

Several studies showed that to some extent water stress could increase the quality of tomato. In comparison to tomato with full irrigation, plants with less irrigation or under water stress produced tomato with higher color intensity, lower water content, higher sugar content although fruit yield, size and number were decreased (Pulupol *et al*., 1996; Nuruddin *et al*., 2003; Johnstone *et al*., 2005; Favati *et al*., 2009; Chen *et al*., 2013).

Table 1. Sugar content (brix number) of tomato grew under different type of fertilizer and soil moisture

Type of fertilizers	Soil Moisture				Mean
	30%	45%	60%	75%	
LOF	10,86 cde	11,51 ab	11,04 bcd	10,73 cde	11,04
LOF+AB Mix	10,84 cde	10,96 cd	10,56 de	10,86 cde	10,80
AB Mix	11,67 a	11,17 abc	10,84 cde	10,39 e	11,02
Mean	11,12	11,21	10,81	10,66	(+)

Means followed by same letter is not significantly different subjected to DMRT (P≤0,05);
(+) There was an interaction between treatments; LOF= Liquid Organic Fertilizer

Fruit storage life can be used as an indicator to find out how long a commodity can be stored while still having good fruit quality. In this study, tomato fruits were harvested when the color of skin fruit was reddish orange, indicating that the fruit has reached its maturity. Tomatoes harvested from plants treated with LOF significantly contained highest sugar content that those treated with LOF+AB MIX or AB Mix at 13 days of storage, However, type of fertilizers did not significantly affect the sugar content at 15 days and 17 days of storage. Plants grew under 30% soil moisture produced fruits contained the highest sugar content than those grew under higher soil moisture (45%, 60% or 75%) at 13 days, 15 days and 17 days of storage (Table 2). It was observed that in comparison to sugar content of tomato at harvest time, the sugar content of tomatoes decreased steadily over the duration of storage (13 days, 15 days, 17 days of storage) (Table 1, Table 2). This result was similar to those of Islam *et al.* (1996).

Table 2. Sugar content (brix number) of tomato of storage in room temperature

Treatment	13 days of storage	15 days of storage	17 days of storage
Fertilizer			
LOF	10,95 a	10,58 a	10,32 a
LOF+AB Mix	10,58 b	10,28 a	10,09 a
AB Mix	10,65 b	10,34 a	10,04 a

Soil Moisture			
30%	11,44 p	11,14 p	10,89 p
45%	11,02 q	10,78 q	10,61 p
60%	10,38 r	10,10 r	9,79 q
75%	10,07 r	9,59 s	9,31 r
Interaction	-	-	-

Means in the same column followed by same letter is not significantly different subjected to DMRT (P≤0,05); (-) No interaction between treatments; LOF= Liquid Organic Fertilizer

Tomatoes after harvesting still carry out metabolic processes using food reserves available in the fruit. The reduction in food reserves cannot be replaced because the fruit is already separated from the plant, so storage accelerates the loss of the nutritional value of the fruit and accelerates the ripening process. Post-harvest ripening will change the chemical composition of fruit, including sugar content (total soluble solids). Islam *et al*. (1996) found that total soluble solids in tomato harvested at vine-ripened stage (deep pink color) decreased linearly over the duration of storage (0-16 days). However, Duma *et al*. (2017) found that soluble solids in tomato fruits harvested at green stage of maturity increased after 24 days of storage and decreased after 36 days of storage. The differences between these studies could be because of the state of tomato fruits when harvested was different. When tomatoes are harvested at mature green, during ripening polysaccharides are degraded into simple sugar. In addition, starch is hydrolyzed into sugar, thereby the sugar content is increase. This phenomenon was also observed by Mulindwa *et al*. (2018) and Sta. Iglesia *et al*. (2013).

Table 3. Fruit weight (gram) of tomato grew under different type of fertilizer and soil moisture

Type of fertilizers	Soil Moisture				Mean
	30%	45%	60%	75%	
LOF	8,67	28,28	39,44	30,67	26,76 a
LOF+AB Mix	18,56	15,33	28,44	34,44	24,19 a
AB Mix	18,67	23,83	29,56	31,28	25,83 a
Mean	15,30 q	22,48 pq	32,48 p	32,13 p	(-)

Means followed by same letter is not significantly different subjected to DMRT (P≤0,05);
(-) No interaction between treatments; LOF= Liquid Organic Fertilizer

Tabel 4. Fruit diameter (mm) of tomato grew under different type of fertilizer and soil moisture

Type of fertilizers	Soil Moisture				Mean
	30%	45%	60%	75%	
LOF	10,47 b	32,13 a	37,47 a	36,27 a	29,08
LOF+AB Mix	26,79 a	21,44 ab	33,89 a	36,57 a	29,68
AB Mix	29,12 a	33,95 a	33,53 a	34,39 a	32,75
Mean	22,13	29,17	34,96	35,74	(+)

Means followed by same letter is not significantly different subjected to DMRT (P≤0,05);
(+) There was an interaction between treatments; LOF= Liquid Organic Fertilizer

Tomato fruit weight was not significantly affected by type of fertilizers, but fruit weight was affected by soil moisture content. Plants grew under 30% soil moisture produced fruit with significantly lighter weight than those grew under 60% or 75% soil moisture (Table 3). Tomato fruit size was significantly affected by interaction between type of fertilizer and soil moisture. Plants fertilized with LOF and grew under 30% soil moisture produced significantly the smallest fruit than plants with other treatment (Table 4). Plant grown under water stress or low soil moisture content will produced smaller fruit and lower yield (Pulupol *et al*., 1996; Nuruddin *et al*., 2003; Johnstone *et al*., 2005; Favati *et al*., 2009; Chen *et al*., 2013).

Water is needed by plants to dissolve nutrients in the soil. Besides that water is also an important component in photosynthesis, so lack of water will reduce the rate of photosynthesis so that the photosynthate produced to form fruit is also less. Macro nutrients NPK (Nitrogen, Phosphor, Kalium) found in organic fertilizers and inorganic fertilizers have the same function in plant growth. Nitrogen plays a role in protein synthesis for the formation of plant cells and serves to encourage vegetative growth with plants (Lawlor, 2002). Phosphor is needed in energy formation, nucleic acid synthesis, photosynthesis, glycolysis, respiration, synthesis and membrane stability, activation / inactivation of enzymes, redox reactions, carbohydrate metabolism, and nitrogen fixation (N) (Vance et al., 2003). Potassium (Kalium) plays a role in biochemical and physiological processes that affect plant growth and plant metabolism. Potassium also functions to increase plant resistance to environmental stress, such as drought, salinity, pests and diseases (Wang et al., 2013). Potassium helps the activation of enzymes and absorption of nutrients and water from the soil and photosynthate transportation from leaves to other plant tissues (Marschner, 2012).

Tabel 5. Fruit rot intensity (%) of tomato grew under different type of fertilizer and soil moisture

Type of fertilizers	Soil Moisture				Mean
	30%	45%	60%	75%	
LOF	30,3	27,8	16,7	25,3	25,0 a
LOF+AB Mix	15,1	33,2	21,2	21,7	22,8 a
AB Mix	13,9	22,4	31,7	27,9	24,0 a
Mean	19,8 q	27,8 p	23,2 p	25,0 p	(-)

Means followed by same letter is not significantly different subjected to DMRT (P≤0,05); (-) There was no interaction between treatments; LOF= Liquid Organic Fertilizer

Type of fertilizers did not significantly affect fruit rot intensity on tomato. However, soil moisture content was significantly affected the fruit rot intensity. Plant grew under 30% soil moisture significantly has the least infestation of fruit rot (Table 5). Tomato fruit rot disease is caused by *Rhizoctonia solani* Kiihn. Pathogen infestation is usually high when micro-climate around the plant is humid. Therefore, when soil moisture increase fruit rot intensity also increase.

4. Conclusions

Sugar content of tomato fruit harvested from plant treated with AB Mix and grew under 30% soil moisture level was not significantly different from tomato grew under 45% soil moisture level and treated with AB Mix or LOF, but the sugar content was significantly higher than those grew under 60% or 75% soil moisture level treated with different type of fertilizer. Tomato plant treated with LOF and grew under 30% soil moisture level significantly produced smaller fruit than those treated with AB Mix only or AB Mix+LOF grew under 45%, 60% or 75% soil moisture except those treated with AB Mix+LOF grew under 45% soil moisture. The percentage of fruit infested by fruit rot was not significantly affected by type of fertilizer but affected by soil moisture. Plants with the lowest soil moisture (30%) suffered from the lowest fruit rot.

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Minimum Fertilizer in Maize Varieties for Economically Disadvantaged Farmers in Suboptimal Land

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Abstract.

Farmers on suboptimal land are generally economically disadvantaged and need to be supported by low-cost technology. The study aimed to find out a low input technology package for maize cultivation on suboptimal land in Riau Province. The research was carried out on the tidal agroecosystem overflow type C, around the Mandau River on alluvial land, peat, and alluvial + peat mixture in Siak District. Time of study in March to December 2018. The materials used were hybrid maize varieties such as Nasa 29, Bima Uri 19, and composite maize Bisma and Sukmaraga, Urea, TSP, KCl, farm yard manure, dolomite, locality liquid organic fertilizer (LLOF), grilled ash, biological fertilizers, decomposers, pesticides, herbicides. There are 4 fertilization packages, i.e.: A (high dosage), B (high dosage + LLOF + Grilled ash), C (50% dosage + LLOF + grilled ash), D (low dosage). Experiments were designed using randomized complete block design and repeated three times. To find out whether farming is profitable or not economically, it is analyzed by using Benefit Cost Ratio. The results showed that Nasa 29 and Sukmaraga varieties produced the best average growth and yield for all soil types and fertilizer doses of 4.0 t ha^{-1} and 3.9 t ha^{-1} dry seeds, respectively. NASA 29 can produce 6.2 t ha^{-1} dry seeds in a mixture of peat + alluvial soil even though the dose of chemical fertilizer is reduced by 50%. Reducing the dose of chemical fertilizer can be done to improve the ability of farmers to buy fertilizer depending on the type of soil and the availability of LLOF and grilled ash. Mixture of peat and alluvial is good soil for maize growth if combined with fertilizer package B. Decrease in chemical fertilizer 50% (package C) causes yields to fall to 6.23 t ha^{-1} and farmers get a profit of Rp 12,418,000 per planting season with B/C 1.9.

Keywords: Maize, low cost, suboptimal, alluvial, peat, liquid organic fertilizer

1. Introduction

One of the targets of extensification for food crops in Indonesia is suboptimal land, such as peat and alluvial in tidal areas. Indonesia has 11 million ha of tidal swamps and 14.9 million ha of peatlands (Mulyani and Sarwani, 2013). According to Notohadiprawiro (1971), alluvial associated with organic land is 44.6 million ha or 23.5% of the land area of Indonesia. Suboptimal soils are distributed along river basins (Sirappa and Titahena, 2014), which in Riau Province is dominated by peat and alluvial soils. These lands are widely used for oil palm or rubber plantations and only a small portion is used for food crop agriculture due to physical, biophysical and chemical inhibiting factors.

Problems in peat soils are related to acid sulphate soils, depths of pyrite layers, tidal dynamics, depth of ground water surface, and soil acidity (Könönen et al., 2015;

Salimin et al., 2010), nutrient Ca, Mg, K and Na, P_2O_5 and K_2O deficiency. The characteristics of peat soils in Riau are very acid soil reaction with pH (H_2O) 3.3 - 3.9, very high organic carbon content, very high carbon stocks, hemic to sapric maturity in the top layer, low bulk density 0.16 - 0.24 g cm^{-3}, content of micro elements of Cu, Mn and Zn were generally moderate to high, Fe content was very high, and high content of exchangeable Al (Hikmatullah and Sukarman, 2014). Based on the criteria of land suitability for agricultural commodities (Ritung et al. 2011), the peat soils of Riau with hemic to sapric maturity, thickness of more than 3 m and clay substratum were classified into marginally suitable for perennial crops (rice, maize , legumes), but moderately suitable for annual crops, such as palm oil and coconut.

The peat soils need inputs such as fertilizers and ameliorants to improve and maintain soil fertility. Some ameliorants such as pugam, manure, inorganic fertilizers, dolomite, and zeolite can be used for peat soils (Hikmatullah and Sukarman, 2014). Subiksa (2013), suggested to use pugam to improve peat soils fertility as ameliorant and fertilizer and decreasing greenhouse gas. Some ameliorant has been applied in order of importance in the fields, namely lime/dolomite, mineral soils, organic fertilizers, combustion ash, and volcanic ash.

Alluvial soils around the Siak River and Mandau River in Riau Province are contains very much iron so that rice plants often experience iron poisoning and cause crop failure. A very high clay content causes the soil to become very hard in the dry season. According to Kasno et al. (2003), alluvial deposits are generally fine-textured, with clay fraction content > 50%. The content of organic matter in alluvial soil of rice fields are varies in the upper layer, some are relatively low (<2%). Meanwhile according to Obia et al. (2018), heavy clay soils are globally widespread but their poor drainage and poor aeration limits their use for agriculture.

Technology suboptimal land management can be done through amelioration, balanced fertilization, tillage and water management (Adnyana et al., 2005), addition of organic materials as fertilizer (Kaderi, 2004; Tisdale et al. 1985), organic fertilizers as much as 2 Mg ha^{-1} in combination with inorganic fertilizers to rice cultivation in the integrated crop management (Pirngadi and Makarim, 2006), organic materials as much as 5 Mg ha^{-1} and 100 kg KCl ha^{-1} were increasing grain yield (Pirngadi and Pane, 2004). Indiscriminate use of hazardous synthetic fertilizers and pesticides caused environmental pollution and deteriorated soil health (Elkoca and others 2010). Proper nutrient management is essential to maximize maize production and sustain agricultural production while minimizing negative impacts on the soil fertility (Mahamood, et al. 2016).

Farmers on suboptimal lands are generally economically disadvantaged farmers. Improvement of soil fertility with the addition of organic material, lime, and high-dose chemical fertilizers is not able to be implemented. Therefore this suboptimal peat and alluvial land becomes unproductive agricultural land. In addition, land clearing using heavy equipment has damaged the soil layer by eroding thin peat that is above the alluvial substratum. Traditional tillage has also caused peat and alluvial to mix. Thus, land along the Siak River can be peat, alluvial, or a mixture of peat with alluvial. Rice and maize cultivation in these three types of soil is unsatisfactory because rice is iron poisoned and maize grows stunted. Farmers need low-cost technology to empower the potential of this vast land. This suboptimal soil can provide benefits with high-dose ameliorant and fertilizer applications. But Burke et al. (2016) conveyed that higher fertilization rates would be marginally profitable or unprofitable in many cases given commercial fertilizer and maize prices. Some efforts to neutralize soil acidity, especially in topsoils are categorized as relatively difficult, expensive and need a comprehensive approach (Armanto et al., 2016).

One way to help farmers is low input technology, increasing the efficiency of fertilizers provided and mining nutrient stocks in the soil and fixation N from the air with biological fertilizers. This method can be done several times the growing season until farmers are able to buy ameliorant and chemical fertilizer.

Low-input system characteristics depend on local conditions, especially on soil fertility and on potential yields. Low-input systems rely on a large variety of strategies to reduce synthetic inputs, especially on crop species diversification to reduce N fertilization (Colnenne-David and Doré, 2015), integrated weed management with modified soil tillage (Rasmussen, 2004; Pardo et al ., 2010), use of resistant cultivars, and modified sowing dates (Debaeke et al., 2009). Traditional knowledge and local wisdom must be used as a foundation in developing technology to realize productive agriculture on suboptimal land (Lakitan, 2014).

The combination of high-yielding varieties of maize and sustainable agricultural practices (SAPs) increases maize yield and smallholder income. Adoption of new high yield varieties of maize alone has a greater impact on maize yield, but the high cost of inorganic fertilizer causes profits to be low. Greater farmer income is derived from SAPs packages such as maize-legume rotation and residual retention (Manda et al., 2016). Application of nitrogen (N) through 50% (organic) + 50% (inorganic) maintained higher soil quality followed by application of 100% N through organics. Reduction in the intensity of tillage to 50% with intercultural practices and combined use of organic and inorganic fertilizers maintained higher soil quality in these degraded Inceptisols compared to inorganics alone (Sharma et al., 2014).

Several studies have shown a fairly good yield on low input treatment. Low input systems can reduce environmental damage than conventional systems (standards, recommendations), while reducing yield losses compared to organic systems. Maize cultivation in low input systems only uses 50% pesticides and mineral N is reduced by 36% but maize yields are no different from conventional systems, and are higher than yields in organic systems (Hossard et al., 2016). The best treatment combination for good soil health and higher yield in maize crop (5.5 t ha^{-1} grain yield) in alluvial soil at Allahabad region were 125 kg Roller 6 times + 50% RDF (NPK + ZnSO4) + FYM 5 t ha^{-1} But decreasing the treatment dose to 50% ie 125 kg Roller 3 times + 25% RDF (NPK + $ZnSO_4$) + Farm Yard Manure 2.5 t ha^{-1} can still produce 4.2 t ha^{-1} maize grain in alluvial soil (Pratap et al., 2016). The highest grain yield (8.37 t ha^{-1}) was found from the treatment of N 300 kg ha^{-1}, P 50 kg ha^{-1}, K 150 kg ha^{-1} and S 30 kg ha^{-1}. The lowest grain yield (7.33 t ha^{-1}) was obtained from treatment of P 50 kg ha^{-1}, K 150 kg ha^{-1}, and S 30 kg ha^{-1} (Mahamood, et al. 2016).

Fertilizing efficiency can also be achieved with the help of biological fertilizers as an important source of microorganisms to help fertilizer efficiency and soil health. According to Kumar et al. (2016), co-inoculation of three rhizobacteria (Enterobacter, M. arborescens and S. marcescens) performed best in the promotion of growth, yield, and nutrient (N, P, Cu, Zn, Mn, and Fe) uptake by wheat and improve the quality of acid sulfate soils. Haryono (2013) states that bio-fertilizers in acidic sulphate soils in South Kalimantan can increase soil pH by more than 40%, substitute lime needs above 80%, reduce sulfate levels by more than 20%, and increase rice productivity.

The treatment was arranged to reduce the need for chemical fertilizers by increasing efficiency or mining nutrients in the soil and testing local wisdom technology (use of manure, compost, burn ash, Local Liquid Organic Fertilizer (LLOF), or peat soils). The research aims to find a low input technology package for maize cultivation in suboptimal land in Riau Province.

2. Materials And Methods

The research was carried out on the overflow type C tidal agroecosystem, around the Mandau River on alluvial, peat, and mixed alluvial + peat soils in Siak district. Research time is from March to December 2018.

The materials used are hybrid maize varieties such as Nasa 29, Bima Uri 19, and composite maizes such as Bisma and Sukmaraga, Urea fertilizer, TSP, KCl, manure, dolomite, biological fertilizer, burn ash, decomposers, pesticides, and herbicides.

The study was conducted on farmer's land in three locations with different types of soil, namely: alluvial, peat, and mixed peat + alluvial. One experimental unit consists of 48 plots with the size of each plot 5 m x 8 m.

Tillage using a mini tractor and hoe, once plow and once rake. After tillage, drainage trenches are made around with the width of 40 cm and depth 30 cm.

The application of manure, dolomite lime, and M-Dec was carried out two weeks before planting. Lime and manure are sown on the surface of the soil on the path to be planted. In the experimental plot there are 10 lanes with a distance between 75 cm. The dosage of lime is 1 t ha^{-1} and dose of organic fertilizer is 2.5 t ha^{-1}. Furthermore, the path to be planted are doused with M-Dec (4 kg ha^{-1}) that has been dissolved in 400 liters of water. The fertilization and ameliorase packages tested are presented in Table 1.

Table 1. Fertilization and ameliorase packages

Treatment component	Fertilization and Ameliorase Packages			
	A	B	C	D
Urea (kg ha^{-1})	300	300	150	150
TSP (kg ha^{-1})	200	200	50	0
KCL (kg ha^{-1})	100	100	50	0
LLOF (liter ha^{-1})	0	400	400	0
Burn ash (kg ha^{-1})	0	500	500	0
Cow manure (kg ha^{-1})	2.500	2.500	2.500	0
Dolomite (kg ha^{-1})	1.000	1.000	1.000	500
Biological fertilizer	Agrimeth	Agrimeth	Agrimeth	Agrimeth

Maize seeds are planted at a spacing of 75 x 20 cm, one seed per planting hole. Insertion of non-growing plants is carried out 5 days after planting.

Biofertilizer is watered into the rooting area 2 times, ie: at 2 and 4 weeks after planting (WAP) with a spray volume of 400 l ha^{-1}. Urea, TSP and KCl fertilizer doses according to treatment. One third of the urea fertilizer, and all TSP and KCl fertilizers were given at planting and two-thirds of urea fertilizer was given at 4 weeks after planting (WAP). Biofertilizer is not given at the time of planting because the seeds have Saromyl fungicide webbed and when planting the planting hole is given carbofuran.

The 4-week-old maize was given fisrt supplementary fertilizer. Urea fertilizer as much as 2/3 of the treatment dose is sprinkled on the surface of the soil about 15 cm from the stem of the plant and then immediately covered with soil. Weeds that begin to grow among 7-days-old plants are controlled with selective herbicides. Harvesting is done when the cornhusk starts to dry or the seeds are dry, hard, shiny, and have a black layer.

LLOF is made from 100 kg of fresh cow manure, 1 kg of NPK, EM4 2 liters, 1 kg of granulated sugar, kitchen waste, and 200 liters of water. All ingredients are stirred evenly, tightly closed and fermented for 3 weeks. After 3 weeks, the lid is opened, the solution is stirred, then left open for 7-10 days to raise the pH. Burned ash is produced from burning wood and rice husks.

Experiments in each environment were designed using RCBD which was repeated three times. Physical and chemical analysis of the soil was carried out before the study by taking composite soil samples to a depth of 40 cm. Socio-economic data was obtained from implementing farmers and farming costs from each of the technologies introduced. The variables observed were: plant height, number of rows per ear, number of seeds per row, weight of 100 seeds, and yield.

Data analysis. Analysis of variance based on randomized complete block designs and further tests used a 5% LSD. Data analysis using STAR program. The yield stability of each variety in each environment was analyzed according to Finlay-Wilkinson (1963) using the PBSTAT program. To analyze the economics of maize farming in each development technology package using MBCR analysis. Mathematically farm income can be calculated by the formula:

$$\Pi = Y.Py - \Sigma X_i.Px_i - BTT$$

Annotation:

Π = Income (Rp)

Y = Yield (kg)

Py = Prices of yield (Rp)

Xi = Production factors (i= 1,2,3,…n)

Pxi = Price of the i-factor production (Rp)

BTT = Total fixed costs (Rp)

To find out whether farming is profitable or not economically analyzed using Benefit Cost Ratio according to Rustiadi et al (2011):

$$B/C = PT/BT$$

Annotation:

B/C = Ratio of benefit and cost

TR = Total Revenue (Rp)

TC = Total Cost (Rp)

The decision making criteria are as follows:

- if B/C > 1, then the farm experiences profits, income is greater than costs
- if B/C < 1, then the farm suffers a loss because the income is less than the cost
- if B/C = 1, then the farm gets even because the income equals the cost.

3. Results And Discussion

Biophysical Condition of Study Location

The research site is an abandoned land that was cleared for rice fields but due to biophysical inhibiting factors, the land was not managed by farmers. The soil is dominated by clay, loam, and partially peat. Dominant vegetations are Ottochloa nodosa (Kunth) Dandy, Melastoma candidum, imperata cylindrical, Eleocharis dulcis, Eleocharis ochrostachys Steud, and various small timbers. Under the peat layer is soft alluvial soil. In the rainy season, the surface of the ground water is shallow so that the soil quickly becomes mud. Topsoil layer is rather dark in color only 10-20 cm deep followed by a gray subsoil layer filled with iron rust. The topsoil layer is the remnants of peat that have been eroded during land clearing. Mixed soil of peat + alluvial in the form of small grains which is a mixture of peat and loam / dry clay. This soils are very porous so organic matter needs to be added. All soil react very acid. According to Armanto et al., (2016), the real problem of soil acidity is related to cation exchange capacity, soil organic matter and C / N ratio, soil nutrient balance, and potential toxicity.

Based on soil CEC status, base saturation value, organic matter content, and P-available, the alluvial substratum soil in the study site is classified as infertile, alluvial + peat mixture is infertile, and peat is infertile. Very low base saturation at all three locations (Table 2), indicates that the soil has experienced a lot of leaching and is infertile or poor soil base.

Table 2. Results of alluvial, alluvial + peat mixture, and peat soil analysis

Variable	Type of soils					
	Alluvial	Criteria	Alluvial+Peat	Criteria	Peat	Criteria
Texture (%)						
Sand	0.13		0.18		-	-
Loam	35.9		35.5		-	-
Clay	64.0		64.3		-	-
pH (1:2,5)						
H_2O	3.47	very acid	3.77	very acid	3.3	very acid
KCl	3.78	very acid	3.97	very acid	3.2	very acid
C-Organic (%)	1.93	Low	5.37	very high	13.10	very high
N Total (%)	0.31	Moderate	0.36	moderate	0.21	moderate
C/N	6.23	Low	14.8	moderate	62.38	very high
HCl 25% (ppm)						
P_2O_5	20.7	Moderate	240	very high	6	very low
K_2O	184	very high	442	very high	5	very low
P-Bray 2 (ppm)	6.85	Low	267	very high	8.70	moderate
CEC (me/100g)	29.0	High	48.8	very high	32.10	high
Exchange base cation (me/100g)						
K	0.18	Low	0.77	high	0.03	very low
Ca	0.40	very low	2.11	low	0.02	very low
Mg	0.29	very low	0.95	low	0.03	very low
Na	0.10	very low	0.28	low	0.04	very low
Base saturation (%)	3	very low	8	very low	0,37	very low
Exchangeable acidity KCl 1 N (me/100 g)						
H	<0.01	-	0.03	-	6.44	-
Al	15.7	Moderate	11.4	moderate	14.66	moderate
Extract Morgan Wolf (ppm)						
Fe	79.9	very high	78.4	very high		

Effect of Treatment Against Maize Yields and Yield Components

The results of analysis of variance in Table 3 show a very significant interaction between soil types, fertilizer packages, and varieties of all observed variables (P = 0.00). The yield is influenced by all sources: soil types, fertilizer packages, varieties, and interactions of soil types x fertilizer packages, soil types x varieties, fertilizer packages x varieties, and soil types x fertilizer packages x varieties. Interaction means that the yields obtained under the influence of varieties depend on the level of the fertilizer package or soil type.

Table 3. Pr (> F) values of treatments for various observed variables

Sources	Plant height	No.of row /ear	No.of seed /row	Weight of 100 seeds	Yield
Replication	0.0294	0.5466	0.4088	0.2610	0.6894
Soil types (ST)	0.0000	0.0000	0.0000	0.0000	0.0000
Fertilizer packages (FP)	0.0000	0.0000	0.0000	0.0000	0.0000
Varieties (V)	0.0000	0.8569	0.0049	0.0476	0.0008
ST * FP	0.0000	0.0000	0.0000	0.0000	0.0000
ST * V	0.0000	0.0017	0.0062	0.0000	0.0016
FP * V	0.1639	0.0021	0.0338	0.0005	0.0000
ST * FP * V	0.0001	0.0000	0.0040	0.0000	0.0000
CV (%)	6.30	8.30	11.32	6.39	16.97
Mean	163.79	11.22	22.53	25.41	3.73

All varieties produce good growth and yields in soil with better chemical properties, ie alluvial + peat (AP) mixture but yields are very low in soils that are chemically very poor, especially the low P-available, CEC, and C-organic content. The average growth and yield of the best varieties in all soil types and fertilizer doses produced by Nasa 29 were 4.0 t ha^{-1} and Sukmaraga were 3.9 t ha^{-1} dried seeds (Table 4).

All varieties responded well to the combination of AP soil with fertilizer package B (FPB) . Maize yields increased in all types of soil treated with FPB and yields dropped if the dose of chemical fertilizer was reduced by 50%. However, the decline in yield can still be tolerated if it is correlated to the amount of costs to buy another 50% fertilizer and economically disadvantages farmers.

In AP soil, the four varieties are potential developed by reducing the dose of chemical fertilizer (C) because the decreased maize yield is not extreme. Nasa 29 variety is better than other varieties in reducing the dose of chemical fertilizer. AP soil has C-organic, P-Bray and base saturation better than subsoil alluvial even though both have the same texture as dusty clay.

The response of Nasa 29 varieties to differences in soil environment and fertilization treatment is the best compared to other varieties. Nasa 29, which was planted on AP soil and treated with FPB, produced 8.63 tons ha^{-1} of dried seed. Reduction of chemical fertilizer dosage up to 50% as in Fertilizer Package C (FPC) only slightly decrease yield compared to decreases of yields in Fertilizer Package A (FPA) and Fertilizer Package D (FPD). The yields of Nasa 29 due to the reduction in the dose of chemical fertilizer from FPB to FPC are higher than other varieties, but the yields will be worse if the fertilizer dose continues to be reduced to FPD.

Reduction in the use of fertilizer on maize yields has been reported by Hossard et al. (2016), ie the average mineral N use was reduced 36% for maize in low input compared to conventional. Maize yields in low input systems are no different from those in conventional systems, and are higher than yields in organic systems (ratio of yields of low inputs vs organic = 1.24). Low input reduces yield loss compared to organic systems. A low input system can significantly reduce the application of pesticides, without strongly reducing crop yields, relative to conventional systems.

High yields in AP soils show better soil fertility. The combination of alluvial with thin peat produces soil with better physical and chemical properties. Good environmental conditions cause the prolific character of Nasa 29 variety to emerge by 42%, ie out of every 100 plant, 42 plants have double ears. This is not seen in other types of soil.

The lowest yield of all varieties was obtained on alluvial substratum. This soil contains very high iron and is very hard during drought. Maize grown in this location grows stunted. The low productivity of the soil is related to the low soil organic matter, soil is hard and compact so it is difficult to be penetrated by water, and high acidity, so that fertilizers which are given a lot cannot be absorbed properly by plants. The use of high doses of fertilizer under conditions of soil carrying capacity is not appropriate, such as in alluvial soils which have a very clayy texture, similar to the case of over dosage which causes a decrease in growth. Singh et al. (2017), states that overdoses of chemical fertilizers in agriculture in order to maximize the crop productivity have caused agronomic, environmental, economic, and health threats because about 50–70% of applied conventional chemical fertilizers get lost in the environment due to leaching, runoff, emissions and volatilization in soil, water, and water.

The poor alluvial environmental conditions in this study occurred due to land clearing that was not environmentally friendly. According to Armanto et al. (2016), landuse types, showed many changes in physical, chemical and biological aspects, and many limiting factors for growing of food crops, especially for rice, maize and others. The limiting factors are the depths of ground water levels and soil acidity.

Variation response of varieties on peat soils appears when treated with fertilizer packages A, B, and C. But in package D all varieties give very low yields and are not significantly different between varieties. On average, all varieties give higher yields in peat soils than in alluvial soils. The average yield reduction ratio of varieties due to reduction in chemical fertilizer doses on peat + alluvial, subsoil alluvial, and peat soils are 0.66, 0.92, and 0.73, respectively.

The minimum fertilizer dose (FPD) does not help production in all types of soil. Biological fertilizer may only help to provide a limited amount of nutrients that are bound in the soil. Fertilizers FPB and FPC in alluvial soils do not significantly increase or decrease yields. Increasing the dose of Urea fertilizer from 150 kg to 300 kg and KCl from 50 to 100 kg, and TSP from 50 kg to 200 kg ha^{-1} cannot increase yields significantly. It seems that the carrying capacity of organic matter, lime, and biological fertilizers provided is not enough to spur the absorption of chemical fertilizers given. Heavy clay and highly acidic requires more lime and organic matter. In this case, the application of FPC is more beneficial to farmers than FPB.

High yields due to fertilizer packages B and C are related to the influence of both LLOF and burned ash. High doses of chemical fertilizers and ameliorants as in FPA, are not able to provide high yields on AP or Alluvial soils because they are not given LLOF and burn ash, except on peat soils. The yields of other hybrid varieties Bima 19 Uri fell 1.97 t ha^{-1} from 6.87 t ha^{-1} to 4.90 t ha^{-1} on AP soils if chemical fertilizer was reduced by 50%. LLOF mungkin mengandung bio-effector yang berinteraksi dengan bahan organic atau menambah aktivitas pupuk hayati yang diaplikasikan sebelumnya. LLOF may contain bio-effectors that interact with organic material or increase the activity of biological fertilizers that were previously applied. Thonar et al. (2017) said that the efficiency of bio-effectors (BE) to increase maize growth and nutrient uptake is very different according to soil types and fertilizer combinations. Promising results are obtained from the combination of BE with organic fertilizer such as compost manure, organic waste, and sewage sludge. This BE effect is largely due to an increase in root growth and P mobilization through accelerated mineralization.

Without the LLOF component and burned ash in FPA, the Sukmaraga and Bisma composite varieties can grow both in AP and peat soils. In substratum alluvial soils, plant growth and yields are highly depressed despite being given high doses of chemical fertilizer if without LLOF and burned ash. The Sukmaraga variety also does not give an extreme response to the decrease in the dose of chemical fertilizers. This variety still produces 5.1 t ha^{-1} of dried seeds in the FPC in AP soil.

In subsoil of alluvial soils, the role of LLOF and burn ash in FPB and FPC is quite positive (yield > 3 t ha^{-1} dry seeds) compared without LLOF and burn ash in FPA (yields 1.5 t ha^{-1} dry seed). In alluvial soils, crop yields drop dramatically without LLOF and burn ash, despite the use of high-dose chemical fertilizers. Very heavy alluvial soil texture is not enough just 2.5 t ha^{-1} of organic matter. The addition of 400 liters of LLOF ha^{-1} and 500 kg ha^{-1} of burn ash increased the yield significantly. But in high C-organic soil conditions (alluvial + peat and peat), the effect of LLOF and burn ash is not significant because the yield of the treatment FPA is higher than the FPC. In alluvial + peat and peat soils, increasing the dose chemical fertilizer is more important than LLOF and burn ash.

Organic fertilizer is very important as a buffer of the physical, chemical, and biological properties of the soil so that it can increase fertilizer efficiency and land productivity. Organic fertilizer can make clay become loose, spur the development of microorganisms in the soil that can produce growth hormones and CO_2 for photosynthesis. Cow manure plays an important role in adding nutrients and accelerating the availability of nutrients for plants. Cow manure can increase aeration and reduce soil density and add soil organic matter. Liquid organic fertilizer will increase the availability of nutrients in the soil, affecting the growth and development of plant roots (Miguel et al., 2018). For barren soils, the provision of organic material + inorganic fertilizer increases microbial biomass which is much higher compared to the treatment of inorganic fertilizer. In addition, the use of native plants combined with organic material is very good for improving soil biological properties (Basanta, 2017).

Soil has a function as a source of nutrients and as a matrix where the roots anchor and ground water are stored. Plant growth does not only depend on adequate and balanced supply of nutrients but must also be supported by good soil physical conditions that directly influence the development of roots, water and soil air, soil biology and chemistry. Soils that contain too much clay can store a lot of water, but water does not easily seep into the soil or cannot penetrate the pores of the soil so that water will flow on the surface of the soil, cause erosion, and is not available to plants. The clay fraction acts more chemically in the soil because it is colloidal or electrically charged. Clay has low porosity characteristics, 35% -40% clay content, less support for root development and disturbs root respiration so it is less productive (Hanafiah, 2005). Heavy clay soils are globally widespread but their poor drainage and poor aeration limits are used for agriculture (Obia et al., 2018).

Table 4. Maize yields on soil types, fertilizer packages, and varieties

Soil types	Fertilizer	Yields (t ha^{-1})	Average soil

packages		Varieties				type and fertilizer packages
		Nasa 29	Bima 19 Uri	Sukmaraga	Bisma	
Alluvial + Peat	A	3,2 c	6,0 b	7,9 a	6,0 b	5.8
	B	8,6 a	6,9 bc	7,6 b	6,3 c	7.4
	C	6,2 a	4,9 b	5,1 b	3,5 c	4.9
	D	2,8 a	1,9 a	2,9 a	2,2 a	2.5
Average		5.2	4.9	5.9	4.5	
Alluvial	A	1,8 a	1,5 a	1,2 a	1,5 a	1.50
	B	4,0 a	2,7 b	3,2 ab	3,4 ab	3.33
	C	3,4 a	3,1 a	2,9 a	2,9 a	3.08
	D	2,2 a	2,2 a	2,5 a	2,6 a	2.38
Average		2.9	2.4	2.5	2.6	
Peat	A	4,4 ab	3,6 b	3,8 b	4,8 a	4.15
	B	5,6 a	4,5 b	4,5 b	4,5 b	4.78
	C	4,3 a	3,4 ab	3,4 ab	2,9 b	3.50
	D	1,5 a	1,6 a	2,0 a	1,3 a	1.60
Average		4.0	3.3	3.4	3.4	
Average of variety		4.0	3.5	3.9	3.5	

Note: Numbers followed by the same lowercase letters on the line mean that they are not significantly different according to LSD 5%.

Table 5. Yield components for combination of fertilizer packages and varieties in alluvial + peat soils

Fertilizer packages	Varieties	Yields	Number of row/ear	No. seeds /row	Weight of 100 seeds	Plant height (cm)
A	Nasa 29	3,20	11,3	29,7	25,8	203,0
	Bima 19 Uri	6,00	14,0	32,3	28,0	199,0
	Sukmaraga	7,93	15,3	34,0	33,1	243,7
	Bisma	6,03	14,0	31,3	30,5	200,0
B	Nasa 29	8,63	14,7	37,7	35,1	220,7
	Bima 19 Uri	6,87	14,0	33,3	30,5	217,0
	Sukmaraga	7,57	14,7	34,7	32,5	258,7
	Bisma	6,33	13,3	33,0	29,4	197,7
C	Nasa 29	6,23	12,0	34,3	29,8	187,0
	Bima 19 Uri	4,90	12,7	28,3	28,1	177,0
	Sukmaraga	5,07	12,0	30,3	28,7	229,7
	Bisma	3,47	10,0	29,0	23,8	174,7
D	Nasa 29	2,80	8,0	25,0	22,3	169,0
	Bima 19 Uri	1,93	8,0	23,7	20,8	152,7
	Sukmaraga	2,87	8,0	31,0	24,7	191,3
	Bisma	2,17	8,7	24,1	21,3	155,3

The role of burn ash on clay has been reported by Anikwe (2000), namely that rice husk dust 4.5 t ha^{-1} is better at repairing heavy clay soils than the dose of 6.0 t ha-1 by improving water transmissivity and soil aeration and then soil productivity. The highest average seed yield and plant height of maize were obtained in plots amended with 4.5 t ha^{-1} rice dust. RHD increases yields through improving soil physical properties such as soil dry bulk density, total porosity, penetration resistance, and saturated hydraulic conductivity.

Soil bulk density decreased to 4.69% with the treatment of 60% chemical fertilizer + bio fertilizer compared to 60% chemical fertilizer + organic matter. The treatment of 60% CF + BF significantly increases total soil nitrogen, P-available, K-available, soil organic carbon, dissolved organic carbon. The resistant enzymatic activities of catalase, peroxidase, polyphenoloxidase, and fluorescein were detected by bio-fertilizer addition, antagonistic bacterial abundance, suppressed pathogens (Li et al., 2017).

Table 6. Yield components of a combination of fertilizer packages and varieties in alluvial soils

Fertilizer packages	Varieties	Yields	Number of row/ear	Number of seeds/row	Weight of 100 seeds	Plant height (cm)
A	Nasa 29	1,82	8,7	14,3	22,9	140,7
	Bima 19 Uri	1,52	8,0	14,0	22,5	120,3
	Sukmaraga	1,20	8,0	13,3	20,9	117,3
	Bisma	1,50	8,7	12,0	21,0	115,0
B	Nasa 29	4,07	12,0	26,3	25,9	150,0
	Bima 19 Uri	2,73	8,0	19,0	23,1	149,0
	Sukmaraga	3,18	8,7	20,0	22,7	174,7
	Bisma	3,42	10,7	16,0	26,4	119,3
C	Nasa 29	3,33	10,7	16,0	22,9	131,0
	Bima 19 Uri	3,13	10,0	14,0	22,6	136,3
	Sukmaraga	2,90	8,0	14,3	21,2	158,7
	Bisma	2,88	9,3	14,7	21,5	123,7
D	Nasa 29	2,25	8,7	13,3	20,5	99,7
	Bima 19 Uri	2,18	10,7	13,3	21,2	96,0
	Sukmaraga	2,45	11,3	16,0	23,6	119,3
	Bisma	2,62	11,3	16,0	24,7	105,0

Based on the Finlay-Wilkinson stability analysis, Nasa 29 and Bima 19 Uri have a regression coefficient close to 1 (bi = 1), indicating that the variety is stable or widely adapted in all environmental combinations of soil types and fertilizer treatments (Table 8). According to Eberhart and Russel (1966), a genotype is stable if it has regression coefficient (bi) of 1.0 and deviation of the regression coefficient equals zero. Genotypes with a regression coefficient significant less than 1.0 (bi <1) will adapt to either the suboptimal environment or not sensitive to environmental changes. Thus, if the input provided is not optimal due to limited capital availability, the yield of Nasa 29 and Bima 19 Uri do not extreme reduced. These varieties can be planted in suboptimal locations with low input.

Table 7. Yield components of a combination of fertilizer packages and varieties on peat soils

Fertilizer packages	Varieties	Yields	Number of row/ear	Number of seeds/row	Weight of 100 seeds	Plant height (cm)
A	Nasa 29	4,44	12,0	20,7	28,8	184,0
	Bima 19 Uri	3,62	12,7	16,7	30,5	178,0
	Sukmaraga	3,77	12,7	20,3	24,6	205,3
	Bisma	4,81	12,7	26,0	26,7	175,0
B	Nasa 29	5,62	13,3	24,3	29,0	182,0
	Bima 19 Uri	4,51	14,0	23,3	28,7	183,0

	Sukmaraga	4,50	12,7	26,0	29,1	206,7
	Bisma	4,47	13,3	26,3	27,7	186,3
C	Nasa 29	4,34	12,0	21,7	26,1	169,0
	Bima 19 Uri	3,43	12,0	23,7	26,8	163,0
	Sukmaraga	3,46	13,3	25,0	26,7	159,7
	Bisma	2,88	14,0	23,3	26,2	152,0
D	Nasa 29	1,53	10,7	15,0	20,3	109,0
	Bima 19 Uri	1,55	10,0	14,7	19,7	128,3
	Sukmaraga	1,97	10,0	14,7	21,5	144,7
	Bisma	1,35	10,0	15,3	19,4	103,7

Tabel 8. Finlay-Wilkinson Stability Analysis for YIELD

Genotype	Yield	b_i
Nasa 29	4.02	1.01
Bima 19 Uri	3.53	0.98
Sukmaraga	3.90	1.13
Bisma	3.49	0.88

The benefitable minimum treatment

In general, farmers expect high yields from farming, but weak economic conditions often lead to desires not being reached because they are unable to provide production facilities such as fertilizers and pesticides. According to Grassini et al. (2015), a maize crop that produces about 13 t ha^{-1} grain absorbs 200 kg of N. Relatively high amounts of resources must be absorbed by the crop to achieve high yields.

The results of this study indicate that the opportunity to reduce fertilizer doses depends on the type of soil to obtain yields that are low but still provide benefits for farmers. FPC and FPD were reviewed to consider the highest yield at a 50% chemical fertilizer dose. Variety Nasa 29 produced 6.23 t ha^{-1} of dried seeds in FPB, giving a profit of Rp 12,418,000 (Table 10).

Table 9. Yields of several varieties on fertilizer packages C and D in three soil types

Varieties	Alluvial		Alluvial + peat		Peat	
	FPC	FPD	FPC	FPD	FPC	FPD
Nasa 29	3.30	2.23	6.23	2.80	4.33	1.53
Bima 19 Uri	3.13	2.17	4.90	1.93	3.43	1.57
Sukmaraga	2.90	2.47	5.07	2.87	3.43	1.97
Bisma	2.90	2.63	3.47	2.17	2.87	1.30

Maize plants adapt widely to diverse environments, but not all locations can provide benefits in maize farming. Environmental differences require different investments in several stages of farming activities ranging from land preparation to harvest. Infertile land only produces 1.5 t ha^{-1} dry seeds. If it is associated with cost, then maize farming in an unfavourable location will cause a loss of Rp 3,848,000.

Maize farming in new opening tidal land is faced with environmental variations, therefore it is necessary to be careful in applying the technology package. Generalizing technology packages for each type of environment can cause harm.

The profit of using fertilizer does not only depend on the price and usefulness of fertilizer, but also on the efficiency of fertilizer use. According to Xu et al (2006), the response of maize yields to nitrogen indexes in various soil types and pH levels, shows that the marginal product of the nitrogen index is highest for groups of households that get fertilizer on time and use animal power or machinery for soil preparation . In addition, the interest rate on loans if farmers apply for loans to buy fertilizer, also affects the benefits of using fertilizer. No clear patterns are found in terms of nitrogen response rates being systematically higher (or lower) for a particular combination of agro-climatic zones, soil types and pH.

Table 10. Analysis of maize farming with fertilizer package C

No	Variable	Unit	Volume	Unit price (Rp)	Total (Rp)
A	**COSTS (C)**				**13.748.000**
1	Main and Supporting Materials				**6.508.000**
	Composite maize seeds	kg	15	14.000	210.000
	Organic fertilizer	kg	2500	1.000	2.500.000
	Dolomite Lime	kg	1000	1.000	1.000.000
	Urea	kg	150	5.300	795.000
	TSP	kg	50	6.000	300.000
	KCL	kg	50	6.000	300.000
	Gramoxone	l	5	75.000	375.000
	Saromyl	gr	30	1600	48.000
	Dithane	kg	2	100.000	200.000
	Selective herbicide	l	1	350.000	350.000
	Biofertilizer, biodecomposer	kg	4	40.000	160.000
	Prevaton 250 ml	botol	2	135.000	270.000
2	Labor Wages				6.240.000
	Soil tillage	OH	20	80.000	1.600.000
	Planting	OH	15	80.000	1.200.000
	Fertilization	OH	4	80.000	320.000
	Weeding	OH	9	80.000	720.000
	Maintenance (irrigation, pest control, supplementary fertilizers, seasonings, etc.)	OH	20	80.000	1.600.000
	Yield processing	OH	10	80.000	800.000
3	Fixed cost				1.000.000
B	**YIELDS**	Kg	6230	4200	**26.166.000**
C	**BENEFITS (B)**				**12.418.000**
D	**B/C**				**1,9**

Table 11. Analysis of maize farming with fertilizer package D

No	Variable	Unit	Volume	Unit price (Rp)	Total (Rp)
A	**COSTS (C)**				**10.148.000**

1	Main and Supporting Materials				**2.908.000**
	Composite maize seeds	Kg	15	14.000	210.000
	Dolomite Lime	Kg	500	1.000	500.000
	Urea	Kg	150	5.300	795.000
	Gramoxone	L	5	75.000	375.000
	Saromyl	Gr	30	1600	48.000
	Dithane	Kg	2	100.000	200.000
	Selective herbicide	L	1	350.000	350.000
	Bio-fertilizer, biodecomposer	Kg	4	40.000	160.000
	Prevaton 250 ml	botol	2	135.000	270.000
2	Labor Wages				**6.240.000**
	Soil tillage	OH	20	80.000	1.600.000
	Planting	OH	15	80.000	1.200.000
	Fertilization	OH	4	80.000	320.000
	Weeding	OH	9	80.000	720.000
	Maintenance (irrigation, pest control, supplementary fertilizers, seasonings, etc.)	OH	20	80.000	1.600.000
	Yield processing	OH	10	80.000	800.000
3	Fixed cost				**1.000.000**
B	**YIELDS**	kg	2870	4200	**12.054.000**
C	**BENEFITS (B)**				**1.906.000**
D	**B/C**				**1,18**

4. Conclusion

Reducing the dose of chemical fertilizer can be done to improve the ability of farmers to buy fertilizer depending on the type of soil and the availability of LLOF and grilled ash. Mixture of peat and alluvial is good soil for maize growth if combined with fertilizer package B. Decrease in chemical fertilizer 50% (package C) causes yields to fall to 6.23 t ha^{-1} and farmers get a profit of Rp 12,418,000 per planting season.

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Study on Application of Jarwo Super Rice Technology Package in Gorontalo Indonesia

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Abstract.

The aims of the study are: 1) to determine the level of rice productivity with the application of *jarwo* super technology, 2) to determine the farmers' perceptions of the *jarwo* super rice technology innovation, and 3) financially analyze rice farming with the application of the *jarwo* super technology package in Gorontalo. The study was conducted in Gorontalo Regency, Gorontalo Province. The total area of the applied study demonstration was 15 hectares by involving 15 cooperative farmers. The study was conducted from March to July 2018. The assessment method was to compare the introduction of technology from IAARD with farmer's technology. The varieties of rice planted were Inpari 30, Inpari 31, Inpari 40, Cigeulis, Mekongga, and IR 64. The results of the study revealed that the average rice productivity with the application of *jarwo* super package was 6.49 tons / ha, higher than the rice productivity with farmer's technology (3.53 tons / ha), so that the application of the *jarwo* super rice technology package can increase rice productivity by 84 percent. The average farmers' perception of *jarwo* super rice technology innovation showed that *jarwo* super technology increases production, income, was easy to implement, and farmers are interested in implementing it again. The results of the financial analysis of farming showed that rice farming with the application of *jarwo* super technology package was able to increase the revenue, profits, and R / C ratio compared to existing rice farming system.

Keywords: applied study, *jarwo* super, rice

1. Introduction

Rice is one of the strategic food crop commodities in Indonesia. The Government through the Ministry of Agriculture continues to increase rice production and productivity in order to meet the increasing domestic needs in line with an increase in population. National rice production and productivity during the last 5 years (2014-2018) has increased every year. The trend of rice production from 2012 to 2017 increased by 70.8 million tons in 2014 and 81.38 million tons in 2018 (Ministry of Agriculture, 2019).

In terms of the level of rice consumption, the trend always follows population growth every year. Indonesia's population in 2018 reached 265 million people or increased by 26.4 million compared to 2010's population of 238.5 million, with a population growth rate of 1.33 percent per year (BPS-Statistics Indonesia, 2019). Calculated from the level of rice consumption per capita, Indonesia's rice consumption in 2017 is 114.6 kg per capita per year. With the population and per capita consumption level, the total rice consumption in 2017 will reach 33.47 million tons. When comparing with the national rice production, which is the rice production in 2017 reached 47.29 million tons, a rice surplus has been achieved (Ministry of Agriculture, 2019).

In order to maintain national rice production so that it can continue to meet domestic and export needs, the Ministry of Agriculture continues to make special efforts to increase national rice production and productivity. The strategy of increasing national rice production by the government is through increased productivity (intensification) and expansion of planting areas, both through increasing the Planting Index (IP) and expanding rice fields (IAARD, 2016). An aspect of concern in increasing rice production is the improvement of efficiency and environmental preservation because it is related to production competitiveness. One of the efforts made in increasing the productivity (intensification) of rice is through the application of cultivation technology. Indonesian Agency for Agricultural Research and Development (IAARD) as a producer of technological innovation, in 2016 has launched an environmentally friendly rice cultivation technology package namely Technology Jajar Legowo (*Jarwo*) Super.

Jarwo super rice technology is an integrated rice cultivation technology based on Jajar Legowo (*jarwo*) planting method (IAARD, 2016). In its implementation in the field, *Jarwo* Super rice technology uses: (1) quality seeds of new high-yielding varieties with high yield potential, (2) biodecomposers during soil processing, (3) biological fertilizers as seed treatment and balanced fertilization, (4) control techniques integrated crop pests, and (5) agricultural machinery especially for planting and harvesting. The application of integrated technology components is expected to increase the efficiency of rice farming production. The superiority of *jarwo* cultivation is in addition to increasing plant population, it is also able to increase the smooth circulation of sunlight and air around the side plants so that plants can photosynthesize better (Husnain et al., 2016).

Jarwo super technology has been tested on farmers' land in Indramayu Regency covering an area of 50 ha. The varieties planted were Inpari 30, Inpari 32 and Inpari 33, yields above 10 tons per ha of milled dry grain compared to Ciherang varieties on farmers' land outside the research area only produce 6 tons per ha milled dry grain (IAARD, 2016). Haryati and Liferdi (2017) revealed that the application of jajar legowo super technology with Inpari 30 rice variety achieved productivity of 7.60 tons / ha with an increase of 15% compared to the way of farmers. With the *jarwo* planting system, the plant population increases by around 20-25 percent compared to the usual planting system (tile plot). This system can in principle increase population by regulating spacing (Wacim and Dani, 2016). The application of jajar legowo planting system provides air circulation, light intake, water flow and absorption of nutrients more evenly so that it affects plant growth (Azwir, 2007). This is because plant spacing is one way to create an environment and nutrients can be available equally for each plant (Kurniawan et al., 2016).

In 2017, the Ministry of Agriculture initiated to develop and expand the application of *jarwo* super rice technology package. Therefore, in 2018 Gorontalo AIAT continues to disseminate and implement rice cultivation with the *jarwo* super system in Gorontalo. To develop and find out more in depth the results, an application of *jarwo* super rice technology was carried out in Gorontalo Regency, Gorontalo Province.

The aims of this study were: 1) to determine the level of productivity of lowland rice by applying *jarwo* super technology package, 2) to determine farmers' perceptions of *jarwo* super rice technology innovation, and 3) analyze financially of rice farming by applying *jarwo* super technology package in Gorontalo Regency, Province Gorontalo.

2. Research Methods

2.1. Location and Time of Study

The application of *jarwo* super rice technology package was conducted on the Kawa 1 Farmers Group in Hutabohu Village, West Limboto District, Gorontalo Regency. West Limboto District is one of the centers of rice production in Gorontalo Regency. The demfarm covers an area of 15 hectares involving 15 cooperative farmers. This applied study was conducted from March to July 2018.

2.2. Research methods

The applied assessment method was carried out by comparing the technology from the Indonesian Agency for Agricultural Research and Development (IAARD) with existing technology practiced by farmers. The technology applied in the Kawa 1 Farmers Group, Hutabohu Village, West Limboto District, Gorontalo Regency, were:

2.2.1. Jajar legowo (*jarwo*) super technology package.

The technological components applied were new superior varieties of lowland rice (Inpari 30, Inpari 31, Inpari 40, Cigeulis), biodecomposer application (M-Dec), biological fertilizer (Agrimeth), jajar legowo 2:1 planting system, balanced fertilization, pest control using bioprotectors and pheromone rice pellers, liquid organic fertilizer bioslurry, use of indo jarwo transplanter planting machines and combine harvester harvesting machines.

2.2.2. Application of environmentally friendly rice technology (organic jarwo super), without the use of chemical fertilizers and chemical drugs.

The technology components applied were IR 64 wet rice varieties, jarwo planting system 2:1, liquid biofertilizer 1 lt/ha, solid biofertilizer at a dose of 50 kg/ha, M-Dec biodecomposer at a dose of 2.5 kg/ha, as much as manure 2 tons/ha, liquid bioslurry organic fertilizer as much as 10 liters/ha, local microorganisms 2 liters/ha, bioprotector vegetable pesticides, use of indo jarwo transplanter and combine harvester machine.

A list of the application of the jarwo super technology package at the applied study location of Hutabohu Village, West Limboto District, Gorontalo Regency is presented in Table 1.

Table 1: Application of Jarwo Super technology package in Hutabohu Village, West Limboto District, Gorontalo Regency

Technology Components	Introductory Technology Package		Existing Farmer Technology
	Inorganic *Jarwo* Super	Organic *Jarwo* Super	
Rice Varieties	Inpari 30, Inpari 31, Inpari 40, Cigeulis	IR 64	Mekongga
Seed Treatment	Biological fertilizer application (*Agrimeth,*	Liquid Biofertilizer 1 lt/ha	-

Technology Components	Introductory Technology Package		Existing Farmer Technology
	Inorganic *Jarwo* Super	Organic *Jarwo* Super	
	Potensida)		
	-	Solid Biofertilizers 50 kg/ha	-
Tillage	Biodecomposer application (M-Dec), dose of 2.5 kg/ha	Biodecomposer M-dec 2.5 kg/ha	-
Planting system	Jajar legowo 2 : 1 (50 x 25 x 12.5 cm)	Jajar legowo 2 : 1 (50 x 25 x 12.5 cm)	Tile planting system
Fertilization	Dose I (Urea: 100 kg / ha and NPK Phonska 200 kg / ha) Dose II (Urea: 200 kg / ha and NPK Phonska 300 kg / ha)	-	Urea: 150 kg/ha and NPK Phonska 250 kg/ha
	Liquid Organic Fertilizer Bioslurry with a dose of 10 liters / ha	Liquid Organic Fertilizer Bioslurry with a dose of 10 liters / ha	-
	-	Local micro organisms 2 lt / ha	-
	Application of manure 1 ton / ha, and non-manure	manure 2 ton / ha	-
Plant Pests and Diseases Control	Bioprotector application 2 lt / ha,	Bioprotector application 2 lt / ha,	Pesticide
Harvest	Transplanter Planting Machine and Combine Harvester Machine	Transplanter Planting Machine and Combine Harvester Machine	Manual planting dan harvesting

In its application in the field, the jarwo super technology package was divided into five technology packages namely *Jarwo* Super Package I (with Inpari 40 rice varieties), *Jarwo* Super Package II (with Inpari 31 rice varieties), *Jarwo* Super Package III (with Inpari 30 rice varieties), *Jarwo* Super Paket IV (with Cigeulis rice varieties), and *Jarwo* Super Package V (Full Organic *Jarwo* Super with IR 64 rice varieties). As a comparison was farmer technology using the Mekongga variety. The *jarwo* super technology package treatment applied at the study area in Hutabohu Village, West Limboto District, Gorontalo Regency were explained in Table 2.

Table 2: Application of jarwo super technology package in the Kawa 1 farmer group, Hutabohu Village, West Limboto District, Gorontalo Regency

No	Technology Package Name	Technology Components	Land Area (ha)
1	*Jarwo* Super Package I	Inpari 40, Biofertilizer, Biodecomposer (M-dec) 2.5 kg / ha, Bioprotector, Jajar Legowo Planting System 2: 1, Fertilization (Urea: 100 kg / ha and NPK Phonska 200 kg / ha), Manure 1 ton / ha , Bioslurry Organic Fertilizer 10 lt / ha, *Jarwo* transplanter planting machine and Combine Harvester harvesting machine	2
2	*Jarwo* Super Package II	Inpari 31, Biofertilizer, Biodecomposer (M-dec) 2.5 kg / ha, Bioprotector, Jajar Legowo Planting System 2: 1, Fertilization (Urea: 200 kg / ha and NPK Phonska 300 kg / ha), Bioslurry Organic Fertilizer 10 lt / ha, *Jarwo* transplanter planting machine and Combine Harvester harvesting machine	3
3	*Jarwo* Super	Inpari 30, Biofertilizer, Biodecomposer (M-dec) 2.5 kg /	3

No	Technology Package Name	Technology Components	Land Area (ha)
	Package III	ha, Bioprotector, Jajar Legowo Planting System 2: 1, Fertilization (Urea: 200 kg / ha and NPK Phonska 300 kg / ha), Bioslurry Organic Fertilizer 10 lt / ha, *Jarwo* transplanter planting machine and Combine Harvester harvesting machine	
4	*Jarwo* Super Package IV	Cigeulis, Biofertilizer, Biodecomposer (M-dec) 2.5 kg / ha, Bioprotector, Jajar Legowo Planting System 2: 1, Fertilization (Urea: 200 kg / ha and NPK Phonska 300 kg / ha), Bioslurry Organic Fertilizer 10 lt / ha, *Jarwo* transplanter planting machine and Combine Harvester harvesting machine	3
5	*Jarwo* Super Package V (Full Organic)	IR 64 rice varieties, Liquid Biofertilizer 1 lt / ha, Solid Biofertilizer 50 kg / ha, Biodecomposer (M-dec) 2.5 kg / ha, Bioprotector 2 lt / ha, Jajar Legowo Planting System 2: 1, Manure 2 tons / ha, Bioslurry Organic Fertilizer 10 lt / ha, Local Micro Organisms 2 lt / ha, Transplant Planting Machine and Combine Harvester Harvesting Machine	2
6	Comparator (Farmer technology)	Mekongga Rice Varieties, Tile Planting System, Fertilization (Urea: 100 kg / ha and NPK Phonska 250 kg / ha), Chemical Pesticides, Planting and Manual Harvesting	2
		Total	15

2.3. Types and data collection procedures

The types of data collected in this activity were agronomic data, including production and productivity data; socioeconomic data, including data on input and output of production, input price and output of production, and data on farmers' perceptions of technological innovations introduced. Production data is the real harvest collected through direct field records. Data on farmers' perceptions of technological innovations were collected through structured questionnaires that were prepared before and interviews with respondent farmers. The number of respondent farmers were 15 people’s who are cooperating farmers and were directly involved in the activities of *jarwo* super rice technology in the field.

2.4. Data analysis

For production analysis, yield data that had been collected were tabulated and analyzed descriptively. To find out farmers' perceptions, the data collected by questionnaire was tabulated using the percentage method of each statement given. For financial analysis of farming is done using descriptive methods, the data obtained are analyzed by tabulation which includes the structure of costs, revenues, and profits of farming. The results of the analysis of revenues and costs can also show the benefits of a farm through the calculation of R / C ratio. Analysis of the balance of revenue and costs (R / C ratio) is used to see the benefits of farming from the amount of revenue received by farmers for each rupiah that has been spent on farming. Farming is indicated as efficient if the R / C ratio value is greater than one. The greater the value of R / C ratio, it shows the more efficient farming activities.

3. Result and Discussion

3.1. Performance of the *jarwo* super rice technology application

In this research, the application of inorganic super *jarwo* technology used superior varieties of rice produced by the IAARD, namely Inpari 40, Inpari 31, Inpari 30, and Cigeulis. For the application of super organic *jarwo* technology, without the application of chemical fertilizers and pesticides, using the IR 64. As a comparison with farmer's technology, Mekongga rice varieties were used. The performance of the application of super *jarwo* rice technology can be seen in Table 3.

Table 3: Performance of the application of jarwo super rice technology in Hutabohu Village, West Limboto District, Gorontalo Regency

No	Technology Package Name	Productivity (Ton / Ha)
1	*Jarwo* Super Package I (Inpari 40 rice varieties)	8.19
2	*Jarwo* Super Package II (Inpari 31 rice varieties)	4.41
3	*Jarwo* Super Package III (Inpari 30 rice varieties)	7.73
4	*Jarwo* Super Package IV (Cigeulis rice varieties)	6.05
5	*Jarwo* Super Package V (Full Organic IR 64 rice varieties)	6.09
6	Comparator / Existing Farmer Technology (Mekongga Rice Variety)	3.52

Source: Primary data in 2018

From the yields it was known, that *jarwo* super package I with Inpari 40 rice variety results the highest rice productivity in the amount of 8.19 tons / ha of harvested dry grain. The second level was jarwo super package III, with Inpari 30 variety, resulting in productivity of 7.73 tons / ha. The third was achieved by *jarwo* super package V (organic *jarwo* super with IR 64 varieties) which reached productivity of 6.09 tons / ha. The fourth was *jarwo* super package IV with productivity of 6.05 tons / ha. The lowest productivity was achieved by the *jarwo* super package II, the Inpari 31 rice variety, with a productivity of 4.41 tons / ha.

Super *jarwo* technology package I applied all components of the *jarwo* super rice planting technology to a new superior variety of Inpari 40 with the use of manure 1 ton/ha. The development of rice plants with the application of the *jarwo* super package I technology package had been very good since the beginning of plant growth, shown by the resilience of the Inpari 40 variety, compared to other rice plants that got relatively many rice stem borer attacks. The results of interviews in the field also showed that the Inpari 40 rice variety, were most preferred by farmers. It was seen from the growth from the beginning to the harvest which was quite good and relatively resistant to pests and plant diseases. Rice varieties that also have quite good growth with the application of the *jarwo* super rice technology package was Inpari 30. This variety is a new superior rice variety which is a derivative of a variety that is widely developed and preferred by farmers, namely the Ciherang variety. Sutaryo (2015) showed that the number of productive tillers of Inpari 30 was quite large (20.50 sticks). The low yields of the application of *jarwo* super technology package II, namely the Inpari 31 variety, was due to the attack of rice stem borer pests with very high intensity from initial growth to harvest.

The application of the full organic *jarwo* super rice technology package (package V) results in excellent productivity reaching 6.05 tons / ha. In the application of this technology package, no chemicals were applied, fertilizers and pesticides were not applied. The variety used for the application of this package is IR 64 variety. This variety was used based on previous farmers' experience that IR 64 rice was very suitable as organic rice because it has good taste and preferred by consumers. Other technological components applied are liquid biological fertilizer at a dose of 1 lt / ha, solid biological fertilizer at a dose of 50 kg / ha, use of biodecomposers (M-Dec) at a dose of 2.5 kg / ha, use of biopesticides "bioprotector" at a dose of 2 lt / ha, *jarwo* row system 2: 1 , liquid organic fertilizer "bioslurry" at a dose of 10 lt / ha, use of local micro-organisms at a dose of 2 lt / ha, use of the *jarwo* transplanter planting machine and combine harvester machine. In addition, *jarwo* super package V is also applied to mature manure at a dose of 2 tons / ha.

The average rice productivity with the application of the *jarwo* super technology package in Hutabohu Village, West Limboto District, Gorontalo Regency is 6.49 tons / ha. This result was higher when compared to the application of rice farming with existing technology by the farmers with Mekongga varieties which was 3.53 tons / ha. If you see the results achieved, the average yield of the application of the *jarwo* super technology package at this location still had not reached the expected yield potential because in that season the intensity of rice stem borer attack was very high. Rice stem borer attacks in most areas in the West Limboto District that cause the average production to be very low.

In addition to the use of high yielding varieties, the characteristics of the application of the *jarwo* super technology package are the application of environmentally friendly rice cultivation technology components such as the use of biological fertilizers, biodecomposers, and biopesticides. The application of this technology reduces chemicals and uses more organic matter which increases soil microbes that are beneficial in improving soil structure, increasing soil fertility and beneficial for plants. According to Suriadikarta and Simanungkalit (2010), the availability of organic matter in the soil can prevent micro nutrient deficiency, increase cation exchange capacity (CEC), and can form complex compounds with metal ions that poison plants such as Al, Fe, and Mn.

The planting system used in the application of super *jarwo* technology package was the 2:1 *jarwo* row system, because it was planted using a 2:1 *jarwo* transplanter planting machine. The *jarwo* row system 2:1 increases the population of rice plants. Ikhwani (2013) stated that the jajar legowo planting system had more clumps per unit area compared to the tiled planting method. Besides that, with the *jarwo* system, there are empty rows every two rows of plants, so that all rows of rice plants become edge crops, which tend to have the potential to produce high productivity because sunlight is more optimal and air circulation is better because of the empty space between rows of rice plants. The more plants absorbing sunlight will accelerate the process of photosynthesis, as well as the formation of photosynthates so that the filling of grain will be optimal (Supriyanto et al., 2010). According to Wang et al. (2013) peripheral effects had an influence on higher biomass production, more panicles per unit area and higher percentages of filled grain. Side effects from the legowo method provide plants the ability to photosynthesize better (Mohaddesi et al., 2011).

The use of agricultural machinery and tools, namely the *jarwo* transplanter planting machine and the combine harvester harvesting machine, can increase the efficiency of rice production. The use of tools and machines can improve time and cost efficiency of rice production. With a combine harvester harvesting machine, it is able to reduce the loss of rice yields, and is more efficient because the crops are broken down and packed immediately. All components of this rice cultivation technology must be managed in an integrated manner. The use of superior varieties, balanced fertilization, pest control, and integrated use of agricultural tools and machinery will enhance the *jarwo*-based rice cultivation (Husnain et al., 2016).

3.2. Farmers' perception of the *jarwo* super technology package

In the study of the application of agricultural innovation, a measurement of farmers' perceptions of technological innovation in *jarwo* super rice was carried out. The number of 15 cooperating farmers involved in the application of the *jarwo* super rice technology package. The results of the analysis of farmers' perceptions of the *jarwo* super rice technology innovation in Hutabohu Village, West Limboto District, Gorontalo Regency can be seen in Table 4.

From Table 4, it can be seen the farmers' perceptions of *jarwo* super rice technology innovation from several statements about the technology components applied. Most farmers (80 percent) agreed and strongly agreed that the application of *jarwo* super rice technology could increase rice yield/production. This was also evidenced by the average yield of rice with the application of *jarwo* super rice technology was higher than the existing technology of farmers. Furthermore, farmers stated that *jarwo* super technology increased farmers' income (> 85 percent). The results are in line with research by Asaad et al. (2017) which revealed that farmers' perceptions of *jarwo* technology mostly agree because it was proven that *jarwo* technology provides higher income compared to the planting system that was commonly practiced by farmers.

From the level of ease of application, farmers stated that the components of the *jarwo* super technology package were easy to understand, and easy to apply at the field (> 65 percent), because farmers were experienced in rice farming and were accustomed to the application of rice cultivation technology components. From this experience, farmers (100 percent) expressed interest in re-implementing the *jarwo* super technology package. The results of this study were consistent with the research of Hutapea et al. (2017).

The main problem in the application of the *jarwo* super technology package is the relative unavailability of production facilities from the *jarwo* super technology components such as biodecomposers, biological fertilizers and biopesticides produced by the IAARD in the farm shop in Gorontalo Province. To get this technology component, farmers must place an order in the Research Center, so it is inefficient in terms of time. To overcome this, it can be advisable to use *jarwo* super components such as biological fertilizers, biodecomposers and biopesticides produced by private industry that are available at farm shops. For the application of this component, most farmers stated that it was easy to apply in the field.

Table 4: Farmers' perceptions of jarwo super rice technology innovation in Hutabohu Village, West Limboto District, Gorontalo Regency

No	Statement	Perception (%)					
		Strongly agree	Agree	Doubtful	Agree Less	Disagree	Total
1	The application of *jarwo* super technology increases rice yield / production	46.67	33.33	20.00	0.00	0.00	100
2	The application of *jarwo* super technology increases farmers' income	53.33	33.33	13.33	0.00	0.00	100

3	*Jarwo* super technology package is easily implemented by farmers	46.67	20.00	26.67	6.67	0.00	100
4	The application of *jarwo* super technology package is beneficial for farmers	46.67	46.67	6.67	0.00	0.00	100
5	*Jarwo* super technology is easily understood by farmers	40.00	33.33	20.00	0.00	6.67	100
6	Farmers are interested in applying *jarwo* super technology again	40.00	60.00	0.00	0.00	0.00	100
7	The use of biological fertilizer (agrimeth) in *jarwo* super technology is easy to apply	40.00	60.00	0.00	0.00	0.00	100

To develop the application of the *jarwo* super package, it is very necessary to provide technological assistance, especially in the application of the planting machine *jarwo* transplanter in terms of preparation of rice seedbed using “dapog” / seedling box. Many farmers in Gorontalo still do not have guidance and know how to develop rice seedlings using “dapog” and the implementation of a *jarwo* transplanter planting mechine. Hutapea et al. (2017) revealed that the knowledge needs to be improved is planting with a 2: 1 *jarwo* system using transplanter machine, “dapog” seedling system, balanced fertilization, control of mice with trap plants and the use of plastic fences.

Financial analysis of farming

The results of the financial analysis of rice farming using the *jarwo* super technology package in Hutabohu Village, West Limboto District, Gorontalo Regency is shown in Table 5. It can be seen that the average rice farming revenue by applying the *jarwo* super technology package was 37,382,400 IDR per ha, higher than the acceptance of rice farming with existing farmer technology, which was 20,332,800 IDR per ha. The assumption of the price of rice used in the analysis of rice farming in this study is to use the price of rice in effect at the time of the study in Gorontalo, which was 9,000 IDR. The total cost of rice farming with the application of the *jarwo* super technology package was 9,364,000 IDR per ha, higher than the total cost of existing rice farming, which was 7,977,000 IDR/ha. These results indicate that the application of the *jarwo* super technology package increases production costs than usual, due to the addition of technology applications.

Table 5: Financial analysis of rice farming by applying the Jarwo Super technology package in Hutabohu Village, West Limboto District, Gorontalo Regency

Description	***Jarwo* Super Rice Technology**		**Existing farmer technology**	
	Value (Rp./Ha)	**%**	**Value (Rp./Ha)**	**%**
Rice Production	4,154		2,259	
Price of rice per kg	9,000		9,000	
Revenue	37,382,400		20,332,800	
Cash cost :				
Land	17,000	0.18	17,000	0.21
Seed	400,000	4.27	400,000	5.01
Biodecomposer	70,000	0.24	-	0.00
Organic fertilizer	82,000	0.29	-	0.00

Urea fertilizer	360,000	3.84	180,000	2.26
ZA fertilizer	-	0.00	-	0.00
Phonska Fertilizer	575,000	6.14	460,000	5.77
Organic fertilizer	500,000	5.34	-	0.00
Vegetable Pesticides	440,000	4.70	-	0.00
Herbicide	650,000	6.94	650,000	8.15
Outside Family Labor	4,525,000	48.32	4,525,000	56.73
Cost is calculated:				
Family Labor	1,721,000	18.38	1,721,000	21.57
Shrinkage of Equipment	24,000	0.26	24,000	0.30
Total Cash Costs	7,619,000	81.36	6,232,000	78.12
Total cost	9,364,000	100.00	7,977,000	100.00
Advantages of Cash Costs	29,763,400		14,100,800	
Advantages of Total Costs	28,018,400		12,355,800	
R / C Over Cash Costs	4.91		3.26	
R / C Over Total Cost	3.99		2.55	

The results of other studies, Abidin et al. (2013), revealed that the application of legowo technology requires an additional cost of around 150,000 – 200,000 IDR per ha. However, the results of the analysis showed that the application of the *jarwo* super technology package was able to increase the profitability of rice farming. The advantage of rice farming with *jarwo* super application was 28,018,400 IDR/ ha, far higher compared to the benefits of rice farming with existing technology, which was 12,355,800 IDR / ha. That was because the application of the *jarwo* super technology package can increase rice productivity. The application of the *jarwo* super rice technology produces an R / C Ratio of 3.99, higher when compared to the existing rice farming which produces an R / C Ratio of 2.55. These results were consistent with the research of Hutapea et al. (2017), which revealed that rice cultivation with *jarwo* super was more efficient with an R / C Ratio of 2.29 while those who do not apply produce an R / C Ratio of 2.19.

4. Conclusion and Suggestion

4.1. Conclusion

1. Rice productivity with the application of the *jarwo* super technology package from highest to lowest respectively was the *jarwo* super package I Inpari 40 (8.19 tons/ha), *jarwo* super package III Inpari 30 (7.73 tons / ha), *jarwo* super package V IR 64 (6.09 tons/ha), *jarwo* super package IV Cigeulis (6.05 tons/ha), and *jarwo* super package II Inpari 31 (4.41 tons/ha) . The average rice productivity with the application of the *jarwo* super package of 6.49 tons/ha, was higher than the productivity of rice with existing farmers technology (3.53 tons/ha), so that the application of the *jarwo* super rice technology package can increase rice productivity by 84 percent from existing technology the farmer.
2. The average perception of farmers on *jarwo* super rice technology innovation shows that the *jarwo* super technology package increases rice production, increases farmers' income, is easy to implement, and farmers are interested in implementing it again.

3. The results of the financial analysis of farming showed that rice farming with the application of the *jarwo* super technology package was able to increase the revenue, profits, and R/C ratio of rice farming compared to existing rice farming system.

4.2. Suggestion

It is necessary to provide and develop production facilities from the technological components of the Indonesian Agency for Agricultural Research and Development (IAARD) such as biodecomposers, bio-fertilizers and biopesticides to be available at farm shops or production input distributors so that farmers can easily obtain when needed or will implement this component.

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Selection of 30 Potato (*Solanum tuberosum* L.) Clones Potential For Chips and French Fries Industry

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Abstract.

The existence of local varieties of potatoes for the processed industry in Indonesia is very necessary, most of the raw materials for the potato chip industry are still imported. Even for French fries, one hundred percent of its material is still imported. Selection of 30 potato clones was conducted at the Margahayu Experimental Field (1250 m asl), in Lembang from January to May 2016. It used a completely randomized block design with 3 (three) replications which every plot consisted of 10 plants. The evaluated characters included plant vigor, plant height (cm), stem diameter (mm), tuber weight (g), percentage of consumption tuber (%), yield (ton/ha), specific gravity (Sg), tuber shape, tuber skin color, tuber flesh color and appearance of tuber skin. Analysis of variance showed that all quantitative characters were very significantly different (P <0.01). Clone 15.33 showed the highest tuber yield per plant (831 grams/plant) which was significantly different from the comparable variety of Atlantic (166 grams/plant). The highest percentage of consumption tubers was obtained from clones 15.26 (75.3%) which were significantly higher than comparable varieties (Amabile, Granola, Medians and Atlantic). The result suggested that 2 (two) clones e.g. 15.33 and 15.23 with specific gravity (Sg) higher than 1.067 are potential to be used for industrial potato chips.

Keywords: potatoes, industrial raw materials, chips, french fries

1. Introduction

Potato is the world's leading for non-grain food commodity, the fourth most important food crop after wheat, maize, and rice (Devaux *et al*., 2014). There are 4 types of potato varieties based on their purpose e.g. table potato, food processing, starch production and other purposes including colorful potatoes (Mori *et al*., 2015). As world lifestyle changes with fast food become a trend, there is an increasing demand for french fry and chip potato production. Nowadays, more than 50% of potato yield (e.g. in the USA and Europe) is driven to food industries (Tesfaye *et al*., 2010; Melito *et al*. 2017). On the other hand, there is still scarceness of suitable raw materials available for processing industry (Ghulam *et al.* 2012). Most of developing country is still importing raw materials for potato crisp and french fries from USA, Germany, Canada and Australia (Wustman *et al.*, 2010), even in Indonesia 100% raw materials for french fries are still imported.

Indonesia Agency for Agricultural Research and Development (IAARD) has released about 30 potato varieties. However, not every potato varieties suitable for processing e.g. French fries or fried chips because several tuber quality characters must be met with industrial standards (Amjad *et al.* 2016; Gautam *et al.* 2016). Therefore, tuber characters such as specific gravity, tuber shape, and color which are important for and related with processing quality potato (Abong *et al.* 2010; Zaman *et al.* 2016) have been included into potato breeding programs recently. Considering market (consumer) and industrial demand, potato breeders, thus, are expected to *first*, produce not only high yielding but also high quality and nutritious varieties (Arslan, 2007; Sands *et al.* 2009), *second*, target both the external quality and internal quality of tuber (Kumari *et al*. 2018; Khalid *et al*. 2019).

The external quality of tuber includes skin color, tuber size, and shape, eye depth (Jansky, 2009) whereas characters such as specific sugar quality, dry matter content are part of internal quality (Storey, 2007). Considering processing standard and market demands, long-oval tuber potatoes are suitable for French fries, meanwhile chipping industries prefer round (spherical) tubers (Kabira and Lemaga, 2006; Abong *et al*. 2010; Ekin 2011).

Selection on given variable genotypes/clones is one of the fundamental steps of plant breeding programs (Carputo *et al.* 2005). This research was aimed to select 30 potato clones collected from our previous breeding programs considering the value of specific gravity and tuber shape for industrial processing potatoes.

2. Methods

The selection was conducted at Margahayu KP, Lembang, West Java, Indonesia. The testing period was from January to May 2016. It used a Complete Randomized Block Design with 3 replications and the number of clones tested was 30 clones. The plant population per plot consists of 10 plants. Manure were used as much as 15 tons of chicken manure/ha, for artificial fertilizers the dose used 1000 kg of NPK Mutiara 16:16:16 was given twice, at the time of planting and when the plants were 3 weeks old. Fertilizer application is done at the age of 3 weeks and 6 weeks after planting.

Plant vigor is measured using a score (1=very bad; 9=very vigor), which is done at the age of 60 and 70 days after planting. Vigor plant is a plant architecture that includes plant height, leaf canopy width, leaf blade size and stem size.

Plant height is measured by measuring the stem of the plant from the base of the stem to the highest plant part. Observations were made when the plants were 70 days after planting. The number and weight of tuber yields per plant are observed from 10 random sample plants. Potential yields per hectare was predicted by using following calculation = (tuber weight per plot / plot area) x 100%

The yield of consumption tubers is calculated by separating the tubers by size (> 60 g). Tubers measuring> 60 g per total tuber yield multiplied by 100%. Specific gravity (Sg) is calculated by weighing the tubers of the harvest in water and air :

Sg = tuber weight in the air/(tuber weight in the air - tuber weight in the water).

Data were computed using PKBTSTAT software program and followed Tukey's LSD with 5% significance level.

3. Results

Some of previous studies showed that plant height along with tuber/plant, main stem/plant had positive effect and high direct on tuber weight/plant and tuber yield (Yildrim *et al*. 1997; Islam *et al*. 2002; Arslan 2007). Thus, selection for processing qualified potato clones must also include their basic agronomic characters such as plant height, vigor, stem diameter, etc. There were 5 (five) IAARD released varieties e.g. Amabile, Atlantic, Granola, Medians and Tenggo used as comparison varieties in our selection for processing potatoes.

Table 1. Vegetative data of 30 evaluated potato clones

No.	Clone	Plant Height (cm)	Stem Diameter (cm)	Plant Vigor	No.	Clone	Plant Height (cm)	Stem Diameter (cm)	Plant Vigor
1	18.10	99.00^{bcde}	1.16^{ab}	7.6^{abc}	16	18.21	108.25^{abc}	1.12^{ab}	9.0^{a}
2	16.10	109.08^{abc}	0.80^{c}	4.6^{de}	17	20.20	99.25^{bcde}	1.00^{abc}	5.7^{cde}
3	19.11	88.92^{bcde}	1.03^{abc}	6.3^{de}	18	18.19	96.08^{bcde}	1.19^{ab}	7.7^{abc}
4	15.22	82.17^{cde}	1.13^{ab}	7.0^{abcd}	19	20.70	97.83^{bcde}	1.13^{ab}	9.0^{a}
5	19.8	91.17^{bcde}	0.93^{bc}	7.7^{abc}	20	18.A	106.83^{bcd}	1.16^{ab}	5.7^{cde}
6	15.29	106.00^{bcd}	1.01^{abc}	5.0^{de}	21	Amabile	108.33^{abc}	1.11^{ab}	9.0^{a}
7	18.3	91.67^{bcde}	1.12^{ab}	7.0^{abcd}	22	Atlantic	78.83^{de}	1.07^{abc}	5.7^{cde}
8	18.7A	99.92^{bcde}	1.21^{a}	9.0^{a}	23	Granola	95.92^{bcde}	1.08^{ab}	9.0^{a}
9	14.3	76.92^{e}	1.07^{abc}	7.0^{abcd}	24	Medians	111.58^{ab}	1.19^{ab}	9.0^{a}
10	18.7B	105.50^{bcd}	1.11^{ab}	9.0^{a}	25	Tenggo	136.42^{a}	1.23^{a}	8.3^{ab}
11	16.11	99.00^{bcde}	0.97^{abc}	7.7^{ac}	26	15.2	90.83^{bcde}	1.08^{ab}	7.0^{abcd}
12	18.4	88.75^{bcde}	1.14^{ab}	8.3^{ab}	27	15.23	98.25^{bcde}	1.04^{abc}	7.0^{abcd}
13	13.9	98.67^{bcde}	1.06^{abc}	7.7^{abc}	28	13.6	91.92^{bcde}	1.05^{abc}	4.3^{e}
14	15.33	114.08^{ab}	1.07^{abc}	7.7^{abc}	29	16.7	107.83^{bc}	0.98^{abc}	6.3^{bc}
15	18.9	75.50^{e}	0.97^{abc}	5.0^{de}	30	15.26	86.67^{bcde}	1.18^{ab}	7.0^{abcd}

The result showed that Tenggo was recorded as the tallest clone (136.42 cm) followed by clone 15.33 (114.08 cm) and Medians (111.58 cm). Clone 18.7A featured the biggest stem diameter (1.21 cm) among other clones, similar to Tenggo (1.23 cm). Another important agronomic trait, plant vigor, was also observed in this selection. Table 1 showed that Amabile, Granola, Medians, clone 18.21, clone 18.7A, 18.7B featured the most vigorous plants (score 9). All of them, except clone 18.21, also produced high yield. Previous researches found positive correlations between plant vigor with yield components assuming that more vigorous plant performed longer period of photosynthesis, thus produced higher yield (Silva *et al.* 2007; Silva *et al.* 2012; Pereira *et al.* 2017). In our study, comparing Table 1 and Table 2, there was a tendency for the relationship between plant height and yield. Tenggo which was the tallest variety and performed sufficient vigor (score=8.3) also showed the highest yield, meanwhile Atlantic performed short plants with the lowest yield. This result also agreed with previous finding (Arslan, 2007) that plant height had a direct effect on yield.

Table 2. Tuber quantitative data of 30 evaluated potato clones

No	Clone	Tuber Weight /plant (g)	Number of Tuber/plant	Percentage of consumption tuber (%)	Yield (ton/ha)	Specific Gravity (Sg)	No.	Clone	Tuber Weight /plant (g)	Number of Tuber/plant	Percentage of consumption tuber (%)	Yield (ton/ha)	Specific Gravity (Sg)
1	18.10	477^{abcd}	12.5^{bc}	56.3^{abcd}	26.53^{abcd}	1.060	16	18.21	679^{abcd}	13.9^{abc}	55^{bcde}	13.9^{bcde}	1.060
2	16.10	684^{abcd}	12.7^{bc}	60.3^{abcd}	22.32^{bcde}	1.058	17	20.20	621^{abcd}	8.7^{efgh}	57^{abcd}	8.7^{efgh}	1.063
3	19.11	480^{abcd}	9.3^{dgh}	51^{def}	17.93^{defg}	1.060	18	18.19	613^{abcd}	13^{bc}	57^{abcd}	24.9^{abcd}	1.060
4	15.22	444^{abcd}	7.1^{gh}	58^{abcd}	12.37^{gi}	1.052	19	20.70	782^{ab}	5.2^{h}	71.3^{ab}	15.07^{fgh}	1.058
5	19.8	675^{abcd}	13.7^{ad}	60^{abcd}	26.3^{ad}	1.051	20	18.A	583^{abcde}	13.7^{abcd}	60.3^{abcd}	21.73^{bcde}	1.047
6	15.29	404^{cdef}	7.9^{fgh}	63.7^{abcd}	12.3^{gi}	1.064	21	Amabile	761^{ab}	14.7^{abc}	52.7^{cde}	29.17^{ab}	1.068
7	18.3	505^{abcd}	14.9^{ab}	33.7^{f}	18.43^{dh}	1.057	22	Atlantic	166^{f}	4.8^{h}	59.3^{cde}	5.7^{i}	1.073
8	18.7 A	657^{abcd}	12.2^{bf}	54^{bcde}	27.4^{abc}	1.062	23	Granola	741^{ab}	17.7^{a}	46.7^{def}	29.9^{ab}	1.055
9	14.3	470^{abcd}	7.4^{gh}	62^{abcd}	14.43^{fgh}	1.060	24	Medians	714^{abc}	11.9^{bcde}	51.7^{cdef}	26.73^{abc}	1.078
10	18.7 B	558^{abcd}	13.2^{bcd}	50.3^{def}	22.47^{bcde}	1.050	25	Tenggo	809^{ab}	14.5^{abc}	61.3^{abcd}	32.6^{a}	1.060
11	16.11	574^{abcd}	7.9^{fgh}	73.3^{ab}	20.03^{cdef}	1.065	26	15.2	447^{bcde}	5.7^{h}	59.7^{abcd}	10.67^{hi}	1.055
12	18.4	568^{abcd}	10.7^{bcdf}	52.3^{cde}	10.7^{cdef}	1.050	27	15.23	429^{cdef}	6.5^{gh}	61^{abcd}	12.9^{ghi}	1.069
13	13.9	687^{abcd}	10.3^{cdef}	63.7^{abcd}	10.3^{cdef}	1.054	28	13.6	570^{abcd}	6.5^{gh}	64.7^{abcd}	10.4^{hi}	1.044
14	15.33	831^{a}	13.2^{bcd}	55^{bcd}	13.2^{bcdf}	1.067	29	16.7	326^{cdef}	7.2^{gh}	64.3^{abcd}	10.1^{hi}	1.065
15	18.9	350^{def}	8.7^{efgh}	42^{cdef}	8.7^{efgh}	1.054	30	15.26	419^{cdef}	7.4^{gh}	75.3^{a}	12.77^{gi}	1.056

Although processing industry demands certain characters of tuber qualities, growers, yet, still call for high yielding varieties considering their profitable income. In this selection, clone 15.33 produced tuber weight/plant higher (831 g) than all comparative varieties. However, its predicted yield was still lower than Tenggo (32.6 ton/ha) which was the highest among all evaluated clones. This probably because yield is defined by some related factors such number of tuber per plant, tuber weight per plant and percentage of consumption tuber.

Specific gravity (Sg) is the key character for french fries potato varieties since it is higly correlated to dry matter content, high value of Sg indicate that the raw potatoes will produce high chip volume (Elfnesh et al, 2011). The result showed that clone 15.23 possessed fairly high Sg (1.069), although still lower than comparative varieties, Medians and Atlantic and standard value for french fries and chipping potatoes (>1.070). Table 2 showed that clones with higher Sg value did not always perform higher yield. Pereira *et al*. (2017) evaluated that tuber yield component e.g. tuber number, total tuber yield were not highly correlated positively with Sg value (0.275). This clone potency could be improved either through breeding program or agronomical approaches. Although genetic make up plays major role in defining tuber qualities, but there are still environmental conditions, agronomic practice, harvest and postharvest circumstances that contribute to yield and tuber qualites (Carputo *et al.*, 2005; Abong *et al.* 2010).

Appearance of tuber potato is another important note in both industry and consumer’s choice. Most of our evaluated clones have yellow tuber skin, cream flesh color and oval tuber shape (Table 3). Tuber skin colors are genetically controlled through presence and absence of red and blue pigments, making up wide range of variability that range from white cream to blackish (Kumari *et al*. 2018). Previous studies also indicated that genotype gave dominant effect on determining quality characters of potato tubers e.g. tuber skin color, tuber shape and specific gravity since they are heritable (Kabira and Lemaga, 2006; Vreughdenhil *et al.* 2007; Abbas *et al.* 2012). Tuber shape determines its utilization in processing industries. In our selection, clone 15.23 which showed fairly high Sg, also bearing round-oval tubers.

Table 3. Qualitative Data of 30 evaluated potato clones

No.	Clone	Tuber Shape	Tuber Skin Color	Flesh Color	Tuber Skin Appearance	No.	Clone	Tuber Shape	Tuber Skin Color	Flesh Color	Tuber Skin Appearance
1	18.10	oval	yellow	cream	smooth	16	18.21	oval	pink	yellow	smooth
2	16.10	oval	cream	cream	netted	17	20.20	oval	cream	cream	netted
3	19.11	long-oval	yellow	yellow	netted	18	18.19	oval	yellow	cream	smooth
4	15.22	oval	cream	cream	netted	19	20.70	oval	cream	cream	netted
5	19.8	oval	yellow	yellow	netted	20	18.A	oval	pink	white	smooth
6	15.29	oval	cream	white	smooth	21	Amabile	oval	cream	cream	netted
7	18.3	oval	yellow	cream	netted	22	Atlantic	oval	yellow	white	netted
8	18.7A	oval	yellow	yellow	smooth	23	Granola	oval	yellow	cream	smooth
9	14.3	oval	yellow	white	netted	24	Medians	oval	yellow	cream	smooth
10	18.7B	long-oval	pink	cream	netted	25	Tenggo	round	yellow	cream	smooth
11	16.11	oval	yellow	cream	netted	26	15.2	long-oval	yellow	white	smooth
12	18.4	oval	yellow	yellow	smooth	27	15.23	oval	yellow	white	netted
13	13.9	long-oval	cream	yellow	netted	28	13.6	long-oval	yellow	cream	smooth
14	15.33	oval	cream	cream	netted	29	16.7	long-oval	brown	cream	smooth
15	18.9	oval	red	yellow	netted	30	15.26	oval	yellow	cream	smooth

Having appropriate weight and round-oval shape are among the tuber characters needed in industry for processing chips meanwhile french fries industry prefers long-oval shaped tuber (Nacheva and Pevicharova, 2008; Wayumba *et al.* 2019). There were six clones bearing long-oval shaped tubers in this selection, unfortunately none of them produced high yield. These clones could be used in further breeding programs to gain high Sg and high yield long-oval tuber potato varieties. Most of evaluated clones were netted (russet) tuber skin appearance, among them were clones with fairly high Sg value e.g. Amabile (1.068), Atlantic (1.073), clone 15.33 (1.067) and clone 15.23 (1.069). Bali *et al* (2018) evaluated that russet potatoes in United States are preferred for French fries considering their high dry matter content which refers to low oil uptake during frying. Although, the inheritance of tuber skin characters is mostly unknown, it seemed to be strongly controlled by genetic factor (Vreugdenhill, 2007)

4. Conclusion

Although still lower than the comparable varieties, Clone 15.23 with round-oval tuber and specific gravity (Sg) higher than 1.067 is potential to be used for industrial potato chips. Clone 15.33 had tuber weight per plant heavier (891 g) than comparable varieties.

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Comparison of Some Pure Line of Sweet Corn at S-4 Generation in Growth, Yield Components, and Downy Mildew Disease Incidence

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Abstract.

Sweet corn (*Zea mays* var *Saccharata*) has high demand but susceptible to downy mildew disease. Downy mildew on maize is a major disease in maize plants and can cause yield losses of up to 100%. The purpose of this study was to obtain and compare information on the character of growth, yield components and downy mildew incidence on various sweet corn lines in the S-4 generation. The study was conducted from August until October 2019 in the Wedomartani Experimental Garden, Faculty of Agriculture, UPN Veteran Yogyakarta. Seven pure line of sweet corn: SB/1-1, SB/1-3, SB/1-4, SB/1-6, SB/2-1, SB/2-2, and 10-2A were planted using a Randomized Block Design with 3 Blocks. Each experimental unit consists of 3 rows and each row consisting of 20 plants. The growth properties: plant height, stem diameter and number of leaves were observed. The yield component: the number of ears, the length of the ear and the diameter of the ear were observed. Disease incidence was observed to determined resistance against downy mildew. Data were analyzed by analysis of variance with 5% significance, followed by Duncan's multiple range test with a level of 5%. SB/2-1 have significantly lowest height and B/1-4 have highest number of leave than other line. There is not significantly different on stem diameter and number of ears. SB/1-3 produce high ear diameter and length. SB/1-1 is having low disease incidence.

Keywords: Growth, Crop, Resistance, Sweet Corn, *Zea mays* var. *Saccharata*.

1. Introduction

The national sweet corn production is not able to fulfill market demand because it has low productivity and number of consumptions increased. Sweet corn (Zea mays var. Saccharata) is popular in developed and developing countries. The demand for sweet corn every year grow due to the population increasing. The Ministry of Industry describes that national sweet corn need increase 8.6 million tons per year in 2015 (Hanifah et al., 2018). The growth of sweet corn needed in line with changes in consumption patterns. Sweet corn is not only used as food, but also raw material for the corn sugar industry. Central Statistics Agency show that sweet corn imports increased by 6.26% per year because national sweet corn production has not been able to fulfill market demand. Low productivity is one of the main problems. The productivity is around 8.31 tons per ha with the potential yield about 14-18 tons per ha (Maryamah, 2017).

Corn downy mildew is one of the important disease cause low production of sweet corn. The disease cause by *Peronosclerospora maydis, P. philippinensis* and *P. sorghi. P. maydis* and *P. philippinensis* are common pathogen infected the corn. Both of it usually found in Java island (Rustiani *et al.*, 2015). Sweet corn at the age from 10 until 60 days after planting is susceptible with the disease (Pakki, 2014). Sweet corn will not produces any ear after infected by the disease (Soenartiningsih and Talanca, 2010). It will cause losses until 100% when it infect susceptible plant at the age between 10 and 15 days after planting (Talanca, 2013). Corn downy mildew disease needs a combination of disease management technologies such as tolerant varieties, induced resistant, biological agents, healthy cultivation techniques, and fungicides when needed.

High productivity and resistance sweet corn was obtained through plant breeding. Recessive mutation that occurs naturally in genes that control the conversion of sugar to starch in corn endosperm produce sweet corn. There are 13 mutant genes that improve sugar levels in sweet corn. The sugary gene (su), sugary enhancer gene (se), and shrunken (sh2) gene are the main genes that effect corn sweetness. Crossing is an process to increase genetic variability and obtain new superior genotype. Characterization is teh initial step to select prospective parent, and then the purification step by self-pollinating to obtain a homozygote plant population. Dialel crossing is one of the crossing that common used. Dialel crossing is a crossing between all pairs of parents without know of the potential yield of a hybrid combination, the value of heterosis, combining ability (general combining ability and special combining ability), and the alleged magnitude of genetic variation of a character (Sujiprihati, et al., 2012).

2. Method

The research was established at the Wedomartani Experimental Garden, Faculty of Agriculture, UPN Veteran Yogyakarta. It was conducted at August until October 2019. Sweet corn seeds from line: SB/1-1, SB/1-3, SB/1-4, SB/1-6, SB/2-1, SB/2-2, and 10-2A were obtained from the base population and used for the research. Nitrogen, phosphorus and potassium fertilizer 16:16:16, urea fertilizer, manure, natural growth regulators were used for the plant nutrients. Drip tape, spray hose, and sprinklers were used for the irrigation system. Furadan 3G and metarizium were used to control pest in the field.

This research was established by using a Completely Randomized Design with 3 replications. This study was a single factor experiment with 7 treatment: Bfa, Bfb, Bfc, Bfd, Sb1, Sb2, Sb3 and Sb4. Duncan's multiple range test at the real level α = 5% was used for further tests (Gomes and Gomes, 1995). The research model was written as follows:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

Y_{ij}	= Observational data
μ	= General mean
τ_i	= Estimation of the influence of sweet corn line
ε_{ij}	= Estimation of trial fatigue estimator (error)

Monitoring variables were divide into three main focus: growth character, yield components and downy mildew disease incidence. The growth characters were observed from plant height, stem diameter, number of leaves. The yield component were describe from number of ears, the length of the ear and the diameter of the ear. Downy mildew disease incidence show the comparison of the resistance level each line.

3. Result and Discussion

Table 1 shows that plant height was not significantly different except line SB/2-1 have significantly lowest height. There is not significantly different on stem diameter. SB/1-4 have highest number of leave but was not significantly different with SB/1-3 and SB/2-1. The morphological similarity of sweet corn number is more influenced by the presence of genotype factors than the growing environment.

Table 2 shows that the number of ears produced by the seven numbers was not significantly different. Sweet corn line SB/1-3 produce longest ear but not significantly different with SB/2-2, 10-2A, SB/1-4, and SB/2-1. Sweet corn line SB/1-3 produced higher diameter than other but was not significantly different with other line except SB/1-6.

Table 1. Plant height, stem diameter, and number of leaves of various sweet corn lines.

Sweet corn line	Plant height (cm)		Stem diameter (cm)		Number of leaves (piece)	
SB/1-1	154,89	a	2,14	a	7,44	c
SB/1-3	169,78	a	2,61	a	8,89	abc
SB/1-4	156,33	a	2,21	a	9,67	a
SB/1-6	116,22	b	2,02	a	8,00	bc
SB/2-1	160,56	a	2,41	a	8,89	abc
SB/2-2	155,56	a	2,20	a	7,67	bc
10-2A	167,78	a	1,93	a	9,11	ab

Note: The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level = 5%

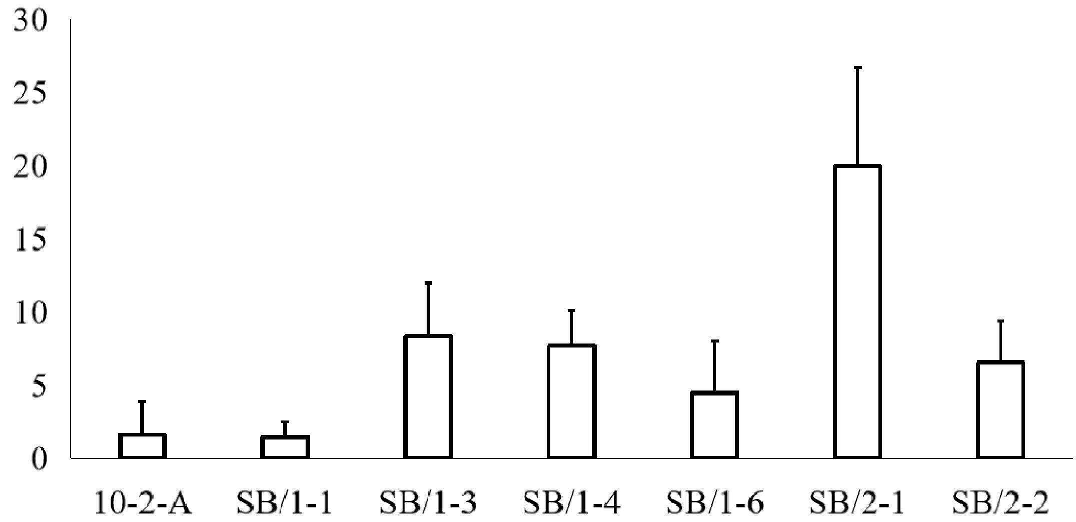
Table 2. Number, length , and diameter of the ears of some sweet corn lines.

Sweet corn line	Number of ears (piece)		length of ears (cm)		diameter of ears (cm)	
SB/1-1	1,56	a	13,89	b	4,39	ab
SB/1-3	1,67	a	17,84	a	4,60	a
SB/1-4	1,67	a	15,99	ab	4,51	a
SB/1-6	1,78	a	14,10	b	4,01	b
SB/2-1	1,78	a	15,82	ab	4,57	a
SB/2-2	1,67	a	17,29	a	4,40	ab
10-2A	1,67	a	17,44	a	4,43	ab

Note: The mean followed by the same letter in each column is not significantly different in Duncan's multiple range test at the significance level = 5%

Figure 1 shows that sweet corn line 10-2-A but it has low number of plant also. SB/1-1 have lowest disease incidence with high number of plant. SB/2-1 has highest disease incidence. SB/1-1 is potential as resistance parent because it has low disease incidence.

Figure 1. Mean of number of plant and disease incidence of various sweet corn lines.



Number of plant	28,67	40,67	46,00	32,67	20,67	25,33	36,00

4. Conclusion

SB/2-1 have significantly lowest height and B/1-4 have highest number of leave than other line.There is not significantly different on stem diameter and number of ears. SB/1-3 produce high ear diameter and length. SB/1-1 is has low disease incidence.

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The Effect of Tuber Size and Growing Media Combination on The Growth and Yield of Shallot (*Allium ascalonicum*.L.)

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Abstract.

The purpose of the research was to determine the effect of tuber size and different in growing media on the growth and yield of shallot. This was conducted in the experimental garden of Agriculture Faculty UPN "Veteran" Yogyakarta, between April and June 2019, using a Completely Randomized Design with factorial arrangement. Furthermore, tuber size is the first factor, consisting of small (1.0-2.5 g), medium (2.6-3.5 g), and large (3,6-4,6 g), while the second is growing media combination, encompassing soil, soil + husk charcoal, soil + baglog mushroom waste, and soil + husk charcoal + baglog mushroom waste. The result showed the absence of an interaction between the tuber size and the different growing media on the growth and yield of shallot, although the large and medium tuber tend to grow better than small sizes in the aspect of leaf number, tillers number, tuber number, fresh weight, air dry weight, and tuber diameter. Comparably, the media of soil + baglog mushroom waste and soil + husk charcoal + baglog mushroom waste provided the best result regarding number of tillers, fresh weight, and tuber diameter.

Keywords*:* shallot, tuber size, growing media

1. Introduction

Shallot is an important vegetable, used as a major source of income for farmers in tropical countries, especially in Asia, including Indonesia. Furthermore, it has frequently been adopted in most houses as a flavouring and seasoning spice in the preparation of dishes such as pickles, fried shallot, salad, etc, and also for the medicinal benefits.

The shallot is consumed more by humans, consequently contributing to daily life. They have been well known as raw materials for the creation of high-quality fried shallot, due to the dense texture, delicious taste, distinctive aroma, as well as the vitamin and mineral content. Furthermore, it is also used in most salads and food, due to the ability of its fat to produce 45 calories/100 g fresh weight (Randle and Lancaster, 2002).

Based on Statistic Center data, an exponential increase was recorded in the aspect of production from 2014 to 2018, encompassing 1.233.984 ton (2014), 1.229.184 ton (2015), 1,446,860 ton (2016), 1.470.155 ton (2017) and 1.503.436 ton (2018).

The productivity enhancement is possibly conducted with the appropriate cultivation techniques, as some farmers actually using various tuber sizes. This is not an efficient approach, as the growth and yield tend to not be uniform, hence, the current size used is unideal for planting. In addition, it was reported that the large tubers provide better growth, in contrast with the small size, due to it high carbohydrate and water content. This size characteristic depends on physiological processes in plant and the uptake of nutrition in soil, therefore, using a bad seed tuber consequently decreases production. According Entaunayah *et. al* (2015), the large sizes tend to grow comparably higher. Also, a good seed tuber encompasses those without disease, deformation, or the experience of prolonged storage in warehouse, characterized by dormancy period, healthy, and of optimal size (Azmi, 2011)

Growing media is possibly adopted as an organic matter, which plays an important role in improving the physical nature of soil (Bellapama, 2015). Hence, its addition in sufficient quantity grossly improves soil structure, and some organic matter used includes husk charcoal and baglog mushroom waste. Husk charcoal is a major by-product obtained from paddy, encompassing a mixture of growing media with the capacity to bind water, enhancing the drainage and aeration, which subsequently affects plant growth. (Syawal *et al,* 2019). Suthamathy and Seran (2011) stipulated that husk charcoal contains a high percentage of potassium and phosphorus, in contrast with nitrogen. Similarly, Tarigan *et. al*. (2015,) reported its composition of SiO2 (52%), C (31%), K (0.3%), N (0.18%), F (0.08%), and Calsium (0.14%), and also some few elements, encompassing Fe2O3, K2O, MgO, CaO, MnO and Cu. In addition, the high silica contents exhibits more benefits as the plant becomes more resistant to pests and diseases, thus, the husk charcoal growing media provided a higher number of tillers.

Baglog is an oyster mushroom planting media created from sawdust and some source nutrients for fungi growth, including organic manure. In addition, their waste as organic compost is possibly adopted as organic manure (Hunaepi *et. al*, 2018), characterized by the experience of decomposition, consequently imposing a significant effect on the dry weight of shallot (Bellapama *et. al,* 2015). Also, baglog waste possesses some nutrients, which includes P (0.7%), K (0.2%), N total (0.6%) and C-organic (49%) (Hunaepi, 2018). The purpose of the research, therefore, was to determine the effect of tuber size and different growing media on growth and yield of shallot.

2. Materials And Method

This research was conducted in the experimental garden, Faculty of Agriculture, UPN "Veteran” Yogyakarta between April and June 2019. The site was located on altitude 104 m above sea level, the shallot of Bima Brebes variety were used, and the planting was conducted in polybag of size 35x35 cm.

A Completely Randomized Design was used, involving the application of two factors, including (1) The tuber size, which consists of small (1.0-2.5 g), medium (2.6-3.5 g), and large (3.6-4.6 g). (2) Growing media combination, including soil, soil+husk charcoal, soil+baglog mushroom waste, and soil+husk charcoal+ baglog mushroom waste. Furthermore, the observed data were analyzed using Analysis of Varian (ANOVA) at a significance level of 5%, and if there were a significant effect continued by DMRT (Duncan Multiple Range Test), at level 5%.

3. Result And Discussion

The analysis of variance revealed a significant effect of tuber size and growing media combination. There is no interaction between the tuber size and the growing media combination on shallot growth and yield. Table 1 indicates the effect of tuber size and growing media combination on plant height, leaf number and tiller number of shallot.

Table 1. Average of plant height, leaf number and tiller number affected by tuber size and different growing media of shallot

Treatment	Plant Height (cm)	Leaf Number (blade)	Tiller Number
Small (1, -2,5 g)	23,90 b	24,42 b	6,33 b
Medium (2,6-3,5 g)	23,95 b	27,58 a	7,83 a
Large (3,6-4,6 g)	28,59 a	26,67 a	8,67 a
Soil	23,27 q	24,89 q	6,78 r
Soil+Husk Charcoal	25,53 q	26,11 p	8,00 q
Soil+Baglog Mushroom Waste	28,06 p	26,67 p	8,11 pq
Soil+ Husk Charcoal+Baglog Mushroom Waste	28,55 p	27,67 p	9,00 p

The means of each parameter followed by same letter within a column are not significantly different according to Duncan Multiple RangeTest 5%.

The large tuber comparably provided the best result in terms of plant height, as they have generally been considered to contain higher amounts of reserved carbohydrates than the small tuber. In addition, large and medium tubers contain more significant food reserves compared to small tubers. These are possibly used for the development of newly formed organs, and the maturation of leaves make them a photosynthate source.

The treatment of varying growing media showed that soil+baglog mushroom waste and soil+husk charcoal+baglog mushroom waste provided plants with comparably better height than others. This is probably because the growth phase requires sufficient N and P to attain increase inplant height, and adequate leaf number is present in baglog mushroom waste. This is in line with the statement by Hunaepi (2018), which stipulated its nutritional composition of P (0.7%), K (0.2%), N total (0.6%) and C-organic (49%). According to Firmanto (2011), N is needed by shallot during the vegetative phase, being the main constituent of chlorophyll and protein, while the husk charcoal possesses lesser amount (0.18%). Wuryaningsih (1997) reported its slow decompose ability, which indicates the enhanced propensity of slow absorption by the shallot plant. Also, N is one of the nutrients for vegetative growth, in the aspect of leaf number, hence a higher supply is reflected in the promotion of plant height and in the number of leaves.

The medium and large tuber provided better number of tillers, in contrast with the small tuber. According to Putrasameja (2007), the best measure for tuber was about 3 g, due to the tuber capacity to have more tillers. This is characterized by, the endosperm possession of larger sizes, consequently improving the plant growth prosses (Purnawanto, 2013). Furthermore, soil+husk charcoal, soil+baglog mushroom waste and soil+ husk charcoal+baglog mushroom waste provided better leaf number than the soil media, although three media with husk charcoal and baglog mushroom waste content produced better number of tillers. Also, the treatment with soil+baglog mushroom waste showed no significant differences with soil+ husk charcoal+baglog mushroom waste and soil+husk charcoal. This is probably due to the soil media inadequate N nutrient content, followed by slow growth of tiller number.

The results in table 2 indicate the presence of significant differences in terms of fresh weight, air dry weight, tuber number and tuber diameter of shallot. Furthermore, the large and medium tuber exhibited a better outcome in contrast with small tubers.

Table 2. Average of fresh weight, air dry weight, tuber number and tuber diameter of shallot as influenced by tuber size and growing media combination of shallot

Treatment	Fresh Weight (g)	Air Dry Weight (g)	Tuber Number	Tuber Diameter (mm)
Small (1, -2,5 g)	34,29 b	27,12 b	8,27 b	17,82 b
Medium (2,6-3,5 g)	36,39 a	29,93 a	9,90 a	22,13 a
Large (3,6-4,6 g)	36,61 a	31,78 a	10,87 a	20,84 a
Soil	33,28 r	25,34 r	7,60 q	16,66 r
Soil+Husk Charcoal	35,07 q	29,96 q	10,71 p	19,52 q
Soil+Baglog Mushroom Waste	36,72 p	31,74 q	10,29 p	22,67 p
Soil+ Husk Charcoal+Baglog Mushroom Waste	37,99 p	34,20 p	10,87 p	22,03 p

The means of each parameter followed by same letter within a column are not significantly different according to Duncan Multiple Range Test 5%

The result of Uke *et al* (2015), showed a significant effect of large tuber sizes on fresh weight, air dry weight, tuber number and tuber diameter. Also, the large and medium tuber sizes produce more significant increase in growth and yield than the small tuber. According Levy (1981), large tuber possess a higher food supply and also have a relatively higher water content, while Islam (2010) reported on the significant positive influence of increasing moisture content on enhanced growth and yield. Therefore, the recorded higher water content of large and medium tuber possibly aids in growth and the subsequent production of a bigger mass. These were reported by Entaunayah (2015) to possess more tuber layer, hence, a larger tuber consists of the enhanced root number and a wider cross section area of root. Furthermore, the occurrence is possibly due to the sufficiency in the amount of absorbable nutrients that is responsible for increased fresh weight, air dry weight, tuber number and tuber diameter.

The treatment with varying growing media showed the enhanced propensity for soil+baglog mushroom waste and soil+ husk charcoal+baglog mushroom waste to provide a better on fresh weight, tuber number and tuber diameter outcome in contrast with other treatments. Also, the use of soil+husk charcoal+baglog mushroom waste specifically displayed the best result on dry weight, possibly due to the more complete nutritional content of the mixture. According to Tarigan *et. al*. (2015), husk charcoal contains SiO2 (52%), C (31%), K (0.3%), N (0.18%), P (0.08%), and Calcium (0.14%), and silica is particularly needed in tuber formation.

The husk charcoal is known to contribute towards the supply of potassium nutrients, and the availability in tuber formation. This was in line with the report by Riadi (2010), which stated the propensity for husk charcoal to improve the physical properties of soil. Futhermore, they also increase the uptake of P, Ca, and Mg, further contributing to the availability of potassium (K), which accelerates the process of photosynthesis (Gunandi, 2015). This consequently increases the yield of shallot, while silica plays an important role in metabolism, which is a nutrition quality determinant, and as an element responsible for the photosynthesis process. Conversely, baglog mushroom waste possesses the following nutrient content: P

(0.7%), K (0.2%), N total (0.6%) and C-organic (49%) (Hunaepi, 2018), where nitrogen is needed by shallot during the vegetative phase, due to the it's a constituent for chlorophyll and protein. However, the combination of soil+husk charcoal did not provide good shallot yield, based on the less nitrogen contained in contrast with baglog mushroom waste. Furthermore, in the soil media provide lowest on fresh weight, air dry weight, tuber number and tuber diameter of shallot, due to its low capacity to provide nutrient and store water for shallot.

4. Conclusion

Based on the results and discussion, the following conclusion were made, there is no interaction between the tuber size and the different in growing media on shallot growth and yield. The large and medium sizes grew better than small tubers in the aspect of leaf number, tillers number, tuber number, fresh weight, air dry weight, and tuber diameter. The different in growing media significantly affects all parameters. In addition, soil+baglog mushroom waste and soil+husk charcoal +baglog mushroom waste provided superior outcomes in terms of plant height, fresh weight, and tuber diameter.

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The Impact of Integreated Pest Management (IPM) Application on Soil Diversity of Fauna and Disease Intensity on Potato Farms

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Abstract.

Potatoes are a vegetable source of carbohydrates so they have great potential as an alternative staple food. Pest and disease disorders are the main obstacles. The purpose of this study was to determine differences in pest population levels and disease attacks in potato crops with application IPM and conventional systems. The study was conducted in Garut Regency and in West Bandung which was conducted from July 2015 - March 2016. In each location the compared between IPM application treatment and conventional treatment (local farmers' way) was compared. The treatment tested are as follows: (1). T1: IPM system that is : plot with the application of IPM technology produced by IVEGRI. (2). T2 : IVEGRI IPM system + use of silver plastic mulch cover. (3). The conventional treatment system. The seeds used are Granola tuber let varieties with a size of 5-7gram. the results of the study show that : (1). The IPM treatment with use of silver mulch increase the benefits of applying IPM. Plant growth and yields are higher than conventional methods. (2). The IPM treatment with or without mulch provides a better environment for the development of soil fauna (3). The use of selective and minimal pesticides in IPM treatment increases the population of Collembola, Acarina and Diplura soil fauna. (4). Attacks of airborne diseases (late blight and early blight) are not infulenced by the treatment but by the season.

Keywords : Solanum tuberosum L., IPM (Integrated Pest Management), Soil Fauna

1. Introduction

Potatoes are a vegetable source of carbohydrates so they have great potential as an alternative staple food. The economic value is high for both the domestic and export markets. The average potato production in Indonesia in 2017 is around 1,164,738 tons. Whereas in 2016 around 1,213,038 tons, there was a decrease of around 3.98%. Likewise, the productivity of potatoes in Indonesia in 2017 was around 15.40 tons / ha and in 2016 around 18.25 tons / ha, down around 15.62%. But the harvested area in 2017 was around 75,611 ha and in 2016 around 66,450 ha, there was an increase in harvested area of 13.79%. Many obstacles are faced in the cultivation of potatoes to obtain high yields, clean and economical. Pest and disease disorders are the main obstacles. The main pests and diseases that attack on potato plants are leaf borers and potato tubers (*Phtheromaea operculella*), Thrips, aphids, leaf rot, wilting, viruses and nematodes and leafminer pests (*Liriomyza huidobrensis*). Loss of results due to pests and diseases above have been widely reported, including due to leaf and tuber borer (*Phthorimaea opercuella*) reaching 36% - 100% (Setiawati and Tobing, 1996), due to leafminer pests can reach 67.7% - 87% (Min Kwon et al., 2017; Walyson *et al*., 2019; Mujica et al., 2013), due to leaf rot *Phytophtora infestans* (Mont.) De Bary 5% - 98.6% (Rakoton indraina et al., 2012), withering bacteria (*Ralstonia solanacearum*) 33% - 90% (Karim et al., 2018), complex viruses 24% - 82% (Damayanti and Kartika, 2015), nematodes 25% (Youssef, 2013). To overcome the problem of pests and diseases of potato crops, farmers generally use pesticides that tend to be excessive and unwise, so that the impact does not only occur in residual products but also environmental degradation and surrounding biological resources.

The concept of integrated pest control implements the use of pesticides truly wisely, most recently used. The use of natural enemies and other non-chemical controls to control pests and diseases is preferred, in order to obtain the quality of healthy potato products without disturbing the quality of the biotic and abiotic environment. Soil fauna is one that is influenced by biotic and abiotic factors because it can determine the population of fauna that live in a habitat. Fauna composition can change due to the influence of changes in vegetation. Soil fauna plays an important role in the decomposition of organic minerals and can determine the cycle of soil organic minerals and can accelerate the supply of nutrients and sources of soil organic matter. The groups of soil fauna that have the highest density and abundance in the soil ecosystem are Arthopoda including Insect, Arachnida, and Myriapoda. The most common insect group was collembola, whereas from the Arachnida group the most common was Acarina.

The development of potato cultivation is a promising business and will continue, so we need a way to manage pest and disease that are effective, safe and environmentally friendly. The adoption of IPM that promises healthy products and a clean environment needs to be promoted and more popularized with evidence of positive impacts better than conventional methods. The purpose of this study was to determine differences in the level of the populations of soil fauna and the intensity of disease in potato crops with application IPM and conventional systems.

2. Material and Methods

The study was conducted in two locations are Garut Regency (Cikajang) and in West Bandung Regency (Lembang) conducted from July 2015 - March 2016. In the experiment in each location, two treatments were compared to applying IPM and one conventional treatment (the way of local farmers) as Control. The treatments tested are as follows:

1. T1 treatment: IPM system, namely: experimental plot with the application of IPM technology produced by the Indonesian Vegetable Research Institute (IVEGRI)

2. T2 treatment: IVEGRI IPM system + use of silver plastic mulch cover.

3. The conventional system treatment is the experimental plot which is treated with the application of a local potato farming system conducted by large / advanced farmers. The conventional treatment is taken with the consideration that the most

dominant impact of conventional farming comes from the most extensive area of potato planting, which is owned by advanced farmers.

The seeds used are Granola varieties derived from tissue culture with size 5-7gram (tuber let). The type and time of application of fertilizer and the use of pesticides as well as other methods of cultivation from each treatment can be seen in (Appendix). The design uses a paired plot without repetition. For the sake of observation and statistical analysis, each main treatment is divided into 6 parts as repetitions to limit observation. Each treatment plot is 500 m2 so that the land area in each location of the three potato pest control treatments is ± 1,500 m2. The treatment using Randomized Group Design and the difference in the average treatment was tested with Multiple Distance Test Duncan at a level of 5%.

Implementation:

1. IPM plot both T1 and T2 is done by researchers.
2. Conventional plots are taken from the land worked by local farmers. From a large expanse of potato plantations, a 500 m^2 spread was taken. Conventional treatment plots are managed by potato farmers themselves. Planting, weeding, spraying of pesticides and their types and others independently (independent) without the burden that the research is being carried out in the plots.
3. Matters relating to the collection of research data in all the observed plots (T1, T2 and Conventional treatment) are done by the researcher.
4. Observations on all plots are the same for: plant height, soil fauna population, incidence / intensity of pest-disease attacks, crop yields and tuber quality.
5. To calculate the soil fauna carried out as follows: in each test plot installed "Pitfall" (a tool to capture soil fauna that is on the surface of the soil)
6. To capture fauna in the soil as follows: soil samples are taken as deep as 20 cm using a ground drill. Then the soil put into the "Barlate Tool Green" tool for 4 days. Existing fauna will float and counted

a. Plant Growth

The seeds used come from tissue culture with a size of ± 5-7 grams (tuber let). Plant growth data can be seen in (table 1).

Table 1. Effects of various pest control methods on potato plant height in Garut and Lembang (cm).

Treatment	Garut		Lembang	
	35 Dap	56 Dap	35 Dap	56 Dap
1. IPM	19,77 a	22,60 b	13,40 a	19,83 b
2. IPM + mulch	20,23 a	28,53 a	13,67 a	29,20 a
3. Conventional	18,53 a	19,73 c	10,77 a	26,03 a

Note: The average number followed by the same letter in each column shows no significant difference in UJB Duncan's level of 5%.
- *Dap = Day after planting*

The bulbs used are small, so the shoots that come out are only 1-2 stems, so to measure growth taken only plant height. The IPM and IPM + mulch treatments are all the same unless there is an additional black silver plastic mulch. It seems clear that mulch on potato plants has a better effect on plant growth, which is the highest compared to other treatments both in Garut and in Lembang. While conventional ones are no better than IPM, except in Lembang.

b. Soil Fauna Population

Soil fauna populations appear to be affected by potato cultivation. Data on soil fauna population observed from the ground and the surface can be seen in (Table 2 - 4). The soil fauna population observed from the soil sample that the composition is more stable. Generally the population in conventional aquaculture treatments is lower than IPM. Whereas in the IPM treatment the addition of silver plastic mulch inputs turned out to be able to increase the number of existing soil fauna populations of the cumulative Collembola, Acarina and Diplura species both in Garut and Lembang. The method of taking samples for observation also has an effect on the amount. The amount of soil surface catches are higher than in the soil catches. It seems that the soil fauna does not always settle in the soil, but there are active periods roaming the surface.

Table 2. Effects of various pest control methods on potatoes on Collembola soil fauna populations in Garut and Lembang

Treatment	Garut on observation to ….			Lembang on observation to ….		
	30 Dap	51 Dap	72 Dap	30 Dap	51 Dap	72 Dap
In the Ground						
1. IPM	6 a	26 a	8 ab	22 a	20 a	24 a
2. IPM + mulch	2 a	16 b	16 a	28 a	34 a	20 a
3. Conventional	2 a	4 ab	2 b	14 a	18 a	24 a
At Ground Level						
1. IPM	120 a	1.300 a	160 ab	748 ab	560 ab	480 b
2. IPM + mulch	52 b	672 ab	352 a	952 a	1.088 a	400 ab
3. Conventional	72 ab	56 b	12 b	280 b	360 b	624 a

Note: The average number followed by the same letter in each column shows no significant difference in UJB Duncan's level of 5%. Data analysis between data originating from the ground and data originating from the surface is carried out separately.

- *Dap = Day after planting*

Table 3. Effects of various pest control methods on potatoes on the Acarina soil fauna population in Garut and Lembang

Treatment	Garut on observation to ….			Lembang on observation to ….		
	30 Dap	51 Dap	72 Dap[	30 Dap	51 Dap	72 Dap
In the Ground						
1. IPM	2 a	10 b	2 a	0	8 a	0
2. IPM + mulch	2 a	10 a	10 a	0	6 a	0
3. Conventional	0 a	2 a	2 a	0	2 a	0
At Ground Level						
1. IPM	2 b	200 a	8 ab	0 b	48 a	0 a
2. IPM + mulch	16 a	20 ab	60 a	0 b	32 ab	0 a
3. Conventional	4 ab	8 b	2 b	6 a	4 b	0 a

Note: The average number followed by the same letter in each column shows no significant difference in UJB Duncan's level of 5%. Data analysis between data originating from the ground and data originating from the surface is carried out separately.

- *Dap = Day after planting*

IPM treatment again shows that the use of pesticides that are selective and minimally increases the population of soil fauna both Collembola, Acarina, and Diplura. The same thing happened in onion plants, that the population of soil fauna in IPM treatment using insecticides was slightly higher **(Setiawati, 2000).**

However, the addition of silver plastic mulch inputs to Acarina inhibits movement on the ground surface. Observations on soil fauna were also carried out on land planted with cabbage, the results showed that the most dominant fauna in cabbage plantations in Lembang was Collembola (72.92%), Diplura (21.67%) and Acarina (5.41%). Overall, it can be seen that the application of IPM conception can increase the population of soil fauna in the soil by 58.0% and the surface surface by 58.34%, when compared with conventional treatments. IPM can increase the population of soil fauna by 70.97% and 113.39% at the surface when compared with conventional treatment **(Setiawati et al., 2000).**

Table 4. Effects of various pest control methods on potatoes on the fauna population of Diplura in Garut and Lembang

Treatment	Garut on observation to ….			Lembang on observation to ….		
	30 Dap	51 Dap	72 Dap	30 Dap	51 Dap	72 Dap
In the Ground						
1. IPM	2 a	6 a	12 a	10 a	14 a	6 a
2. IPM + mulch	10 a	8 a	12 a	6 a	12 a	2 a
3. Conventional	6 a	4 a	2 a	0 a	10 a	2 a
At Ground Level						
1. IPM	28 ab	168 a	a72 ab	220 a	196 ab	32 a
2. IPM + mulch	100 a	112 ab	120 a	132 ab	261 a	4 b
3. Conventional	12 a	32 b	16 b	12 b	100 b	12 b

Note: The average number followed by the same letter in each column shows no significant difference in UJB Duncan's level of 5%. Data analysis between data originating from the ground and data originating from the surface is carried out separately.
- Dap = Day after planting

c. Potato Disease

The most dominant disease according to the season that occurs, during the ordeal. The condition of potato disease in Garut and Lembang can be seen in (Table 5).

Table 5. Effects of various methods of controlling pests on the intensity of Late blight disease and Early blight on potatoes at the age of 56-68 days after planting (HST).

Treatment	Garut		Lembang	
	Late blight	early blight	Late blight	early blight
1. IPM	4,67 a	0,00 a	36,33 a	- *)
2. IPM + mulch	6,00 a	1,33 a	24,00 a	-
3. Conventional	8,00 a	4,67 a	36,67 a	-

*Remarks: *) = early blight are not found in Lembang*
- The average number followed by the same letter in each column shows no difference evident at UJB Duncan at the 5% level.

Late blight (*Phythophtora infestan*) and early blight (*Alternaria solani*) are airborne pathogens which are certainly not affected by treatments on the soil. The results of the statistical analysis were not significantly different between the treatment and the amount. However, there is a tendency that the intensity of these two diseases in the IPM + mulch treatment is the lowest. At the time of the research in Lembang there was no alternaria (early blight) attack found. The high incidence of leaf rot in Lembang due to high rainfall and humid conditions, where such conditions are suitable for the development of leaf rot disease as stated **(Rahayu et al., 2015)**, that in the months where the air temperature is high, for example in May to August the infestation of dry spot disease is more dominant than leaf rot disease.

d. Yields

The yield per plot between the two locations is impossible to compare, because in Lembang the potatoes are harvested earlier because the plants are destroyed by leaf rot. The harvest data is balanced by taking 10 sample plants. Statistically IPM treatment has no effect on tuber yield compared to conventional methods. In Garut the yield quantity is higher while in Lembang it is lower. However, IPM added with silver plastic mulch was able to increase yields both in numbers (2.5 times conventional systems and 2 times IPM systems), and weight (10 times that of conventional systems and 7 times that of IPM systems) and were significantly different from other treatments. Similar crop yields occur in the Lembang area during the rainy season (Table 6).

Table 6. Effects of various pest control methods on potato crops on yields per 10 sample plants in Garut and Lembang.

Treatment	Garut		Lembang	
	Amount	Weight (kg)	Amount	Weight (kg)
1. IPM	68 a	1.748 a	92 a	1.360 a
2. IPM + mulch	135 b	7.674 b	200 b	3.870 b
3. Conventional	49 a	764 a	106 a	1.560 a

Remarks : The average number followed by the same letter in each column shows no difference evident at UJB Duncan at the 5% level.

The spread of potato tubers by size shifts towards smaller sizes (<40 g). The average size of large tubers (> 40 g) from each treatment in Garut is 20% and 17% in Lembang. For the best treatment Garut is PHT + mulch where the percentage of tubers with the highest size. This situation is different from the rainy season (in Lembang), where the percentage of tubers with a size> 40 g is the lowest. The distribution of the tuber size is more to the small size in Lembang because the harvested plants are not yet old due to high leaf rot disease. The distribution of bulbs from each treatment in the dry season (Garut) and rainy season (Lembang) can be seen in (Figures 1 and 2).

Figure 1. Distribution of Potato Tuber Size from Various Ways of Control Pest and Disease in Garut

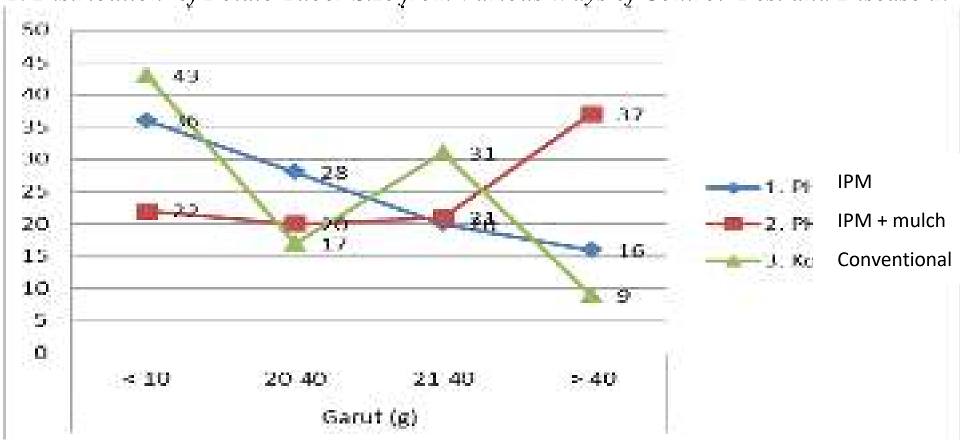
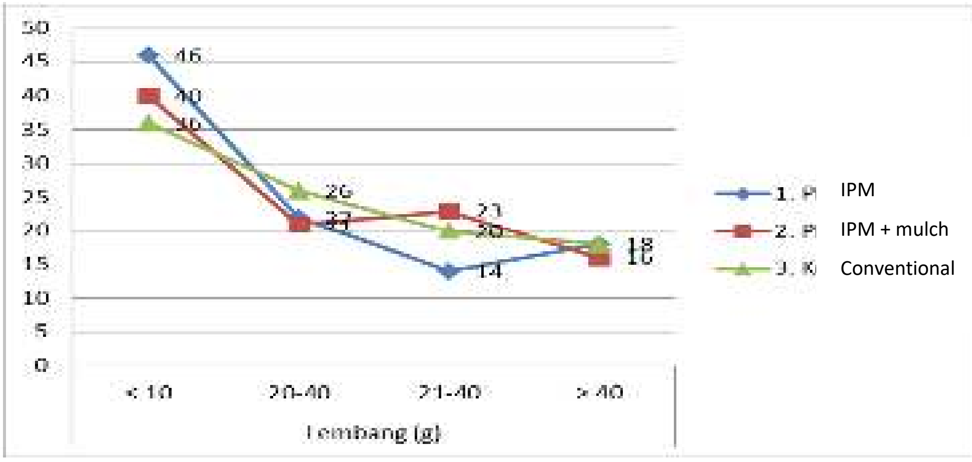


Figure 2. Distribution of Potato Tuber Size from Various Ways of Control Pest and Disease in Lembang



3. Conclusion

(1). The IPM treatment with use of silver mulch increase the benefits of applying IPM. Plant growth and yields are higher than conventional methods.

(2). The IPM treatment with or without mulch provides a better environment for the development of soil fauna

(3). The use of selective and minimal pesticides in IPM treatment increases the population of Collembola, Acarina and Diplura soil fauna.

(4). Attacks of airborne diseases (late blight and early blight) are not infulenced by the treatment but by the season.

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Appendix 1. IPM component treatment assemblies tested in Garut and Lembang

Components of Cultivation	IPM Balitsa	IPM Balitsa + Mulch	Garut Farmers	Lembang Farmers
1. Seed	Granola	Granola	Granola	Granla
2. Fertilizer per ha : - Basic - Artificial	- Chicken 10 ton - Twice giving 1). ½ Urea+ZA+KCl)+SP- 36 planting time 2). ½ Urea+ZA+KCl)+SP- 36 planting time	- Chicken 10 ton - Twice giving 1). ½ Urea+ZA+KCl)+SP- 36 planting time 2). ½ Urea+ZA+KCl)+SP- 36 planting time	- Cow 30 ton - Once giving at planting time	- Horse 30 ton - Once giving at planting time (Urea, ZA, Kl dan TSP)
3. Planting space	30 x 60 cm, double row	30 x 80 cm, double row	30 x 80 cm, single row	30 x 80 cm, single row
4. Soil cover	-	Silver plastic mulch	-	-
5. Setting trap : - Afid - Tuber borer - Leaf cutter	-Not installed -Not installed - Yellow tie	-Not installed -Not installed -Yellow tie	-Not installed -Not installed -Not installed	-Not installed -Not installed -Not installed
6. Observation :	Once a week	Once a week	Once a week	Once a week
7. Pesticides : - Application time : - Types of active ingredients of pesticides:: Interval :	- 41 days after planting 1. Mankozeb, Mefendoksam 2. Mankozeb 3. Abamektin 4. Deltametrin 5. Imidaclorprid 6. Karbofuran Once a week	- 39 days after planting 1. Mankozeb, Mefendoksam 2. Mankozeb 3. Abamektin 4. Deltametrin 5. Imidaclorprid 6. Karbofuran Once a week	- 43 days after planting 1. Mankozeb, Mefendoksam 2. Mankozeb 3. Abamektin 4. Deltametrin 5. Imidaclorprid 6. Karbofuran 7. Triazofos 8. Cymoxanil twice/week	- 38 days after planting 1. Karbofuran 2. Mankozeb, Mefendoksam 3. Betasiflutrin twice/week
8. Harvest	80% yellow plants	80% yellow plants	80% yellow plants	80% yellow plants

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The Influence Of Delay Time And Pile Thickness Of Seed Drying On Seed Viability And Growth Of Rice (*Oryza sativa* L.) Using Innovated Drying Floor

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Abstract.

Seeds were susceptible to drying injury in several ways i.e the delay time and the pile thickness of seed drying . The research was carried out to found the maximum delay time and the pile thickness to obtain the best seed viability and growth of rice using Innovated Drying Floor. This research was done from June to September 2019 at UPT Barongan Balai Benih Pertanian, Barongan, Sumber Agung Village, Bantul, Yogyakarta. The experiment was arranged on Split Plot design with two factors. The main plot was delay time of drying process: 2, 4 and 6 days. The subplot was the seed pile thickness: 3, 5, 7, and 9 cm. The treatments were repeated 3 times. Data were analyzed by analysis of variance 5% and test further with DMRT 5% (Duncan's Multiple Range Test). The results showed that there was not interaction between the delay time and seed pile thickness on all parameters. The delay time of drying process: 2, 4 and 6 days and the seed pile thickness: 3, 5, 7, and 9 cm showed no significantly different on germination capacity and the growth of rice seed. The delay time of drying process until 6 days can be tolerated on the germination capacity and growth rice. The seed pile thickness until 9cm also can be tolerated on the germination capacity and growth rice.

Key words: delay time, pile thickness, innovated drying floor, seed viability and growth of rice

1. Introduction

Rice (*Oryza sativa* L.) is a staple crop in Indonesia because most Indonesians consume rice as a staple food. The need for staples in Indonesia is increasing along with the increasing population growth. Low rice production in Indonesia requires to make improvements in the seed system so that it can produce high crop production. One example of low seed production is in Bantul Regency. Since 2005, Bantul Regency government has released and developed Bantul Seed Center program. Through this program, Bantul Regency government as a producer of certified rice seeds guarantees and improves the service of certified superior rice seeds.

However, around 30% of rice farmers in Bantul Regency still use uncertified rice seeds. In addition, the availability of certified rice seeds in Bantul Regency has not been able to meet the needs. At present, 60% of the requirement for certified rice seeds has been fulfilled by Bantul Regency itself, and the remaining 40% is fulfilled from other Regencies in DIY and surrounding areas.

The Technical Service Unit (UPT) of Barongan Agricultural Seed Office is a provider of certified rice seeds in Bantul Regency under the auspices of the Agriculture and Forestry Department of Bantul Regency. UPT BBP Barongan is one of the seed producers in Bantul

Regency which is believed by farmers to produce superior rice seeds at low prices, so that almost most farmers buy seeds here. However, to produce rice seeds according to the target needed by farmers, in this Barongan BBP UPT there are also some obstacles in the implementation of the seed processing that is in the drying process. The condition of the land for a limited drying area, the rainy season, and the grain yield of farmers who must be dried in the sun is one of the problem factors so that the prospective seeds encounter a delay in drying. Setting the seed layer thickness on the drying floor in order to make the water level drops quickly is also a major problem at Barongan UPT.

After harvesting the seeds, the rice must be dried immediately because if there is a delay in drying, the seeds will experience a decrease in seed quality. Delay of drying time will cause nonstandard water content and humid storage space and the accumulation of grain in the container/chilling ahead of the processing which will cause high respiration. Limitations on the location of drying, drying in the rainy season and limited labor is one of the important issues in seed producers that resulting in a delay in the process of drying the grain, as well as a decrease in the quality of the dried grain produced.

Drying is one of the important postharvest activities, with the aim that the grain moisture content is safe from the possibility of the proliferation of insects and microorganisms such as fungi and bacteria. In the drying process, one of them needs to be considered is drying time after harvest. Drying should be conducted immediately after the prospective seed is removed because if there is a delay in drying the seeds will experience a decrease in seed quality. If the conditions do not allow the prospective seed must be spread out and aerated. Drying must begin as soon as possible from the time of harvest. If drying cannot be conducted, try to keep the unhusked rice from being piled up but spread out to avoid the possibility of fermentation.

Stated that the difficulty of drying in the rainy season can cause grain damage. Delay in drying up to 3 days can cause grain damage by 2.6%. The accumulation of wet rice in the field for 3 days can cause grain damage 1.66% - 3.11%, depending on the thickness of the pile. Thus, it is clear that it can be detrimental to farmers economically, both qualitatively and quantitatively which ultimately reduces income for farmers. Therefore, after harvesting the harvest, it is necessary to immediately secure the grain by drying so that grain damage can be avoided.

Uneven drying because the drying media/drying floor is not suitable will cause cracks in the grain and vice versa which is too dry grain will break easily when ground. Meanwhile, in conditions that are still too wet besides difficult to grind, it is also not good in terms of storage because it will be easily attacked by warehouse pests and fungi. To avoid the grain becoming cracked, a layer of rice paddy is not too thin when it is being dried. Drying from a moisture content of 25.5% to 14.7% with an area of 1 m^2 stretches takes 4.5 and 16 hours for 1 and 7 cm thick overlays [2], but the volume of seeds with a thickness of 1 cm is lower.

In order to maintain the quality of crop yields and reduce the number of losses to farmers, UPT Sumberagung Bantul Agricultural Seed Institute created a drying method/system that is practical, efficient and effective that is by making drying techniques. This engineering is a drying technology innovation that has been created by the UPT BBP Bantul which is with the concept of making a rice-drying floor to form a tent that uses a cover over it. By using this system, farmers will be more profitable because farmers can still dry even in the rainy season. The sale value will be higher than when the harvest takes place.

Therefore, it is necessary to conduct research on the Treatment of Various Delays in Drying and Seed Layer Thickness Using Innovative Drying Floors on Viability and Growth of Rice Plants (*Oryza sativa* l.). The purpose of this study is to determine the time for drying and the maximum thickness of the seed layer which produced the best viability and growth of rice seeds (*Oryza sativa* L.).

2. Methods

The study was conducted at the UPT Barongan Agricultural Seed Office, Bantul. UPT Barongan Agricultural Seed Office (BBP Barongan) is a hall of quality superior seed providers under the Department of Agriculture and Forestry of Bantul Regency. Seed quality testing was conducted at the Plant Breeding Laboratory of the Agrotechnology Study Program, Faculty of Agriculture, UPN "Veterans" Yogyakarta from June to September 2019.

The research method used was a laboratory experiment arranged in a Split Plot Design which was arranged in a Completely Randomized Design with two factors. As Main Plot, there are 3 levels of delaying drying time which are W1 = 2 days after harvest, W2 = 4 days after harvest and W3 = 6 days after harvest. Sub plot is the seed pilethickness. There are 4 levels including K1 = 3 cm from the drying floor, K2 = 5 cm from the drying floor, K3 = 7 cm from the drying floor, and K4 = 9 cm from the drying floor. There are 12 treatment combination which each of which were repeated 3 times.

After harvesting the rice seeds delay the drying process for 2, 4 and 6 days. Then, drying the rice seeds on seed pilethickness 3, 5, 7 and 9cm from the drying floor. The drying process stopped after the seed mouisture content reached 10%, and then cleaned the rice seed using cleaner/blower. Stored the the clean rice seed until the seeds broke their dormancy. The sample of seed can be evaluated their viability and their growth.

Observation parameters include: Seed germination (%), Plant height at 14 days after planting. The number of tillers aged 14 days after planting and the dry weight of plants aged 14 days after planting. The seed quality test method according to. Analysis of variance was performed to determine the effect of treatment at the 95% confidence level, followed by Duncan's multiple range test (DMRT) to discover which treatment was significantly different (Gomez and Gomez, 1983). Data analysis was performed using the SPSS 10.0.5 program

3. Results and Discussion

3.1 Seed Germination

The results of the analysis of variance showed that the treatment of seed pile thickness and the treatment time of delayed drying did not have a significant effect and there was no interaction with seed germination. The average percentage of seed germination power is presented in Table 1.

Table 1 shows that the average percentage value of germinating capacity at the time of the 2, 4, and 6 day drying delay was not significantly different, as well as the seed thickness treatments of 3, 5, 7 and 9 cm. Seeds have very good germination capacity, the average percentage is 92.28% even when drying is delayed for up to 6 days with thickness up to 9 cm.

Table 1. Seed germination rate (%)

Delay Time	Seed Pile Thickness				Average	
	K1 (3 cm)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	95.33	93.33	92.00	92.67	93.33	P
W2 (4 days)	92.67	93.33	90.67	91.33	92.00	P
W3 (6 days)	94.00	92.67	90.00	89.33	91.50	P
Average	94.00	95.33	90.89	91.11	92.28	
	A	A	a	A	(-)	

Note: The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction.

Germination is a measure of seed viability, that is, the ability of seeds to germinate normally under favorable conditions. The minimum limit of passing the seed certification test for germination is 80%. Drying using an innovative drying floor allows water levels that have fallen during the day not to increase again at night because at night the seeds also still experience drying under the tarpaulin as a result of heating in the sun during the day so that the process of reducing water content up to 10% faster reached. Increased seed moisture content will cause seed viability to fall due to fungal attack.

Non-standard water content and humid storage space and the accumulation of grain in the container/cage before processing will cause high respiration so that the longer the storage or stacking in a place will have an effect on increasing the grain water content. It also causes the growth of fungi in the grain because the water content after harvest is still high around 20-26%, so that the grain is not fit to be a seed. Seed water content is the main factor that determines the shelf life of seeds. Seed damage during storage is largely influenced by the water content in the seed.

3.2 Plant Height 14 Days After Planting

The results of the analysis of variance showed that the treatment of seed pile thickness had no significant effect, but the drying time delay had a significant effect and there was no interaction with plant height at the age of 14 days after planting. The average plant height is presented in Table 2.

Table 2. Average Plant Height 14 Days After Planting (cm)

Delay time	Seed Pile Thickness				Average	
	K1 (3 cm)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	26.33	25.67	26.45	25.84	26.07	p
W2 (4 days)	23.89	24.94	25.28	25.56	24.92	q
W3 (6 days)	25.00	26.00	25.28	24.56	25.21	q
Average	25.08	25.54	25.67	25.32	25.40	
	A	a	a	a	(-)	

Note:The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction.

Table 2 shows that the mean height of plants aged 14 days after planting at the 2 day drying delay time was significantly higher than the 4 and 6 day drying delay, while the treatment of seed pile thickness of 3.5.7 and 9 cm did not show any difference in the plant height at 14 days after planting. Delays in drying for 4 and 6 days are thought to cause a longer increase in seed water content because the seed water content when harvest is still high so that the respiration rate increases resulting in H_2O and heat which allows the growth of fungi and results in lower plant height at 14 hst. The thickness of the 3 cm seed layer where the seeds are dried in a thinner layer than 5 cm, according to [2], conditions when the seeds exposed to the sun's heat with higher temperatures so that it can result in seed cracking and result in lower seed viability including plant height. Tents in the afternoon and at night on the drying floor innovation allows aeration in the tent to run well so that the 3 cm seed layer does not damage the seeds..

3.3 Number of tillers 14 days after planting

The results of the analysis of variance showed that the thickness of the seed layer treatment and the time delay for drying did not have a significant effect and there was no interaction with the number of tillers at 14 days after planting. The average number of tillers aged 14 days is presented in Table 3.

Table 3 shows that the average value of the number of tillers at the time of the 2, 4, and 6 day drying delay was not significantly different, nor was the treatment of seed pile thicknesses of 3, 5, 7 and 9 cm. It shows that the delay of drying for up to 6 days and thicknesses of up to 9 cm can still be tolerated by the innovative drying method.

The drying method using the innovative drying floor allows the drying process to be evenly distributed throughout the seed so that it does not cause seed damage due to fungal attack reflected by the high seed viability which is reflected by the germination rate of the seeds which reaches (92.28%) exceeding the minimum standard of passing certification by 80%. High viability will also correlate with plant growth in the field represented by the number of tillers parameter.

Table 3. Average Number of Tillers Age 14 Days After Planting

Delay time	Seeds Pile Thickness				Average	
	K1 (3 m)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	6.67	7.78	6.55	7.56	7.14	p
W2 (4 days)	6.89	6.78	7.22	7.11	7.00	p
W3 (6 days)	6.89	6.89	7.11	7.67	7.14	p
Average	6.82	7.15	6.96	7.45	7.09	
	a	A	a	a	(-)	

Note: The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction

3.4. Plant Dried Weight 14 Days After Planting

The results of the analysis of variance showed that the treatment of seed pile thickness and the treatment of drying time did not have a significant effect and there was no interaction with the plant dry weight parameters at 14 days after planting. The average dry weight of plants aged 14 days after planting is presented in Table 4.

Table 4. Average Dry Weight of Plant Age 14 Days After Planting (g)

Delay time	Seeds Pile Thickness				Average	
	K1 (3cm)	K2 (5 cm)	K3 (7 cm)	K4 (9 cm)		
W1 (2 days)	0.71	0.88	0.76	0.87	0.81	P
W2 (4 days)	0.70	0.87	1.05	0.64	0.82	P
W3 (6 days)	1.00	0.73	0.83	1.04	0.90	P
Average	0.80	0.82	0.88	0.85	0.84	
	a	a	a	a	(-)	

Note: The mean followed by the same letter in the same column and row in one treatment category shows no significant difference in DMRT level of 5%. Sign (-) indicates that there is no interaction.

Table 4 shows that the mean dry weight value of plants aged 14 days after planting at the drying time delay of 2, 4, and 6 days was not significantly different, as well as the treatment of seed pile thickness of 3, 5, 7 and 9 cm. It shows that the delay of drying for up to 6 days and thicknesses of up to 9 cm can still be tolerated by the innovative drying method. The drying method using an innovative drying floor allows the process of drying evenly throughout the seed and sufficient aeration/air flow so that it does not cause the seed to be damaged/cracked or attacked by fungus.

4. Conclusion

The treatment of the drying time delay of up to 6 days and the thickness of the sun drying layer up to 9 cm can be tolerated with an innovative drying floor.Treatment time of 2.4 and 6 days delay of drying does not show differences in seed germination, number of tillers and dry weight of plants aged 14 days after planting.The treatment of seed drying pile thickness 3,5,7 and 9 cm by using the innovation drying floor does not show differences in seed germination, plant height, number of tillers, and dry weight of plants aged 14 days after planting. The treatment of 2 days delay of drying showed the highest plant age of 14 days after planting.

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The Effect Of Phytohormone Picloram And Bap On Shallot Meristematic Proliferation

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Abstract.

Shallot (*Allium ascolonicum* L) is one of *Allium* species that is vegetatively propagated. In vitro/micropropagation has been carried out for virus free-seed production. The research was conducted at the Vegetable Research Institute Tissue Culture Laboratory started from August until December 2018. The research goal was to observe the effect of phytohormon picloram and BAP on the growth of meristematic cv. Maja. Totally 9 (nine) treatments were resulted from modified composition e.g. basic MS media (1962) + MS vitamins + sucrose 30 g / l + IAA 2 mg / l + kinetin 2 mg / l + GA_3 0.01 mg / l + Myo inositol 100 mg / l + CaP 2 mg / l + gel rite 2 g / l, pH 5.7, combined with phytohormon picloram (0,1,2 mg / l) and BAP (0,1,2 mg / l). Parameters observation showed that (1) percentage of contamination until 8 WAP was 30- 50 %, generally caused by fungi or bacteria, (2) percentage of visual proliferation was between 65 - 100%, (3) explant growth in M1 to M9 media was one shoot per explant. DAS ELISA detected that tested plants were infected with OYDV, SYSV 36.36% - 53.85%.

Keywords: Shallot (*Allium ascolonicum* L), picloram, BAP, MS Media.

1. Introduction

Shallot (*Allium ascolonicum* L), is one of Allium species that is propagated vegetatively through bulbs. In developed countries onion seeds have been produced through in vitro / micropropagation or unconventional either for the purpose of improving quality or simply for plant propagation (Abo El Nill, 1977; Kamstaityte and Stanys 2004, Bittner *et al* , 1989).

Plant tissue culture unconventional propagation, carried out in aseptic artificial media. The basic principle of tissue culture is cell theory proposed by Scheiden and Schwann (1839 - 1939) that cells are the smallest biological unit capable to reproduce and perform living activities (Ayabe and Sumi, 1998; Gabriela *et al* , 2001)

Unconventional propagation/ tissue culture is known as a technique for growing cells, tissues, organs into plants in artificial media which is carried out aseptically. The growth media used in tissue culture techniques consists of macro, micro elements, amino acids, vitamins and other orginal supplements such as carbohydrate sources, growth regulators (Gamborg *et al* , 1976; Seif *et al* , 2011). Onion propagation using tissue culture techniques is influenced by several factors, ~~e~~g. the composition of the media, genotype from explant source, original explant/donor explant, and explant source treatment (Buiteveld, *et al* 1994; Eady *et al* , 1998; Zheng *et al* 1998).

The aims of this experiment was to observe the effect of phytohormone picloram and BAP in MS media on the growth of meristematic tissue of cv .Maja. Submitted hypothesis was that by adding BAP, picloram on MS medium will increase the growth and development of the meristematic tissue.

2. **Material and Methods**

The research was conducted in the tissue culture laboratory of IVEGRI from August to December 2018 using shoot tip material (meristematic tissue with some primordia leaves) from cv. Maja (local variety) were used as material.

There were totally 9 (nine) treatments made from combination between modified composition e.g basic MS (1962) + MS vitamins + sucrose 30 g / l + IAA 2 mg / l + K inetin 2 mg / l + GA $_3$ 0.01 mg / l + Myo inositol 100 mg / l + CaP 2 mg / l + gel rite 2 g / l, pH 5.7 combined with phytohormone picloram (0, 1.2 mg / l), BAP (0.1.2 mg / l),

Table . 1 The media composition of the treatment .

Treatment	Picloram mg / l	BAP mg / l
M1	0	0
M2	0	1
M3	0	2
M4	1	0
M5	1	1
M6	1	2
M7	2	0
M8	2	1
M9	2	2

The experiment was carried out through following steps:

a). The OYDV as well as SYSV infected explants which had been tested with DAS ELISA were peeled for shoots seclution which then dipped in alcohol 70 % and soaked for 15 minutes in chlorox solution 25%. The shoot was rinsed with a sterile aquadest 3-5 times, transferred to a sterile petri dish.

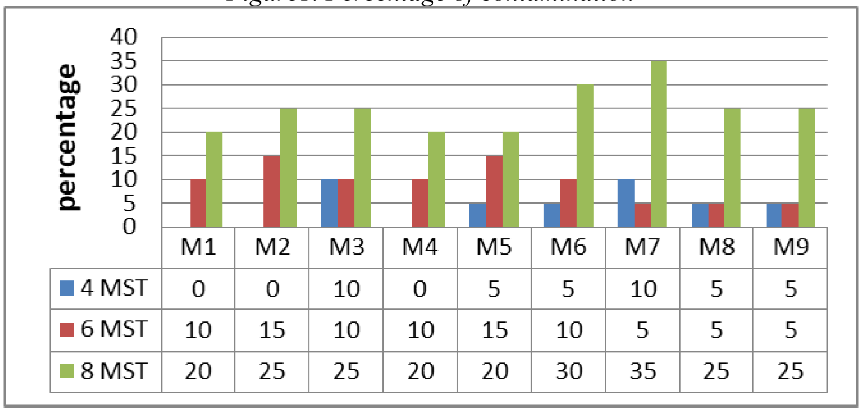
b).Explant culture/inoculation was carried out in a sterile environment in the laminar airflow cabinet (LAFC). Culture ~~is~~ was placed in a test tube 20 x 150 mm with ~~a~~ 8-10 ml media . Culture was incubated in the culture room with temperature of 22-24 ^{o}C, photoperiode 16 hours light, 8 hours dark.

c). Each treatment consisted of 20 tubes, the total number of cultures were 180 test tubes. Visual observations were made for (1) % explant growth (2) average number of leaves, (3) % normal and abnormal plants, (4) average number of roots, (5) incidence of viral diseases from plantlets with DAS ELISA tested for OYDV and SYSV viruses.

3. **Results and discussion**

The results of visual observation on the treatment of planting media and explant shallots of cv Maja at the 4,6,8 WAP as follows:

Figure1. Percentage of contamination



	M1	M2	M3	M4	M5	M6	M7	M8	M9
4 MST	0	0	10	0	5	5	10	5	5
6 MST	10	15	10	10	15	10	5	5	5
8 MST	20	25	25	20	20	30	35	25	25

Note: MST = Weeks after planting/WAP

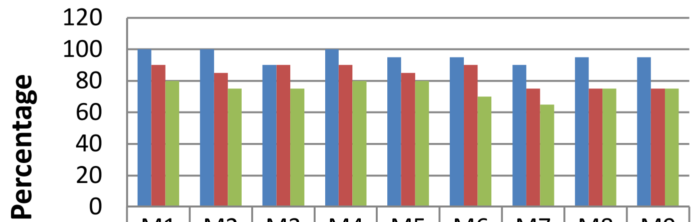
Figure 1 showed that the total contamination was 30-50% of the total culture. Contamination is generally caused by bacteria and fungi. Sources of contaminants ould be resulted from the explant source, surface sterilization, or insufficient explant material/donor explant (Haque *et al,* 1997; Roksana *et al,* 2002).

Free contaminant multiplication through inconventional /plant tissue culture is a very important step, in other words, contamination is a constrain in tissue culture technique.

If the contaminants are not removed from the donor explant, when the explant was grown on media which contain sugar, vitamin and mineral sources, the contaminants will grow and develop rapidly. Explant covered either fungal contaminants or bacteria will stop to grow ~~or~~ and finally died as ~~a~~ direct result of fungus attacks, bacteria or indirectly due to toxic compounds produced by fungi or bacteria (Armini, 1992; Naik and Chandra, 1993).

According to Gunawan (1987), the source of contaminants is generally carried out from explant material either on the surface or in the tissue explant (endogenous). It can also be caused by poor planting techniques, inadequate environment in the culture room at the time of incubation. Of all the sources of contaminations, the most difficult to overcome is the source of contaminants originated from explants.

Figure 2 . Percentage of proliferation



	M1	M2	M3	M4	M5	M6	M7	M8	M9
4 MST	100	100	90	100	95	95	90	95	95
6 MST	90	85	90	90	85	90	75	75	75
8 MST	80	75	75	80	80	70	65	75	75

Note: MST = Weeks after planting/WAP

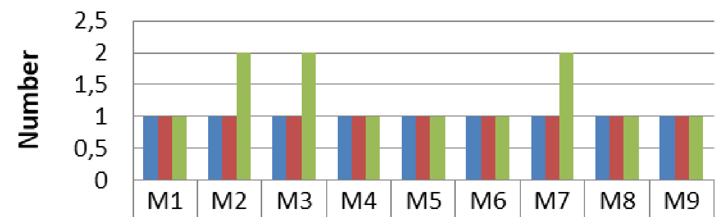
The percentage of growth and development of shallot explant shoot tip visually observed at the age of 4-8 WAP, was between 65-100% . At the time of 4 WAP in the media M1, M2, M4 grew 100% but decreased at the age of 8 WAP.

The successful application of tissue culture in propagation plants by various goal is strongly influenced by the composition of growth media, genotype and the type of explant (George, 2008; Geier 1990 ; Hamidah *et al* 1977, Khar *et al* , 2005).

According to George and Sherington (1984) propagation of plants in vitro has several advantages including (1) the plant material used is smaller so it does not damage the parent tree, (2) the environment grows from aseptic and controlled explants, (3) high propagation speed, (4) can produce disease-free plantlet from a parent that already contains internal pathogens and (5) requires a relatively small place to produce large amounts of plantlets.

In the shoot growth treatment of shallot cv.Maja, media MS with BAP treatment (M4, M5) and without the addition of hormones (BAP or picloram) M1 formed 80% proliferation at the 8 WAP. In the addition of picloram (auxin), percentage of proliferation is generally lower compared to BAP (cytokinin) addition. It can be considered that the addition of picloram (auxin) decreases the percentage of proliferation. In addition to the composition of chosing media explant in tissue culture were important role in the successfulin proliferation (Geier, 1990). –Moreover the selection explant is closely related to the ability explant regenerate (Theng, 1997). Also the purpose of propagation will be achieved (Chen *et al* , 1997; Kamstaity and Staney, 2004)

Figure 3. The average number of shoots .



	M1	M2	M3	M4	M5	M6	M7	M8	M9
4 MST	1	1	1	1	1	1	1	1	1
6 MST	1	1	1	1	1	1	1	1	1
8 MST	1	2	2	1	1	1	2	1	1

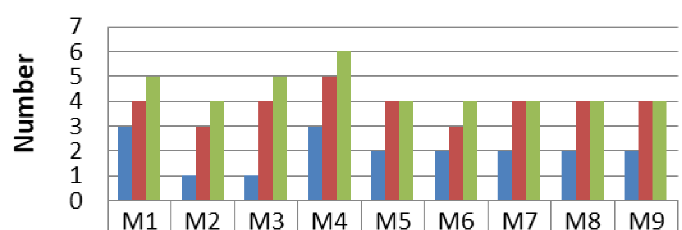
Note: MST = Weeks after planting/WAP

The average number of shoots at 4 – 8 WAP was generally only one shoot per explant except M2, M3 and M7, where the growing media added ZPT picloram (1-2 mg / l), with the exception of M7 media with the addition of BAP 2 mg / l. Visual observations showed that generally the addition of picloram (auxin) will induce a growing shoot.

The formation of shoots on in vitro culture is influenced by various factors (Shen et *al* , 2008), including the type and intensity of light in the culture room / incubation room. In addition, the growth and development of plants /shoot in vitro could be influenced by a variety of very complex factors, a.i (a) genetic factors, (b) nutrition: macro, micro elements, carbohydrate sources, growth regulators added to the media, (c) factors physical: light, temperature, pH of the media, concentration of O_2 and CO_2.

Generally, each genotipe can be offered in different responses to explant and media formulations (Haque an Manfield, 2004; Luc and Bridgen, 1996). The use of explants, basic media, explant treatment, growing environment and proper regeneration systems are thought to increase plant multiplication.

Figure 4. Average number of leaves

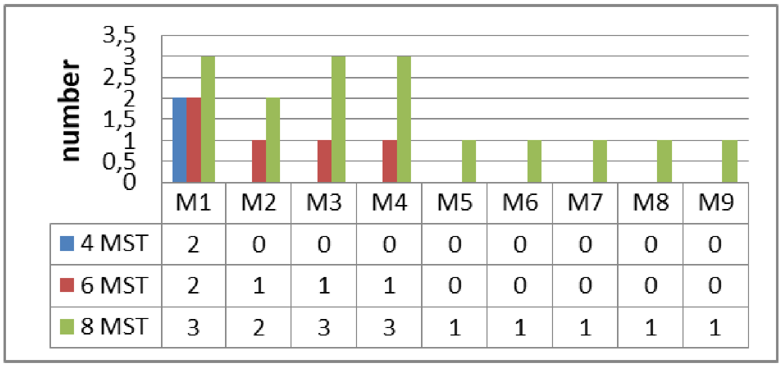


	M1	M2	M3	M4	M5	M6	M7	M8	M9
4 MST	3	1	1	3	2	2	2	2	2
6 MST	4	3	4	5	4	3	4	4	4
8 MST	5	4	5	6	4	4	4	4	4

Note: MST = Weeks after planting/WAP

On visual observation number of plantlets leaves , the addition of BAP or picloram in the growing medium did not effect on the average number of leaves. In plant propagation through tissue culture techniques, the response of the explant planted in the growing media will have variation. It depends on several component, culture conditions (media composition, elements added in the growing media), explant type (cultivar, size, origin of explant). The combination of two or more components are applied, simultaneously or partially necessary to improve the response of the explant (Roksana *et al* , 2002; Kamstaity and Stanys , 2004; Kapoor *et al* , 2011).

Figure 5. Average number of roots



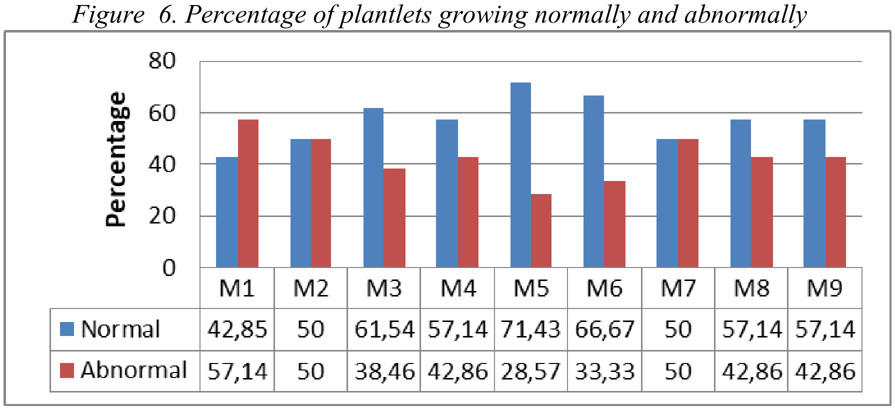
	M1	M2	M3	M4	M5	M6	M7	M8	M9
4 MST	2	0	0	0	0	0	0	0	0
6 MST	2	1	1	1	0	0	0	0	0
8 MST	3	2	3	3	1	1	1	1	1

Note: MST = Weeks after planting/WAP

Data showed that the number of roots at 4 - 8 WAP, treatment of M1 without the addition of ZPT, was the same as the media M3 and M4, which is added auxin / picloram 2 mg / l (M3) and BAP 1 mg / l (M4) . According to Welander (1985) and Noit an *et al* , (1992), treatment for increasing root number of explant can be done by sub-culture of explant on the same medium. With several times of sub culture the explant will be more easily rooted, but this can also cause a decrease in the ability to regenerate and plantlet growth.

Success in the propagation technique is influenced by the response of the varieties (genotype), the type of explant and the composition of the media used (Geier 1990; Hamidah *et al* , 1997). According to George *et al* (2008), the successful development and aplication on plant tissue culture with various objectives depend on media composition and level of conformity with explant material being planted. It is also dependent on the regeneration ability of plants in a in vitro growing media .

Figure 6. Percentage of plantlets growing normally and abnormally



	M1	M2	M3	M4	M5	M6	M7	M8	M9
Normal	42,85	50	61,54	57,14	71,43	66,67	50	57,14	57,14
Abnormal	57,14	50	38,46	42,86	28,57	33,33	50	42,86	42,86

Note: MST = Weeks after planting/WAP

Figure 6 showed that normal and abnormal growths of explant shoot tip shallot cv.Maja. The percentage of normal growth ~~is~~ was always higher than abnormal in the media added by picloram (auxin) a.i M3, M5, M6, M8, M9. In case of addition of BAP and picloram with the same concentration between BAP and picloram, percentage of abnormal and normal were 50%.

Some of the main factors that are key to success in in vitro culture are (a) explant sources (b) growing media and added of ZPT, (c) physical environment and (d) regeneration system (Wattimena *et al* , 2011; Dinarti *et al* , 2008; Dugassa and Feyssa, 2011). Moreover plant genotypes also influence the success of in vitro culture. Generally each genotype responds differently to treatment and the explant media formulation (Haque and M ansfield 2004 ; Luc and Bridgen 1996). The use of explants, media, explant origin treatment, growing environment and proper regeneration systems are thought to increase plant multiplication .

Table 2. Results of serology tests DAS ELISA plantlet var. Maja

Media	Amount of Culture	Number of infected cultures		Total	
		OYDV	SYSV	Number of infected	% infected
M1	9	1	3	4	4/9 = 44.44
M2	10	2	3	5	5/10 = 50
M3	12	3	2	5	5/12 = 41.67
M4	11	4	1	5	5/11 = 45.45
M5	14	4	1	5	5/14 = 35.71
M6	13	5	2	7	7/13 = 53.85
M7	10	3	2	5	5/10 = 50
M8	11	2	2	4	4/11 = 36.36
M9	11	2	2	4	4/11 = 36.36

Description: OYDV = Onion Yellow Dwarf virus, SYSV = Shallot Yellow Strip virus

Efforts for virus diseases elimination on different types of plants have been successfully performed using several methods, such as meristem culture, heat therapy / thermotheraphy or using antiviral Ribavirin / Chemotheraphy followed by propagation through tissue culture techniques (Tan *et al* , 2010). The success of elimination can also be influenced by several things

such as the size of the explant (Ashnayi *et al* , 2012, Hu *et al,* 2012) virus concentration in plant tissue (Pramesh and Baranwal, 2015), plant genotypes, types of ZPT used in tissue culture and methods elimination (Bhojwani and Datu, 2013).

Virus-free plants can be interpreted with negative detection of certain viruses. The most common group of viruses that attack the *Allium* is derived from Carla - V irus, Potty virus and Allexi - virus. The main viruses in onion plants include OYDV (Onion Yellow Dwarf virus), SYSV (Shallot YellowStrips virus) and LYSV (Leeks Yellow Strips virus) (Diekmann, 1997) . The results of research by Gunaeni *et al* (2011), the serology DAS Elisa method in Indonesia detected 3 types virus that is OYDV, SYSV and LYSV. A compound of some viral infection is a phenomenon that is often found in diseases caused by virus.

In table 2. the DAS ELISA test results, the percentage of plantlets infected with OYDV and SYSV 35, 71 - 50%. And according to Zaitlin and Palukautis (2000), the virus was still detected. This indicates that planting of shoot tip shallots has not been able to eliminate the virus which means particles virus have been still regenerate.

4.Conclusion

The results of experiment :

The percentage of contamination 30 to 50% is generally caused by fungi or bacteria. Based on visual observation, the percentage of proliferation is between 65-100%, on 4 to 8 WAP where the leaves and roots have been formed.In average, there was only one shoot grown per explant from all teatment media .The highest percentage of abnormal was found in media M1 and the lowest was found in M5.The results of DAS ELISA test showed that plantlets were infected OYDV and SYSVin a range between 36.36 % to 53.85%.

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The Effect Of Antiviral Ribavirin On Proliferation Of Garlic Cv. Lumbu Hijau, Cv.Lumbu Putih And Cv.Tawangmangu

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Abstract.

The garlic (*Allium sativum* L) belongs to the genus Allium, propagated in vegetative through bulb. In the plants propagated by the vegetative technique virus is an important disease. The tissue culture techniques in combination with chemotherapy can eliminate virus diseases. The experiment was carried out in the laboratory tissue culture of IVEGRI. The experiment aims to observe the effects of several antiviral Ribavirin concentrations in MS medium on growth and development Shoot tip cv. Lumbu Hijau, cv. Lumbu Putih, cv. Tawangmangu, to produce a virus-free plant. Media composition, were: R1 to R4 that is: MS + MS vits + sucrose 30 g / l + IAA 2 mg / l Kinetin + 2 mg / l + GA $_3$0:01 mg / l + gelgro 2 g / l + (Ribavirin 0, 5, 10, 15 mg / l), pH 5.7. The results of the experiment a) Culture contamination were caused by bacteria and fungi with a percentage of 25 to 55%. b). In high concentration of antiviral Ribavirin gave results on decreasing growth and development of three cultivar garlic. c). On visual observation cultivar and added of antiviral Ribavirin has no effect on the number of shoots. d). The added of antiviral Ribavirin and cultivar does not affect the growth of three cultivar garlic. e) The virus test by serological DAS ELISA, the percentage of infected plantlets were 54.55% to 100%.

Key word; Garlic (*Allium sativum* L); Antiviral Ribavirin; cultivar

1. Introduction

Plant tissue culture technique is a technique of growing parts of plants in the form of pieces of tissue or plant organs that are separated from the natural environment in an artificial medium. The basic principle in tissue culture is cell theory proposed by Scheiden and Schwann (1839 - 1939), that cells are the smallest biological unit that can carry out living, reproductive and growing activities (Ayabe and Sumi, 1998; Abo El-Nil, 1977 ; Gabriela *et al* , 2001).

Garlic (*Allium sativum* L) belonging to the genus *Allium* are propagated by vegetative through bulbs. In developed countries garlic propagation has been done in vitro / micropropagation or in conventional either for the purpose of improving quality or just propagation of plants (Abo - El-Nill, 1977; Moriconi, *et al* 1990).

In plants that are propagated vegetatively, viruses are one of the important diseases that need to be solved. According to Walkey (1987), infection with this systemic viral disease can reduce production between 25-50% of the number of cloves (clove), the number and weight of bulbs can be reduced to 45%. Viruses that have infected will continue to develop to next generation. To eliminate the virus in plants with vegetative propagated chemotheraphy treatment / addition of antiviral Ribavirin, heating or by planting meristematic tissue (tissue culture). This combination of techniques can improve the quality and quantity of seeds.

Propagation in conventional / tissue culture plants is known as a technique for growing cells, tissues, organs become perfect plants in artificial media conducted aseptic. Media composition that is used in the tissue culture technique consists of macro, micro elements, amino acid, vitamins and organic supplements other source of carbohydrates, plant growth regulators (Gamborg *et al,* 1976; Barandiara *et al* , 1999; Koch *et al* , 1995). Plant propagation of garlic using tissue culture techniques is influenced by several factors, a.i the composition of the growing media, genotype, explants / donor explants (Buiteved, *et al* , 1994; Eady *et al,* 1998, Zheng *et al,* 1998).

The aims of experiment to observe the effect of several antiviral Ribavirin concentration in media MS (1962) on the growth and development of the shoot tip of garlic cv. Lumbu Hijau , cv. Lumbu putih and cv. Tawangmangu. To produce disease-free plants by using tissue culture techniques combined with Chemotheraphy (antiviral Ribavirin)

2. Materials and Methods

The research was conducted in tissue culture laboratory of IVEGRI , and plant materials (explants) that is used is a bulb of garlic cv. Lumbu Hijau, cv. Lumbu putih , and cv. Tawangmangu. which infected with the virus results of the DAS ELISA serology test .

Step of expriment as follows:

1. Sterilize explants

   Garlic bulbs that have been broken the dormancy shelled and took that are in the garlic cloves. The shoots are washed with detergent solution and rinse with aquadest 2-3 times, then dip in 70% alcohol solution and soak in 25% chlorox solution for 15 minutes, rinse with sterile aquadest 3-5 times, transfer to sterile petri dishes .

2. Proliferation explants before treatment

   Explant was grown in MS media + MS vits + sugar 30 g / l + IAA 2 mg / l + Kinetin 2 mg / l + GA_3 0.01 mg / l + agar 0.65%, pH 5.7 - 5.8. The growth of explants is carried out for 2-3 weeks until the plantlets have 2-3 leaves.

   Shoot tip / meristematic with some primordial leaves is carried out in a sterile laminar airflow cabinet (LAFC), and planted / inoculated in a 20 x 150 mm test tube with 8-10 ml of media. Cultures are incubated in culture room with temperature 22-24 ^{o}C, photo periode of 16 hours of light, 8 hours of dark.

3. Treatment of experiment,

   After explants have been grown into plantlets with leaves 2-3 transferred to the treatment media,:

   Media R1: MS + M S vits + sucrose 30 g / l + IAA 2 mg / l + Kinetin 2 mg / l + GA_3 0.01 mg / l + gelgro 2 g / l + Ribavirin 0 mg / l, pH 5.7

Media R2: MS + M S vits + sucrose 30 g / l + IAA 2 mg / l + Kinetin 2 mg / l + GA_3 0.01 mg / l + gelgro 2 g / l + Ribavirin 5 mg / l, pH 5.7

Media R3: MS + M S vits + sucrose 30 g / l + IAA 2 mg / l + Kinetin 2 mg / l + GA_3 0.01 mg / l + gelgro 2 g / l + Ribavirin 10 mg / l, pH 5.7

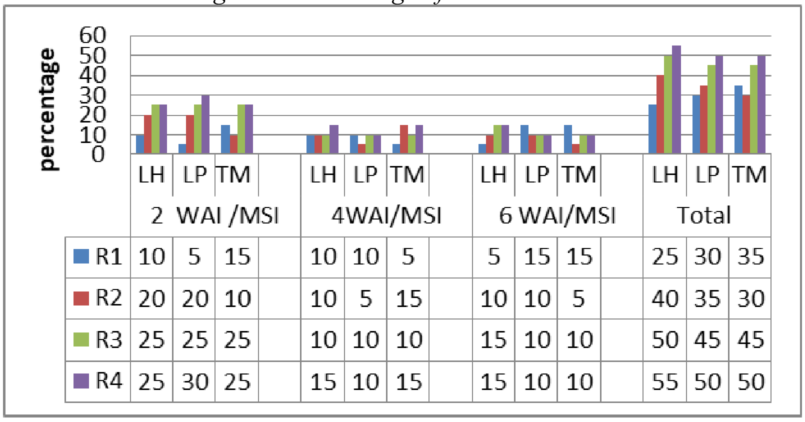
Media R4: MS + M S vits + sucrose 30 g / l + IAA 2 mg / l + Kinetin 2 mg / l + GA_3 0.01 mg / l + gelgro 2 g / l + Ribavirin 15 mg / l, pH 5.7

Each treatment planted 20 test tubes 25 x 200 mm with 10 ml of treatment media. Observations were made visually on 10 tubes taken randomly on the growth and development of the garlic plantlet.

3. Results and Discussion

The observation of the growth and development plantlet in media with antiviral Ribavirin treatment in cv garlic culture. Lumbu Hijau (LH), cv. Lumbu Putih (LP) and cv. Tawangmangu (TM), is obtained:

Figure 1. Percentage of contamination.



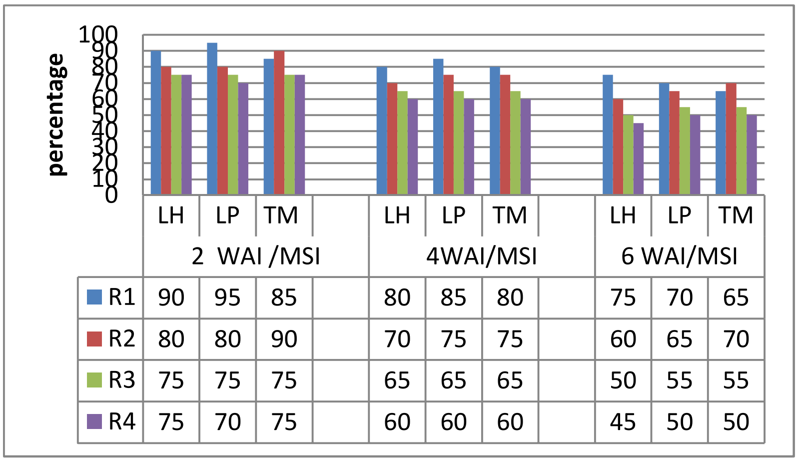
	2 WAI /MSI LH	LP	TM	4WAI/MSI LH	LP	TM	6 WAI/MSI LH	LP	TM	Total LH	LP	TM
R1	10	5	15	10	10	5	5	15	15	25	30	35
R2	20	20	10	10	5	15	10	10	5	40	35	30
R3	25	25	25	10	10	10	15	10	10	50	45	45
R4	25	30	25	15	10	15	15	10	10	55	50	50

Note: R1 = Ribavirin 0 mg / l; R2 = Ribavirin 5 mg / l; R3 = Ribavirin 10 mg / l; R4 = Ribavirin 15 mg / l
LH: cv.Lumbu Hijau; LP : cv. Lumbu Putih ; TM = cv. Tawang Mangu

On the figure the percentage of contamination in 2 to 6 WAI total contamination between 25 % to 55 % . Contamination generally caused by bacteria and fungi, antiviral Ribavirin treatment has no effect on percent contamination. It could be said that the source of contamination was carried by explants. The surface sterilization of explants material has not been sufficient to remove the source of contaminants on the surface of the explants source (Haque *et al* , 1997; Roksana *et al* , 2002)

In tissue culture techniques plant material / explants that are free from contaminant sources is a very important step. Contaminants can be fungi and bacteria. If contaminants are not removed in growth media containing sugar, vitamins, mineral sources of contaminants will grow quickly. Explants that are covered with contaminants will eventually die or not develop, as a direct result of fungal, bacterial or indirect attacks due to toxic compounds produced by fungi, bacteria (Naik and Chandra, 1993; Badoni and Chamka, 2010).

Figure 2. Percentage of plantlets proliferation



Note: R1 = Ribavirin 0 mg / l; R2 = Ribavirin 5 mg / l; R3 = Ribavirin 10 mg / l;
R4 = Ribavirin 15 mg / l
LH: cv.Lum bu Green; LP : cv. Lumbu putih ; TM = cv. Tawang Mangu

Visually plantlet growth on 4 WAI , concentration of Ribavirin were affected. The higher concentration will give the lowest of growth and development on 3 cultivar of garlic.

The success of the development and application of tissue culture in many plants with various purposes is strongly influenced by the culture media and the level of compatibility with the planted explants, namely genotype and type of explants (George, 2008; Geier, 1990; Hamidah *et al,* 1977; Koch *et al* , 1995; Khar *et al,* 2005)

According to George and Sherington (1984), plant propagation in vitro has many advantages including (1) the plant material used is smaller so that it does not damage the parent tree, (2) aseptic and controlled invitro culture growing environment, (3) high propagation speed, (4) can produce disease-free seeds from a parent that already contains internal pathogens and (5) requires a relatively small place to produce large amounts of plantlets. Geier (1990), states that the selection of explants in tissue culture plays an important role in success, and the selection of explants is closely related to the ability of regeneration (Teng, 1997) as well as the purpose of the multiplication to be achieved (Chen *et. Al,* 1997; Kamstaiyte and Stanys, 2004)

Table 1. Average number of garlic plantlets.

Treatment	*2 W AI / MSI*			*4 W AI / MSI*			*6 W AI / MSI*		
	Cv.LH	*CV LP*	*CV TM*	*CV LH*	*CV LP*	*CV TM*	*CV LH*	*CV LP*	*CV TM*
R1	*1 ± 0.38*	*1 ± 0.33*	*1 ± 0.32*	*1.29 ± 0.11*	*1.11 ± 0.37*	*1.2 ± 0.38*	*1.43 ± 0.16*	*1.22 ± 0.41*	*1.40 ± 0.44*
R2	*1 ± 0.45*	*1 ± 0.32*	*1 ± 0.32*	*1..40 ± 0.15*	*1.30 ± 0.41*	*1.2 ± 0.38*	*1.40 ± 0.15*	*1.40 ± 0.15*	*1.20 ± 0.38*
R3	*1 ± 0.38*	*1 ± 0.33*	*1 ± 0.32*	*1.51 ± 0.19*	*1.11 ± 0.37*	*1.2 ± 0.38*	*1.51 ± 0.19*	*1.11 ± 0.37*	*1.30 ± 0.41*
R4	*1 ± 0.41*	*1 ± 0.35*	*1 ± 0.32*	*1.67 ± 0.27*	*1.13 ± 0.39*	*1.2 ± 0.38*	*1.67 ± 0.27*	*1.13 ± 0.39*	*1.11 ± 0.35*

Note: R1 = Ribavirin 0 mg / l; R2 = Ribavirin 5 mg / l; R3 = Ribavirin 10 mg / l; R4 = Ribavirin 15 mg/l
LH: cv.Lumbu hijau ; LP : cvLumbu putih ; TM = cv. Tawang Mangu ; MSI/WAI: Weeks after inoculation

In the table 1, it can be seen that the average number of garlic shoots 3 cultivars plantlets is 1.0 to 1.67 per plantlet, it can be seen from one explant that only grows an average of 1 plantlet. Visual observations in general the addition of antiviral Ribavirin and cultivar did not give a different effect. The formation bud growth of plantlets in vitro culture is influenced by many factors (Shen *et al,* 2008), such is the type and intensity of light. In addition to the growth and development of plants in vitro culture is influenced also by many factors are very complex, namely (a) factors genes , (b) nutrition in a growing medium, water, elements of macro and micro as well as a source of carbohydrates, (c) factors physical: light, temperature, pH medium, the concentration of O_2 and CO_2, (d) organic acids , plant growth regulator is added to the growing media , as well amino acids and vitamins.

Table 2 . Average number of garlic plantlets.

Treatment	*2 Week After Inoculation*			*4 Week After Inoculation*			*6 Week After Inoculation*		
	Cv.LH	*CV LP*	*CV TM*	*CV LH*	*CV LP*	*CV TM*	*CV LH*	*CV LP*	*CV TM*
R1	*4.0 ± 1.51*	*2.89 ± 0.96*	*3.5 ± 1.11*	*5.0 ± 1.89*	*3.44 ± 1.15*	*4.0 ± 1.27*	*5.0 ± 1.89*	*3.78 ± 1.26*	*4.30 ± 1.36*
R2	*3.6 ± 1.36*	*3.30 ± 1.04*	*3.3 ± 1.04*	*3.8 ± 0.68*	*3.90 ± 1.23*	*3.9 ± 1.23*	*3.90 ± 0.68*	*4.0 ± 1.27*	*4.0 ± 1.27*
R3	*4.14 ± 1.56*	*2.89 ± 0.96*	*3.0 ± 0.95*	*3.14 ± 1.18*	*3.33 ± 1.11*	*3.5 ± 1.10*	*3.42 ± 1.53*	*4.0 ± 1.33*	*4.20 ± 1.33*
R4	*3.33 ± 1.36*	*3.38 ± 1.19*	*2.9 ± 0.92*	*3.33 ± 1.36*	*3.75 ± 1.33*	*3.6 ± 1.14*	*4.0 ± 1.63*	*4.13 ± 1.46*	*4.1 ± 1.29*

Note: R1 = Ribavirin 0 mg / l; R2 = Ribavirin 5 mg / l; R3 = Ribavirin 10 mg / l; R4 = Ribavirin 15 mg/l
LH: cv.Lumbu Hijau; LP : cv. Lumbu putih ; TM = cv. Tawang Mangu , MSI/WAI : Weeks after inoculation

In the observation of the average number of leaves 3 cultivars garlic plantlet, number of leaves increases with increasing plantlet aged. The addition of antiviral Ribavirin visually did not affect the number of leaves. For the 3 cultivars garlic cultivar only the higher concentration of antiviral Ribavirin affected leaf growth and the development plantlet 3 garlic cultivars.

Propagation of plants through tissue culture, the response of explants varies depending on the components: culture conditions (media composition; elements added in the growing media), type of explants (cultivar, size, origin of explants). Often a combination of two or more components applied simultaneously or partially necessary for increasing response of explants (Roksana *et al* , 2002; Kamstaityte *et al* , 2004)

Table 3 . Average number of plantlet roots of garlic.

Treatment	2 WAi / MSI			4 W AI / MSI			6 W AI / MSI		
	Cv.LH	CV LK	CV TM	CV LH	CV LK	CV TM	CV LH	CV LK	CV TM
R1	1.04 ± 0.43	1.44 ± 0.48	2.3 5 ± 0.73	1.57 ± 0.22	2.33 ± 0.78	3.2 1 ± 1.01	1.54 ± 0.43	2.89 ± 0.96	3.6 1 ± 1.14
R2	3.99 ± 1.51	2.65 ± 0.85	1.7 1 ± 0.54	3.8 ± 0.30	3.5 1 ± 1.11	2.5 1 ± 0.79	3.2 1 ± 0.45	4.2 1 ± 1.33	3.6 1 ± 1.14
R3	2.86 ± 1.26	1.24 ± 0.41	1.3 4 ± 0.41	2.86 ± 1.26	2.22 ± 0.74	2.39 ± 0.76	3.43 ± 1.29	2.99 ± 1.0	2.89 ± 0.92
R4	3.75 ± 1.63	2.48 ± 0.84	1.1 5 ± 0.35	3.85 ± 1.63	3.0 5 ± 1.06	2.21 ± 0.66	4.01 ± 1.63	3.51 ± 1.24	3.0 1 ± 0.95

Note: R1 = Ribavirin 0 mg / l; R2 = Ribavirin 5 mg / l; R3 = Ribavirin 10 mg / l; R4 = Ribavirin 15 mg / l
LH: cv.Lumbu Hijau; LP : cv. Lumbu putih ; TM = cv. Tawang Mangu , MSI/WAI: Weeks after inoculation

Visual observation of the average number of roots, Ribavirin and cultivar treatments had no effect, roots grew in all treatments. According to Welander (1985) and Noiton *et al* (1992) to increase the root growth of explants can be done with explants sub culture on the same media. With the addition of sub-culture explants were difficult to rooted becomes easier to take root, but also led to a decrease in the ability of plantlet regeneration

Success in propagation techniques with tissue culture is influenced by the response of cultivars (genotypes), the type of explants and the composition of the media used (Geier, 1990; Hamidah *et al* , 1997). According to George *et al* (2008), the successful development and application of tissue culture in many plants for various purposes are deeply influenced by the culture and the level of compliance with the material explants were planted.

Tissue culture techniques are increasingly popular as an alternative propagation plant that is propagated vegetatively. This technique includes asexual propagation method with the main objective to make plants that have superior properties. The success of this in vitro propagation depends on the ability of plant regeneration in aseptic growing media in vitro.

Plant propagation in vitro provide an alternative in the elimination of viral diseases through meristematic culture combined with heat treatment or the addition of antiviral Ribavirin in the growing medium. In experiment was carried out planting meristematic tissue in the form of shoot tip or meristem tissue with few leaf primordia on MS medium with the addition several concentrations of antiviral Ribavirin.

Table 4 . Result of % infected virus with DAS ELISA test

Treatment		*The amount of culture*	*Number of infected cultures*		*Total infected cultures*	*% of cultures infected*
Media	*Cultivar*		*OYDV*	*SYSV*		
R1: 0 mg / l	*cv. LH*	*15*	*7*	*6*	*13*	*86.67 (13/15)*
	cv. LP	*14*	*5*	*8*	*13*	*90.86 (13/14)*
	cv. TM	*13*	*6*	*7*	*13*	*100 (13/13)*
R2: 5 mg / l	*cv. LH*	*12*	*5*	*6*	*11*	*91.67 (11/12)*
	cv. LP	*13*	*5*	*5*	*10*	*76.92 (10/13)*
	cv. TM	*14*	*4*	*5*	*9*	*64.29 (9/14)*
R3: 10 mg / l	*cv. LH*	*10*	*3*	*4*	*7*	*70 (7/10)*
	cv. LP	*11*	*4*	*2*	*6*	*54.55 (6/11)*
	cv. TM	*11*	*3*	*4*	*7*	*63.64 (7/11)*
R4: 15 mg / l	*cv. LH*	*9*	*2*	*3*	*5*	*55.56 (5/9)*
	cv. LP	*10*	*3*	*4*	*7*	*70 (7/10)*
	cv. TM	*10*	*3*	*3*	*6*	*60 (6/10)*

Note: R1 = Ribavirin 0 mg / l; R2 = Ribavirin 5 mg / l; R3 = Ribavirin 10 mg / l; R4 = Ribavirin 15 mg / l
OYDV = Onion Yellow Dwarf virus; SYSV = Yellow Strip Virus Shallots
LH: cv.Lum bu Green; LP : cv. Lumbu putih ; TM = cv. Tawang Mangu

According to the research of Diekmann (1997), the group of viruses that commonly attack onions comes from Carla - virus, Poty - virus and Allexi - virus. The main viruses in onion plants include SLV, OYDV, SYSV. In Indonesia Gunaeni *et al* (2011), reported the incidence of tuber-borne viral diseases in onions and detected infections of OYDV, SYSV and combined OYDV, SYSV. Mixed infection of several viruses is a phenomenon often found in diseases caused by viruses. A viral infection of the onion crop will be acumulated from one generation to the next. Seed borne virus that can cause plant growth , because of the virus could be develops with the growth of plants.

The results of detection of viral diseases in garlic plantlets (Table 4), seen the percentage of infected cultures 54.55% to 100%. From these results it can be said with antiviral Ribavirin treatment of infected plantlets percentage is still high. Viral disease is still detected, this indicates that the addition of antiviral Ribavirin is not optimal for eliminating the virus so that when explants are planted on regeneration media the virus particles are still carried on plantlets. (Zaitlin and P. Palukaitis, 2000).

4. Conclusion

The results of experiment :

The culture contamination is generally caused by bacteria and fungi with a percentage of 25 to 55 %. And the addition of high concentration antiviral Ribavirin in MS media, have the lowest percentage of growth and development for 3 cultivars with visually observetion. Treatment antiviral Ribavirin has no effect on the number of shoots, leaves, roots for all three cultivars, (c v. Lumbu Hijau, cv. Lumbu Putih , cv. Tawangmangu). The results of virus testing using the DAS ELISA technique percentage of infected cultures were 54.55% to 100%.

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The Growth Of Several Soybean Genotypes In The Saline Soil

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Abstract.

One of the strategic efforts to increase soybean production towards self-sufficiency with 2.8 million tons of production is through the expansion of suboptimal planting areas, among others, by using saline soil. The area of potential saline land in Indonesia is 140,300 ha. This study aims to determine the growth of several genotypes at a salinity soil level of 10 dS/m. This experiment was conducted using a randomized block design (RBD) repeated three times. The treatments tested were genotypes consisting of Deja 2, Dering, Karat 13, Panderman, Gepak Kuning, Daun Lancip, Dega1 and Tanggamus. Variables observed in this study include: plant height, root length, stover weight, root dry weight and soil salinity level at the age of 24 days, 45 days, 60 days and 75 days. All genotypes still live up to 45 days, but at 60 days after Dering, Tanggamus, Gepak kuning is dead, and only Daun Lancip can survive up to 75 days.

Keywords: soybeans, growth, saline soil

1. Introduction

One strategic efforts to increase soybean production towards self-sufficiency with 2.8 million tons of production is through the expansion of planting areas, considering that fluctuations in national production have been closely linked to fluctuations in harvested areas, and in the past six years (in 2009-2015) soybean harvested area was only 493-723 thousand hectares with low productivity, 1.2-1.3 t/ha. Based on calculations, to achieve soybean self-sufficiency, national productivity needs to be increased to 1.4-1.5 t/ha in the 2.0 million ha harvested area (BPS, 2017). Expansion of the area can be done by utilizing marginal land such as dry land, acid dry land, and saline land. In Indonesia it is estimated that the total of saline land 440.300 ha which were 304.000 ha rather saline and 140,300 ha saline (Rachman et al., 2008).

Salinity stress causes changes morphology of soybean genotype. Stress salinity affect the roots, canopy of plants soybeans and plant height decreased (Purwaningrahayu and Taufiq, 2017; Bustingorri and Lavado, 2011; Hashi et al., 2015, Sabagh et al., 2015; Farhoudi and Tafti, 2011, Aini, 2014[b]). Legumes have different respons against stress salinity depend on both interspecies and varieties. Based on decreasing yield, critical point salinity stress on soybean, peanut, and green beans are 5 dS/m, 3.2 dS/m, and 1–2.65 dS/m respectively (Kristiono et al., 2013). At the soil salinity 3.91 dS m-1 soybean biomass could decreased up to 48.14% (Aini et al., 2014). Plant height and number of leaves have not decrease yet at the level of salinity of 3 dS/m up to the fourth week of Dering1, Demas1, Devon1 varieties. But the number of pods, pod weight and 100 seeds that genotypes were decreased since at level 3 dS/m of soil salinity (Yunita, 2018). The research objective was to study the growth of several genotypes at 10 dS/m soil salinity level.

2. Materials and methods

The study was carried out in a greenhouse Balitkabi in July - September 2017 used slight alfisol soil from Muneng Probolinggo. The soil was dried and put in polibag 12 kg capacity, filled with 8 kg of soil. The soil in polybag was irrigated up to 100% moisture content. Phonska inorganic fertilizers are distributed alongside the plants during planting. Each pot is fertilized as much as 4 g per pot. At the beginning of planting, each pot planted with four seeds and then thinned at 15 days so that there were only two plants per pot. Saline water was applied when entering V1 phase (after the first trifoliate is fully formed). During the study, the crop is protected from pest, disease and weed disturbances for getting optimal growth of plants.

The study was arranged using a Randomized Block Design with the various of genotype as treatment. The various of genotypes were Deja 2, Dering, Karat 13, Panderman, Gepak Kuning, Daun Lancip, Dega1 and Tanggamus. Variables observed in this study include: plant height, root length, stover weight, root dry weight and soil salinity level at the age of 24 dap, 45 dap, 60 dap and 75 dap.

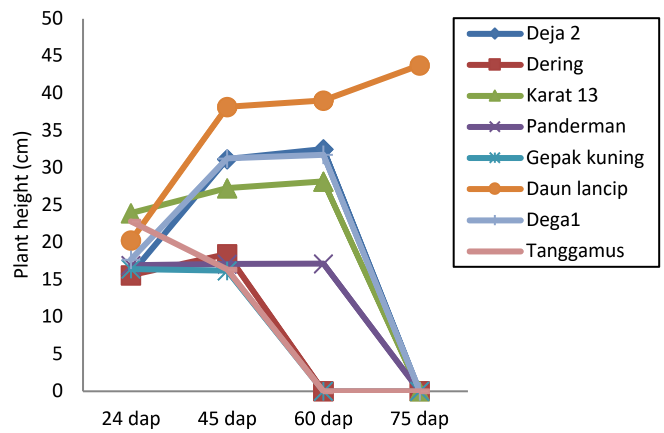
3. Results and discussion

There were variety response of several genotypes in this research. That response show that every genotype have different defense attact to salinity. Firstly, all genotypes still alive at 45 days after planting (dap), but at 60 dap Dering, Tanggamus, Gepak kuning were dead, and only genotype Daun Lancip could survive up to 75 dap.

3.1 Plant height

When it was 24 dap, Karat 13 was the highest plant among 7 other genotypes, it was 23,9 cm. Then, when at 45 dap, the height of the Gepak Kuning and Tanggamus didn't increased since 24 dap, which is about 16 cm. While the height of Deja 2, Dering , Karat 13, Panderman, Daun Lancip, Dega1 increased 97.9%; 18.2%; 13.9%; 1.0%; 88.6%; and 76.9% from the height plant at 24 dap. Its very slight increased plant growth when entering 60 dap, Deja 2 only increased by 4.3%; Karat 13 increased by 3.4%, Panderman increased by 0.3%; Daun Lancip increased by 2.2%; and Dega 1 increased 1.6% compared to 45 dap, while Dering, Tanggamus, Gepak Kuning were dead. Then at 75 dap, the height of Daun Lancip increased 12.2% compared to 60 dap, while the others had died (Figure 1)

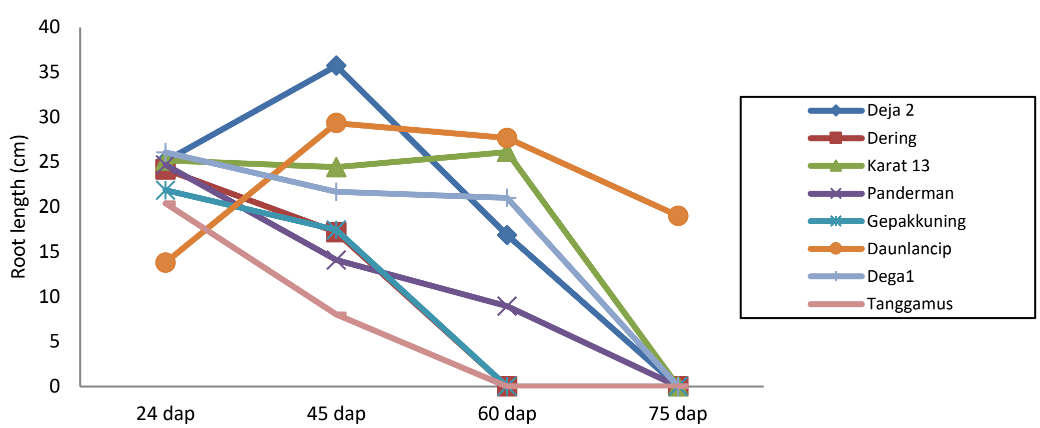
Fig 1. The Plant height of several genotypes at several observation



3.2 Root length

Only Deja 2 and Daun lancip whose roots continued to grow up from 24 dap to 45 dap, that were 42.4% and 112% respectively. While Dering, Panderman, Gepak kuning, Daun lancip, Dega1 and Tanggamus approximately decreased 29.0%, 42.9%, 20.3%, 16.9% and 60.8% compared to the root length at 24 dap respectively. The root length of Karat 13 tends to be stable until 60 dap. Generally, the root length of the plant decreases at 60 dap, it could caused by the roots begin to fragile before the plant dies (at 75 dap). The only one Daun Lancip that still alive but also get decreasing the length of roots at 75 dap. It was 31.3% decreased length of root compared to 60 dap (Figure 2).

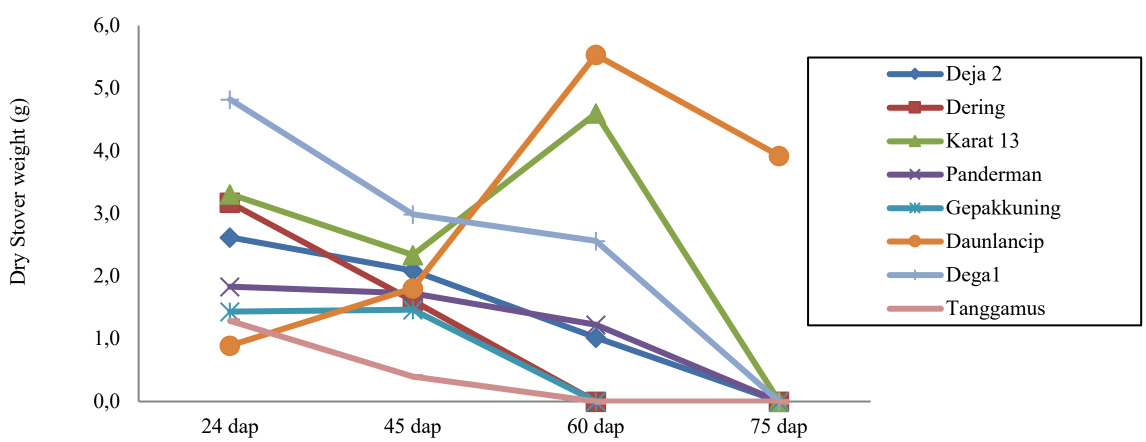
Fig 2. The Plant height of several genotypes at several observation



3.2 Root length

When it was 24 dap, the Dega had the highest stover weight compared to 7 other varieties, but at the age of 45 dap, all genotypes decreased dry stover weight except Gepak kuning and Daun lancip genotypes. Deja 2, Dering, Karat 13, Panderman, Dega1 and Tanggamus decreased dry stover weight up to 20.4%; 49.4%; 29.2%; 6.0%; 38.0%; and 69.2% respectively compared to 24 dap. Whereas Gepak kuning and Daun Lancip increased dry stover by 2.3% and 102.2% compared to 24 dap respectively. Then at the 60 dap, Gepak Kuning was dead, while dry stover weight of Karat 13 and Daun Lancip increased dry stover weight 96% and 206.3% compared to 45 dap. While Deja 2, Pandeman, and Dega1 decreased dry stover weight by 51.1%; 29.0% and 14.2% compared to 45 hst. At 75 hst, only daun lancip genotypes that survived but also get dry stover weight reduction by 29.1% compared to 60 dap (Figure 3).

Fig 3. The dry stover weight of several genotypes at several observation

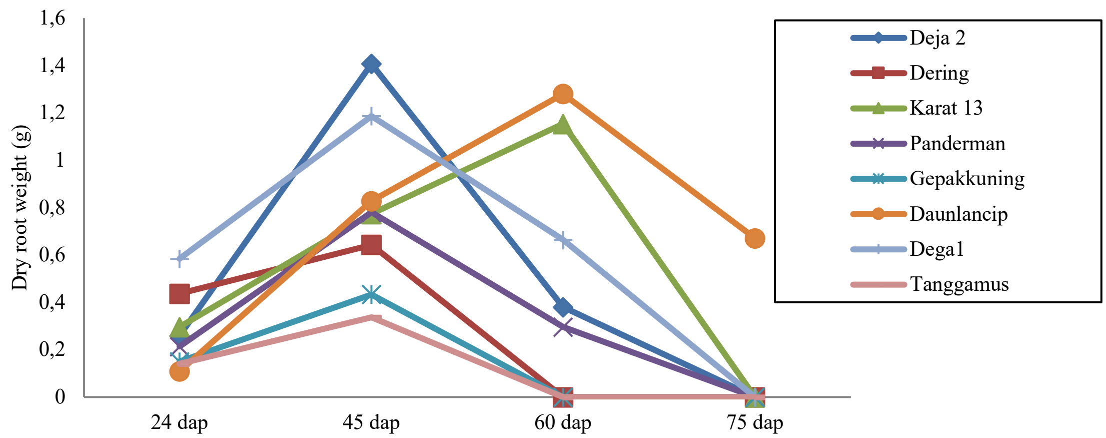


3.4 Dry Root Weight

Dega 1 was the genotype which has the highest root dry weight compared to the other seven genotypes at 24 dap, which is about 0.58 g/polybag. However, at the age of 45 days after planting Deja 2 was a genotype that had the highest dry root weight of 1.4 g/polybag or an increase of 441% from the 24 dap. The growth of roof of Daun Lancip was the highest of other although it wasn't the most dry stover weight, but it increase 651,5% compared by 24 dap, its about 0,8 g/polybag. Dering, Karat 13, Panderman, Gepak Kuning, Dega 1 and Tanggamus only increased 47.3%, 160.7%; 265.6%; 188.9%; 103.4% and 140.5% respectively compared to 24 dap or 0.6 g/ polybag; 0.8 g/polybag; 0.8 g/polybag; 0.4 g/polybag; 1.2 g/ polybag; and 0.3 g/polybag. At 60 dap, only Karat 13 and Daun lancip genotypes that increased the dry weight of roots, as many as 49.1% and 54.8% compared to 45 dap as much as 1.15 g/polybag and 1.28 g/polybag. Deja 2, Panderman and Dega 1 decreased dry root weight by 73% ; 62.0% and 44.1% compared to 45 dap or about 0.4

g/polybag; 0.3 g/polybag; and 0.7 g/polybag. Dering, Gepak Kuning and Tanggamus are dead on this time (60 dap). At the age of 75 days, only genotypes Daun lancip that still alive and get decreasing dry root weight 47.7% compared to 60 dap or 0.7 g/polybag (Figure 4).

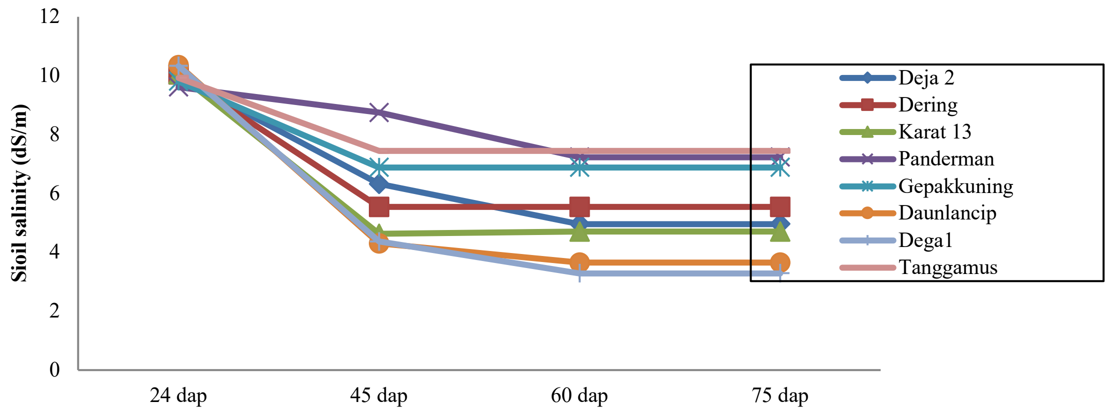
Fig 4. The dry root weight of several genotypes at several observation



3.5 Soil Salinity

Until the age of 24 dap, all genotypes still have the same soil salinity which is 10 dS/m then get decreasing at the age of subsequent observations. At 45 dap, the hardest decreased had occurred on Karat 13, Daun lancip and Dega 1 genotype. These three genotypes have soil salinity content between 4.3 dS/m - 4.6 dS/m. While the other five genotypes have soil salinity content ranging from 5.5 dS/m - 8.8 dS/m. The soil salinity content of Daun lancip and Dega 1 more decreased at 60 dap, its about 3.2 to 3.7 dS/m. While Deja 2, karat 13, Panderman, has soil salinity ranging from 4.7 dS/m - 7.23 dS/m. Dering, Gepak Kuning and Tanggamus are dead from the age of 45 dap, its caused the soil salinity does not change from the age of 60 hst up to 75 dap.

Fig 5. The soil salinity at several observation



Daun lancip was categorized as resistant plant to high salinity and Karat 13 was categorized as rather resistant. Dering, Tanggamus, Gepak Kuning, Deja 2, Panderman and Dega 1 were not resistant. Plants that can survive at saline condition were plants that can absorb the salt content in soil and able to excrete it. These plants relatively has low level of electrical conductivity in the soil and get high dry biomass weight. For these plants, K^+ and Na^+ content are needed for efficiency of cell membrane osmosis regulation and growth of leaf area (Shabala et al., 2010). This plant will have stability of K^+ and Na^+ content although the soil electrical conductivity levels were added (Aini et al., 2014[a]).

Genotypes that are not resistant to saline soil will get thickening of cuticle, thinning cortex, and widening xylem tissue diameter. The high K+ and Na+ content at these plant can reduce water potential cell which ultimately prevents water from being absorbed into the leaves (Dolatabadian et al., 2011). The other side, a wide xylem diameter will reduce cohesion speed that will affect the arrival of water to the leaves then caused water uptake decreased (Totoa and Yulismab, 2017; Hang and Mai, 2016; Khan et al., 2015), where water is the main element needed by plants to carry out photosynthesis. The high K^+ and Na^+ content in plant also reduced N and Mg uptake, where those are macro element that needed on photosynthesis process (Anitha and Usha, 2012, Subramanyam et al., 2012, Aini et al. 2014[a], Taufiq et al. 2015, El Sabagh et al., 2015).This phenomenon that caused the weight of soybean biomass and its growth decreased since 45 dap.

4. CONCLUTION

The soil salinity was decreased plant height, root length, dry stover weight and dry root weight of soybean. Decreasing of it variable were varied based on potential defences of it genotype. Based on this research could be said that all genotypes still live up to 45 days, but at 60 dap, Dering, Tanggamus, Gepak kuning is dead, and only Daun Lancip can survive up to 75 days.

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The Development Of Kemiri Sunand Plants For Supporting Energy Security

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Abstract.

High community dependence on fossil fuels can spur energy scarcity or energy crisis. Kemiri Sunan or Sunan candlenut is one of the types of vegetable oil producing plants that has great potential as a raw material for biodiesel. The development of biofuel on marginal land in the context of supporting national energy security. In the development of kemiri sunan plants in marginal land, it is necessary to do innovation in its cultivation, namely the use of chitosan, an organic fertilizer made from natural materials derived from shrimp shells that are processed with radiation technology to produce useful products in agriculture. Based on the results of the study showed that plants were treated with chitosan showed a better growth response compared to plants that were not treated with chitosan.

Keywords: kemiri sunan, energy security

1. Introduction

Energy becomes an important part of the drive of human life. Energy demand will continue to increase in line with population growth and economic growth. High community dependence on energy sourced from fossils can spur energy scarcity or crisis. When fossil energy is on the verge of a crisis and human needs for energy are increasing, the agricultural sector provides the right answers and solutions to meet people's energy needs. The government's effort to overcome the energy crisis is conducted among others by finding alternative energy that can be renewed (new renewable energy) that is environmentally friendly. In tropical countries, Indonesia has several types of plants that meet these renewable energy source criteria. Among them, which is prospective is kemiri sunan or sunan candlenut plant.

Kemiri sunan or sunan candlenut (*Reutealis trisperma* (Blanco) Airy Shaw) is one type of vegetable oil producing plant that has great potential as a source of raw material for biodiesel. The level of productivity that can reach 8-9 tons of crude oil or equivalent to 6-8 tons of biodiesel/ha/year has a strategic value related to government programs in finding alternative renewable energy sources. Kemiri sunan plants have many advantages. Among them are (1) can grow in critical land so it is suitable as a plant for reforestation and as a conservation plant because of its rapid growth and deep roots so that it can resist landslides and erosion, (2) kemiri sunan oil contains acids - oleostearate which is poisonous so that it can be used as a mixture of vegetable pesticides, (3) including long-lived plants (> 30 years) so that it has a long production life and economic value, (4) plants have wide leaf canopies with dense leaf structures so can reduce air pollution because it absorbs CO_2 and produces a lot of O_2, (5) has a high adaptability to the environment, and (6) can increase soil fertility because the leaves will fall out in the dry season so that it can form thick humus as a soil fertilizer (Tresniawati *et al*., 2014).

During its growth and development, plants will form various organs. In general, plant organs consist of vegetative organs and generative organs. Roots, stems, and leaves are classified as vegetative organs, while flowers, fruits, and seeds are classified as generative organs. Vegetative growth is characterized by various plant growth and development activities related to leaf formation and enlargement, formation of apical or lateral meristems and growth into branches, and expansion of plant root systems.

The vegetative growth of kemiri sunan plants is an important thing to know where later it is expected to support better generative plant growth so that plants can provide optimum productivity. Therefore, it is necessary to do innovations in the cultivation of sunan candlenut on vegetative growth, one of which is the use of chitosan.

Chitosan is an organic nutrient obtained from processing waste skin or shrimp shells, crabs, molds and others which solution contains macro and micro nutrients, plant hormones and is able to increase plant antibodies. Chitosan has an environmentally friendly nature and is easily degraded (Anonymous, 2016). Application of chitosan in agriculture can reduce environmental stress due to drought or nutrient deficiency, increase seed viability, vigor and production. Chitosan application is also able to increase chlorophyll content thereby increasing the effectiveness of photosynthesis (Subiksa, 2013). In addition, chitosan acts as a fertilizer to strengthen growth (Anisa, 2014).

Based on the test quality, chitosan contains 6.74% organic C; 0.05% N; 0.01% P2O5; and 0.01% K2O. Levels of micro elements such as Fe, Cu, Zn, and B are 8 ppm each; 0.8 ppm; 7 ppm; and 1 ppm. Levels of micro elements of Mn, Zn, and Mo were not detected. Heavy metal content of Cd was detected 0.02 ppm and other heavy metals such as Pb, Co, As and Hg were not detected. The content of growth hormones such as auxin (IAA) 319.11 ppm; cytokinin (zeatin) 18.46 ppm and gibberellins (GA_3) 252.48 ppm per chitosan solution (Anonymous, 2013).

One of the factors that influence plant growth is growth hormone, including the hormone gibberellins (GA_3). In an effort to increase the influence of chitosan on the growth of kemiri sunan plants, it is necessary to add gibberellins (GA_3). Gibberellins will affect the extension of plant segments by increasing the number and size of cells in these segments (Wattimena, 1988 in, Tetuko *et al*., 2015). With the help of fertilizing, it is expected that the sunan candlenut plants can grow well.

The balance of the use of inorganic and organic fertilizers is the key to proper fertilization. That is because organic fertilizers and inorganic fertilizers have their respective advantages. Nitrogen (N), Phosphorus (P), and Potassium (K) are macro nutrients that plants need in large quantities. Nutrient N in plants functions as forming of green substances (chlorophyll) and protein forming elements. Nutrient P serves as a storage and transfer of energy, an important component in nucleic acids, coenzymes, nucleotides, phosphoproteins, phospholipids, and phosphate sugars. Nutrient K functions in the formation of starch, activates enzymes and photosynthesis storage catalysts.

Based on the description above, the researchers tried to apply chitosan to young sunan candlenut plants, conducted in several stages of research. The purpose of this study is to determine the effect of chitosan on various agronomic characteristics of vegetative growth parameters of Kemiri sunan or Sunan candlenut plants.

2. Materials and research methods

Kemiri sunan plants which are the object of research are planted on marginal land where the availability of water and nutrients is very limited in the energy garden located in Gunung Kelir sub-Village, Pleret Village, Pleret District, Bantul Regency, Yogyakarta Special Province. It is a garden developed in collaboration with The Center for Research and Development of Electricity Technology, New Energy, Renewable and Energy Conservation (P3TKEEBTKE) Ministry of Energy and Mineral Resources of the Republic of Indonesia with Universitas Pembangunan Nasional "Veteran" Yogyakarta, is a pilot plant of vegetable energy sources. The research took place from 2016 to 2019, conducted in 3 stages using superior varieties of KS2 planted with a spacing of 8 m x 8 m.

The first study with plants aged ± 18 months, using a Randomized Completely Block Design consisting of 2 factors. The first factor is how to give chitosan (C) consists of 3 levels, which are: C1 (poured into the planting hole near the root), C2 (sprayed on the leaves), and C3 (sprayed on the stem). The second factor is the frequency of administration of chitosan (F), consisting of 3 levels, which are: F1 (3 times giving at 20, 40, and 60 days from the application of NPK fertilizer), F2 (4 times giving at 15, 30, 45, and 60 days from the application of NPK fertilizer), and F3 (5 times giving, which are at the time of 20, 30, 40, 50 and 60 days after the application of NPK fertilizer). Of the two factors, nine treatment combinations were obtained, repeated three times, each treatment combination consisting of 3 plants. As a control is without chitosan treatment, so that the total = 84 kemiri sunan plants.

The second study with plants aged ± 36 months, using a Randomized Completely Block Design consisting of 2 factors. The first factor is the concentration of chitosan (C) consisting of 4 levels, which are: C1 (10 ml/l), C2 (20 ml/l), C3 (30 ml/l), and C4 (40 ml/l). The second factor is the frequency of administration of chitosan (F), consisting of 3 levels, that is: F1: 3 times giving, which are at the time of 20, 40, and 60 days from the beginning of the observation, F2: 4 times giving that are at the time of 15, 30, 45, and 60 days since the beginning of the observation, and F3: 5 times the giving is at the time of 20, 30, 40, 50 and 60 days since the beginning of the observation. From these two factors, 12 treatment combinations were obtained, repeated three times, each treatment combination consisting of 3 plants. The control was without chitosan treatment, so that the total number = 111 kemiri sunan plants. The way chitosan is administered through leaves is the result of the first research.

The third study with plants aged ± 48 months. The experiment used a two-factor Randomized Completely Block Design. As the first factor is the dose of Urea + SP36 + KCl fertilizer, consisting of 3 levels, which are: D1 = 150 g + 90 g + 90 g; D2 = 200 g + 120 g + 120 g; D2 = 200 g + 120 g + 120 g (Herman *et al*., 2013); D3 = 250 g + 150 g + 150 g. The second factor is the provision of chitosan, consisting of 3 levels, comprising of: K1 = chitosan concentration of 30 ml/l (the best concentration of the second study, Sasmita *et al*., 2018); K2: chitosan 30 ml/l + GA_3 (100 ppm) per plant; K3: without chitosan. In order to obtain 9 treatment combinations, each treatment combination was repeated 3 times, each treatment combination consisted of 3 plants, so the total = 81 plants.

3. Result and Discussion

Based on the results of Sasmita and Haryanto's (2016) research on the Response of Chitosan to Vegetative Growth of Kemirin Sunan Plants showed that from several parameters observed, it was seen that vegetative growth of plants that were given chitosan showed a better growth response compared to plants that were not given chitosan. (Table 1).

Table 1. Average increase in plant height (cm), increase in number of leaves (strands), root dry weight (g) and plant dry weight (g) of sunan candlenut plants

Treatment	Plant Height (cm)	Number of Leaves (sheet)	Root Dry Weight (g)	Plant Dry Weight (g)
How to Give Chitosan				
Through the root	43,76 b	65,07 b	106,67 a	500,00 b
Through theleaves	49,10 a	68,19 a	100,00 a	548,89 a
Through the stem	44,81 b	63,04 b	100,00 a	462,22 b
Frequency of Chitosan administration				
3 times	38,57 q	56,90 q	91,11 q	491,11 p
4 times	47,45 p	58,55 q	91,11 q	508,89 p
5 times	51,65 p	77,85 p	124,44 p	511,11 p
Treatment combination	45,89 (-) x	64,43 (-) x	102,22 (-) x	503,70 (-) x
Without Chitosan	34,99 y	38,31 y	60,00 y	440,00 y

Note: Average treatment between columns and rows followed by the same letter shows no significant difference in the DMRT test at 5% level. The (-) sign indicates that there is no interaction

Increased plant growth due to chitosan is caused by the role of chitosan in improving plant metabolism. Chitosan is a form of polysaccharide that functions as a biological signal in cells and is able to regulate symbiotic defenses and plant development processes. Chitosan contains Plant Growth Promoter in the form of gibberellins, IAA, and Zeatin. According to Anonim (2016), chitosan is known to increase the number of leaves, chlorophyll, and the availability of amino acids for plants.

In table 1, it can be seen that the application of chitosan through leaves is more effective than the application of chitosan through the roots and sprayed on the stem of the plant. Chitosan application through leaves has several advantages including the absorption of nutrients more quickly because through the mouth of the leaf or stomata. The mechanism of nutrient entry through leaves is related to the process of opening and closing the stomata, nutrient absorption through the leaves can occur due to diffusion and osmosis through the stomata hole so that it is easy for the plants to absorb and has an effect on increasing the vegetative growth of sunan candlenut plants. In general, chitosan which is applied with the frequency of giving chitosan 5 times (applications aged 20, 30, 40, 50 and 60 days) gives a better effect than frequency 3 times (applications aged 20, 40, and 60 days) and 4 times (applications age 15, 30, 45 and 60 days).

Plant dry weight is an indicator commonly used to determine whether or not the vegetative growth of plants, because plant dry weight can describe the efficiency of physiological processes in plants. Increasing plant height and increasing the number of leaves affects the dry weight of plants. If the increase in plant height and number of leaves has increased, the dry weight of the plant will increase.

Based on the results of research by Sasmita *et al*., (2018) on the Effects of Concentration and Frequency of Chitosan Giving on Vegetative Growth of Kemiri sunan or sunan candlenut plants shows that the use of chitosan can be an alternative nutrient that can be given in an effort to increase the vegetative growth of sunan candlenut plants. The results showed vegetative growth of sunan candlenut plants which were given chitosan showed a better growth response than those not given kemiri sunan (Table 2). The increasing diameter of the stem is caused by a reasonably good plant growth. Good growth is indicated by the ability of plants to photosynthesize higher and more photosynthesis results. More carbohydrates are transplanted through phloem and can be used to stimulate secondary growth, that is the expansion of stem cells, indicated by a larger stem diameter than others.

Nutrition must be applied properly, both the concentration and the frequency. Appropriate concentration is when fertilizing the given concentration must be in accordance with the needs of the plant. Giving improper concentration will cause inefficiency to plants, even damage plants. Exact frequency, that is when applying fertilizer should be adjusted when the need for nutrient intake and at the right time. The concentration of 30 ml/L is the right concentration, meaning that it is in accordance with the needs of the plant so that it is efficient for its growth. The frequency of giving 4 times is the right frequency and is sufficient to support the vegetative growth of Sunan candlenut plants.

Table 2. The mean increase in plant height, number of leaves, stem diameter, number of secondary branches, and width of the canopy of Sunan candlenut leaves

Treatment	Plant height (cm)		Number of leaves (sheet)		Stem diameter (cm)		Number of secondary branch		Leaf canopy width (cm)	
Chitosan consentration										
10 ml/L	38,55	c	61,30	c	4,85	b	13,29	b	50,41	b
20 ml/L	43,01	b	65,40	bc	4,97	b	16,32	b	55,92	b
30 ml/L	61,43	a	80,82	a	6,15	a	20,88	a	64,75	a
40 ml/L	48,64	b	71,07	b	5,12	b	19,74	a	61,00	a
Frequency of Chitosan Administration										
3 times	39,48	q	67,44	q	5,13	p	14,49	b	59,67	q
4 times	50,83	p	74,13	pq	5,45	p	19,15	a	66,55	p
5 times	43,52	q	74,97	p	5,24	p	16,47	b	65,83	p
Treatment Combination	32,24	(-) x	72,21	(-) x	5,29	(-) x	16,72	(-) x	60,02	(-) x
Without Chitosan	14,77	y	45,25	y	5,15	x	15,33	x	50,67	y

Note: Average treatment between columns and rows followed by the same letter shows no significant difference in the DMRT test at 5% level. The (-) sign indicates that there is no interaction

Based on the results of the study of Sasmita *et al*., (2019) about the Effect of NPK Fertilizer Dose and the Application of Chitosan to the Growth of Kemiri Sunan Plants in Marginal Land, showed that there was no interaction between NPK fertilizer dosage treatment and chitosan administration on all vegetative growth parameters observed. The NPK fertilizer dose gives 200 g Urea + 120 g SP_{36} + 120 g KCL per plant gives a better effect on the parameters of plant height and number of leaves but has the same effect on the parameters of stem diameter and width of the leaf canopy. Chitosan plus (chitosan 30 ml/L + GA_3) gives a better effect on all vegetative parameters observed. Chitosan treated plants had a better effect on the vegetative parameters observed (Table 3).

Table 3. The mean increase in plant height, number of leaves, stem diameter, number of secondary branches, and width of the canopy of Sunan candlenut leaves

Treatment	Plant Height (cm)		Number of leaves (sheet)		Stem diameter (cm)		Number of secondary branch		Leaf canopy width (cm)	
Dose of Urea+SP36+KCl (g/tan)										
150 + 90 + 90	41,93	b	60,22	b	3,42	a	15,20	b	60,62	a
200 +120 + 120	63,81	a	71,59	a	3,23	a	17,22	b	56,44	a
250 + 150 + 150	40,15	b	62,73	b	3,29	a	19,44	a	66,32	a
Chitosan admninistration										
30 ml/L	46,16	q	61,56	q	3,45	q	17,11	q	57,59	q
30 ml/L + GA3	57,34	p	76,62	p	3,70	p	20,93	p	73,59	p
Without chitosan	41,74	r	56,25	r	2,80	r	13,82	r	50,30	r
Interaction	(-)		(-)		(-)		(-)		(-)	

Note: Average treatment between columns and rows followed by the same letter shows no significant difference in the DMRT test at 5% level. The (-) sign indicates that there is no interaction

Fertilization of 200 g Urea + 120 g SP_{36} + 120 g KCl per plant is the right dose, the plant is able to utilize the available nutrients optimally. The existence of NPK fertilizer as an inorganic fertilizer is very quickly absorbed by plants, especially the nitrogen element compared to elements P and K. According to Lingga and Marsono (2007), the role of nitrogen for plants is to stimulate overall growth and encourage the formation of chlorophyll so that the leaves turn green which is useful for the process photosynthesis.

Chitosan 30 ml/L + GA_3 treatment gives a better effect. According to Abidin (1990), GA_3 can stimulate stem growth, increase plant cell enlargement and propagation, so that plants can reach a maximum height. GA_3 affects the extension of plant segments by increasing the number and size of cells in these segments (Wattimena, 1998 *in*., Tetuko *et al*., 2015. The addition of gibberellins causes elongation of the stem by spurring cell division and cell elongation so that plant height is more significant than the plant height. Without the addition of gibberellins, one of the effects of gibberellins is to encourage leaf lengthening (Ratna, 2008), expand leaves and influence the growth of leaf counts (Tetuko *et al*., 2015). The more the number of leaves, the more secondary branches are produced, the number of leaves affected by genotype and environment. The addition of gibberellins is effective in influencing the number of productive branches, this is in accordance with Willkins (1989) opinion that the hormone gibberellins work on genes so that it requires the right concentration Concentration of the 100 ppm gibberelline hormone can effectively increase the number of productive branches. Leaves have something to do with the number of secondary branches. The more the number of secondary branches will cause an increase in the leaf growing segment, the number of leaves tends to be more and the leaf canopy wider. In addition, gibberellins have a synergistic effect on cambium activity and differentiation of the transport network which causes the trunk diameter to be greater.

4. Conclusion

1. Cultivation innovation through the use of chitosan which is applied to the kemiri sunan or sunan candlenut plants gives a better effect than plants that are not given chitosan.
2. Application of chitosan through leaves is more effective than application of chitosan through roots and sprayed on the stem of the plant.
3. The concentration of chitosan 30 ml/L and the frequency of giving chitosan 4 times is the right treatment according to the needs of plants and efficient to support the vegetative growth of kemiri sunan or sunan candlenut plants.
4. The treatment of chitosan 30 ml/L + GA_3 gives a better effect than the treatment of chitosan without the addition of gibberellins.

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Soybeans (*Glycine max* (L.) Merill) Variety Tolerance Under Young Oil Palm Shadding

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Abstract.

The research purpose was to select the soybeans variety that tolerance at the young oil palm shading. The research conducted at oil palm smallholder at 2 years aged at Sungai Mandau sub district siak regency, using Randomized Block Design with 10 high yielding soybeans varieties wereArgomulyo, Anjasmoro, Dering 1, Dena 1, Burangrang, Grobogan, Dena, Gema, Kaba, dan Devonwith 5 times replication. The result showed that he highest plant height was shown by the Argomulyo variety (61.52 cm), and the lowest plant height is the Anjasmoro variety (38.72 cm). The highest number of primary branches was shown by Grobokan and Gema varieties, while Argomulyo, Dering 1 and Burangrang varieties showed the least number of primary branches, but these three varieties were not significantly different from Anjasmoro, Dena 1, Denas, and Kaba. Therewere a wide diversity among varieties in the number of podsproducing. Gema is the variety that gives the highest number of pods compared to other varieties, followed by the Devonian variety, and Denas, on the other hand Kaba gives the least number of pods, followed by Grobokan and Dena 1 varieties, the number of other variety pods is between the two groups. Anjasmoro, Dering 1, and Gema showed the highest productivity compared to other varieties, but not significantly different with Argomulyo, Dena 1, Grobokan, Denas and Devon.

Keyword: peat soil, oil palm, shading

1. Introduction

The position of soybeans as a food crop ranks third after rice and corn. Based on 2014 fixed figures, Riau soybean production was 2,145 tons of dry beans or decreased by 187 tons (down 8.02 percent) compared to the previous year. This decline in production occurred due to a decrease in harvested area by 514 hectares or down 25.32 percent. (BPS, 2015).

Riau has the largest oil palm plantation area in Indonesia, reaching 23% of the national oil palm plantation area, covering 1,781,900 ha. 17.60% of the area is immature plantations (Ditjenbun, 2014). No less than 20% of the area of immature oil palm plantations is on peatlands. Until now the space between immature oil palm trees is left without useful cover crops, weeds become easy to grow, this has resulted in additional costs in its management.

Technically, the space between immature oil palm plants can be utilized for the cultivation of food crops that will add value to the land. Soybean is one of the suitable food crops used as intercropping in oil palm plants not yet produced, this refers to the inter-crop integration system workshop between oil palm plantations which confirms that soybeans are one of the recommended food crop commodities, the results of overlapping farming analysis Kelapa sawit soybean juice produces B / C ratio of 1.29 (Wardiana and Mahmud, 2003).

The obstacle faced when cultivating soybean plants as intercropping is the low intensity of light received as a consequence of the closure of the canopy of oil palm plants. One form of plant response to low light is the morphological changes in the stem due to the shade effect so that the stem is etiolated (Yunita et al, 2008). According to Muhuria (2006), an increase in leaf area is another mechanism of adaptation of plants to low light intensity which allows an increase in the catchment area, also causing the leaves to become thinner because the palisade cells consist of only one or two layers.

Tests on 17 soybean genotypes planted under rubber trees aged 1, 2, and 3 years showed the ability of soybean genotypes to adapt to the conditions of lack of light, soybean productivity under conditions of rubber plants aged 1, 2 and three years in a row 0, 8%, 1.5% and 1-13% lower than in open conditions (Jufri, 2006). Other studies have also shown results that show the ability of soybean varieties to tolerate low light intensity. The decrease in low light intensity affects the density of the stomata and the density of the leaf trichome as well as the growth and yield of soybean plants. 50% shade treatment increases surface trichome density of soybean leaves but decreases total leaf area, number of primary branches, top surface stomata density, number of pods per plant, number of pods contained per plant and weight of 100 seeds (Pertiwi et al, 2012). Darma et al. (2012) stated the results of their research that the provision of 50% shade in the Petek variety showed tolerance tolerant to shade through increased chlorophyll a, chlorophyll b, decreased chlorophyll ratio higher, and weight 100 seeds higher than that of Jayawijaya varieties.

Susanto and Sundari (2011) suggested the results of their research on the effect of shade on 4 soybean varieties, the results showed that the Wilis variety had the highest number of filled pods compared to Argomulyo, Anjasmoro, and Grobogan and were considered to be very tolerant in the shade of 50%.

2. Methods

The study was carried out in Muara Kelantan Village, Sungai Mandau District, Siak Regency in 2017. The location was shallow peatland (80-100 cm) planted with 2-year-old oil palm. Using a Randomized Group design, with a single factor of 10 levels consisting of new superior varieties of soybeans: Argomulyo, Anjasmoro, Dering 1, Dena 1, Burangrang, Grobogan, Denas, Gema, Kaba, and Devon, repeated 5 times. So there are 50 research units. The area of one experimental unit is 19m x 4m according to the size of the available interposed land. Implementation of research activities include: 1. Clearing the experimental land, beginning with the spraying of a systemic herbicide to remove weeds in the field, continued with the removal of the remnants of disturbing plants .; 2. Soil processing, carried out if the soil is perfect, the soil is covered with a depth of 20 cm, after one week followed by crushing the soil using rotary; 3. Amelioration, in general peat soils in Riau react acidly, so it is necessary to provide ameliorant to increase soil pH. the granting of 2 tons / ha of agricultural lime is done in conjunction with the second tillage; 4. Planting, carried out 1 week after tillage II. The number of seeds is 2 seeds per planting hole, before the soybean seed was given rhizobium inoculant. The spacing in the plot is 40 cm x 20 cm while the distance between plots is 1 m .; 5. Fertilization, done by giving 50 kg Urea /ha, 100 kg TSP/ ha and 100 kg KCl/ ha at planting time; 6. Replanting, done by replacing dead plants with other seeds, replanting is done a week after planting; 7.

Weeding, done by removing all the weeds that grow in the trial unit, is done by taking into account the condition of weeds in the test plot; 8. Pest and disease control, carried out by following the Integrated Pest / disease control pattern; 9. Harvest, carried out after the leaves of the plant turn yellow and begin to fall out. Harvesting is done by cutting the base of the stems of plants; 10. Drying is done by drying the sun's tarpaulin, so the seeds that come out of the pods do not fall to the ground.

Variables observed in the study included vegetative and generative growth variables and yield components. The variables are as follows: 1) Plant height: plant height is measured from the ground level to the highest growing point in cm. measurements taken before harvest, taken from 5 sample plants per treatment plot; 2) Number of primary branches: i.e. counting all branches that were formed and producing pods, carried out before harvesting were taken from 5 sample plants per treatment plot; 3) Number of pods per plant by counting the number of filled pods and number of empty pods per plant taken from 5 sample plants per treatment plot; 4) Number of seeds per Productivity pod, obtained by converting seed weight per plot into tons / ha. Growth data, yield components, and yields of plants were analyzed for variance at a 95% confidence level, if there were real differences, they were further tested using the DMRT Test using STAR software.

3. Result

Plant Height

The results of observations of the plant height of 10 varieties tested in the first planting season in 2017 are shown in Table 1. Based on table 1, the highest plant height was shown by Argomulyo varieties as high as 61.52 cm followed by Grobokan varieties 51.29 cm. On the other hand the varieties that showed the lowest plant height were Anjasmoro varieties 38.72 cm followed by Burangrang 38.24 cm, the lowest plant height was not significantly different from some of the other tested varieties, such as Dering 1, Dena 1, Denas, Kaba and Devon. Variation between varieties in displaying plant height is thought to be the plant's response to the received light intensity. As it is understood that soybean plants planted between oil palm plantations have not produced yet. The condition of soybean cropping between oil palm causes the intensity of light received is not as much as in open land. One form of adaptation to obtain adequate lighting, soybean plants do elongation segments so that the figure becomes taller and can receive better light

Table 1. Plant height, amount of primary branches / plants and amount of soybean pods under the shade of immature oil palm

Varieties	Plant height (cm)		Amount of primary branches		Amount of soybean pods/plant	
Argomulyo	61.52	A	1.88	b	75.94	ef
Anjasmoro	38.72	D	2.32	ab	94.36	d
Dering 1	40.54	Cd	2.04	b	91.26	de
Dena 1	47.92	Bc d	2.96	ab	55.90	g
Burangrang	38.24	D	1.88	b	90.00	de
Grobokan	51.92	B	3.36	a	71.00	fg
Denas	44.00	Bc d	2.28	ab	110.46	c
Kaba	48.52	Bc	3.00	ab	28.06	h

		d				
Gema	50.16	Bc	3.40	a	186.34	a
Devon	45.72	Bc d	3.12	ab	154.80	b

Note: Numbers in the same column followed by lowercase letters are not significantly different according to the DMRT test at a 95% confidence level

Amount of Primary Branches

The number of primary branches of 10 varieties tested ranged from 1.88 to 3.4 fruits per plant, this condition actually did not show the optimal condition of each variety in demonstrating the primary branch (Table 1). The optimum primary branching condition has not yet been achieved which is thought to be related to the low light intensity received, so that the plants try to raise the height of the plants rather than multiplying the number of primary branches.

Amount of Pods/ Plant

There is considerable diversity among varieties in producing the number of pods per plant (Table 1). Gema is the variety that gives the highest number of pods compared to other varieties, the second most produced by the Devon variety followed by Denas, on the other hand Kaba gives the least number of pods, followed by Grobokan and Dena 1 varieties, the number of other variety pods is between the two groups.

Variations shown by varieties in producing the number of pods in addition to being determined by genetic diversity between varieties, allegedly also as an effect of the soybean growing environment. Between varieties there is diversity in adapting to the intensity of light received. In this study, the Gema variety shows better adaptability in responding to low light, this variety still provides the highest number of pods compared to other varieties. Kaba is a variety that is not good enough to respond to low light intensity, as seen from the performance of the smallest number of pods produced compared to other varieties.

Table 2. Performance of number of seeds / pods and soybean productivity under the shade of oil palm that has not produced yet

Varieties	Amount of seed/pod		Productivity (tons/ha)	
Argomulyo	2.54	a	1.63	ab
Anjasmoro	2.90	a	2.03	a
Dering 1	2.50	ab	2.04	a
Dena 1	3.00	a	1.68	ab
Burangrang	2.70	a	1.41	b
Grobokan	2.80	a	1.69	ab
Denas	2.50	ab	1.65	ab
Kaba	2.00	b	0.83	c
Gema	2.60	a	2.11	a
Devon	2.64	a	1.61	ab

Note: Numbers in the same column followed by lowercase letters are not significantly different according to the DMRT test at a 95% confidence level

Amount of Seeds/pod

The performance of the number of seeds per pod of 10 tested varieties is shown in table 2. In general the number of seeds per pod of soybean plants ranged from 1 to 3 seeds. The results of the data analysis showed that 9 test varieties had the number of seeds per pod not significantly different, from the table it was seen that only Kaba displayed the number of seeds per pod lower than other varieties, except for the Dering 1 and Denas varieties. The number of seeds per pod shows that almost all varieties display the same number of seeds. This condition shows that the number of seeds per pod is more controlled by genetic factors than the environment, so that even though the conditions of light intensity are lacking, plants still display the number of seeds per pod no different.

Productivity

The productivity performance of 10 soybean varieties tested as shown in table 2 shows variations in the ability of varieties to produce seeds. Anjasmoro, 1st ring, and Gema showed the highest productivity compared to other varieties, but statistically it was still not significantly different from the Argomulyo, Dena 1, Grobokan, Denas and Devon varieties. This result was different from research conducted by other researchers who stated that soybean genotypes were indicated very tolerant of the shaded environment characterized by higher plants than in conditions without shade but plants do not collapse (Susanto and Titik, 2011). This condition can be seen from Gema and Anjasmoro, although they have a lower plant figure compared to Argomulyo but can produce higher production with other varieties. Kaba variety in this study shows the lowest yield compared

Gema varieties show high productivity with other varieties compared to Kaba. This is thought to be related to the ability of these varieties to adapt to their environment. This can be seen from the consistency of these varieties in the performance of other variables such as the number of pods/plant and the number of seeds/ pod.

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Making of Solid Organic Fertilizer from Organic Waste

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Abstract.

The abundance of leaves waste in the Sukolilo Dian Regency (SDR) Surabaya housing can be utilized as organic fertilizer. In the community service program, making organic fertilizer from leaf waste is implemented in SDR housing. This objective research is to make organic fertilizer from dried leaves by using effective microorganisms (EM4) as bio activator . The condition for producing the fertilizer are 20 ml EM4/5 kg dried leaves. In this research, fermentation process used the aerobic method, and kept the dried leaves stacked on a wooden box with dimension 6 m x 6 m. The results showed that the best levels of C, N, P, K were in aerobic condition with levels of C = 51.76%, N = 3.96%, P = 19.79% and K = 0.49%. And for the anaerobic condition shows levels of C = 73.44%, N = 3.49%, P = 10.38% and K = 0.57%. The organic fertilizer applied to the growth of many plants in the area of Keputih Dian Regency, Surabaya.

Keywords: dried leaves, EM4, organic fertilizer, organic waste

1. Introduction

Nowadays household waste is a problem that needs careful and careful attention, because it is difficult to find household waste that is in accordance with standards, because it has been polluted from various household activities, and the human connection with waste is getting increased in line with increasing population.

Domestic waste or household waste is waste that arises because of human life, environmental and public health problems arise in various areas, both urban and rural. Waste disposed of carelessly can cause various disasters, both on the environment or on humans themselves. All countries on this earth realize that waste or waste is one of the problems that bring discomfort to life in an environment.

The increase in population, changes in consumption patterns, and people's lifestyles have increased the amount of waste generation, type, and diversity of waste characteristics. Increasing the purchasing power of the community towards various types of staples and the results of technology as well as increasing businesses or activities supporting the economic growth of a region also contribute greatly to the quantity and quality of waste produced. Increasing the volume of landfill waste requires management. Waste management or waste that does not use methods and techniques of environmentally friendly waste management can have a negative impact on health and is also disruptive

To realize a clean and green city, the government has designed various programs aimed at encouraging and increasing the capacity of the community in waste and waste management. To foster an awareness within us of the importance of living cleanly and fostering a shared sense of responsibility from the rubbish problem that never ends in our environment (Ali., et.al 2011).

One solution to this problem is to make the municipal waste leaves waste as a basic ingredient of organic fertilizer. Organic fertilizer is fertilizer that contains microbial active ingredients that are able to produce compounds that play a role in the process of providing nutrients in the soil. The group of microbes that are often used in biological fertilizers are microbes that can tether N from the air, microbes that dissolve P and K nutrients with the help of microorganisms EM 4 (Effective Microorganism 4).

One of the wastes produced from municipal waste is municipal waste. The leaves have a high lignin content, and therefore need a long time to degrade the lignin. With the addition of microbes contained in organic fertilizer will be able to help the composting process be faster. The composting process with anaerobic method will be faster, which is between 10-40 days. This method of making organic fertilizer is available in two stages, namely aerobic and anaerobic. Addition of organic material derived from plant residues and animal dung in addition to adding soil organic matter also contributes to the availability of N, P, and K nutrients, and streamlines the use of inorganic fertilizers. Organic matter and types of animal waste (kendang fertilizer) are generally easily decomposed because of the low C / N ratio. In addition, the use of organic material is economically cheap, easily obtained and without a high technological approach so it is relatively easy to reach by farmers (Djuarnani, 2005).

The objectives of the research was to make the organic fertilizer from dried leaves by using EM4 as bioactivator. will be implemented in SDR housing by controlling water content, temperature, pH, humidity, material size, volume of material piles and material selection needs to be done intensively to maintain an optimal composting process. This intensive control is a hallmark of the aerobic composting process. The end result of aerobic composting is in the form of material that resembles black soil and brown, crumbs and friable (Fahey., et.al., 2005).

2. Material and Methods

2. 1 Fertilizer Ingredients

All ingredients are mixed together with the accelerator (dried leaves and EM4 solution). The mixture of materials is made layer by layer, according to the variable. Each make a layer, sprinkling on top of the activator solution (EM4). Waste mixture as raw material is made layer by layer up to. Fertilizer material covered with a plastic roof (tarpaulin) and left for 30 days. After undergoing fermentation, the pile is stirred by transferring the pile. Transferring the pile is done by shovelling a fertilizer runway and scattering the new fertilizer runoff. This is done with the aim to provide aeration in the fertilizer pile, so that the inside of the fertilizer that has an oxygen deficit will receive oxygen, resulting in aerobic decomposition. Fermentation is stopped when the results of mature fertilizer have been achieved. New ripe fertilizers are ready for use in the next few weeks.

2. 2 Treatments

For planting, many kind of plant are prepared which are already softened in advance and added water to increase soil moisture. The land to be prepared is approximately 150 cm x 300 cm. Plants to be planted are plants that have been sown first. The steps for using compost are as follows:

a. Add organic fertilizer from compost above to the plants of corn, chili, tomatoes and mustard with a size of 500 grams for each fertilization.

b. Plant height and leaf width measurements were carried out once a week.

c. Harvest the results of the plants when they have reached harvest age and weigh the harvest weight of the test plants.

3. Results

The Making organic fertilizer is done by using as many dried leaves as much as 2 tons of dried leaves waste mixed with EM4 8L with water 20L. The organic fertilizers produced were analyzed content of N, P, K, and C. The fertilizer produced is applied to chilli plants.

3. 1. Organic Fertilizer Process

In the process of making Solid Organic Fertilizer made from, all raw materials are taken from Sukolilo Dian Regency, as it is shown in figure 1. Then all the raw materials are mixed with other materials evenly, and placed in wooden boxes in accordance with the variables that have been determined to be composted. The composting process is carried out in an aerobic manner where the place is protected with a tarpaulin to protect it from direct sun heat and rainfall but still pay attention to the air for circulation (Permentan., 2009).

For the manufacture of solid organic fertilizer using aerobic methods, there are variations in the variables used. The process of making solid organic fertilizer begins by mixing all ingredients made layer by layer and sprinkling the bacterial mixture according to variables. Fertilizers will be stirred once a week to help the aeration process. So that the inside of the fertilizer that has an oxygen deficit will receive oxygen. The composting process is carried out for 30 days. Every 3 days, the temperature, humidity and pH are checked. Humidity is maintained because it affects the temperature of the pile. Humidity is maintained so that it is not too low so that the temperature is kept not too high, so that it stays within the optimal temperature range of bacteria to live well. Aside from temperature, the process of making compost also takes into account the pH being maintained at a vulnerable 6-8. And the process of making compost also takes into account the humidity being maintained at a vulnerable 40-60% (Pratiwi., 2013). The results of the cooked fertilizer are shown in the figure 2.

Figure 1. Process of making organic fertilizer

Figure 2. Organic fertilizer

3. 2. Analysis Results C, N, C/N, P, K Ratio

Table 1 showed the result of analysis of C, N, C / N, P and K Ratios of fertilizer in laboratory scale. These materials are analyzed at Laboratorium Teknologi Air dan Konsultasi Industri ITS, Surabaya.

Table 1. *Results C, N, C / N, P, K Ratio of each variable*

Parameter	C (%)	N (%)	P_2O_5 (%)	K_2O (%)	C/N
Aerob	51,76 %	3,96 %	19,79 %	0,49 %	13,07
Anaerob	73,44 %	3,49 %	10,38 %	0,57 %	21,04

3. 3. Compost Results in The Test Plants

After the compost has been tested for C, N, P, and K levels, the compost will be used as fertilizer in planting test plants. In this test will be seen the growth of test plants. This fertilizer is implemented on chilli plants and is obtained at the time of harvesting fresh chili 5.023 grams per fruit and the total weight in one tree is 45, 207 grams. The number of chili leaves is 38 strands.

4. Conclusion

From this research that has been conducted the following conclusions can be drawn:

1. The content of elements N, P, and K of organic fertilizer in accordance with SNI standards and the compost quality standard by Permentan No. 28 / Permentan / SR / 1305/2009) namely N = <6%, P = <6% and K = <6%.
2. Based on the nutrient content test results, the best organic fertilizer results were found in the aerobic condition with levels of N = 3.96% levels of P = 19,79% and levels of K = 0,49% for 30 days of composting.
3. This chili plant that uses organic fertilizer produces fruit weighing 45,207 grams per tree

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Slope Reinforcement Method With Green Construction Concept To Reduce Risk of Landslides

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Abstract.

Landslides are common events that occur on a slope structure, this event can occur on land slopes or rock slopes. Landslide events may occur on natural slopes or man made slopes. Improvement of the slope stability, aims to reduce the forces that move the landslide mass, and increase the shear resistance of land itslef. Methods for improving slope stability that are recommended for being environmentally friendly are geometric slope improvements, improvement and addition of horizontal drainage systems, and slopes strengthening with vegetation (soil bioengineering).

1. Introduction

Landslides are common events that occur on a slope structure, this event can occur on land slopes or rock slopes. Landslide events may occur on natural slopes or man made slopes. The occurrence of landslides is caused by the movement of soil or rock mass due to the collapse of the shear strength of the soil or rock mass along its potential landslide field. Hardiyatmo (2012) states that mass movements that trigger landslides are generally caused by gravitational forces, and / or vibrations caused by earthquake events or by other sources of vibration.

The number of landslide events that occurred in Indonesia, encourages us to take anticipatory steps to prevent or reduce the occurrence of landslides, so that it can reduce the losses that occur due to landslides and of course also reduce fatalities due to landslides. One of the anticipatory steps taken to prevent landslides is to improve slope stability. The improvement of the stability of the slope aims to reduce the forces that move the landslide mass, and increase the soil shear resistance (Hardiyatmo, 2012). Recommended methods for improving slope stability because they are environmentally friendly are geometric improvements to slopes, repair and addition of horizontal drainage systems, and strengthening slopes with vegetation (soil bioengineering). The purpose of this study is to examine several slope reinforcement methods that have the concept of environmentally friendly structures (green construction)

Green construction is a structural concept which is a sustainable movement that aspires to create construction from the planning, implementation that use environmentally friendly construction products. (Harimurti, 2012).

2. Material and Methods

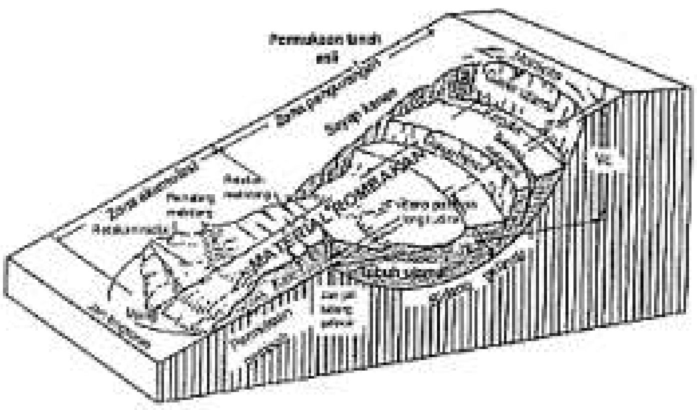
This research is a library/ literature research namely by taking data and information sourced from reference books, encyclopedias, and scientific journals. Data taken from scientific journals from the identification studies, investigative studies, and detailed design studies. With the limitation of qualifying scientific articles that are used as references, it is expected that the method of library research conducted will present the latest literature.

3. Result

3.1. Triggering Factors of Landslides

The initial occurrence of landslides is marked by the presence of cracks at the top of the slope which are relatively perpendicular to the direction of movement. In the rainy season, if the cracks have not been closed or not immediately closed, they will be filled with rain water which will then make the soil soft and will also add horizontal forces that encourage landslides. Landslide sections are shown in Figure 1.

Figure 1. Landslide cross section



Gambar 1. Penampang Longsoran
(Cruden dan Varnes, 1996 dalam Hardiyatmo, 2012)

Landslide events occur because of some causal factor, where these factors will become active if there are trigger factors that activate them. Factors causing landslides are defined as factors that make slopes vulnerable to collapse at certain locations and times. In general, the factors causing landslides are caused by geological factors, morphological factors, and human activity factors. While the trigger factor is a single event that drives the cause of a landslide, these trigger factors include: rain, earthquake, and volcanic activity. Table 1 below describes the factors that cause landslides.

Table 1. Causing Factors of Landslides (Muntohar, 2012)

Group Factors	Source Cause
Geological Factors	1. Weak and sensitive rock layers
	2. Weathering of rocks
	3. Shifting rocks
	4. Cracks or confluence of rock layers
	5. Difference in permeability of soil layers
	6. Difference in rock strength
Morphological Factors	1. Tectonic or volcanic removal
	2. Ice layers
	3. Erosion

	4. Change the location of the load on the slope
	5. Plants on the slope
Human Factors	1. Slopes excavation
	2. Deforestation
	3. Mining
	4. Artificial vibration due to explosion

According to Vernes (in Muntohar, 2012) slope will experience a collapse or landslide mechanically caused by two components, namely increased shear stress and reduced shear strength. The increasing value of the shear stress on the slope is influenced by:

a. Adding loads to the slope, for example, the addition of building structures and embankments at the top of the slope

b. Eliminating reinforcement structures due to cutting and moving of the foot section of the slope, or collapse of the retained slope

c. Changes in groundwater levels very quickly on the slope

d. The force from an earthquake which causes an increase in force that pushes a block of mass in the horizontal direction

Another factor that causes mechanical landslides is reduced shear strength, according to Ralph and Peck (in Hardiyatmo, 2012) is caused by:

a. Increased pore water pressure due to infiltration of water into the slope, uncontrolled water discharge in the drainage channel, or earthquakes which results in increased pore water pressure.

b. Soil on slopes contains clay minerals that expand so that it is easy to absorb water but can eliminate soil adhesiveness.

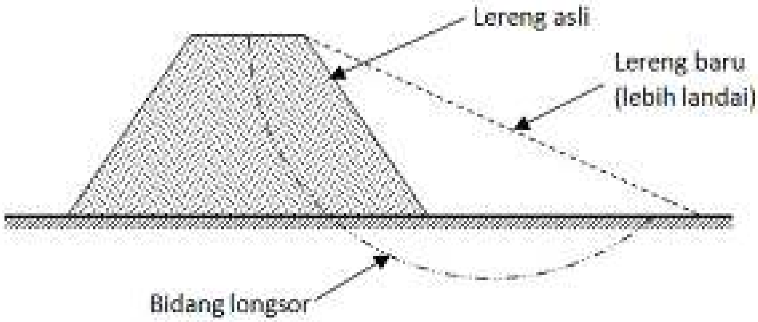
c. Weathering and physical-chemical degradation due to ion exchange, hydrolysis, and salting.

d. Gradual collapse due to strengthening of shear strain softening

1. Improve Slope Geometry

Improving the geometry of the slope aims to reduce the force or moment of movement by changing the shape of the slope. Improvement of the geometry of the slope is done by making the slope more gentle or reducing the slope angle, and or reducing the height of the slope.

Figure 2. the concept of inclining the slope



Gambar 2. Konsep melandaikan lereng (FHWA, 1988)

Figure 2 is the concept of improving the slope geometry by reducing the slope degrees, where the important thing to consider in changing the geometry is the sloping marking work must cover the foot of the landslide area. Sloping the slope that does not cover the foot of the landslide area will only add to the forces that cause the slope movement.

Figure 3. concept of traps / benches for the improvement of the slope geometry

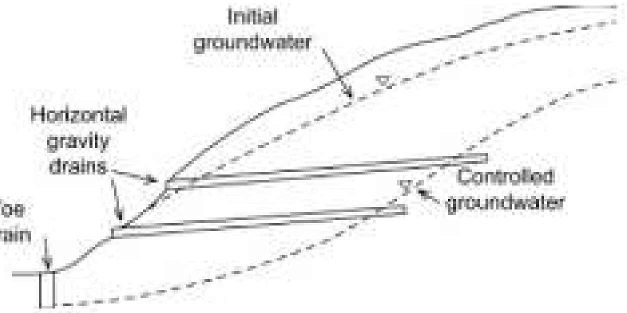
Gambar 3. Konsep trap/bangku untuk perbaikan geometri lereng (FHWA, 1988)

Trapping or bench-shaped excavations as in Figure 3. are carried out on steep slopes, where repairs by this method are carried out if the slope is not possible to be sloped.

2. Controlling Drainage and Seepage

The main purpose of using drainage to support slope stability naturally is to drain groundwater out of the slope so that the soil remains dry. The study of slope collapse due to the water infiltration process conducted by Muntohar (2006) concludes that changes in water content due to water infiltration into the soil will immediately increase water content and reduce shear strength in the soil. Water flow in the soil will accelerate the process of slope collapse, this is because water can reduce the level of viscosity of soil grains. Increasingly the water that enters the pores of the soil or stagnant on the surface of the soil will accelerate the collapse of the soil.

Figure 4. the concept of horizontal slope drainageimprovement of the slope geometry



Gambar 4. Konsep drainase horisontal lereng (Nicholson, 2015)

4. Vegetative Strengthening Methods

Sittadewi (2017) explains that soil bioengineering or slope strengthening methods using vegetation or plants, has an important role, especially in reducing the surface flow velocity which can wash away soil particles that are not dense. For the application of soil bioengineering, vegetation is needed that meets the criteria, including fast growing, has a deep root penetration system and the ability to bind the soil well and can live on various types of soil. The type of root fibers can form natural nets that serve to strengthen the soil so it is not easily carried by surface water flow.

The main advantage of having a plant on the stability of the slope is its roots which mechanically strengthen the slope-forming soil. Tall and strong plant stems have a function like anchors that work as a barrier to the downward slope movement, even if under certain conditions due to the load of wind that moves the stems of the plant will also make these plants as dynamic loads that disturb the stability of the slope. One alternative to the vegetative strengthening method is to choose plants that are small but have deep roots and have a high density.

Akar Wangi (vetiviera grass) is one of the plants that can be used as a slope strengthening vegetation. Agustina (2012) in her research on the effect of vetivarias on slope stability, concluded that the use of vetivarias as a stabilization method can improve the stability of the slope, from the results of tests on soils planted with vetivary grass. show increased shear strength. Hamdhan (2018) in his research on Akar wangi (vetiviera grass) recommends that the role of Akar Wangi (vetiviera grass) in supporting slope stability is effective if planted in regular patterns and distances.

5. Conclusion

Landslide is a common event that occurs on a slope structure, this is caused by the movement of soil or rock mass due to the collapse of the shear strength of the soil or rock mass along the field of potential landslides. Green construction is a structural concept which is a sustainable movement that aspires to create construction from the planning, implementation and use of environmentally friendly construction products. The right methods to improve slope stability in accordance with environmentally friendly concepts are geometric improvement of slopes, repair and addition of horizontal drainage systems, and slopes strengthening with vegetation (soil bioengineering).

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Iodine Status, Thyroid Function, Ferritin Status, And Heavy Metal Distribution In Peripheral Endemic Area of Iodine Deficiency Disorder in Ponorogo District, East Java, Indonesia

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Abstract.

The previous investigation was reported in an area with mental retardation due to iodine deficiency disorders (IDD) in Ponorogo. Low iodine intake, heavy metal contamination, goitrogenic consumption, and low iron intake might play a role in mental retardation incident. The aim of study was to investigate iodine status, heavy metal contamination, and iron status of population in endemic area of IDD area in Ponorogo. About 118 childbearing women age (CBW), 124 school-aged children 9-11 years old (SAC) and 123 children under five (CUF) from Dayakan and Watubonang Village, Ponorogo were selected as sample. Spot urinary iodine excretion (UIC), thyroid stimulating hormone (TSH) and free-tetraiodothyronin, and ferritin serum concentration of the sample were measured. About 29 soil and 87 water samples were taken from both village to measure iodine, mercury (Hg) and lead (Pb) concentration. Median UIC of CBW and SAC were 105 and 121.5ug/L, respectively. Hypothyroid in CBW, SAC and CUF in Dayakan 38.1%; 27.9%; 17.9% and Watubonang 7.3%; 14.3%; 17.9%, respectively. That respondents with ferritin deficiency were 25.8% in Dayakan Village, and 19.8% in Watubonang Village. Mean of iodine concentration in soil and water were 36.74mg/Kg and 13.6ug/L respectively. Mean of Hg soil was 96.46mg/kg and <1ppb in water both areas. Mean of Pb in soil was 5.81mg/Kg, while not detected in water in both area. The IDD and anemia control program should be undertaken to prevent future public health problem in both areas.

Keywords: Iodine, IDD, UIC, heavy metal, goitrogenic

1. Introduction

Iodine deficiency is one of major global public health problem. Wide range of negative impacts resulting from iodine deficiency on human growth events from the beginning of life in the womb to adulthood called Iodine Deficiency Disorders (IDD).

In fetus, IDD might cause abortion, birth-death, congenital abnormalities, increased perinatal mortality and child mortality. In women of childbearing age, IDD can manifest clinically in the form of goiter, hypothyroidism, and impaired mental function. While in toddlers and school children, iodine deficiency is known to cause hypothyroidism, impaired growth and decreased intellectual capacity. A number of studies comparing the school children, who lived in endemic and non-endemic area of IDD, showed that children who lived in endemic areas had lower levels of cognitive development and school achievement. In general, the impact of iodine deficiency is mental retardation, which in turn has an impact on social and economic development of the country (Zimmermann, 2007; Djokomoeljanto, 1986). Epidemiological observations suggest that environmental factors have a significant effect on the settlement and development of new IDD cases in endemic areas (Hetzel and Dunn, 1989).

Low iodine content of the environment is a main cause of IDD. Iodine content of the soil is specific for its environment. Ecological processes has eliminated iodine in many regions through flooding and exacerbated by heavy rains. Mountain areas and flood plains generally contain low iodine. Food produced in an iodine lack environment would not be able to provide enough iodine for human needs. Similarly, water from iodine lack environment might contain low iodine. Theoretically, in the mountainous areas might found IDD case, generally. However, IDD was also found in coastal areas and islands, where the materials goitrogenik, blocking agents, and genetic factors apparently played a role in these conditions (Taha and Dahlan, 2002; Sulchan, 2007; Zimmermann, 2015).

Land management that was not in accordance with the principles of green industry might indirectly affect the GAKI problem through the loss of iodine from the environment. Loss of environmental iodine often occurs anthropogenically in areas due to loss of vegetation from clearing for agricultural production, overgrazing by livestock and tree-cutting for firewood, ensures a continued and increasing loss of iodine from the soil (Karmarkar et al., 2003).

The presence of heavy metals in the environment in many cases was related to the incidence of endemic goiter. Drinking water from shallow water is often contaminated by heavy metals. Heavy metals are known to inhibit the use of iodine in the thyroid gland (Sulchan, 2007). Iron deficiency exacerbates the effects of iodine deficiency. Iron deficiency reduces heme-dependent thyroperoxidase activity in the thyroid and impairs production of thyroid hormone. In goitrous children, iron deficiency anemia blunts the efficacy of iodine prophylaxis while iron supplementation improves the efficacy of iodized oil and iodized salt. (Zimmermann, 2007).

Figure 1. Location of Ponorogo Regency

Ponorogo is regency (kabupaten) in East Java Indonesia. Ponorogo regency lies between 92 and 2,563 meters above sea level and covers an area of about 1,305.7 km2. The previous investigation showed that Ponorogo had problem of IDD. In 1998, Total Goiter Rate (TGR) among school children was 23.6 % ; with the range 3.3 % to 60.1 % in all district (WHO, 2001). Based on Muftiana and Munawaroh (2016), at least 400 residents who experience idiots or mental retardation in Ponorogo Regency. The reason of it was the lack of iodine consumed by population. The aim of study was to investigate iodine status both in population and in environment, heavy metal contamination, and iron status of population in endemic area of IDD area in Ponorogo.

2. Method

This research is a descriptive study with cross-sectional design. About 118 childbearing women age (CBW), 124 school-aged children 9-11 years old (SAC) and 123 children under five (CUF) from Dayakan and Watubonang Village, Ponorogo were selected as sample. About 50 mL urine from CBW and SAC were taken and measured of its iodine concentration through spectrophotometric method by Sandell Kholthoff reaction principle. About 5 mL blood were taken from CBW and SAC for thyroid stimulating hormone (TSH) and free-tetraiodothyronin (fT4), and ferritin serum concentration measurement throuh ELISA (enzyme-linked immunosorbent assay). For CUF, only fT4 were measured from blood sample that were taken through same way with CBW and SAC. All measured were conduct in Iodine Deficiency Disorders Research and Development Center Magelang. Soil samples from 29 point samples and water samples from 87 water sources were collected and measured concentration of iodine and mercury (Hg) and lead (Pb) of each sample through Atomic Absorption Spectrophotometry (AAS) method in Integrated Research and Testing Laboratory (Laboratorium Penelitian dan Pengujian Terpadu, LPPT) Gadjah Mada University and Center for Environmental Health Engineering and Disease

Control (Balai Besar Teknik Kesehatan Lingkungan dan Pengendalian Penyakit, BBTKLPP) Yogyakarta.

3. Result

3.1. Iodine Status

Overall percentage of UIC less than 100 ug/L in CBW was 44.9 % and median 105 ug/L; and UIC in SAC was 33.9 % and median 121 ug/L. In Dayakan Village UIC less than 100 ug/L in CBW was 46.0 % and median 106 ug/L; and UIC in SAC was 35.3 % and median 119 ug/L. In Watubonang Village UIC less than 100 ug/L in CBW was 43.6 % and median 105 ug/L; and UIC in SAC was 32.1 % and median 127 ug/L (Table 1).

There were no population in this two villages with percentage of UIC less than 100 ug/L less than 50 % and median UIC less than 100 ug/L both in CBW and SAC. It showed that population both in Dayakan and Watubonang had no iodine deficiency based on World Health Organization criteria.

Table 1: Percentage and Median Urinary Iodine Excretion (UIC) in Dayakan and Watubonang

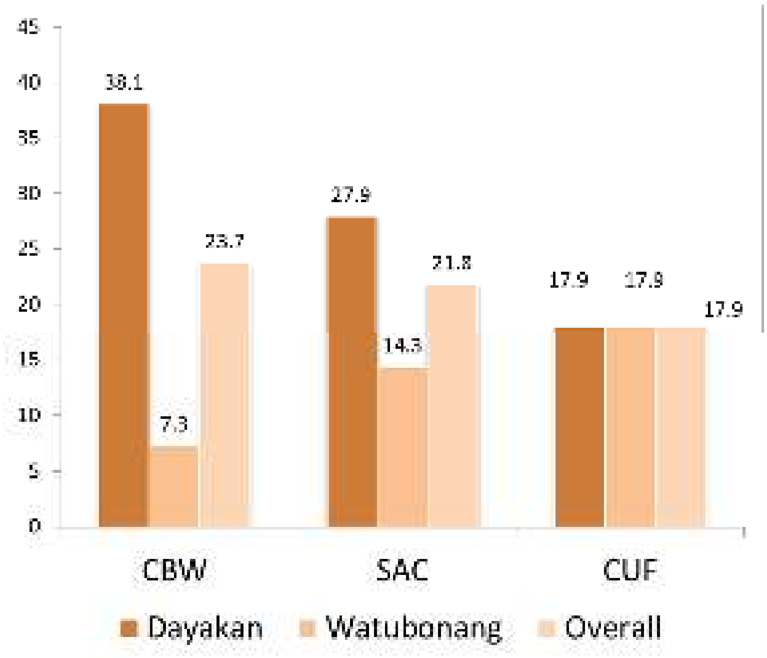
Area/Population	Percentage of UIC			Median UIC
	<100ug/L	100-199ug/L	>200ug/L	
Dayakan Village				
Childbearing Women Age (CBW)	46.0 %	41.3 %	12.7 %	106 ug/L
School Age Children (SAC)	35.3 %	42.6 %	22.1 %	119 ug/L
Watubonang Village				
Childbearing Women Age (CBW)	43.6 %	45.5 %	10.9 %	105 ug/L
School Age Children (SAC)	32.1 %	51.8 %	16.1 %	127 ug/L
Overall				
Childbearing Women Age (CBW)	44.9 %	43.2 %	11.9 %	105 ug/L
School Age Children (SAC)	33.9 %	46.8 %	19.4 %	121 ug/L

Note: In children and non-pregnant women, median urinary iodine concentrations of between 100 µg/l and 299 µg/l define a population which has no iodine deficiency, when the median is 100 µg/l, at least 50% of the samples will be lower than 100 µg/l (WHO, 2007).

3.2. Thyroid Status

Hypothyroidism was found in CBW, SAC, and CUF both in Dayakan and Watubonang Village. Hypothyroidism percentage in Dayakan in CBW was 38.1 % and SAC was 27.9 %. Percentage of hypothyroidism in Watubonang Village in CBW was 7.3 % and in SAC was 14.3 %. Hypothyroidism in CUV was in the same condition both in Dayakan Village and Watubonang Village was 17.9 %. Overall in Dayakan and Watubonang Village, hypothyroidism percentage in CBW was 23,7 %, in SAC was 21.8 %, and CUV was 17.9 % (Figure 2).

Figure 2: Hypothyroidism in CBW, SAC and CUF in Dayakan and Watubonang (%)



3.3. Ferritin Status

Both population in Dayakan and Watubonang Village had ferritin deficient. Overall, 23.0 % respondent had ferritin deficiency. About 25.8 % and 19.8 % respondents in Dayakan and Watubonang, respectively, had ferritin deficiency (Table 2).

Table 2: Ferritin Status in Dayakan and Watubonang

Area	Percentage of Ferritin Status	
	Normal	Deficient
Dayakan Village	74.2 %	25.8 %
Watubonang Village	80.2 %	19.8 %
Overall	77.0 %	23.0 %

3.4. Iodine in Water and Soil

It was detected wide range of iodine concentration in water and soil in Dayakan and Watubonang Village. Overall iodine concentration in water range between 0-49 ug/L and median 8.5 ug/L. Iodine concentration in water from Watubonang Village ranged between 2-49 ug/L with median 16.0, and in Dayakan Village where iodine concentration ranged between 0.0-5.0 ug/L with median 0.0 ug/L. Soil iodine concentration ranged between 6.6-108.0 ug/L and median 33.77 ug/L. Soil iodine concentration in Watubonang Village ranged between 51.96 mg/Kg, and in Dayakan Village ranged between 6.6-108.0 mg/Kg and median 17.41 mg/Kg (Table 3).

Table 3: Iodine Concentration in Water and Soil in Dayakan and Watubonang Village

Iodine Concentration	Dayakan	Watubonang	Overall
- Water	0.0 ug/L (0.0-5.0)	16.0 ug/L (2-49)	8.5 ug/L (0-49)
- Soil	17.41 mg/Kg (6.6-108.0)	51.96 mg/Kg (33.7-100.2)	33.77 mg/Kg (6.6-108)

3.5. Lead (Pb) and Mercury (Hg) in Water and Soil

It was detected mercury in water in these two village, it ranged between 0.0-23.24 ppb and median 0.0 ppb. In Dayakan Village, mercury concentration ranged between 0.0-4.91 ppb and median 0.28 ppb and it was higher than in Watubonang Village with mercury concentration 0.0-23.24 ppb and median 0.0 ppb. In soil, mercury concentration in Dayakan Village ranged between 7.43-296.4 mg/Kg and median 71.79 ppb, and it was higher than in Watubonang Village where it ranged between 21.15-462.05 and median 63.32 ppb (Table 4).

Lead concentration in water was not detected both in Watubonang and Dayakan Villages. In soil, lead was detected up to 25.23 mg/Kg and median 3.27 mg/Kg overall. In Dayakan Village, lead in soil was detected in concentration up to 25.23 mg/Kg and median 2.61 mg/Kg, while in Watubonang Village range from 21.15 to 562.05 mg/Kg and median 8.90 mg/Kg (Table 4).

Table 4: Iodine Concentration in Water and Soil

	Dayakan	Watubonang	Overall
Mercury (Hg)			
- Water	0.28 ppb (0.0-4.91)	0.0 ppb (0.0-23.24)	0.0 ppb (0.0-23.24)
- Soil	71.79 ppb (7.43-296.4)	63.32 ppb (21.15-562.05)	68.64 ppb (7.43-562.05)
Lead (Pb)			
- Water	0.00 ppm (0.00-0.00)	0.00 ppm (0.00-0.00)	0.00 ppm (0.00-0.00)
- Soil	2.61 mg/Kg (0.00-25.23)	8.90 mg/Kg (2.97-19.54)	3.27mg/Kg (0.00-25.23)

4. Discussion

Ponorogo Regency is an endemic goiter area. Various studies related to child growth and development show that various growth and development disorders that occur in Ponorogo Regency are related to iodine intake deficiency. Efforts to intensify the management of IDD that have been carried out since the 1990s have shown improvements in iodine intake, including in Ponorogo District. This is illustrated from the results of this study which showed that iodine intake in the two target villages had no iodine deficiency. However, adequate iodine intake alone cannot guarantee normal thyroid function which produces sufficient thyroid hormone. Hypothyroidism found in school-age children, women of childbearing age, or toddlers in this study showed that there are other factors besides iodine as a cause of thyroid dysfunction in addition to lack of iodine intake.

The low environmental iodine in Ponorogo is a fundamental enabling condition causing IDD problems in the past, as in general. However, this condition may be exacerbated by the presence of pollutants in the form of heavy metals identified in drinking water and soil. Although detected in very low concentrations, but because of exposure in a long time it will cause an accumulative effect in the form of disruption of iodine metabolism in the synthesis of thyroid hormones. Contamination of heavy metals in children during growth and development both during the womb or in the first years of life has a more severe impact. Heavy metal contamination can reach population via digest contaminated drinking water and food and heavy metal dust complex inhalation. The problem of iron nutrient anemia found in Ponorogo Regency identified in this study through ferritin, deficiency can also be a condition that aggravates the problem of IDD. Iron nutrient anemia causes iodine metabolism to be suboptimal. In children lacking iodine intake, iron nutrient anemia inhibits the effects of iodine supplementation thereby inhibiting the elimination of the impact of IDD.

In endemic areas, IDD is very likely to return due to the low availability of environmental iodine, such as in Ponorogo Regency. Therefore, prevention efforts need to be continued either through iodine intervention through the distribution of iodized salt and to avoid other factors that can exacerbate or prevent the success of the intervention. The implementation of iodized salt program for all, efforts to meet the needs of iron and community sanitation related to the quality of drinking water need to be improved to ensure the continuity of community iodine adequacy and prevent the emergence of IDD in the community.

It is frequently said that the nations that have succeeded in bringing iodine and iron deficiency under control did so with less knowledge and technology than is available today. But those nations usually had the advantages of higher incomes, better diets, and more developed health services. Industrialisation and development will generally lead to the improved nutritional status of a population including iodine and iron status due to foodstuffs originating from outside the local environment. As the production of manufactured food increases there will also be more sources of adventitious iodine and iron in the diet. That was iodine added to food but not for the purpose of iodine supplementation. There were many adventitious sources of iodine in the diet in industrial cultures including iodine content of poultry and eggs increased by the use of fish flour as chicken food, iodoform used in water as a disinfectant, iodates used as oxidants and sanitising agent in the bread making process, use of iodophors as antiseptic cleansing agent in the dairy industry, and iodine-rich red food colouring erythrosine. In agriculture several I-containing herbicides and fungicides release iodine to soil as they decompose. Commercial products were regularly fortified with iron. The fortification of cereal products with iron and ascorbic acid is important in meeting the high dietary needs, especially considering the importance of an optimal iron nutrititure during this phase of brain development.

Agricultural practices through the implementation of green industry concepts further guarantee the conservation of iodine in nature and the quality of water in the environment. The erosion prevention of soils in riverine areas due to loss of vegetation from clearing for agricultural production, overgrazing by livestock and tree-cutting for firewood, ensures a preventing loss of iodine from the soil, then ultimately determines iodine levels in foodstuffs of local products. Protection of surface and groundwater pollution need to be done for unpolluted drinking water that was need to healthier life including thyroid function.

Surveillance of IDD need to be done to track emerging IDD-related issues at an early stage and find active solutions in a timely manner. Continuous, systematic collection, analysis and interpretation of health-related data needed for the planning, implementation, and evaluation of public health practice including in IDD elimination. Industry 4.0 offers technology with computer involvement and automation that encourages interoperability, data transparency, technical assistance, and decentralized decision making. The application of industry 4.0 concepts in the surveillance system will support effective decision making in the handling of IDD.

5. Conclusion

Overall, thyroid function disorder was still found in Ponorogo Regency despite iodine status of population showed in normal value. Heavy metal contamination and iron deficiency in population might cause thyroid disfunction. Iodine intervention in Ponorogo district must continue to be carried out supported by efforts to overcome iron malnutrition and improve sanitation, especially the supply of water that is free of heavy metals.

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Adaptation of Dry Season with the Cultivation of Feed Maize in Playen Gunungkidul D.I. Yogykarta

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Abstract.

Adaptation to the dry season are carried out by some farmers in Gunungkidul Regency by planting feed maize. This research aimed to study the cultivation of feed maize during the dry season. The study was conducted at Playen Gunungkidul D.I. Yogyakarta using the farmer interview and field survey methods. The results showed that farmers growing feed maize with irrigation from deep well pumps. Irrigation were performed on average 7 days, as needed. Farmers are plants maize with an average spacing of 20 x 40 cm and 2-3 seeds per hole. The average of urea fertilizer were 20 kg/1,000 m^2 and NPK too. The fresh weight of feed biomass was 7.512 ton/1,000 m^2. B/C 2.35, farmers profit Rp. 2,384,000/1,000 m^2. The fresh weight of root biomass was 0.788 ton/1.000 m^2. Feed biomass was transported out from the land. Root biomass was returned to the soil. In addition, carbon dioxide absorption occurs in feed maize, consists of feed biomass of 3.673 ton/1,000 m^2 and root biomass of 0.623 ton/1,000 m^2.

Keywords: water deficit, biomass, carbon, profit

1. Introduction

Agricultural land in Gunungkidul Regency depends on rainfall. Only 2,189 ha (2.9%) irrigated, from the total 75,304 ha of agricultural land (BPS Kabupaten Gunungkidul, 2018). Rainfall determines in the management of agricultural land (Suryanti, et al., 2010). However, with limited water, farmers still survive (Twigg, 2004). Farmers plant twice a year, in the first and second rainy season and without plant in the dry season (Anshori, et al., 2012), as a form of adaptation. The third planting during the dry season is prone to failure due to lack of water.

Water determines the success of land use. On rainfed, rain water determines for crop cultivation (Rengganis, 2016), requires additional irrigation. Development and revitalization of water harvest infrastructure in the form as reservoirs, ditches, long storage and pump irrigation to irrigate agricultural land, has the potential to increase cropping index (Kartiwa, et al., 2017), so that the welfare of farmers is realized (Kementerian Pertanian Republik Indonesia, 2015) .

Ground water has been used for agricultural, through pump irrigation. Groundwater has the potential to be developed, although it is not easy (Rengganis, 2016). Utilization of ground water for irrigation is determined by the debit and crop water requirement (Zulkarnaen, et al., 2017). The development of groundwater irrigation must consider local conditions (Lasmana and Millo, 2018). The use of ground water has increased the cropping index (Zuhaedar and Suriadi, 2012). Development and management of irrigation systems is carried out participatory, integrated, environmentally friendly, transparent, accountable and fair (Pemerintah Republik Indonesia, 2006).

Groundwater for irrigation, as an alternative adaptation to rainfed land (Mulyadi, et al., 2015; Mulyadi, et al., 2016), potential for crop cultivation during the dry season. The benefits are increased production, farmer income, biomass production and carbon sequestration. Biomass are organic product of plants (Erenstein, et al., 2011). Carbon sequestration is the absorption of carbon dioxide (CO_2) by plants in the process of photosynthesis, then stored as plant biomass (leaves, twigs, stems, roots) (Bongen, 2003). Carbon dioxide sequestration protects the environment (Gonzalez, et al., 2013; Hese, et al., 2005; Lal, 2001; Lal, 2004a; Lal, 2004b; Navas, et al., 1995; Yoshioka, et al., 2002).

Maize is developed during the dry season, producing biomass for animal feed. The problem of animal feed is not continuous availability, low quality and limited during the dry season (Syamsu and Abdullah, 2009). Biomass maize as a source of animal feed are stems, leaves and cob/kelobot. Composition of biomass maize consists of 39.47% cellulose, 27-32% hemicellulose, 3-5% lignin, 12-16% ash and 1-3% extractive (Riyanti, 2009). This research aimed to study the cultivation of feed maize during the dry season by irrigation from deep well pumps.

2. Methods

The study was conducted at Playen Gunungkidul D.I. Yogyakarta Indonesia, in the dry season, July-October 2019. The cropping patterns applied by farmers as in Table 1. Without plants during the dry season. But, feed maize, groundnuts and vegetables are planted with additional irrigation from deep well pumps. The research period were day without rain.

Table 1. Cropping pattern without and with irrigation at Playen Gunungkidul

	Rainy Season I	Rainy season II	Dry Season
Without Irrigation	Paddy, Maize, Soybean, Groundnut	Mayze, Soybean, Groundnut	-
With Irrigation (Deep Well Pump)	Paddy, Maize, Soybean, Groundnut	Paddy, Maize, Soybean, Groundnut, Vegetables	Feed Maize, Groundnut, Vegetables

Interviews were conducted with 5 key farmers. Interview has to find out the factors that play a role in the adaptation to the dry season by planting feed maize, cultivation techniques and social-economic data. The survey was conducted to obtain the data of feed maize productivity. Wet biomass productivity data were obtained from 2 x 2 meter tiles. Dry biomass were obtained based on percentage of water content. (Eviati and Sulaeman, 2009), total organic carbon is calculated based on the percentage of organic carbon biomass. The percentage of organic carbon is measured based on ash content (Eviati and Sulaeman, 2009), the absorption of carbon dioxide (CO_2) is calculated based on the equivalence of CO_2 and $C_6H_{12}O_6$ in photosynthetic reactions (Baharuddin, et al., 2014 ; Daud, et al., 2014 ; Gardner, et al., 1991). The data were analyzed descriptively (Creswell, 2010).

3. Results

Gunungkidul Regency lacks animal feed during the dry season. Feed maize cultivation are sufficient to feed livestock and increase farmers' incomes. During the dry season, animal feed is limited, demand for animal feed is high, so the price of animal feed is expensive.

Feed maize is a maize that biomass harvested for animal feed. Feed maize is harvested around 60 days after planting, when the highest accumulation of stem and leaf biomass.

According to Paat (2011) there is the highest accumulation point of biomass as a result of photosynthesis in maize.

The deep well pump at Logandeng Playen Village in Gunungkidul is sufficient for agricultural water when low rainfall or in the dry season. Water debit are 15 litre/second. Deep well pump is an adaptation of farmers to lack of water. The use of deep well pumps for feed corn is accepted by farmers, because affordable operational costs, potential to continue. Illustration of deep well pump can be seen in Figure 1.

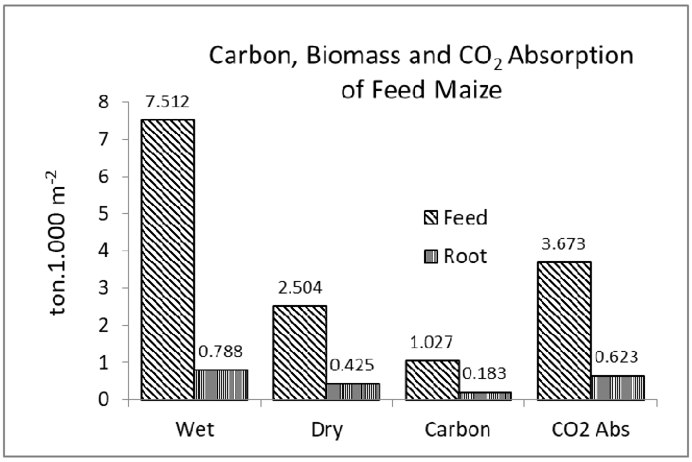
Feed maize cultivation technology has been understood by farmers. Farmers plant with a tugal system and without tillage, planting distance 40 x 20 cm with 2-3 seeds per hole, organic fertilizer 200 kg/1,000 m2, urea 20 kg/1,000 m2 and NPK 20 kg/1,000 m2, weeding when plants age 10 and 25 days after planting, watering with deep well pump every week for 9 times or if needed, and harvested at 60 days after planting. Illustration of feed maize can be seen in Figure 1.

Figure 1. Water pump deep well and feed maize harvesting

Harvesting of feed maize wet biomass produced feed biomass of 7.512 tons/1,000 m^2 and root biomass of 0.788 tons/1,000 m^2. After drying, the feed biomass was 2.504 tons/1,000 m^2 and root biomass was 0.425 tons/1,000 m^2. Organic carbon in feed biomass was 1.027 tons/1,000 m^2 and roots was 0.183 tons/1,000 m^2. The total organic carbon in feed maize biomass (feed and roots) were 1.210 tons/1,000 m^2 (Figure 2). Contribution of feed maize biomass were high. According to Subandi and Zubachtirodin (2004) the potential for maize biomass is high because most photosynthates are directed at the formation of feed biomass, while seed formation is stressed.

Carbon dioxide (CO_2) absoprtion by feed maize in the dry season was 3,673 tons/1,000 m^2 in feed biomass and 0.624 tons/1,000 m^2 in root biomass (Figure 2). Feed maize cultivation in the dry season has reduced the concentration of carbon dioxide (CO_2) in the atmosphere, thus mitigating greenhouse gases. Carbon dioxide (CO_2) is one of the atmospheric greenhouse gases.

Figure 2. Carbon, biomass and CO_2 absorption of feed maize



Farmers get benefit by cultivation of feed maize during the dry season. Low profits due to narrow land ownership. Farming analysis can be seen in Table 2.

Table 2. On farm analysis of feed maize in dry season at Playen Gunungkidul

Nu.	Description	Unit	Price / Unit	Volume	Rp. / 0.1ha
A	***Explicite Cost***				***796,000***
I	*Material (I+II)*				*166,000*
1	Seed				80,000
	Maize	kg	20,000	4	80,000
2	Anorganic Fertilizer				86,000
	Urea	kg	2,000	20	40,000
	NPK	kg	2,300	20	46,000
II	*Weeding Labor*	*Person*	*60,000*	*6*	*360,000*
III	*Irrigation*	*Times*	*30,000*	*9*	*270,000*
B	***Implicite Cost***				***220,000***
	Organic Fertilizer	kg	500	200	100,000
	Planting and Fertilizing Labor	Person	60,000	2	120,000
C	TOTAL COST (A+B)	Rp.			**1,016,000**
D	**REVENUE**	Rp.			**3,400,000**
	Feed Maize Price	Rp.	3,400,000	1	3,400,000
E	**INCOME (D-A)**	Rp.			***2,604,000***
F	**BENEFIT (D-C)**	Rp.			***2,384,000***
	Feasibility Indicator				
	R/C (D/C)				3.35
	B/C (F/C)				2.35

Cultivation of feed maize is the choice of farmers in the dry season because it saves labor. Manpower is needed when planting, fertilizing and controlling weeds. Labor in the family minimize the explicit costs paid by farmers. The time needed to grow plants is 2 months, thus reducing the cost of watering. For every 1,000 m^2, the total cost is IDR 1,016,000, revenue IDR 3,400,000, income IDR 2,604,000, profitable for farmers, with R/C 3.35 and B/C 2.35 (Soekartawi, 1995). This condition is more profitable compared to maize cultivation on dry land by Taufik, et al (2015) in South Sulawesi with an R/C value of 2.06. This can be a consideration for farmers in choosing commodities to be planted in the dry season.

4. Conclusion

Feed maize are cultivated by farmers with supplementary irrigation from deep well pumps, with the farmer technology, as adaptation to the dry season. Feed maize cultivation during the dry season are beneficial. Feed maize cultivation during the dry season contributes biomass, organic carbon and absorbs carbon dioxide (CO_2). Feed maize cultivation during the dry season with supplementary irrigation has the potential to continue.

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Indigenous Peat Soil Phosphate Solubilizhing Microbe Inoculation And Amelioration On Carbon Emission

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Abstract.

The un-right peat soil management will cause excessive CO_2 emissions that affected to the Global climate. Research related to learning of MPF induction in peat-lands and the application of ameliorant at oil palm nurseries to CO_2 emissions released has been implemented on farmers' nurseries at Kampar District in June 2013 till March 2014. Using a Factorial Randomized Block Design with 3 replications. As a first factor, MPF inoculation (control; *Burkholderia gladioli* and *Penicillium aculeatum*) while the second factor was Ameliorants (Control, Oil Palm Empty Fruit Bunch (TKKS) Compost, 4 kg TKKS compost/polybag and 25% recommended dosage, 4 kg TKKS compost/polybag and 50% recommended dosage, 4 kg TKKS compost/polybag and 75% recommended dosage, 4 kg TKKS compost/polybag and 100% P recommended dosage, 25% recommended dosage, 50% recommended dosage, 75% recommended dosage , 75% recommended dosage P and 100% recommended dosage P. Measurement of CO_2 emissions was done using a closed chamber and an Infrared Gas Analyzer tool. The collected data is tabulated and analyzed using SPSS. The results showed that the MPF inoculation and the combination of ameliorant and P fertilizer did not affect the CO_2 emissions increased.

Keyword: Compost, *Burkholderia gladioli*, *Penicillium aculeatum,* CO_2 emission

1. Introduction

Limited productive soil causes agricultural expansion activities leading to sub-optimal soils such as peat soils. The results of the Research Center for Palm Oil show that peat soils have the potential for oil palm development because these plants are tolerant of the nature of peat, especially in the depth of the layer less than 4 meters with the level of hemic to saprist maturity. The level of oil palm productivity in peatlands ranges from 20.25-23.74 t ha^{-1} TBS (Barchia, 2006) with a yield of 23 per cent or 11.27 per cent lower than mineral soils (Wahyunto *et al.*, 2013).

In 2010 the total area of oil palm in peatlands was 701,868 hectares in Kalimantan and 500,000 ha in Riau (Wahyunto and Ani, 2011). Peatland was chosen mainly by Estate because of its relatively sparsely populated population so that the possibility of land-use conflicts is relatively small. One of the problems in developing peatlands is related to the high carbon content of weathering of peat raw material. Improper management causes the release of large amounts of carbon. The results showed that on oil palm plantations replanting led to carbon loss in the form of CO_2 emissions of 56 t ha^{-1} $years^{-1}$ (Wahyunto *et al*., 2012). Each gram of peat soil contains 180-600 mg of carbon ten times higher than mineral soil (Agus and Subiksa, 2008). Each hectare of peatland has a carbon potential equivalent to 8.07-13.58 million t CO_2 per year (Mulyani and Noor, 2011). It was further stated that in stable conditions carbon deposits will increase every year but in disturbing conditions such as the presence of land clearing activities for oil palm plantations causing carbon loss in the form of CO_2 and CH_4 emissions. Fertilization applications caused an increase in plant metabolism and soil biota to produce CO_2. The high concentration of CO_2 in the air causes climate change which indirectly affects agricultural production in a broad sense. An increase in temperature of more than 2°C can threaten humans because it causes scarcity of clean water caused by a decrease in groundwater level, flooding and drought so that the management of peatlands needs to be considered carefully, P fertilization on the growth of oil palm seedlings and reducing CO_2 emissions in peat soils. The potential microbes (MPF) using to reduce the costs of production inputs and environmental pollution. Istina *et al*. (2015) results that indigenous phosphate solubilizing microbes can be used to increase peatland productivity. The research purposed to determine the effect of indigenous phosphate solubilizing microbe inoculation and ameliorant combination on CO_2 emissions increasingly at oil palm nurseries

2. Material and methods

The study was carried out on oil palm nurseries using saprist peat soilin Kampar District. Materials used include oil palm seedlings aged 16Week after planting, ameliorant oil palm empty fruit bunches that having a pH of 9.02 with a moisture content of 46.6% and organic C 21.54% inoculants of Phosphate Solubilizing Microbe, N, P and K fertilizers; Insecticides, and fungicides, while the equipment used is polybags, rags, shovels, hoes, electric scales, measuring cups, pipettes, Infrared Gas Analyzer (IRGA) and other aids. This study used a factorial randomized block design with 3 replications. The first factor was MPF isolate (3 levels) and the second factor was combination of ameliorant and fertilizer dosage (10 levels). The first factor were:

k : Control
l : Bulkholderia gladioli isolate with a density of 109 ml $cell^{-1}$ suspension of $polybag^{-1}$ as much as 15 ml
m : Penicillium aculeatum isolate with a density of 109 ml $cell^{-1}$ suspension of $polybag^{-1}$ as much as 15 ml

While the combination of ameliorant and P fertilizer dosages include

a : Control
b : 4 kg TKKS compost/polybag
c : 4 kg TKKS compost /polibag dan 25 % P recommended dose
d : 4 kg TKKS compost /polibag dan 50 % P recommended dose
e : 4 kg TKKS compost /polibag dan 75 % P recommended dose
f : 4 kg TKKS compost /polibag dan 100 % P recommended dose

g : 25 % P recommended dose
h : 50% P recommended dose
i : 75 % P recommended dose
j : 100 % P recommended dose

Table 1. Fertilizer recommended dosages and time application

Weeks	Fertilizer dosages (g/seedling)							
	N	P					K	Mg
		100%	75%	50%	25%	Control		
16	1,139	0,917	0,688	0,458	0,229	0	0,554	0,402
18	1,594	1,283	0,963	0,642	0,321	0	0,774	0,563
20	2,278	1,833	1,375	0,917	0,458	0	1,106	0,804
22	2,278	1,833	1,375	0,917	0,458	0	1,106	0,804
24	2,278	1,833	1,375	0,917	0,458	0	1,106	0,804
26	3,644	2,933	2,200	1,467	0,733	0	6,271	7,638
28	3,644	2,933	2,200	1,467	0,733	0	6,271	7,638
30	3,644	2,933	2,200	1,467	0,733	0	6,271	7,638
32	4,556	3,667	2,750	1,833	0,917	0	7,839	8,04
34	4,556	3,667	2,750	1,833	0,917	0	7,839	8,04
35	4,556	3,667	2,750	1,833	0,917	0	7,839	8,04
Total	34,167	27,499	20,626	13,751	6,874	0	46,976	50,411

In the control, each polybag was contains 8 kg of peat soil, while in the combination the ameliorant ratio between TKKS compost ameliorant and peat is 1: 1 (4 kg of peat soil: 4 kg of TKKS compost). Each of the 16-week-old oil palm seedlings planted on a perforated polybag containing peat media and oil palm empty fruit bunch (TKKS) compost that has been watered to field capacity and given a planting hole with a diameter of 14 cm. Before the seedlings are planted into the planting hole, the fertilizer is given according to the recommended dosage. The seedling fertilizer were 0.569 g Urea + 0.58 g TSP + 0.276 g KCl +0. 201 g Kieserit. Fertilization of seedlings in the main nursery (main nursery) is done 2 weeks after planting by using a single fertilizer sprinkled around the plant and immersed into the soil at the recommended dosage, while inoculation is carried out in the afternoon by pouring inoculant suspension according to the treatment dose into the plant root area.

Measurement of CO_2 emissions is done by using a hood that serves to capture gas emissions released by peat. Gas concentrations are measured using IRGA software. Calculation of CO_2 gass concentrations using the USEPA equation

E =dc/dt x mW/mV x t x {273,2/(273+T)

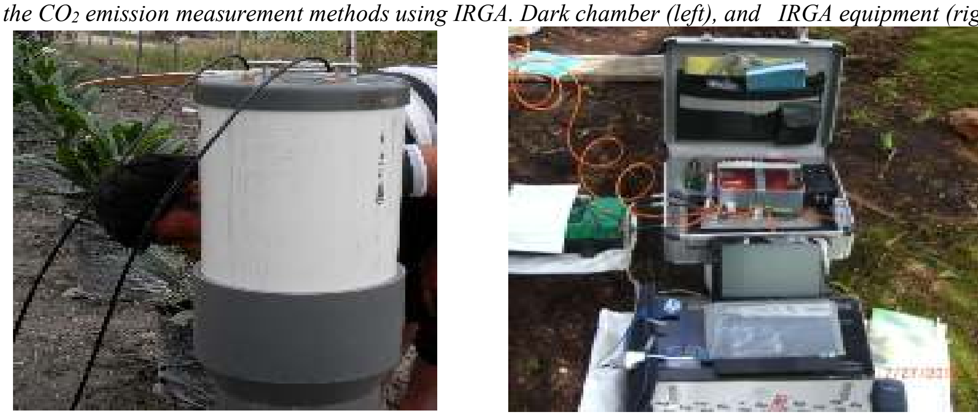
Remaks :

E = fluks CO_2 (mgm^{-2} hour^{-1})

Dc/dt = changes in CO2 concentration per time (ppm menit^{-1})

t = containment height (cm)
mW = molecular weight CO_2 (g)
mV = molecular volume CO_2 (22.41 liter)
T = Temperature in the chamber (^{o} C)
22.41 liter is volume 1 mol gass at the standart pressure

Figure 1 the CO_2 emission measurement methods using IRGA. Dark chamber (left), and IRGA equipment (right)

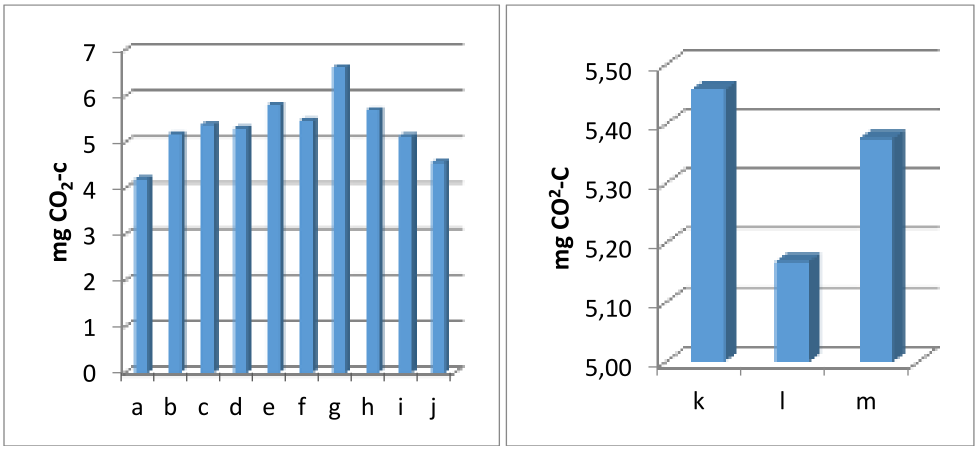


Observation data were collected and analyzed using Anova variance at α 0.05 level. To find out the effect between treatments doe to Duncan's multiple range test (DMRT) was at 5% using SPSS software

3. Result and discussion

Agricultural land causes high concentrations of CO_2 in the air include soil pH, soil carbon content, nutrient availability, water, temperature, root respiration and other environmental factors (Wahyunto *et al*., 2005; Knorr *et al*., 2009; Sukarman *et al*., 2011). Statistical analysis showed that amelioration treatment, P fertilization and MPF inoculation on saprist peat soils affected respiration and CO_2 emissions at 4 weeks after treatment, but were not significantly different until 20 weeks after treatment and had a downward trend (Figure 2). This indicates that peatland management through MPF inoculation and the combination of TKKS ameliorant and P fertilizer does not affect CO_2 emissions. In Figure 2 it can be seen that respiration at 25% P fertilization showed a significant difference with the control even though it was not significantly different from other treatments. The addition of ameliorant in the form of fertilizer and its combination with compost indicates higher respiration compared to without ameliorant. The addition of P fertilizer to ameliorated peat shows that the higher dose of P fertilizer given, the higher the respiration, although there is a decrease if the dose is increased up to 100%.

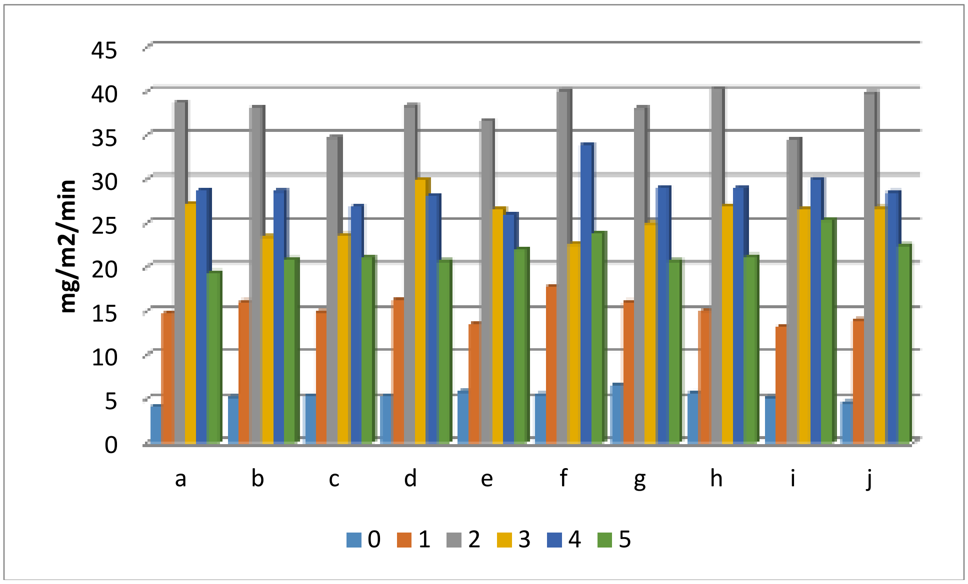
Figure 2 Effect of MPF inoculation and combination of ameliorant TKKS compost and P fertilizer on oil palm seedling growing media on soil respiration. a = control, b= TKKS compost, c= combination of TKKS compost and 25 % P fertilizer , d= combination of TKKS compost and 50 % P fertilizer, e= combination of TKKS compost and 75 % P fertilizer, f= combination of TKKS compost and 100 % P fertilizer, g= 25 % P fertilizer, h= 50 % P fertilizer, i= 75 % P fertilizer, j= 100 % fertilizer P, k= control for MPF, l= isolate Burkholderia gladioli and m= Penicillium aculeatum isolate



Peat soils which were no ameliorant applied, showed that the higher dose of P fertilizer makes lower respiration. The highest respiration occurs in the addition of a dose of 25 % P fertilizer. This condition caused by microbial activity, where the higher dose of P fertilizer microbial phosphate solubilizing microbe cannot work properly and the excess P fertilizer that is mobile is bound by soil organic acids so that respiration is reduced. Ameliorated peat soils showed an increase in respiration up to a 75% P fertilizer dosages increased. This was caused by changes in soil conditions, especially pH, which was more in line with microbial growth to inhibit the loss of P fertilizer and decomposition activities.

The results of statistical analysis of the CO_2 emissions released into the air in each treatment every month showed that the fluctuations with a downward tendency at 20 weeks after the highest treatment of emissions occurred in the third month (Figure 3). At the beginning of the observation, the addition of P fertilizer by 75% dosage to the ameliorated peat soils and showed no lower CO_2 emissions and significantly different from the amelioration of peat soil and 100% of P fertilizer dosage. This was probably due to the addition of P nutrients needed by microbes to carry out activities in the preparation of cells and phosphatase enzymes that play a role in stimulating root and microbial growth there by increasing CO_2 emissions.

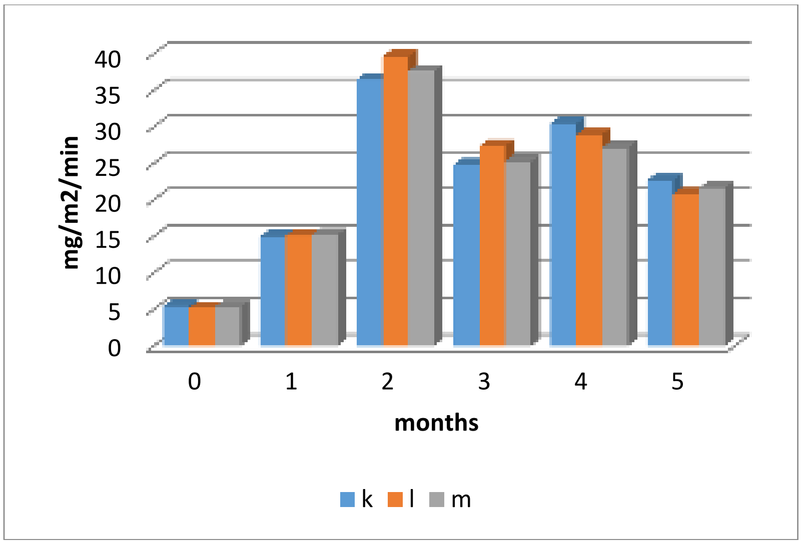
Figure 3 Histogram of CO_2 Emission on combinations of ameliorant and P fertilizer at 20 weeks after treatment: (0) CO_2 Emission at the first time (October), (1) CO_2 Emission 4 weeks after treatment (November), (2), CO_2 Emission 8 weeks after treatment (November), (3), CO_2 Emission 12 weeks after treatment (January), (4) CO_2 Emission 16 weeks after treatment (February), and (5) CO_2 Emission 20 weeks after treatment (March). a= control, b= TKKS compost, c= combination of TKKS compost and 100 % P fertilizer, d= combination of TKKS compost and 75 % P fertilizer, e= combination of TKKS compost and 50 % P fertilizer, f= combination of TKKS compost and 25 % P fertilizer, g= 100 % P, h= 75 % P, i= 50 % P, and j= 25 % P



Carbon dioxide emissions in nurseries fluctuated with a tendency to decrease tenth week after treatment. This is presumed by the presence of Fe in oil palm empty fruit bunch compost (1,223 ppm) which interacts with organic acids to form a stable Fe-organic complex that is difficult to be decomposed by microorganisms which result in inhibited activity and reduces CO_2 production. The results of this study were supported by Nelvia (2009) and Sabiham and Sukarman (2012) who stated that the addition of ameliorant containing Fe cation could reduce the toxic nature of organic acids and increase the stability of peat soils and reduce CO_2 emissions. The results of the laboratory analysis of oil palm compost showed that the Fe content in the compost used was 1,223 ppm. Besides, it is also caused by the reduction by photosynthesis activity of oil palm seeds to produce photosynthesis for plant growth and development (Kusumaningrum, 2008).

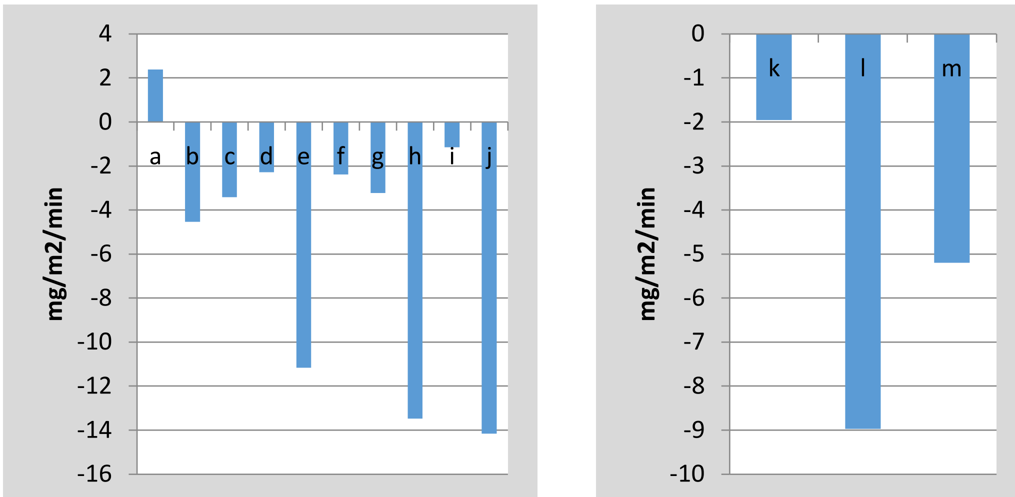
The results of the analysis of the MPF inoculation treatment showed a similar trend with the combination treatment of ameliorant and P fertilizer, which decreased (Figure 4). CO_2 emissions in the *Burkholderia gladioli* inoculation treatment contributed to average CO_2 emissions (26.40 mg/m^2/mg) followed by control (25.92 mg /m^2/mg) whereas the *Penicillium aculeatum* fungi treatment (25.41 mg/m^2/mg). This shows that microbial inoculation which was feared would contribute to CO_2 emissions through the mechanism of respiration did not occur. The results also showed a tendency that *Burkholderia gladioli* contributed lower CO_2 emissions than *Penicillium aculeatum*, presumably due to Burkholderia gladioli originating from a depth of 90-120 cm emitting less CO_2. The results of this study also indicate that the inoculation of phosphate solubilizing microbes and the combination of ameliorant and P fertilization have a positive effect on peat, increasing soil pH, soil nutrients and providing a good atmosphere for potential microbes and carrying out their activities even though it is not real.

Figure 4 Histogram of CO_2 Emission on MPF isolate application at 20: (0) CO_2 emission at the initial time (October), (1) CO_2 emission 4 weeks after treatment (November), (2), CO_2 8 weeks after treatment (November), (3), CO_2 emission 12 weeks after treatment (January), (4) CO_2 emission 16 weeks after treatment (February), and (5) CO_2 emission 20 weeks after treatment (March) k= CO_2 emission on control, l= CO_2 emission on B. gladioli inoculation, dan m= CO_2 emission on P. aculeate inoculation



The observations showed that CO_2 sequestration occurred in all treatments except control treatments. Excessive CO_2 emissions will disrupt environmental stability and can cause pollution. Naturally, nature has formed a balance through the mechanism possessed by each component. Plants maintain climate balance through the photosynthesis process. Microorganisms support and stabilize changes, especially micro climate in the soil; through the mechanism of production and consumption of CO_2, CH_4 and nitrogen for their metabolic processes (Chatzipavlidis *et al.,* 2013). Based on the calculation of CO_2 emissions, the inoculation of *Burkholderia gladioli* can mitigate CO_2 emissions up to 7.01 mg /m^2/week or 336.48 mg / m2 / year, while Penicillium aculeatum is 3.24 mg / m2 / week or 155.52 mg /m^2/year compared to controls. Sequestration in microbes occurs through the mechanism of catalysis of CO_2 to HCO_3 and in *Bacillus pumilus*, HCO_3 will be converted into calcite (Komala and Khun 2014).

Figure 5. Histogram of of CO2 emission sequestration at 20 weeks after treatment. a= control, b= TKKS compost , c= combination of TKKS compost and 100 % P fertilizer, d= combination of TKKS compost and 75 % P fertilizer, e= combination of TKKS compost and 50 % P fertilizer, f= combination of TKKS compost and 25 % P fertilizer, g= 100 % P fertilizer, h= 75 % P fertilizer, i= 50 % P fertilizer, j= 25 % P fertilizer, k= control (no isolate), l= B. gladioli, and m= P. aculeatum



Phosphate Solubilizing Fungi inoculation especially *Burkholderia gladioli* and *Penicillium aculeatum* showed that CO_2 emissions which fluctuated and decreased in the 20^{th} week, this was allegedly due to CO_2 emissions related to the amount of carbon contained in the soil and the treatment of the soil. Plant growth that was not ameliorated is not good although it is not significantly different when compared to that amelioranted plant. Poor growth results in a lack of plant ability to absorb CO_2 so that CO_2 produced by root respiration and soil biological activities is emitted into the air. Conversely in plants that are not given ameliorant, their growth is better so that their ability to recapture CO_2 for photosynthesis and microbial metabolism is higher. CO_2 sequestration naturally can occur through biological mechanisms, namely photosynthesis, microbial activity and land management.

4. Conclusions

Phosphate Solubilizing Fungi inoculation and its combination with ameliorant in the form of Palm Oil Empty Bunches compost and P fertilizer was not significantly affect to increase carbon dioxide emissions on peat soils.

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Climatic Features Of Spring And Autumnal Frost Occurences In The Wine Regions Of Hungary (1961-2010)

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Abstract.

While frost is a natural phenomenon in Hungary from autumn to spring, frost damage, causing crop damage and yield reduction or even harvest shortfall, does not occur every year. The aim of the study was to estimate the occurrence and frequency of frost damage in fall, winter and spring using the CarpatClim data base, in the wine regions of Hungary. The daily distribution of the LT_{50} function between September 7 and May 15, using the Cold Hardiness model which contains 23 grape varieties, the occurrence probability of fall, winter and spring frost damage was determined. The extent of frost damage, frost duration and strength of frost is significantly affected by tolerance of grape varieties. We analysed the extent of fall, and spring frost damage respectively for frost susceptible, moderately frost-tolerant and frost-tolerant grape varieties. We examined the step overs of frost damage thresholds using CARPATCLIM database during the period between 1961-2010. The results not only provide frost damage quantification, but they may also help to judge the complex value of cultivation areas more accurately and to parameterize the crop safety of wine regions.

Keywords: frost damage, LT50 function, wine regions, wine grapes, CarpatClim data

1. Introduction

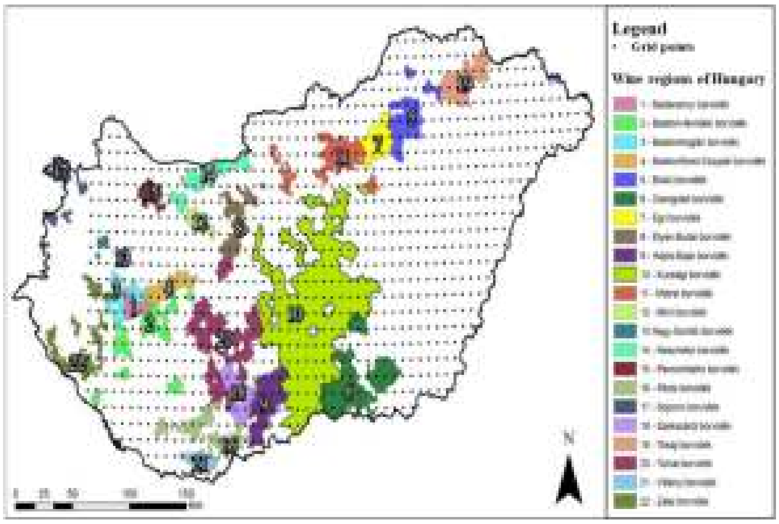
Frost is one of the most extraordinary phenomena in nature. However, from a meteorological point of view, frost is not an extreme phenomenon, as it is only a segment of the temperature range of our environment. Nevertheless, it can induce physiologically significant, irreversible changes in living cells. Cell injury or dehydration are the main cause of severe frost damage in most plants. The frost range is quite wide on Earth, with the lowest ever recorded temperature of nearly minus 90 degrees (-89.2 °C), recorded on July 21, 1983 at the Vostok Research Station in the South Pole. The lowest temperature so far in Hungary, which was measured on 16 February 1940 in Miskolctapolca, may seem insignificant compared to this being -35.0 °C.

It is very important for domestic viticulture to find out the changes in the extent and nature of frost occurrence in the main wine regions over time. The occurrence of frost from autumn to spring is a natural feature of our country. If its value falls below a threshold dependent on the particular grape variety, frost damage occurs. The increasing risk of frost in spring, or the increasing warm periods during winter can cause severe difficulties, or even significant yield losses. By studying changes over time, we can answer whether the trends of the examined variables support these fears. Previous frost studies (Oláh, 1979) were mainly aimed at determining the frequency of days with different threshold temperatures (Dunkel & Kozma, 1981): that is, temperatures of minus 17 °C and minus 21 °C. Frequencies were analyzed for domestic wine regions. Recently, more and more studies have been published on how index values , calculated for different climate scenarios such as the Huglin index (Huglin, 1978), have changed in recent decades and how they will change in the future (Horváth, 2008; Mesterházy, 2013). In this study, climate scenarios were not only examined for the previous threshold minima, but also introduced new minimum index categories, such as the number of frosty days below -15 °C and below -18 °C (Szenteleki et al. 2011). As our climate warms, fewer days below -21 °C will occur. The changes in 10-year increments may not be noticeable, therefore, we will not be able to quantify the changes. The occurrence of frost damage has already been studied in domestic apricot and peach plantations (Szalay et al. 2000; Lakatos et al. 2005). Knowing the LT50 values, the number of days that cause significant frost damage in the pre-rest, rest, and forced-rest periods and the probability of their occurrence can be accurately determined. The results can be used to quantify the extent of frost damage. Using these data, the complex value of each production site can be more precisely assessed, i.e., the yield safety of the areas can be parameterized (Lakatos et al. 2006).

2. Materials and Methods

The CARPATCLIM database was used for the temporal and spatial analysis of frost damage. Daily minimum temperatures were analyzed for the period 1961-2010. The available climate database does not fully cover the country, so only 21 of the 22 domestic wine regions could be examined (Figure 1).

Figure 1: The Hungarian grid points of the CarpatClim database and the location and numbering of the studied wine regions.



Source: R. Nagy, S. Molják

The Sopron wine region is not included in the study and the coverage of the Zala wine region is not complete as the wine region continues beyond the available database. The 7 grid points that characterize the wine region cover approximately two thirds of the area, so we included the region but characterized it using the available data points. We have an average of 14 grid points for characterizing a wine region. However, this shows a rather wide variation by wine region, since the Kunság wine region was analyzed on the basis of 100 points, while the Nagy-Somló, Badacsony, Villányi, Móri wine regions were only be analyzed on the basis of 3 grid points.

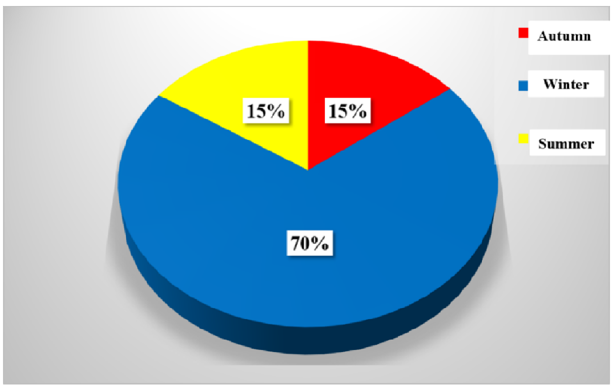
ArcMap 10.4 GIS software was used to display the results in space. Based on the database, we created a point grid (0.1˚ x 0.1˚) and then the results were applied to the points. Raster maps were generated from the value of the points by spline interpolation. The spline is an interpolation function that estimates the value of intermediate points by following the shape of a 'flexible membrane' based on fixed input points, minimizing the curvature of the entire surface. The result is a smooth surface that contains the values of all input points, but has a minimal curvature.

3. Results and Discussion

3.1. Frost occurrence in domestic wine regions

While frost is a natural phenomenon in our country from autumn to spring, frost damage, which causes plant damage and crop loss or even crop failure, does not occur every year. The occurrence of frost is an easily measurable or predictable meteorological phenomenon. To produce frost statistics, you can determine the number of days or hours below 0 °C, monthly, seasonally, or during the vegetation or dormancy period. In this study, we analyzed the incidence of autumn, winter, spring frosts in domestic wine regions using daily minimum temperatures. Autumn frosts are usually not a problem for grapes, as there are wines, such as "ice wine", which are typically made from grapes that have been frozen or have previously undergone a freeze. In this way, the grape's content values such as sugars, acidity will be more favorable, as they will have higher dry matter content and concentration. Of course, this process produces sweet and high acidity wines only in mild frosts. If the autumn frosts are severe and occur early during the beginning of dormant periods they can cause severe and irreversible damage to the buds. In winter, when the grapes are in the dormant stage, they tolerate relatively low temperatures relatively well. However, in the case of frost below -25 °C, most of the domestic wine regions suffer significant damage. During the dormancy period, the minimum temperature that grapes can withstand without frost damage changes daily. Spring frost damage poses a risk for cultivation if it occurs after the onset of budding and sap flowing. If the global temperature increase causes budding dates to be shifted, even frosts in late March may cause frost damage in the future. As a result of warming climate, the number of frosts will also decrease, and frosts in May or April will become less frequent. But a single frosty day is enough to cause frost damage. If the rate of withdrawal of spring frosts to the earlier period of the year exceeds the rate of the shift of vegetation period to the previous calendar period, a significant decrease in frost risk is expected in the future. If this condition is not met, the likelihood of late spring frost damage similar to or even greater than in previous years may occur in the coming decades. The figure below shows that autumn and spring frosts can be expected with the same frequency of 15–15% in the Hungarian wine regions (Figure 2).

Figure 2: Percentage distribution of frosts occurring in different seasons in Hungarian wine regions 1961-2010

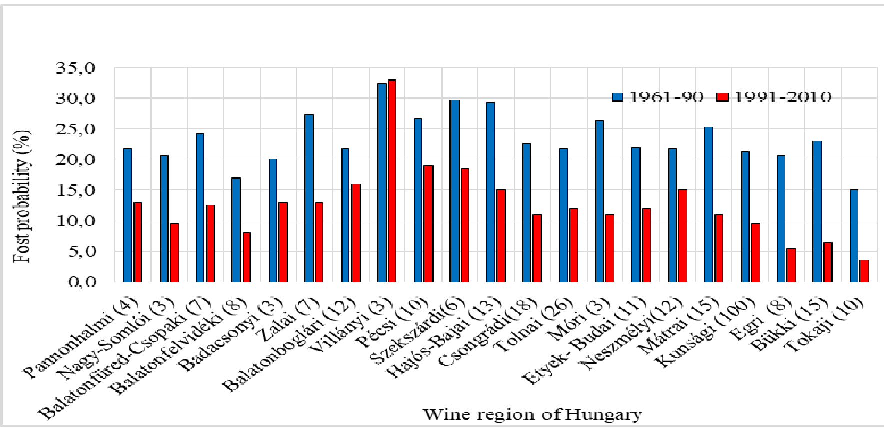


Previous winter and spring frost tests have statically investigated winter minimum temperatures. They assumed that when the minimum temperature drops below a certain threshold, frost damage may occur. This is indeed the case if a sufficiently low threshold is chosen. However, it is not necessary to have very low temperatures for frost damage to occur to the examined plant if the frost occurs before or after the dormant period. Most of the studied grape varieties show very good frost tolerance during the dormant period, but before or after the grape reaches this state, the degree of frost tolerance changes significantly. Previous studies did not take into account that the dormancy period of vines and other fruit trees, and consequently their frost tolerance, is a dynamically changing process.

3.2. Minimum temperatures below -1 °C during the growing season

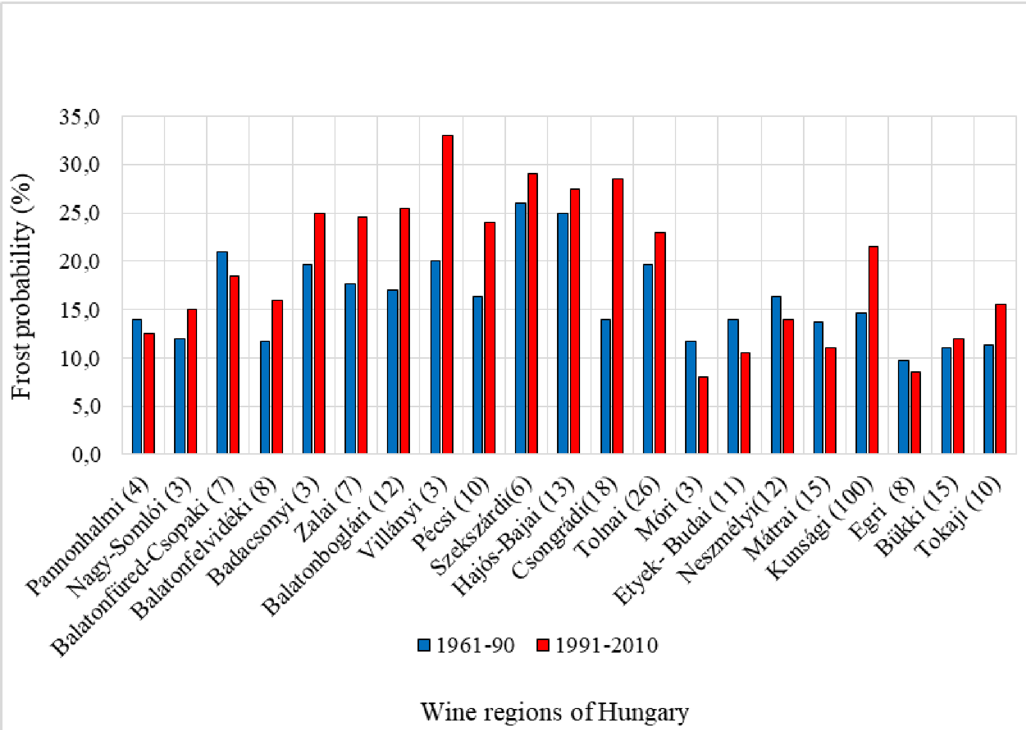
The vegetation period for grapes can be calculated from the average daily temperature exceeding 10 °C for at least 7 days. Of course, during the vegetation period, the average daily temperature can fall below 10 °C for several days. In this case there is no plant growth, no weight gain, but plant processes do not stop until the average daily temperature drops below 10 °C for 7 days. When that happens, the plant enters a period of rest. Days below -1.0 °C degree in spring, especially during the late spring, April and May, pose a risk to the grape growers. In the summer, between June and August, we do not have to deal with this phenomenon. However, low temperatures can occur in summer, which can also cause stress to the grapes. Generally speaking, temperatures below 5 °C can be considered as a significant cold effect at this time of year, which can reduce the value of the quality indicators of the berries, such as sugar content. At the beginning of the vegetation period, in the spring period, we have to expect frost about every 5 years. The most risky conditions for cultivation in the examined wine regions are the Villány wine region, where the probability of spring frost is 32.6%, i.e., we can expect spring frost every three years. The lowest spring frost risk (10.4%) is expected in the Tokaj wine region. In this wine region we have to deal with spring frosts every 10 years. The beginning of the vegetation period is shifted almost 10 days later in this region, so during the period from the end of April to the end of May frost damage is less likely to occur. If we compare the values of the frost probabilities from 1961–1990 and 1991–2010 in Hungarian wine regions, we can conclude that the spring frost risk has significantly decreased in recent decades. On average, the probability of frost occurrence in the Hungarian wine regions changed from 23.3% to 12.7% (Figure 3). In the Bükk wine region, the decrease in the occurrence of spring frost was the greatest, with its value reaching 16.5%. In the Villány wine region the probability of spring frost has not decreased, but increased by nearly 1% in the last 20 years compared to the previous 30 years.

Figure 3: Changes in frost probabilities below -1 °C during the spring vegetation period in Hungarian wine regions between 1961-2010.



Early autumn frost does not usually pose a significant problem for the vineyard. There may be quality problems with the sale of fresh grapes after frost. In the case of wine-grape cultivation, we can expect a decrease in quantity with berries that are prone to it. A slight frost can increase the sugar and acid content concentration which can be measured after the frost. However, more intense autumn frosts can damage buds on unripe canes, affecting next year's crop. The autumn frost shows a very strong regional variation in Hungary. During the autumn part of the vegetation period, frost can be expected on average every fifth or sixth year. During the period 1961–2010, the domestic wine regions were characterized by an average frost probability of 17.3%. Autumn frost was the least likely in the Eger wine region (9.2%), while in the Szekszárd wine region the occurrence of autumn frost was more than 27%. If we analyze the temporal variation in the likelihood of frost, we can see that autumn frosts have become more prevalent in many wine regions over the past two decades than in previous decades. In the period 1991–2010, autumn frost was on average 3% more likely to occur during the vegetation period than in 1961–1990. As shown in Figure 4, the autumn frost risk in the Csongrád wine region increased by 14.5% and in the Villány wine region by 13% compared to the base period of 1961-1990.

Figure 4: Changes in the probability of frost below -1 °C in Hungarian wine regions during the autumn vegetation period in Hungarian wine regions between 1961–2010.



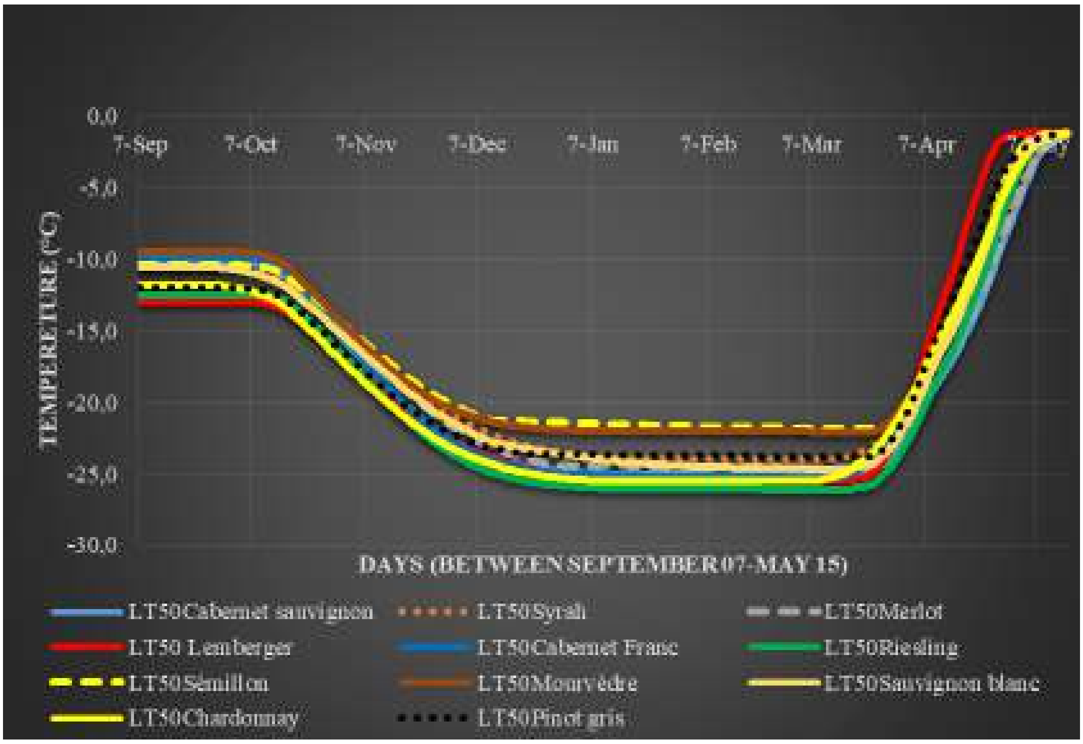
The increase in frost risk in the fall may even create favourable conditions for the production of special wine varieties, such as “ice wine”, and may also assist in the production of other wine specialties. However, it may pose a risk for late harvesting of freshly consumed table grapes. More frequent early-autumn frosts can cause bud damage in some wine regions, where local microclimatic conditions may cause frosts to appear more intensively and last longer.

3.3. Derivation of LT50 values

Defining frost damage is a somewhat complex task. The extent of injury to individual plant parts, shoots or flower buds caused by frost, i.e. the extent of frost damage, can be determined from plant samples placed in freezing chambers. If the test plant, or parts thereof, are cooled to a certain temperature, some samples will die completely, while others will not suffer any damage after warming. By knowing the lethal minimum (LT) temperatures, it is possible to determine how long parts of the plant can be cooled without permanent damage. LT values differ significantly between plant species and varieties. There are excellent, good and less frost tolerant varieties. Frost susceptibility tests are designed to accurately determine the percentage of plant samples that are damaged when cooled to below freezing point (Mills et al. 2006). Generally, 3 lethal temperature categories, i.e., that is the frost damage categories, LT10, LT50, and LT90 are usually tested. LT10 means that if the temperature is lower than the lethal temperature, 10% of the samples tested suffer frost damage. In this study, LT50 was determined using a model developed by Washington State University (Ferguson et al. 2011). The lethal minimum temperature of at least 50% frost damage was determined from 50-year averages. The average LT50 function was determined separately for each wine region examined. The input parameters of the model were daily minimum, maximum, and average temperatures. In this study we have determined the lethal minimum function on the basis of daily averages of many years instead of annual determination. We did not take into account the effect of the year-on-year temperature changes, since our aim was not to compare the vintages but to assess the frost sensitivity and frost risk of the wine regions, and for this purpose the daily data of multiple years between September 7 and May 15 for each vine regions is suitable. The model determines the lethal minimum function course for 23 grape varieties for the entire dormancy period (Ferguson et al. 2014). For the sake of ease of handling, we reduced the number of varieties examined, i.e., we examined the frost tolerance of the “warmth preferring” international varieties grown in Hungary, and Mediterranean varieties. The study of Mediterranean varieties is justified by the fact that, due to global warming, we will be able to grow these varieties in the future in the Carpathian Basin. Varieties accustomed to warmer climates are likely to exhibit greater frost risk than our domestic varieties.

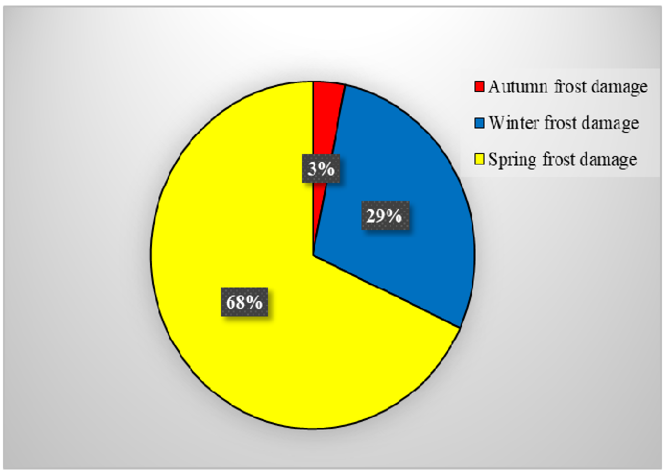
Based on the long-term daily average, minimum and maximum temperatures, the LT50 function was calculated for 21 wine regions and 11 grape varieties. The varieties include particularly frost tolerant varieties such as Riesling and Chardonnay, medium-frost-sensitive varieties such as Cabernet Sauvignon and Merlot, and frost-sensitive varieties such as Sémillon or Mourvèdre. However, the seasonal frost tolerance of the cultivars varies considerably. The one that has excellent frost tolerance in winter may show extreme frost sensitivity in spring. This is the case for the Lemberger grape, which has a very good frost tolerance in the winter, while in spring it was one of the most frost-sensitive varieties. Knowing the LT50 functions, we can determine the frost damage probability of the current domestic varieties or varieties recommended for Hungarian cultivation in the future, which could be adapted to the domestic climatic conditions. Using the available model, LT50 values were determined for each site and variety from September 7 to May 15, based on the long-term daily average, minimum, and maximum temperatures for each site. Thus, the derived function contains only temperature parameters, but does not take into account the autumn moisture values of the soil and its changes, nor the changes in the moisture content of the canes at the end of the vegetation period. There are significant differences in the course of LT50 functions between wine regions and varieties during the examined period. In the Eger region, it can be clearly seen that Kékfrankos has one of the best frost tolerances in autumn and winter, but in spring it is one of the most frost-sensitive grape varieties (Figure 5). Riesling has been shown to be one of the most frost tolerant varieties tested, but in the autumn period Lemberger outperforms its frost tolerance. Not surprisingly, the difference between the maximum winter frost tolerance of Mediterranean and domestic varieties can reach up to 5 °C. The difference between the varieties' frost tolerance is greatest in spring and late April. The difference between the LT50 function values calculated by the model can be up to 8 °C.

Figure 5: Evolution of temperature values (LT50) affecting at least half of the population in the Eger wine region for the examined grape varieties.



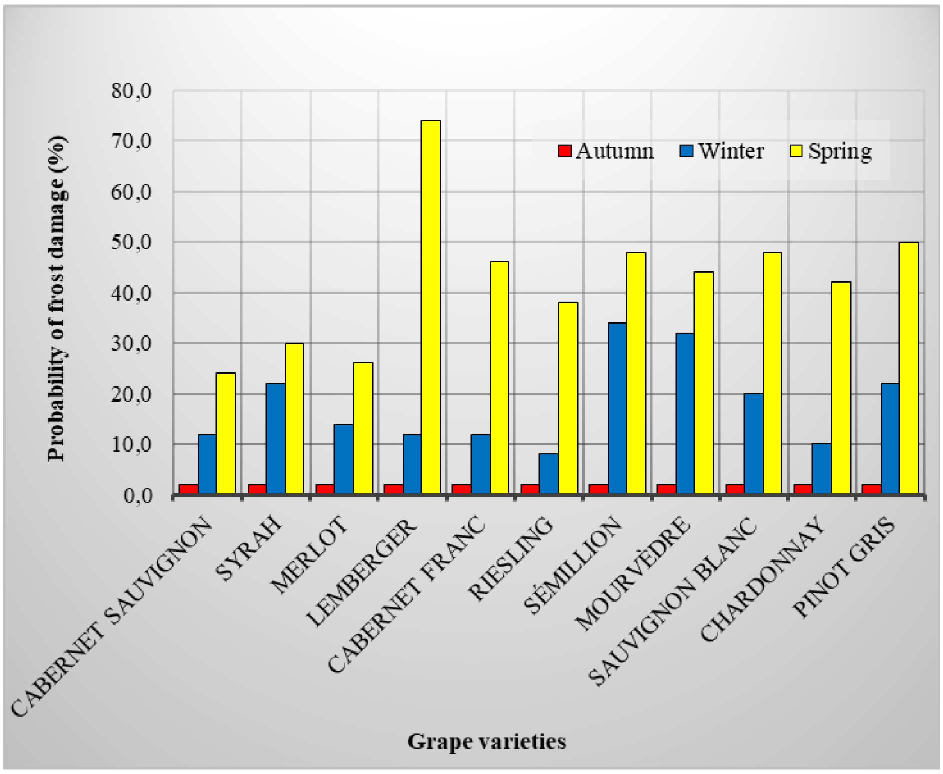
By producing lethal minimum functions for each of the 11 grape varieties studied, it is possible to determine the incidence of frost damage in autumn, winter and spring. In addition, we can calculate the probability of annual frost damage for the 21 wine regions. While the likelihood of frost occurring is the same in the autumn and spring vegetation periods, the rate of frost damage in spring is significantly higher than in autumn. For the wine region as a whole, spring frost damage accounts for the highest proportion, with over two-thirds (68%) of frost damage occurring during this period, followed by winter frost damage, with a prevalence rate of 29%. Only 3% of frost damage occurs in autumn (Figure 6).

Figure 6. Percentage of autumn-winter-spring frost damage in domestic wine regions between 1961-2010.



Analyzing the probability values of the frost damage of the varieties, it can be clearly seen that not only is the likelihood of frost damage is low in autumn but there is no significant difference between the frost tolerance of the varieties. Cabernet Sauvignon and Merlot are very slightly more frost-sensitive than the other grape varieties examined (Figure 7). In the winter season, the Mediterranean varieties (Sémillon, Mourvédre) have the highest probability of frost damage. In a spring we can expect an extremely high risk of frost damage in Kékfrankos. The probability of Kékfrankos frost damage in a domestic wine region is more than 70%. Compared to this, the risk of frost damage to the second most frost-sensitive domestic variety, Pinot Gris, is significantly lower, which is "only" 50% in the spring period.

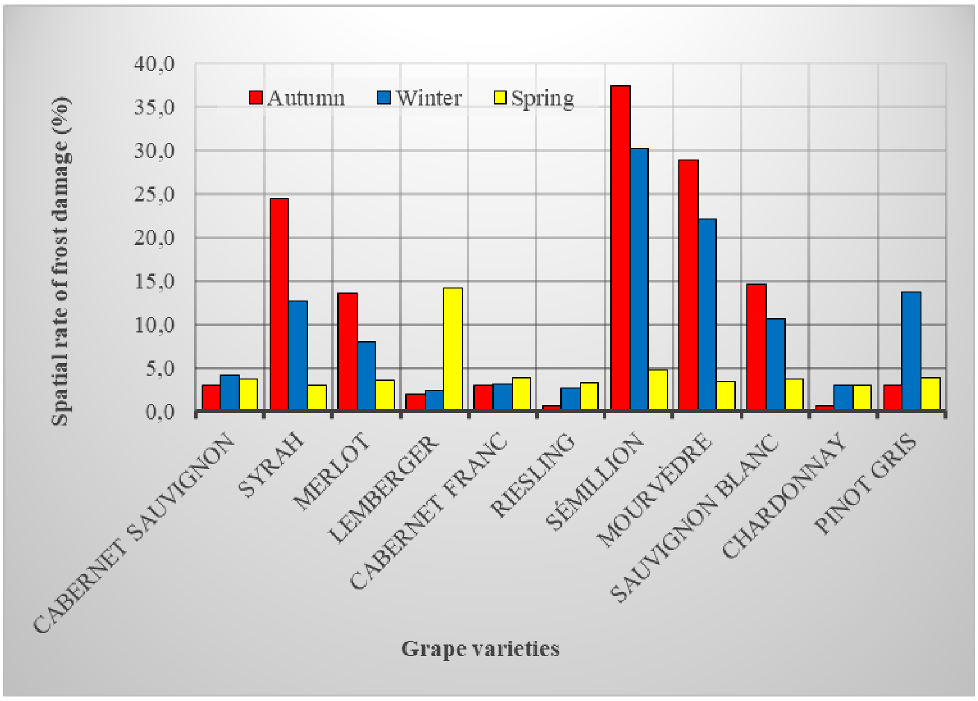
Figure 7: Distribution of at least 50% frost damage occurring in different seasons in the Hungarian wine regions for the examined grape varieties between 1961–2010.



Of course, the above results do not apply to the entire wine region. We also considered frost damage if only one data point in the wine region had the minimum temperature reached or lower than the LT50 function value for that day. If we analyze in detail the regional rate of frost damage in the Hungarian wine regions for the examined varieties, the following conclusions can be made:

Although spring frost damage is most likely to occur every year and autumn frost damage is the least common, in terms of area, autumn frost damage is about 2% higher than spring frost damage. Especially in the case of Mediterranean varieties (Sémillion, Mourvédre), frost damage occurs on a larger area than other varieties, but it does not exceed 40% (Figure 8). In winter, the same two Mediterranean varieties have the highest frost damage, but are 6–7% lower than in autumn. The regional rate of spring frost damage is generally below 5%. In spring, the frost damage of the Lemberger grape variety, which is otherwise very sensitive to frost, does not exceed 15% (Figure 8). In summary, frosts occur in a small proportion of Hungarian wine regions and, fortunately, it is rare for the whole wine region to be affected by frost damage. Because we are not sure which year and in which part of the wine region frost damage will occur, it is worth setting up long-term frost protection in all wine regions even with low territorial rate of frost damage.

Figure 8: The regional rate of frost damage occurring in different seasons in the Hungarian wine regions for the examined grape varieties between 1961–2010.



4. Conclusion

During the dormant period, predominantly extreme low temperatures can cause frost damage, while in the vegetation period even temperatures below -1 °C can cause severe frost damage. By monitoring the response of vineyards to the weather elements, we are able to take the necessary measures in time to ensure the undisturbed development of the vineyards and to protect it from harmful effects. If we know the statistical indicators of the occurrence of frost and the probability of the occurrence of frost damage, we will have the opportunity to recommend optimal varieties in the Hungarian wine regions.

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Soil Fertility and Rice Biomass Production of Organic Farming System in Termas Village Sragen Regency

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Abstract.

In many cases the yield and quality of organic rice farming system are better than semi organic and conventional rice farming systems; so many farmers want to move to organic rice farming system. The aim of the study was to evaluate soil fertilities and yield of rice biomass under organic system. The study was conducted in organic rice farming system in Termas Village, Sambung Macan Sub District, Sragen Regency from March 2019 to the end of June 2019. Soil was sampled in March 2019 at organic rice farming system. Composite soil samples were collected from ten sampling points and mixed. These samples were analysed for soil fertilities properties. The results indicated that in general the soil fertility under organic rice farming was superior including pH, C-organic, N total, P and K extracted with HCl 25 %. The same result was found in rice biomass production namely rice grains yield (12.68 tons $ha^{-1}season^{-1}$), rice straws (7.25 tons $ha^{-1}season^{-1}$) and rice residues (4.15 tons $ha^{-1}season^{-1}$).

Keywords: soil fertility, rice organic farming

1. Introduction

Rice, vegetables and fruits are not only crop with high economy value, but also source of income providing jobs for most villagers. The farmers also realize that Green Revolution technology, combination between high external inputs (fertilizer and pesticides) and high yielding varieties, is not sustainable, production cost become more expensive and rice production tend to decrease. Therefore, some farmers want to move to other rice farming systems, some want to change to organic farming system, some to semi organic and the rest still doing conventional system with some improvement (Sukristiyonubowo *et al.* 2018a; b). The term of organic refers to a process that uses methods respectful of the environment, from production stages through the handling and processing. Organic farming is not only concerned with the product, but also the whole system used to produce and deliver the product to the ultimate consumers (Anonymous 2004).

Recently, research in organic farming systems have been developed both in plot, farm and community scales with different purposes. Some researchers from different countries have mentioned the advantages doing organic rice, vegetables and fruits including in the soil, quality and quantity of yields and income. According to Sukristiyonubowo *et al.* (2018) soil chemical-physical fertilities in organic field in Kopeng Village, Semarang Regency, was more superior than in conventional vegetables farming system including soil pH, C organic and N, P and K total, bulk density, particle density, soil porosity and permeability (slow and fast drainage). In Bogor Regency, the soil chemical, physical and biological properties of organic vegetable farming are better than conventional farming systems in term of soil pH, organic C, total N, P, and K extracted with HCl 25%, bulk density and dehidrogenase enzyme (Sukristiyonubowo *et al.* 2015). Similar results was reported in rice farming in Sambiredjo Sub District, Sragen Regency, the soil chemical-physical fertility in organic field in Sambiredjo Sub District, Sragen Regency, was more superior than both in semi organic and conventional and in semi organic was better than in conventional system in terms of soil pH, organic C and N, P and K total, bulk density, particle density, soil porosity and permeability. The similar finding was also observed in rice biomass production (Sukristiyonubowo *et al.* 2018). Furthermore, Prakhas *et al.* (2002) reported that rice planted in organic technology has better in milling and cooking quality like total and head milled rice recovery, protein content, kernel elongation and lower in amylose content than cultivated inconventional system with commercials fertilizers and pesticides. Zhang and Shao (1999) reported that higher protein grains content will result in higher head rice recovery and lower amylose content. Chino *et al*. (1987) found that in the organic cultivation, the asparagine's content of plant phloem sap is significantly lower than in conventional systems. Kajimura *et al*. (1995) reported that the low densities of B*rown Plant Hopper* and White Backed Plant Hopperare observed in organic fields. Similar finding was reported by Alice *et al.* (2004). In line with the soil, organic farming is usually associated with a significant higher level of biological activities and soil organic matter than in green revolution technology (Oehl *et al*. 2004; Mader *et al.* 2002; Hansen *et al*. 2000; Stolze *et al.* 2002). In fact, there are still limited studies on comparing organic versus conventional systems (Hasegawa *et al.* 2005).

The aimed of this research was to study the soil fertility and rice biomass production under organic rice farming system in Termes Village, Sambung Macan Sub District, Sragen Regency.

2. Methodology

The experiment was conducted at Vertisols Sambung Macan Sub District of Sragen Regency for conventional, semi organic and organic rice farming systems from March to June 2019. In organic rice farming they apply only organic fertilizer as much as 3 tons ha^{-1} every cropping season. In Sragen Regency, they start organic rice farming systems since 1999.

Composite soil samples of 0-20 cm in depth were taken in March 2019, before soil preparation and submitted to the laboratory of AIAT (Assessment Institute for Agricultural Technology) in Jogyakarta for analysing. One kg soil composite was collected from ten sampling points at every site and mixed. These samples were submitted to the Soil Analytical Laboratory of the Jogyakarta Assessment Institute for Agricultural Technology for analyses of chemical properties of the soils. Chemical analyses included the measurement of pH (H_20, organic matter, phosphorus, and potassium, Organic matter was determined using the Walkley and Black method, pH (H_2O and KCl) was measured in a 1:5 soil-water suspension using a glass electrode, total P and soluble P were measured colorimetrically, extracted using HCl 25% and Olsen methods, respectively. The total K was extracted using HCl 25% and subsequently determined by flame-spectrometry (Soil Research Institute, 2009).

3. Results And Discussion

3.1. Soil Fertility

The soil fertility of the organic rice farming is presented in Table 1. Generally in 2019, the soil pH of the organic rice farming was 6.65 and classified as neutral. The neutral of the soil in organic rice farming may be due to continues appliying manures as much as 3 tons ha^{-1}. Meanwhile, the level of soil organic carbon (SOC) was 2.90 % and classified as height in organic rice farming and higher than in conventional rice farming (1.72%) and semi organic (2.17 %) systems (Sukristiyonubowo *et al* 2019). According to Sommerfeldt et al. (1988) and Clark et al. (1998), they stated that the higher soil Organic Matter levels in soils managed with animal manure and cover crops than in soils without such inputs. Increasing of soil organic carbon (SOC) will be easily soil to be plough. The total N in organic fields was 0.22 % and clasified as medium. This was happened due to addition of organic material (manure and compost). In year 2019, the CEC in organic fields was 31.67 cmol/kg and considered as medium to high. This due to the farmers applied different in organic materials and different in rates (manure and straw compost) that can build the colloids.

Table 1. The soil chemical fertility under organic rice farming systems in Termas Village Sambung Macan, Sragen Regency

Parameters	Organic rice farming
$pH_{(H20)}$	6.65
C-Organic (%)	2.90
N-Total (%)	0.22
P extracted with 25% HCl	184
K extracted with 25% HCl	180
CEC (cmol/kg)	31.67

In organic rice farming system, P extracted with HCl 25% classified as very height, suggesting that application of 3 tons manure ha^{-1} season^{-1} in organic system can increase the availability of P. Total K in rice organic farming was considered very high, higher than in semi organic and conventional farming systems, indicating that application of 3 ton organic materials (manure and straw compost) was enough to increase the total K in the soil. It was suggesting that straw compost applied was rich in K content. Clark *et al.* (1998); Rasmussen and Parton (1994) and Wander *et al.* (1994) also reported similar findings. Therefore, it may be concluded that in general in 2019 the rice organic farming was considered better including pH, C-organic, nitrogen content, and P, and K extracted with 25 % HCl.

3.2. Rice Biomass Production

Rice biomass production of organic farming at Termas Village, Sragen Regency was presented in Table 2. In 2019, according to the farmer organic rice farming system showed the highest rice biomass productions namely rice residues, rice straw, and rice grains productions. Furthermore, the organic rice system also showed the highest income. This due to environmental factors were abundant (there was enough water and abundant sunlight), so photosynthesis took place optimally and photosynthesis results (carbohydrate) was generated a lot. The rice biomass production reached about 4.15, 7.25 and 12.68 $ha^{-1}season^{-1}$ for rice residues, rice straw and rice grains, respectively (Table 2). This was also due to the soil quality including soil chemical, physical and biological fertilities in organic cultivation were getting better and C-organic was getting higher.

Table 2. Rice biomass production of organic and conventional farming systems at Termas Village, Sambung Macan Sub District, Sragen Regency, Central Java Province

Rice Farming	Rice Biomas Productions (tons ha^{-1} $season^{-1}$)		
	Rice Grains	Rice Straws	Rice residues
Organic rice farming	12.68	7.25	4.15
Coventional rice farming	7.00	6.25	3..15

4. Conclusions

In general, in 2019 the soil fertility under organic rice farming was excellent including pH, C-organic, N total, P and K extracted with HCl 25 %. The same result was happened in rice biomass production namely rice grains yield (12.68 tons ha^{-1} $season^{-1}$), rice straws (7.25 tons ha^{-1} $season^{-1}$) and rice residues (4.15 tons ha^{-1} $season^{1}$).

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Potential Use of Composted Sugar Palm Solid Waste in Improving The Availability of Nitrogen in Regosol and Its Uptake by Sweet Corn

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Abstract.

The Heap of sugar palm solid waste often become pollutants, potentially used as organic fertilizer by making it compost, because it contains organic matter and high N. Regosol is soil that has poor physical and chemical soil conditions for corn growth because it is constrained by sand dominated soil texture and low N. This study aims to determine the effect of compost from sugar palm solid waste on the availability of N Regosol and its uptake by corn. This research is a pot experiment, using Complete Random Design method (CRD) with 5 treatments, each treatment was replicated 3 times. The five treatments are: K0 = Compost at a rate of 0 tons / ha (control), K1 = Compost at a rate of 22.24 tons / ha, K2 = Compost at a rate of 44.48 tons / ha, K3 = Compost at a rate of 66.72 tons / ha and K4 = compost at a rate of 88.96 tons / ha. The results showed that the application of palm sugar solid waste compost could increase the Nitrogen availability of Regosol and Nitrogen uptake of corn. Application of palm sugar solid waste compost at a rate equivalent to 44.48 tons/ha significantly responds to the increased availability of Nitrogen Regosol and the best Nitrogen uptake of corn.

Keywords: compost, Regosol, Nitrogen, uptake, corn.

1. Introduction

Sweet corn is one of the sources of carbohydrate plants. In Indonesia, the need for corn from year to year continues to increase, but the average national production is still low. Corn plants are sensitive to aspects of soil fertility especially by the low availability of nutrients such as N. To get good corn growth and high yields, nutrient elements available and able to be used by plants must be an insufficient condition. Nitrogen is one of the important nutrients for the growth of corn (Sutoro et al., 1988). Nitrogen absorption by corn takes place during its growth. At the beginning of growth, Nitrogen accumulation in plants is relatively slow and after the plants are 4 weeks old Nitrogen accumulation is very fast. At the time of flowering (male flowers appear) corn plants have absorbed N as much as 50% of all their needs, therefore to get good results, Nitrogen in the soil must be sufficiently available at this growth phase. Corn that lack Nitrogen elements will show stunted growth and yellowish-green plant leaves in the shape of the letter V from the leaf tip to the leaf bone and start from the bottom leaf first (Suntoro, et al., 1988).

Corn can grow on various types of soil as long as it gets good processing. Good soil for corn is loose and fertile because this plant needs good aeration and drainage. Regosol is one of the potential soils for growing corn but has some physical constraints including sand texture, grained structure, loose consistency, very porous, so that water and nutrient buffer capacity is very low (Pusat Penelitian Tanah dan Agroklimat, 1994), while the chemical constraints including low organic matter content so that it is sensitive to erosion, Cation Exchange Capacity (CEC) and low base saturation and low nutrient availability especially N. nutrients (Sarief, 1985).

To overcome these obstacles, manipulation was carried out so that Regosol can be used as a medium for growing sweet corn. Manipulation that can be done is by adding organic fertilizer in the form of compost from sugar palm solid waste so it is expected to provide benefits to improving the quality of soil structure and chemical properties of the soil. With improved soil structure and good pore balance and spread, soil aggregates can provide a dense balance and pore space that is more beneficial for corn growth. The improvement of the physical properties of the soil, the chemical properties of the soil will also be improved including an increase of soil cation exchange capacity and the availability of nutrients, especially nitrogen.

Compost from sugar palm solid waste is very good to use because the material from this compost is a mixture of compost from sugar palm solid waste and manure and microbial starter. The results of compost analysis of sugar palm solid waste show that the total N and available N content which is very high influences the reduction in the C / N ratio (Nugroho, 2009). Application of sugar palm solid waste compost which is rich in organic matter and N nutrients is expected to be able to increase the availability of Regosol N and its uptake by corn. This study aims to determine the effect of sugar palm solid waste compost on the availability of N Regosol and its uptake by corn plants.

2. Method

This research is a pot experiment, using a completely randomized design (CRD) method with 5 treatments, each treatment was replicated 3 times. The five treatments are: K0 = Compost with a dose of 0 tons / ha (control), K1 = Compost with a dose of 22.24 tons / ha equivalent to 80 g / pot, K2 = Compost with a dose of 44.48 tons / ha equivalent to 160 g / pot, K3 = Compost with a dose of 66.72 tons / ha equivalent to 240 g / pot and K4 = Compost with a dose of 88.96 tons / ha equivalent to 320 g / pot.

This research was conducted in the greenhouse of Programme of Study in Soil Science of UPN "VETERAN" Yogyakarta. Soil chemical analysis was carried out at the Laboratory of Balai Pengkajian Teknologi Pertanian (BPTP) Yogyakarta and of Programme of Study in Soil Science of UPN "VETERAN" Yogyakarta.

Table 1. Physical and Chemical Properties

Soil Properties	Values	Rate (PPT, 2005)
C-Organic (%)	0,39	Very Low
N-Total (%)	0,04	Very Low
N-Available (%)	0,0009	Very Low
pH (H_2O)	6,15	Neutral

Table 2. Composition of Sugar Palm Solid WasteCompost

Soil Properties	Values	Rate (PPT, 2005)
C-Organic (%)	20,50	Very High
N-Total (%)	1,36	Very High
pH (H_2O)	7,0	Neutral

This research is a pot experiment, using a completely randomized design (CRD) method with 5 treatments, each treatment was repeated 3 times. The five treatments are: K0 = Compost with a dose of 0 tons / ha (control), K1 = Compost with a dose of 22.24 tons / ha equivalent to 80 g / pot, K2 = Compost with a dose of 44.48 tons / ha equivalent to 160 g / pot, K3 = Compost with a dose of 66.72 tons / ha equivalent to 240 g / pot and K4 = Compost with a dose of 88.96 tons / ha equivalent to 320 g / pot.

The Regosol taken from the field were air dried and sieved through a 2 mm. This soil is put in a plastic pot, each pot is equivalent to 10 kg of absolute dry soils. Weigh the compost from sugar palm solid waste according to the calculation results into the pot, then mix the compost into a pot of soil. After being mixed between soil and compost sugar palm solid wastecompost, then given water to reach the field capacity, then incubated for two weeks.The soil moisture is maintained at the field capacity by water weighing.The amount of water is determined by weighing the trial pots every day.The difference between the weight at the original weight is the weight of water that must be added.

As a bioassay to determine the response of cultivated plants to soil conditions and treatments, corn seeds were planted in the soil in pots that had been treated.Planting is carried out on soil samples with a weight equivalent to 10 kg of absolute dry soils. Before planting, the soil is softened and then in each pot is planted with 3 sweet corn seeds.

At the age of 7 days after planting, thinning leaves one of the best plants per pot.Plants treated reach a maximum vegetative phase. After the maximum vegetative phase is reached, soil sampling is carried out to test nutrient uptake and plant growth.

To find out the effect of treatment on the parameters of the experiment using Analysis of variance with significant of 5%, whereas to find out the comparison between treatments used Duncan's Multiple Range Test (DMRT) with significant of 5% (Gomez and Gomez, 1995)

3. Results and Discussion

From table 1 it can be seen that the Regosol used in this study has very low N-total and soil N available, there is 0.04% for N-total and available N levels of 0,0009%. The results of the C-Organic are very low at 0.39% and organic matter is also very low at 0.67%. From table 2 it can also be known that sugar palm solid waste compost N-total levels of 1,360% and available N evels are also high at 0.42%. C-Organic levels are very high at 20.50% and the pH of the sugar palm solid waste compost is neutral, which is 7. The C/ N value of compost is a medium level of 15.08 so it can supply the mineralized nitrogen.

Nutrient uptake is an indicator of soil response to fertilization. The response of nutrient uptake of N to the application of sugar palm solid waste compost in Regosol can be seen from the parameters of Nitrogen availability, plant growth and N nutrient uptake at maximum vegetative age (table 3).

Table 3 Effect of sugar palm solid wastecomposton available N, plant height, dry weight, N content and N uptake of corn

Treatment	N-Available (%)	Plant Height (cm)	Dry Weight (g)	Tissue Nitrogen Content(%)	N Uptake (mg/plant)
K0	0,0024 c	40,21 c	2,05 c	0,46 b	0,002 a
K1	0,02 b	76,99 b	10,41 b	0,80 a	0,027 b
K2	0,043 a	83,43 a	17,24 a	0,87 a	0,050 b
K3	0,040 a	80,32 a	14,05 a	0,84 a	0,046 b
K4	0,014 b	71,60 b	12,36 b	0,85 a	0,029 b

Description : Average followed by the same letter in the same row or column shows there is no significant difference based on Duncan's Multiple Range Test at the level of 5%.

K0 = Compost with a dose of 0 tons / ha (control)
K1 = Compost with a dose of 22.24 tons / ha equivalent to 80 g / pot
K2 = Compost with a dose of 44.48 tons / ha equivalent to 160 g / pot
K3 = Compost with a dose of 66.72 tons / ha equivalent to 240 g / pot
K4 = Compost with a dose of 88.96 tons / ha equivalent to 320 g / pot.

From table 3, the results of analysis of variance of 5% significance level can be seen that sugar palm solid waste compost has a significant effect on increasing the availability of N Regosol, plant height, plant dry weight, tissue N content and corn N nutrient uptake. This condition indicates that sugar palm solid waste compost application plays a role in increasing these parameters. This is due to the addition of N nutrients resulting from the mineralization of palm starch solid waste, as evidenced by compost of sugar palm solid waste used which has a very high N content (table 2).

Regosol N-available increases with increasing amounts of sugar palm solid waste compost given up to the equivalent of 44.48 tons / ha (K2) (table 3, figure 1).Compost equal to 22.24 tons / ha (K1) and 44.48 tons / ha (K2) showed a significant increase of K0. This means that compost application has an effect on increasing the level of available N soil.The highest N available in the compost of sugar palm solid waste is equivalent to 44.48 tons / ha (K2), giving a dose above equal to 66.72 tons / ha (K3) and the equivalent of 88.96 tons / ha (K4) decreases yield.This condition is caused by environmental changes that cause a decrease in pH.According to Mengel and Kirkby (1987) cit. Wardani (2007) at low pH, nitrate is absorbed faster than ammonium; whereas at neutral pH, the absorption of both is possible.This is caused by the competition of OH anion with NO_3^- anion so that nitrate absorption is slightly inhibited. At pH 4.0 nitrate absorption is more than that of ammonium. Rosmarkam (2002) says that when giving Nitrogen is raised above the optimal point,then some assimilated Nitrogen separates as amide,so giving excessive nitrogen only raises N levels in plants but reduces carbohydrate synthesis. According to Agus cit. Wardani (2007), nitrogen needs for corn plants last a lifetime.The increase in N available Regosol due to the compost used is very high N content (table 2).

The increase in N available in the soil seems to respond to plant growth, which is indicated by an increase in plant height,plant dry weight (biomass), levels of N and uptake of N-plant tissue (table 3), in this case Corn absorbs N from the soil in available forms (NH^{4+} and NO_3^-),due to the addition of N from sugar palm solid waste compost (table 2).

Increased nutrient uptake of N by corn occursas the amount of sugar palm solid waste compostis increased. This increase in nutrient uptake is due to an improved plant root systemas evidenced by an increase in plant height and total dry weight of plants at the maximum vegetative age (table 3).This increase in plant height and total dry weight was caused by increased availability of N Regosol nutrients. This is because photosynthate in plant tissue that is formed due to the increased dose of sugar palm solid wastecompostgiven is widely used for cell division.N is needed by corn in very large quantities. Nitrogen in plants functions to plant growth process, affect the work of chlorophyll, and increasing protein levels in the body of the plant (Hakim et al. 2006).While the need for nitrogen for corn lasts throughout life. Nitrogen uptake is not the same in every phase of growth of corn, so plants want nitrogen availability continuously at all stages of growth. Therefore, if there is an addition of N in the soil, plant growth will increase.

Figure 1. Effect of sugar palm solid wastecompost on available N Regosol

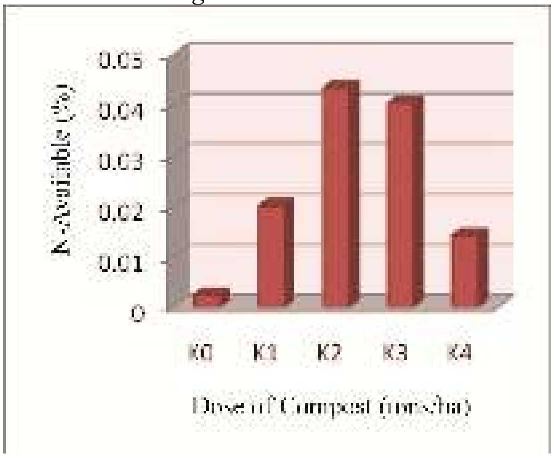
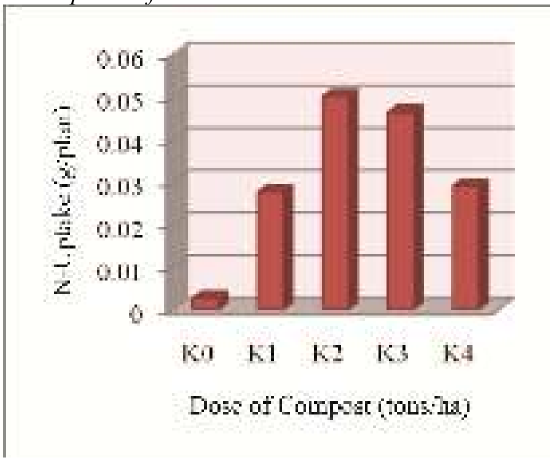


Figure 2. Effect of sugar palm solid wastecompost on N uptake of corn



Description : K0 = Compost with a dose of 0 tons / ha (control)
K1 = Compost with a dose of 22.24 tons / ha equivalent to 80 g / pot
K2 = Compost with a dose of 44.48 tons / ha equivalent to 160 g / pot
K3 = Compost with a dose of 66.72 tons / ha equivalent to 240 g / pot
K4 = Compost with a dose of 88.96 tons / ha equivalent to 320 g / pot.

From table 3 and figure 2 it is known that the uptake of plants at the maximum vegetative age increases with increasing compost doses.The highest N uptake was achieved in the provision of compost equivalent to 44.48 tons / ha (K2), the application of the above dose was equivalent to 66.72 tons / ha (K3) and the equivalent of 88.96 tons / ha (K4) actually decreased.This phenomenon is as said by Mitscherlich in the law of decreasing yield (low of diminishing yield increment), the addition of nutrients increases the yield to a certain point, however the subsequent addition of nutrients provides an increase singly diminished yield (Mitscherlich 1910 cit. Nasih 2010).This is understandable because sugar palm solid waste compost equivalent to 44.48 tons / ha (K2) has the highest percentage in increasing N-available soil, plant height, plant dry weight, N levels in plants (table 3).

4. Conclusion

a. sugar palm solid waste compost application significantly increases the availability of N in Regosol and N uptake in sweet corn.
b. Application of sugar palm solid waste compost at a rate of 44.48 tons / ha (K2) gives the best response to the Nitrogen availability of Regosol and Nitrogen uptake in sweet corn.

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Study of The Utilization of Ruminant Ruments as A Bioactivator For Palm Oil Frond Compost Quality

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Abstract.

The aims of this study were to determine the physical and chemical quality of oil palm frond compost with the addition of ruminant liquid bio-activator cattles (cattle, goats and buffalo). The material used in this research was palm fronds and ruminant animal rumen fluid obtained from Gandus Slaughterhouse in South Sumatra. This study used a Completely Randomized Design with 5 treatments with 3 replications consisting of P0 (compost of oil palm fronds without addition of bio-activator), P1 (Compost of oil palm frond with bio-activator EM4), P2 (Compost of oil palm frond with bio-activator goat rumen liquid), P3 (Compost of oil palm fronds with bovine rumen liquid bio-activator), and P4 (Compost of oil palm fronds with buffalo rumen liquid bio-activator). The parameters measured in the study are physical quality (odor, texture, pH, temperature and color) and chemical quality (nitrogen, water content, phosphorus, calcium and C-organic). The data obtained were analyzed by ANOVA, if there any significant differences were followed by Duncan's test. The best ruminant rumen bio-activator in the composting process is cow bio-activator, with produced temperature of 33.66 ºC, moisture content of 61.47%, particle size of 74.0%, compost color is dark, compost has soil smelt, pH 7.30, N-Total 0.50%, P-Available 0.0061%, K-Total 0.24, C-Organic 6.58 and C/N 13%.

Keywords: bio-activator, compost, ruminant rumens

1. Introduction

Palm fronds are one of the most wasteful uses of oil palm plantations. The production of the midrib can reach 22 kg / tree / year, where the weight of the midrib meat is around 2.2 kg and the palm frond biomass reaches 6.3 tons / hectare / year. The content of the chemical compounds making up the oil palm fronds consists of cellulose, hemicellulose, and lignin, respectively 31.7%, 33.9%, and 17.4% [1]. Oil palm midrib, including material with high cellulose content and has a density more than wood, that is equal to 1.16 g / cm3, where it is an organic material that can be composted with nitrogen content per dry weight reaching between 2.2- 2.5% and the C / N ratio is 20 (Rokhman, 2004).

Many farmers have known very well with inorganic fertilizers which nutrients are very high but the rate of economic input has greatly increased, this has an impact on increasing yield including the price of inorganic fertilizers. Problems like this can be overcome by making compost organic fertilizer, namely by using palm fronds as organic material which is assisted with ruminant rumen fluid as a bio-activator.

Bio-activator is a bioactive material that is able to decompost organic materials in general. The use of bio-activator derives from ruminant animal rumen fluid is a simple step to obtain good quality compost and composting time which is considered faster in the composting process. The function of this bio-activator is to speed up the decomposition process and improve the quality of nutrients. In the rumen fluid there are microorganisms that can help in decomposition, namely bacteria, fungi, and protozoa. The survey results indicate that the availability of ruminant rumen fluid is very large, if every day slaughtering ruminant animals by 5 animals, rumen fluid is obtained as much as 155 liter (Saidi et al., 2008).

Compost is the result of incomplete decomposition of a mixture of organic materials that can be artificially accelerated by populations of various microbes in warm, humid, and aerobic or anaerobic conditions. Compost can increase soil fertility and stimulate healthy roots, improve soil structure by increasing soil organic matter content and will increase the ability of soil to maintain soil water content.

The purpose of this research is to get the best ruminant rumen bio-activator (goat, cow and buffalo) in the composting process and to compare the results of decomposition of ruminant bio-activator and Effective Microorganism 4 (EM4) on the quality of compost of palm oil fronds.

2. Research Methodology

This research was carried out for 5 months at the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University.

This study used a Randomized Design of the Bio-activator Treatment Group:

1. B0 = Compost of oil palm fronds without addition of bio-activator
2. B1 = Compost of oil palm fronds with EM4 bio-activator
3. B2 = Compost of oil palm fronds with goat rumen liquid bio-activator
4. B3 = Compost of oil palm fronds with buffalo rumen liquid bio-activator
5. B4 = Palm frond compost with a cow rumen fluid bio-activator

Starter Agent Treatment

1. S1 = Chicken manure
2. S2 = NPK fertilizer

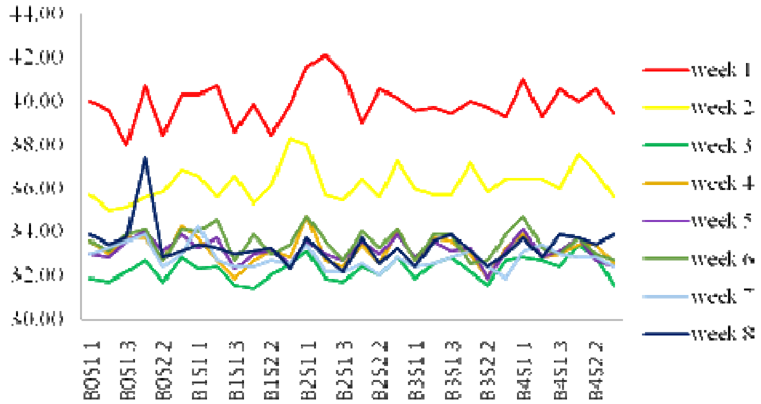
All treatments are replicated 3 times so there are 30 experimental pots

3. Results And Discussion

3.1 Compost Temperature

In the composting process, observation of compost temperature needs to be done to determine the level of compost maturity and to know the decomposition process is still on going. Following are observations of average compost temperature every week (Figure 1).

Figure 1: Graph of the average temperature of compost on every week for Composting



Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

According to Indriani, (2007), an important indicator in the composting process is the temperature of the composting, because the temperature at the time of composting can show the process of microorganisms in decomposing organic matter.

Of the thirty trials conducted temperatures experienced an increase in the first week and for subsequent weeks decreased but still above 30ºC. According to Indriani (2007) the optimal temperature in the composting process is 30 -50 ºC. Based on SNI 19-7030-2004 the temperature of compost that has been ready is the maximum temperature of ground water temperature.

3.2 Compost Water Content

The important role of humidity becomes very important for oxygen supply and microbial metabolism.

Table 1: Compost water content

No	Treatment	Water content (%)
1.	B_0S_1	55.90
2.	B_0S_2	62.04
3.	B_1S_1	60.15
4.	B_1S_2	63.64
5.	B_2S_1	59.47
6.	B_2S_2	63.11
7.	B_3S_1	59.28
8.	B_3S_2	62.18
9.	B_4S_1	59.39
10.	B_4S_2	61.47

Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

According to Kusumawati's research (2011), water content affects the rate of compost decomposition and temperature parameters except for pH and nitrogen levels. Water content affects the rate of compost decomposition and temperature caused by microorganisms need optimal water content to decompose organic material. Based on 30 experiments, there are some treatments whose water content exceeds 60% and there are also below 50%.

Moisture compost affects the activity of microorganisms involved in composting (Yenie, 2008), and the optimum humidity for aerobic composting is 50-60%.

3.3 Compost Color

The color of compost that has been matured is black. The color change from 10YR 4/6 (brown) at the beginning of composting to black is on a mature fertilizer due to the decomposition of organic matter by the activities of various microorganisms. The aerobic decomposition process is shown by the change of color to black (Sutanto, 2002).

At the first week after decomposting and mixing it with other ingredients, the color has become dark brown and at the last week or 8th week the color starts to get darker or blackish, in accordance with SNI 19-7030-2004, the color of ripe compost that is black.

3.4 Compost Smell

Mature compost is characterized by a soil-like odor. Aeration can be increased by reversing the compost collision. This is because the material used is not the same as organic material in general, because the material used is difficult to decompose (Djuarnani et.al 2006).

From the observation of compost odor, all treatments have experienced odor changes from the beginning of the composting process until the end of the composting process. Matured compost in this study smells like soil, this is in accordance with SNI 19-7030-2004 the smell of ripe compost smells like soil.

3.5 Compost Particle Size

The smaller the piece of raw material, the faster the decay time. The size of the material about 5-10 cm suitable for compost in terms of aspects of air circulation that may occur. To speed up the weathering process, manually chopped leaves, twigs and other organic material by hand or machine.

Table 2: Compost particle size

No	Treatment	Particle size (%) 5 mm
1.	B_0S_1	57.3
2.	B_0S_2	40.7
3.	B_1S_1	62.3
4.	B_1S_2	49.7
5.	B_2S_1	58.7
6.	B_2S_2	50.3
7.	B_3S_1	56.7
8.	B_3S_2	52.7
9.	B_4S_1	58.3
10.	B_4S_2	74.0

Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

In this research, the counting of oil palm leaf fronds uses a chopping machine so that the initial particle size of the material is around 3-5 cm. according to SNI 19-7030-2004 the particle size for mature compost ranges from 0.55-25 mm. Referring to compost SNI which has a maximum particle size of 25 mm, all treatments are in accordance with SNI.

3.6 N, P, K, C / N ratio and C-Organic Compost (%)

The nutrient content in each compost is different. The difference in content can be seen in Table 3 below.

Table 3: Compost analysis data.

No	Treatment	pH	N-Total	P-available	K-Total	C-Organik	C/N
1.	B_0S_1	7.17	0,62	0,0062	0,20	8.19	20
2.	B_0S_2	6.80	0,45	0,0062	0,20	7,31	16
3.	B_1S_1	7.29	0,51	0,0060	0,22	8,99	18
4.	B_1S_2	7.02	0,49	0,0059	0,23	8,35	17
5.	B_2S_1	6.98	0,52	0,0061	0,23	7,79	15
6.	B_2S_2	6.98	0,58	0,0060	0,22	10,95	19
7.	B_3S_1	7.12	0,41	0,0062	0,26	5,74	14
8.	B_3S_2	6.89	0,40	0,0062	0,20	7,25	18
9.	B_4S_1	7.04	0,51	0,0065	0,22	9,25	18
10.	B_4S_2	7.30	0,50	0,0061	0,24	6.58	13

Source: the Center for Organic Fertilizer Research at the Department of Soil and the Laboratory of Chemistry, Biology and Soil Fertility, Faculty of Agriculture, Sriwijaya University

It can be seen in the data in Table 3 above that the pH, N, P, K, C / N and C-Organic content of all treatments varies greatly. Based on the above results, it can be compared with SNI 19-7030-2004. All pH, N, P, K, C / N and C-Organic contents are in accordance with the standards. In this research, the initial content of C / N ratio of composted material is 62.67%. Compost is determined by low C / N levels. The lower the C / N level the more mature the compost. According to the standard compost requirements, the C / N ratio must be <20, if> 20 then compost has not been said to be matured.

4. Conclusion

The best ruminant rumen bioactivator in the composting process is buffalo bioactivator with NPK fertilizer starter agent, producing a temperature of 33.66 ºC, moisture content of 61.47%, particle size of 74.0%, compost color is dark, compost has smelly soil, pH 7, 30, N-Total 0.50%, P-Available 0.0061%, K-Total 0.24, C-Organic 6.58 and C / N 13%.

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The Effects of Application of Chicken Bone Flour and Organic Matters on Phosphorus and Calcium Availability of Latosol and Growth of Maize

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Abstract.

Chicken bone is a by-product that causes bone heaps. Chicken bone contains 24-30% of Ca and 12-15% of P, so it can be used as a source of P and Ca, but not yet available. To dissolve it needs the addition of organic matter. Latosol is a soil that lacks of P and Ca. This study aims to determine the effect of application of flour from chicken bone waste and organic matters on availability of P and Ca of Latosol and growth of corn. The study was carried out in the greenhouse of UPN "Veteran" Yogyakarta Faculty of Agriculture, on January to April 2019. The study used a completely randomized design of two factors. The first factor is the dose of chicken bone flour, are without chicken bone flour (A0), chicken bone flour 2%(A1), 4% (A2), and 6% (A3). The second factors is organic matters, are without organic matter (B0), compost 3% by weight of the soil (B1), and manure 3% by weight of the soil (B2). Each treatment was replicated 3 times. Application of chicken bone flour had a significant effect in increasing pH H_2O, C-Organic, available-P, and available-Ca, plant height and plant dry weight. Application of various types of organic matter had a significant effect in increasing pH H_2O, C-Organic, available-P, available-Ca, plant height and plant dry weight. The combination of chicken bone flour and organic matters interacted each other in increasing available-Ca, while there are no interactions to affect pH H_2O, C-Organic, available-P, plant height and plant dry weight.

Keywords: chicken bone flour, organic matters, p, ca, latosol.

1. Introduction

Bone is a by product of chicken livestock. Every day slaughterhouses, food processing industries and chicken meat become processed feed products such as chicken filleting, nuggets, and chicken sausages produce chicken bones in large quantities. However, the utilization of bone has not been carried out optimally due to the low economic value of the bone, thus causing bone heaps. According to Rasyaf (2002), chicken bones contain 24-30% calcium and 12-15% phosphorus. Based on this composition, chicken bones can be used as a source of phosphorus (P) and calcium (Ca) for plants in the form of chicken bone flour.

The P element has a role in the metabolic process as well as a structural constituent of the molecule, while Ca has a role in strengthening plant tissues and supporting elongation of root cells, so the shortage of P and Ca is very influential on plant growth.

P and Ca salts contained in chicken bones are bound in soft matrix tissue consisting of organic material containing collagen fibers, and mucopolysaccharide gels (Piliang, 2004). Chicken bones as a source of mineral P and Ca, before use must be treated first. This is because bone mineral in the form of hydroxyapatite crystal ($Ca_{10}(PO_4)_6(OH)_2$) and calcium carbonate ($CaCO_3$) are components that are bound in the structure of bone collagen so that its presence is not yet available. The release of hydroxyapatite and calcium carbonate from the collagen structure of chicken bones can be immersed with an alkaline solution, one of which uses 4% NaOH with 48 hours of soaking (Rusmana et al, 2016).

Calcium hydroxyapatite is inorganic phosphorus that dissolves in an acidic solution (Jeng et al, 2008), so that P and Ca which are arranged in minerals can be released optimally it is necessary to add organic matter. Organic materials in the decomposition process will produce organic acids that can dissolve P and Ca (Rahayu, 2009). Organic matters can come from primary sources (plant tissue) in the form of compost and secondary sources (animal dung) in the form of manure. With the addition of organic matter, it is expected that the release of P and Ca from chicken bone flour can be optimal.

One of the plants that need P and Ca elements is corn, which is the most important food crop after rice and wheat. Corn (*Zea mays*) is an agricultural commodity that has a high agronomic value and is much sought after by farmers. This plant needs fertile, loose, well-drained soil, soil pH ranges from 5.6-7.0 (Syafruddin et al, 2015). For optimum growth, corn requires 100 kg P / ha and 30 kg Ca / ha (Mulyanto et al, 2015). Corn in Indonesia is grown from the lowlands to the highlands. With the shrinking of land in the lowlands, to stimulate corn production is done by utilizing land in the highlands. Latosol is a land that develops in the highlands, its spread is quite extensive in Indonesia and has the potential to grow corn. However, this land has obstacles including high acidity, causing low Ca solubility. The high Al and Fe which causes high P fixation so that its availability is low. This soil is also poor in organic matter, low cation exchange capacity, and low N, K, Ca and Mg nutrient availability. To overcome the above obstacles need to be manipulated so that Latosol can be used as a medium for growing corn. Manipulation that can be done is by giving chicken bone flour and organic matters in the form of compost and manure.

2. Method

The research was carried out in the greenhouse of the UPN "Veteran" Yogyakarta Faculty of Agriculture in January 2019 to April 2019. The analysis of soil samples was carried out at the Laboratory of the Soil Faculty of Agriculture UPN "Veteran" Yogyakarta.

The materials used in this study consisted of F1 sweet corn hybrid seeds (Sweet Boy), Latosol from Tuksongo village, Borobudur District, Magelang, chicken bones from the Slaughterhouse in Muntilan, compost, manure, distilled water, 4% of NaOH, and chemical material for analysis in the laboratory. The equipment that will be used consists of; ovens, buckets, hoes, polybags, scales, stationery and tools for laboratory analysis.

The study was conducted with a completely randomized design method (CRD) consisting of two factors. The first factor is the measurement of chicken bone flour, consisting of 4 levels (Vebriyanti, 2011) are: A0 = without chicken bone flour, A1 = chicken bone flour 2% from compost/manure equivalent to 5,88 g/polybag, A2 = 4% chicken bone flour from compost /manure equivalent to 11,76 g/polybag, A3 = 6% chicken bone flour from compost/manure equivalent to 17,64 g/polybag. The second factor is the type of organic matters, consisting of 3 levels (Sari et al., 2017) are: B0 = without organic matter, B1 = compost 3% of soil weight equivalent to 294 g/polybag, and B2 = manure 3% of the weight of the soil equivalent to 294 g/polybag. Each treatment was repeated 3 times, so 36 treatments were obtained.

This research was conducted in 2 sets of treatments, namely for the corn growing media and for the analysis of P and Ca available of Latosol. Soil preparation is done by taking Latosol soil as deep as 20 cm in the village of Tuksongo, Borobudur District. After the soil has been dried, it is pounded and sieved with a 2 mm. Then put into a polybag as much as 9 kg of absolute dry weight or equivalent to 9,8 kg of wind dry soil for corn growing media, and as much as 1 kg of wind dry weight for the analysis of P and Ca available of Latosol.

The treatment is given by mixing 3% of organic matter of soil weight which is equal to 294 grams per polybag for corn growing media and 30 grams per polybag for analysis of P and Ca available of Latosol and chicken bone flour according to treatment. Organic matters that will be used are compost and manure. Then given water until field conditions are reached. Then the mixture of soil, organic matters, and chicken bone flour were incubated for 1 month. Soil moisture is maintained in the condition of field capacity, namely by weighing polybags. The difference between the weight of the polybag at the time of weighing and the original weight is the weight of water that must be added. After incubation ends, analysis of available P and Ca available of Latosol.

As a bioassay to determine the response of cultivated plants to soil conditions and treatments, planting of corn on soils in treated polybags. The corn seeds used are F1 (Sweet Boy) hybrid corn seeds which are selected in uniform size, then proceed with planting 3 seeds per planting hole per polybag.

At the age of 7 day after planting thinning leaves one of the best plants per polybag. Observation of plant height is done once a week by measuring plant height from the base of the stem to the longest leaf tip. Plants are maintained until reaching a maximum vegetative growth marked by the appearance of male flowers at the age of 45 day after planting.

After the maximum vegetative phase is achieved, the plant dry weight measurement is carried out by cutting the plant into 5 parts, aerated, then wrapped in paper. Then put it in the oven with a temperature of 60 ° C for 72 hours, after that it was weighed.

The parameters used before treatment were pH H_2O, pH KCl, KPK, C organic, P available, Ca available. The parameters after treatment are pH H_2O, C organic, P available, Ca available for soil samples and plant height and plant dry weight for plant growth.

To determine the effect of treatment with variance (ANOVA) and to determine the comparison between treatments using Duncan Multiple Range Test (DMRT) at 5% level.

3. Research Results and Discussion

Based on the results of the chemical analysis of Latosol before handling (Table 1) submitted from Tuksongo Village, Borobudur District, Magelang, the chemical properties of Latosol were obtained. Chemical properties parameters that include pH H_2O, pH KCl, organic C, cation exchange capacity (CEC) of soil, P available, Ca available. The results of the soil analysis before implementation are the basis for discussion and approval of the land after the grant.

Table 1. Latosol Analysis Results before Treatment

Soil Properties	Values	Rate (PPT,1983)
pH		
a. H_2O	5.5	Acid
b. KCl	5.3	Acid
C-organic (%)	1.95	Low
CEC (me %)	9.47	Low
P- available (ppm)	9.05	Very low
Ca- available (%)	0.708	Very low

Table 1 shows that there are chemical fertility constraints of Latosol including the soil reaction (pH H_2O) around 5,5 which has acidity. This is because Latosols often wash base cations such as Ca, Mg, K, and Na which are replaced by Fe, H^+ and Al^{3+} (Foth, 1994). Organic C is 1,95% which is low rank. The cation exchange capacity value of this soil is 9,47 me%, this value is relatively low due to the lack of organic matter in the soil (Foth, 1994). The available P element is classified as very low at 9,05 ppm. This is because Al and Fe in acid soils are relatively high. Al and Fe can bind P so that the availability of P is reduced and not available (Damanik et al., 2010). Ca is available on this soil is very low at 1,14 me% because Ca has high mobility so it is easily leached.

Table 2. The Analysis Results of Chicken Bone Flour, Compost, and Manure.

Parameters	Chicken bone flour	Compost	Manure
C-organic (%)	15.34	18.39	15.39
P-total(%)	12.73	5.82	2.07
Ca-total(%)	23	0.19	0.53

From Table 2 it is known that the analysis of chicken bone meal shows that it has an organic C value of 15.34 %. The total P content in chicken bone flour is 12.73 % and the Ca-total value is 23 %. The C-organic content in compost is higher at 18.39 % while that of manure is 15.39 %. The total P-total in compost was 5,82 % and 2,07 % manure. The level of Ca in compost is 0.19 % and manure 0.53 %.

From table 3, the results of analysis of variance of 5% significance level can be seen that application of chicken bone flour and organic matters have a significant effect on increasing the availability of Latosol P, pH H_2O, and C-organic. This condition indicates that the chicken bone flour and organic matters application plays a role in increasing these parameters.

The application of 6% chicken bone flour from organic matter (A3) has a significantly higher H_2O pH than the treatment without chicken bone flour (A0) and chicken bone flour treatment 2% (A1), but not significantly different from the 4% chicken bone flour treatment. (A2). The treatment without chicken bone flour (A0) was not significantly different from the treatment of chicken bone flour 2% (A1). This means that chicken bone flour starting from A2 treatment significantly increases the pH (H2O) of Latosol. This is because the Ca content of chicken bone flour is 23%. Calcium contained in flour can be used as an alternative mixing, which works in increasing soil pH (Lestari, 2015). By applying chicken bone flour which has high Ca content into the soil, a chemical reaction will occur which produces OH- ions.

Table 3 The effect of chicken bone flour and organic matter application on pH H_2O, C-organic, and P-available.

Treatment	pH H_2O	C-organic (%)	P-available (ppm)
Chicken bone Flour			
A0	5.92 c	2.38 b	31.48c
A1	5.98 bc	2.46 ab	40.20b
A2	6.11 ab	2.54 ab	45.15ab
A3	6.27 a	2.59 a	51.47a
Organic matters			
B0	5.94 q	2.07 r	35.79 q
B1	6.15 p	2.79 p	44.24 p
B2	6.12 p	2.62 q	46.19 p
Interaction	(-)	(-)	(-)

Description: Average followed by the same letter in the same row or column shows there is no significant difference based on Duncan's Multiple Range Test at the level of 5%.
A0: Without chicken bone flour
A1: 2% Chicken bone flour from organic matter
A2: 4% chicken bone flour from organic matter
A3: 6% chicken bone flour from organic matter
B0: without organic matter
B1: compost 3% by weight of the soil
B2: manure 3% by weight of the soil

The application of compost organic material (B1) has a higher H2O pH value than without organic material (B0), but it is not significantly different from manure (B2). The application of organic matter can increase the pH (H_2O) of Latosol. This is in accordance with research conducted by Minardi, et al (2011) that the addition of organic matter can increase soil pH due to the exchange of anion ligands anion resulting from the decomposition of organic matter especially fulvic acid against OH- free at the exchange location so that it affects the increase in the number of OH^-.

Treatment of chicken bone meal 6% (A3) was significantly higher than without chicken bone flour, but it was not significantly different from chicken bone flour 2% (A1) and 4% (A2). The treatment without bone meal (A0) was not significantly different from chicken bone flour 2% (A1) and 4% (A2). This is because chicken bone flour is composed of extracellular matrix (organic and inorganic matrix. The organic matrix in chicken bone flour is a source of carbon. Therefore, the addition of chicken bone flour can increase C-organic (Maftuhin et al., 2015). Compost (B1) is significantly higher than that of manure (B2) and without organic matter (B0). Manure (B2) is significantly higher than without organic matter (B0). This is because the C-organic content in compost is greater at 18.39% while the C-organic content in manure is 15.39%. This is because compost is an organic fertilizer from the mineralization of several organic materials. By adding compost to the soil it will automatically increase the source of organic carbon in the soil which will ultimately increase the organic C content of the soil (Pane et al., 2018).

The application of chicken bone flour 6% from organic matter (A3) was significantly higher than chicken bone flour 2% (A1), 4% from organic material (A2) and without chicken bone flour (A0). the application of chicken bone flour 4% from organic material (A2) was not significantly different from the treatment of chicken bone flour 2% (A1), but it was significantly different from the treatment without chicken bone flour (A0), while chicken bone flour 2% was not significantly different from the treatment without chicken bone flour (A0). This means that the more chicken bone flour the higher P-available Latosol is available. Chicken bone flour has a high total P content which is valued at 42.73%. Compost (B1) is significantly higher than without organic matter (B0), but not significantly different from manure (B2). This means that the addition of organic matter plays a role in increasing P available Latosol. This is because organic matter influences the availability of P directly through the mineralization process or indirectly by assisting the release of fixed P. The process of mineralization of organic matter results in the release of P minerals (PO_4^{3-}), through the action of organic acids or chelating compounds from the decomposition. Resulting in the release of phosphates that bind with Al and Fe which are not soluble into dissolved form. Besides, organic matter will reduce phosphorus sorption because humic acid and fulvic acid function to protect sesquioxide by blocking the exchange site. Then, the addition of organic matter can activate the decomposition process of native soil organic matter and form a phospho-humate and phospho-fulvate complex that can be exchanged and is more available to plants, because phosphate is absorbed in organic matter weakly (Atmojo, 2003)

Table 4. Effect of chicken bone flour application and organic matters on Ca-available (me%)

Organic matters	Chicken bone flour dose				Average
	A0	A1	A2	A3	
B0	1.24b q	1.47b q	3.04b p	2.15b pq	1.98
B1	2.40 ab r	3.71 a q	4.49a pq	5.33a p	3.98
B2	2.46a qr	2.35b r	3.50ab q	4.87a p	3.26
Average	2.03	2.47	3.68	4.12	(+)

Description: Average followed by the same letter in the same row or column shows there is no significant difference based on Duncan's Multiple Range Test at the level of 5%.
A0: Without chicken bone flour
A1: 2% Chicken bone flour from organic matter
A2: 4% chicken bone flour from organic matter
A3: 6% chicken bone flour from organic matter
B0: without organic matter
B1: compost 3% by weight of the soil
B2: manure 3% by weight of the soil

From the results of variance it can be seen that both the treatment of chicken bone flour and the provision of organic material have a significant effect on the increase in Ca-available soil and the interaction between the two. This means that chicken bone flour and organic matter play a significant role in increasing levels of Ca-available soil. In the best combination of chicken bone flour and organic matter the treatment occurs in chicken bone flour 6% from organic matter and compost 3% (A3B1), but not significantly different from the combination of 6% chicken bone flour treatment from organic matter and 3% manure (A3B2). The higher the dose of chicken bone flour that is given along with organic matter, the higher the Ca content available in the soil.

The addition of organic matter helps in dissolving Ca in chicken bone flour which is still in the form of calcium hydroxyapatite so that it is not yet available. Calcium hydroxyapatite can dissolve in acidic solutions. Organic matter produces organic acids such as citric acid, oxalate, humic, and fulvic which can release these bonds so that Ca becomes available (Jeng et al., 2008). The addition of Ca from chicken bone flour can increase the availability of energy sources for microorganisms in organic matter to carry out biological activities. The interaction between chicken bone flour and organic matter which is given in increasing Ca available shows that the two factors tested influence each other.

Table 5. The effect of chicken bone flour and organic matter application on plant growth

Treatment	Plant height	plant dry weight
Chicken bone Flour		
A0	168.44b	55.59b
A1	173.44ab	66.58ab
A2	176.89ab	66.7ab
A3	182.11a	72.72a
Organic matters		
B0	166.83q	46.93 q
B1	179.92p	72.04 p
B2	178.92p	77.25 p
Interaction	(-)	(-)

Description: Average followed by the same letter in the same row or column shows there is no significant difference based on Duncan's Multiple Range Test at the level of 5%.
A0: Without chicken bone flour
A1: 2% Chicken bone flour from organic matter
A2: 4% chicken bone flour from organic matter
A3: 6% chicken bone flour from organic matter
B0: without organic matter
B1: compost 3% by weight of the soil
B2: manure 3% by weight of the soil

From the results of variance can be seen that the provision of chicken bone flour and organic matter significantly affected the height of corn plants and plant dry weight, but there was no interaction between the two.

In Table 5 it can be seen that the application of 6% chicken bone flour from organic matter (A3) is significantly higher than without chicken bone flour, but it is not significantly different from chicken bone flour 2% (A1) and 4% from organic material (A2). In the application of organic matter, compost (B1) is the best treatment although it is not significantly different from manure. This is due to an increase in the availability of P (Table 3) and Ca (Table 4) and organic C (Table 3) in the soil which results in better plant growth. According to Sutanto (2005), the element P has a role in the metabolic process and as a structural constituent of molecules, Ca has a role in strengthening plant tissues and supporting elongation of root cells, while organic matter as an energy source for soil microorganisms can release nutrients for plants. Increasing the availability of nutrients in the soil can increase metabolic processes so that plant growth is good.

Increased dry weight can also be caused due to an increase in available P (Table 3) due to treatment. This is because P plays an important role in vegetative and generative plant growth. The P element plays a role in the formation of energy sources for every living cell, thus these nutrients increase photosynthesis. Photosynthesis which is respected with various organic compounds formed will be stored in plant stem tissue, in this case used for enlargement of stems and leaves (Marschner, 1995). Besides, an increase in plant dry weight can also be caused by an increase in available Ca (Table 4) due to treatment. Ca has a good effect on the development of stems, root tips, and root hairs. Ca is mainly needed in the shooting area in cell division. The element Ca also plays a role in the synthesis of new cell walls (Caldwell and Hwang in Marschner, 1995).

4. Conclusion

a. The application of chicken bone flour fertilizer has a significant effect on increasing the pH of H_2O, C organic, available P, available Ca of Latosol, and plant growth in the form of plant height and dry weight of corn plants.

b. The application of organic matters significantly increases the pH H_2O, C organic, available P, available Ca, and plant growth in the form of plant height and plant dry weight.

c. The application of chicken bone flour and organic matter interacts in increasing available Ca and there is no interaction with pH H_2O, organic C, P is available Latosol and plant growth in the form of plant height and plant dry weight.

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The Effects Of Mycorrhizae And Organic Matters Application On Soil P Availability Of Limestone Post Mining And The Growth Of Maize In Karangdawa Village, Tegal Regency

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Abstract.

Limestone post mining soil had high levels of calcium carbonate and pH, this condition causing a lack of soil P availability, so that the application of mycorrhizae and organic matter is necessary. This study aims to determine the effect of mycorrhizae and types of organic matter, and the best combination of mycorrhizae and types of organic matter on soil P availability of limestone post mining and growth of maize. This study was conducted at the Greenhouse in Taman Teknologi Pertanian Lebaksiu, Tegal Regency, Central Java, from February to May 2019. This study used a Completely Randomized Design (CRD) with two factors. The first factor was the dose of mycorrhizae, namely without mycorrhizae (M0), mycorrhizae 10 g / pot (M1), and mycorrhizae 20 g pot (M2). The second factor was thr type of organic matter, namely without organic matter (B0), cow manure 20 tons / ha (B1), corn litter 20 tons / ha (B2), and legumes liter 20 tons / ha (B3). Each treatment was repeated 3 times. The result shows that the aplication of mycorrhizae had a significant effect on the increasing C-organic soil, Cation Excange Capacity (CEC), plant height and plant dry weight, but it did not significantly affect on P-available, Ca and Mg. The application of various types of organic matter had a significant effect on the increasing P-available, C-Organic soil, CEC, plant height, and plant dry weight, and decreasing soil pH (H_2O) and Ca, but it did not significantly affect on Mg. There was an interaction between mycorrhizae doses and kinds of organic on the increasing plant dry weight of 6 WAP.

Keywords: Mycorrhizae, Organic Matters, Limestone Post Mining Soil, P-Availability, Growth of Maize.

1. Introduction

Type of mining that has potential in Tegal Regency is limestone mining. limestone mining activities mining activities can cause changes in land topography, damage to soil structure, porosity, erosion, reduction in soil organic matter content, declining population and activity of soil microorganisms and plant growth. The topsoil that is lost causes a reduction in essential nutrients, like Nitrogen and Phosphorus. Limestone post mining has a pH above 7 with the highest mineral content is calcium carbonate. On alkaline soils, calcium carbonate can cause phosphate deposition, because the available phosphate will react with Ca which is difficult to dissolve in the soil and is in an unavailable form. The most optimum and more available form of P occurs in the pH range of 6 to 7. Most of the P in the soil is bound by Ca so it is not available by plants (Winarso, 2005).

Cow manure, Corn litter, and Legume litter is an abundant source of organic material and has the potential as ameliorant material to improve soil properties in limestone post mining. Organic matter provides carbon as an energy source for soil organisms for decomposition and mineralization of organic matter, and the application of organic matter can increase the availability of P in soil. The effect of organic matter on the availability of P can be directly through the mineralization process or indirectly by assisting the release of fixed P.

Vesicular-Arbuscular Mycorrhiza (MVA) is a type of soil microbe that can increase plant growth through increased availability and absorption of nutrients in the soil. MVA can be associated with plant roots to form hyphae that have a larger area than plant roots that are not associated with MVA. MVA Hyphae can increase the ability to absorb nutrients like phosphorus. Mycorrhiza hypha produces the enzyme phosphatase which can release the element of phosphorus which is bound by other elements, into nutrients that can be available by plants (Suparno, 2008). The application of organic matter can increase energy and food sources for MVA activity in carrying out metabolism and absorption of nutrients, while the application of MVA can improve the process of mineralization and decomposition of organic matter, because the production of phosphatase enzymes and organic acids from MVA metabolic activities of and can increase corn growth. Corn plants have adaptability and easy to cultivate. Based on these things, research is needed to determine the effect of a combination of MVA and organic matter will increase soil fertility, availability of phosphorus, and can increase the growth of corn in limestone post mining soil.

2. Method

This research was conducted in the greenhouse of Taman Teknologi Pertanian Lebaksiu, Tegal Regency, Central Java, from February until May 2019.

This study used a Completely Randomized Design (CRD) with two factors. The first factor was the dose of mycorrhizae, namely without mycorrhizae (M0), mycorrhizae 10 g / pot (M1), and mycorrhizae 20 g pot (M2). The second factor was thr type of organic matter, namely without organic matter (B0), cow manure 20 tons / ha (B1), corn litter 20 tons / ha (B2), and legumes liter 20 tons / ha (B3). Each treatment was repeated 3 times. Each treatment was repeated three times and consisted of 12 combinations, so that in total there were 36 experimental unit units. The experimental results were analyzed with an Analysis of Variance of 5%. If the treatment has a significant effect, it will be further tested with the 5% DMRT Test (Duncan Multiple Range Test).

Growing media from the limestone post mining of KOPINKRA 'Sentra' Karangdawa Limestone, the soils are air-dried and sieved with a size of ⌀2mm of 10 kg of absolute dry soils or equivalent to 12.3 kg of dry wind weight. Organic material that has been dried aerated, chopped and filtered at a size of ⌀2mm. Corn litter selected have golden yellow that has been dried aerated, while litter beans have dark green that has been dried aerated.

Soil that has been sifted, mixed with organic matters in accordance with the treatment that is without organic matter, 20 tons of cow manure/ha is equivalent to 86.52

grams/pot, 20 tons of fresh corn litter/ha is equivalent to 86.52 grams/pot, and 20 tons/ha of legume litter is equivalent to 86.52 grams/pot, then put in polybag. Soil and organic matter in polybags incubated for 1 month with maintained at field capacity conditions.

After incubation, one third of the MVA dose is placed in the planting hole, which is two thirds mixed / glued covering 3 corn seeds, then covered with soil. After the plants are 1 week after planting (1 WAP), thinning is carried out and the best corn plants are left. Fertilization using urea at the recommended dosage of 350 kg / ha is equivalent to 1.3 gram / pot, and KCl at a dose of 75 kg / ha is equivalent to 0.2798 gram / pot (Anonymous, 2018). Watering every day and cleaning the weeds that grow in polybags. After the age of 2 WAP, soil analysis is carried out by taking soil samples which are then analyzed in the laboratory.

3. Result

Preliminary Soil Analysis Results

Table 1. Preliminary Soil Analysis Results

No.	Parameter		Percentage	Value*
		Silt %	45 %	
1	Soil Texture	Clay %	22,5 %	Loam
		Sand%	32,49 %	
2	P-Available Olsen (ppm)		27,40	Low
3	C-Organic(%)		0,77	Very Low
4	pH H_2O		8	Slightly Alkalis
5	CEC (cmol(+).kg^{-1})		22,92	Medium
6	Ca^{2+} dd (me%)		12,24	High
7	Mg^{2+} dd (me%)		0,53	Low

Based on the results of the analysis it can be seen that, the soil used in the study has a loam soil texture. The chemical properties of these soils have low available P levels of 27.4 ppm. The low content of P-available due to the limestone post mining has a pH of H2O of 8 so it is rather alkaline. Calcium carbonate levels found in post mining can cause phosphate precipitation, because the phosphate will react with Ca ions which are difficult to dissolve in the soil and it in an unavailable form. In alkaline soils, Ca reacts with P so that P becomes less available by plants (Winarso, 2005). The C-Organic content is very low at 0.77%, the soil CEC with a medium value of 22.92 cmol (+), kg-1, the Ca2 + dd content of 12.24 with a high value, and the Mg2 + dd content with a low value of 0.53 (me%).

Quality of Organic Matter

Table 2. Results of Analysis of Organic Matter

Parameter	Organic Matters		
	Cow Manure (B1)	Corn Litter (B2)	Legume Litter (B3)
N-Total (%)	0,28	0,25	2,81
P-Total (%)	2,82	0,28	1,03
C-Organic (%)	15,98	19,02	23,48
C/N	57	76	8,36
pH H_2O	8	7,6	7,4
Ca^{2+} dd (me %)	19,04	10,62	9,85
Mg^{2+} dd (me %)	3,24	4,15	2,45

Soil properties After experiment

pH H_2O

Table 3. Effects of application of Mycorrhiza and Organic Matters on the average of pH H_2O

Treatment	Organic Matters				
***Mycorrhiza* Dose**	**B0**	**B1**	**B2**	**B3**	**Average**
M0	7,33	7,27	7,50	7,13	7,30 **p**
M1	7,23	7,37	7,33	7,03	7,24 **p**
M2	7,50	7,17	6,93	6,90	7,13 **p**
Average	7,36 **a**	7,27 **a**	7,26 **ab**	7,02 **b**	**(-)**

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Table 3 shows the results of variance in the parameters of pH H_2O levels that the application of legume litter 20 tons / ha (B3) significantly different in decreasing the pH H_2O compared to other treatments, however, the mycorrhiza treatment did not show any significant difference to the pH H_2O parameter. The legume litter decomposition process produces organic acids that can reduce pH. Organic acids produced from organic matter will release H^+ ions from the roots thereby reducing pH in the root region (Troeh and Thompson, 2005 in Agustina, 2014).

The mycorrhiza treatment did not show any significant difference to the pH parameter because of mycorrhiza activity in producing organic acids has not been able to increase the concentration of H^+ ions in the soil so that it has not been able to produce significantly different results in reducing the pH. Mycorrhiza plays a role in increasing ion absorption with low levels of mobility, such as phosphate (PO_4^{3-}) and ammonium (NH^{4+}) (Suharno and Santosa, 2005).

C-Organic

Table 4. Effects of application of Mycorrhiza and Organic Matters on the average of pH C-Organic

Treatment	Organic Matters				
***Mycorrhiza* Dose**	**BO**	**B1**	**B2**	**B3**	**Average**
M0	0,86	1,57	1,62	1,87	1,48 **q**
M1	1,22	1,65	1,75	2,11	1,68 **pq**
M2	1,23	1,81	1,96	2,20	1,80 **p**
Average	1,10 **c**	1,67 **b**	1,78 **ab**	2,06 **a**	**(-)**

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Based on analysis of variance, it is known that the application of 20 tons / ha (BK) legumes litter and 20 g / pot (M2) mycorrhiza gives a significant difference to the soil C-Organic content compared to other treatments (Table 4). The treatment of legumes litter 20 ton / ha (B3) gave the highest average C-Organic content of 2.06%. In the process of decomposition of legumes litter release carbon compounds (C), so it increase the levels of C-Organic soil. This is in accordance with the opinion of Bertham (2002) in Morgo, et al., (2015) which states that organic material that has undergone decomposition will produce carbon compounds such as CO_2, CO_3^{2-}, HCO^{3-}, CH_4 and C.

In mycorrhiza treatment, the application of mycorrhiza 20 g / pot (M2) gives the best average C-Organic content of 1.80%. This is due to mycorrhiza can add organic carbon from the production of glycoprotein or glomalin which is a source of carbon.

Glycoproteins or glomalines are relatively resistant to decomposition so that these compounds as carbon sources and aggregate holders, as well as fungal cell walls that contain lots of chitin that are resistant to weathering are also carbon sources (Jastrow et al., 2007 in Musafa, et al., 2015).

CEC Soils

Table 5. Effects of application of Mycorrhiza and Organic Matters on the average of CEC Soils (cmol(+).kg^{-1})

Treatment	**Organic Matters**				
***Mycorrhiza* Dose**	**BO**	**B1**	**B2**	**B3**	**Average**
M0	18,56	24,05	28,10	29,93	25,16 **q**
M1	22,19	33,62	20,34	34,50	27,66 **q**
M2	24,53	29,42	31,43	36,83	30,56 **p**
Average	21,76 **c**	29,03 **b**	26,62 **b**	33,75 **a**	**(-)**

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Table 5 shows the results in the parameters of soil CEC levels that the application of legume litter 20 tons / ha (BK) and the application of mycorrhiza 20 g / pot gives a significant difference in increasing soil CEC compared to other treatments. The application of legume litter 20 tons / ha (B3) gave the highest average CEC content with 33.75 cmol (+) kg^{-1}. Legume litter increases soil CEC levels because it produces organic compounds so that it causes humus (organic colloids) as a source of negative charge soil is also high, so the positive charge (cations) in the soil that can be exchanged is also higher so that it can increase CEC soil.

According to Mokolobate and Haynes, (2002) in Wahyudi (2009) stated that the addition of organic matter will be able to increase soil CEC. The amount of contribution of organic matter to the increase in soil CEC is caused by the high carboxyl (-COOH) and hydroxyl (-OH) compounds which if hydrolyzed will produce / increase the negative charge of the soil. This is indicated by increasing levels of C-Organic (Table 4) so that it can increase soil CEC.

The application of mycorrhiza 20 g / pot gives the best average of CEC soil with 30.56 cmol (+). Kg^{-1}. The application of mycorrhiza can accelerate the decomposition process because mycorrhiza produces organic acids and phosphatase enzymes in its activity, so that it can accelerate the decomposition of organic matter. Humus as a result of the decomposition of organic matter is the result of synthesis of microorganisms and mycorrhiza activity.

The application of mycorrhiza increases soil CEC levels due to the direction of increased levels of C-Organic (Table 4). These results are consistent with research conducted (Syib'li, et al, 2013) that the cation exchange capacity (CEC) in the soil increases with increasing number of AMF spores. The involvement of MVA in the process of absolute decomposition can increase CEC in the soil.

P-Available

Table 6. Effects of application of Mycorrhiza and Organic Matters on the average of P- Available (ppm)

Treatment	Organic Matters				
Mycorrhiza Dose	BO	B1	B2	B3	Average
M0	23,24	45,16	48,90	74,88	48,04 **p**
M1	44,49	56,36	52,53	39,75	48,28 **p**
M2	28,03	73,45	58,76	78,55	59,70 **p**
Average	31,92 **b**	58,32 **a**	53,39 **ab**	64,39 **a**	**(-)**

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Table 6 shows that the application of various kinds of organic matter was significantly different from the P-available, but there was no significant difference in the mycorrhiza treatment. The treatment of giving of legume litter 20 tons / ha (B3) litter gives the highest average available P content, this is due to the direct contribution of the P element contained in the legume litter, so P in the soil increases.

The increase in P-available was also influenced by a decrease in soil pH in the treatment of giving legume litter 20 tons/ha to neutral values (Table 3), where if the pH of the soil was at neutral levels, the availability of P would increase. Stevenson (1982) explains the availability of P in the soil can be increased by the addition of organic matter by reducing phosphate sorption because humic acid and fulvic acid function to protect sesquioxide by blocking exchange sites and forming phospho-humic and phospho-fulvic complexes that can be exchanged and are more available for plants, because phosphate is weakly absorbed in organic matter, thus increasing levels of p-available. These results are in accordance with the research of Morgo et al. (2015) who found that giving legume bokashi was significantly different from other treatments (bokashi johar, bokashi goat manure, bokashi cow manure, bokashi chicken manure, and control) which were able to increase the availability of P.

Mycorrhiza application is not significantly different from the P-available, this is because mycorrhiza has not been able to produce the maximum phosphatase enzyme so that it does not affect the organic P mineralization process into more available elements for plants. Mycorrhiza does not affect the P-available soil but rather the P uptake of the host plant, because its external hyphal tissue plays a role in expanding the absorption capacity of nutrients so that plants get enough phosphorus nutrients for plant growth and production. This is in accordance with Yusra's (2005) study that mycorrhiza administration had no significant effect on the total P, available P and Ultisols soil pH.

Ca^{2+} and Mg^{2+}

Table 7. Effects of application of Mycorrhiza and Organic Matters on the average of Ca^{2+} dd (me %)

Treatment	Organic Matters				
Mycorrhiza Dose	BO	B1	B2	B3	Average
M0	7,82	7,19	7,60	6,17	7,14 **p**
M1	9,37	6,43	6,37	6,75	7,23 **p**
M2	7,50	7,03	6,74	5,81	6,84 **p**
Average	8,28 **a**	6,88 **b**	6,91 **b**	6,25 **b**	**(-)**

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Table 8. Effects of application of Mycorrhiza and Organic Matters on the average of Mg^{2+} dd.

Treatment	Organic Matters				
Mycorrhiza Dose	BO	B1	B2	B3	Average
M0	1,07	1,14	1,12	1,23	1,14 **p**
M1	1,15	1,29	1,27	1,35	1,26 **p**
M2	1,24	1,02	1,35	1,16	1,19 **p**
Average	1,15 **a**	1,15 **a**	1,25 **a**	1,25 **a**	**(-)**

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Table 7 shows the results of the variance that the application of legume litter 20 tons / ha (B3) was significantly different in reducing the Ca2 + dd parameter. compared to other organic materials, but the mycorrhiza treatment did not show any significant difference in Ca^{2+} dd levels. The level of Ca^{2+} dd from the results of the initial soil analysis that is equal to 12.76 me% has a high level, there is a decrease after the treatment of various kinds of soil organic matter. The application of legume litter 20 tonnes/ha (B3) gives the lowest Ca^{2+} dd yield. This is because the legume litter is an organic material that has a low C / N ratio which causes the decomposition process to run faster. This is shown by increasing levels of C-Organic (Table 4), decomposed organic material will produce organic acids that increase cation exchange capacity (Table 5), but reduce base saturation and pH (Table 3). Organic matter which is rich in functional carboxyl (COOH) and phenolate (OH) functional groups plays a role in chelating and decreasing Ca^{2+} activity in soil solution which further promotes the dissolution of natural phosphate so that phosphate becomes available (Table 6). This is in accordance with research Tambunan, et al., (2014) corn plants at the age of 14 DAP showed the treatment of the combination of 20 t / ha biochar corn litter and 40 t / ha sugarcane litter (Fresh Organic and Biochar) which was the best in reducing Ca -dd soil that is equal to 18.75%.

The mycorrhiza treatment did not show any significant difference to the parameters of Ca^{2+} dd levels. This is because mycorrhiza in maize aged 2 MST has not been able to produce more organic acids so that it does not increase the concentration of H^+ ions, namely by showing that there is no significant difference in soil pH (Table 3) so it has not been able to replace / hydrolyze Ca^{2+} cations dd in the ground.

The parameters of Mg2 + levels showed that the application of organic matter and mycorrhiza treatment did not show any significant difference to the parameters of Mg2 + dd. This is because the soil organic matter and mycorrhiza are still unable to further mineralize, so it does not add more Mg2 + concentrations in the soil. Whereas the administration of mycorrhiza plays a role in increasing nutrient uptake compared to the availability of Mg, plant roots inoculated with AMF besides being able to increase the absorption of nutrients P, also able to increase the absorption of other nutrients such as N, Ca, Mg, M, N and Zn (Pan and Cheng, 1988 in Sartini, 2004).

Parameter Plant Growth

Plant Height

Table 9. Effects of application of Mycorrhiza and Organic Matters on the average of Plant Height (cm)

Treatment	Organic Matters				
Mycorrhiza Dose	BO	B1	B2	B3	Average
M0	43,33	122,67	95,67	124,33	96,50 **q**
M1	70,33	151,67	98,67	189	127,42 **p**

M2	97	144	128,67	183	138,17 **p**
Average	70,22 **c**	139,44 **a**	107,67 **b**	165,44 **a**	**(-)**

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Table 9 shows the results of variance in the parameters of the height of maize plants aged 6 MST that the application of 20 tons / ha (B3) Peanut litter was significantly different in increasing the height of corn plants which was higher at 165.44 cm, compared with other treatments. The provision of bean litter can increase the levels of C-Organic (Table 4) and increase the level of P-available (Table 6) so that it can supply nutrient requirements for plants to grow better than without the application of organic matter. Darmawan and Baharsyah (1983) stated that the availability of sufficient and balanced nutrients would affect the metabolic processes in plant tissue better.

The treatment of mycorrhiza 10 g / pot (M1) gives a real difference in increasing the height of the best corn plant that is 127.42 cm, compared with other treatments. Giving mycorrhiza in plants will cause infected roots to have hyphae. Mycorrhiza external hyphae can increase the surface area of contact with the soil, thereby increasing the area of root absorption which makes it easier to access nutrients in the soil. Hifa plays a role in helping plant roots absorb phosphate, nitrogen, sulfur, zinc, and other essential elements (Smith and Read, 2008 in Agustin, 2011). This is in accordance with (Riza, et al, 2015) which states that the combined treatment concentration of 60 mL of tempe / 100 mL water, industrial wastewater and 20 g / plant mycorrhiza given the highest plant height (cm) parameters compared to other treatments.

Plant Dry Weight

Table 10. Effects of application of Mycorrhiza and Organic Matters on the average of Plant Dry Weight 6 WAP (gram)

Treatment	**Organic Matters**				
***Mycorrhiza* Dose**	**BO**	**B1**	**B2**	**B3**	**Average**
M0	2.67 **a** **(p)**	17.24 **a** **(p)**	5.84 **a** **(r)**	13.23 **a** **(r)**	**9.74**
M1	3.63 **b** **(p)**	30.90 **a** **(p)**	8.74 **b** **(q)**	44.75 **a** **(q)**	**22.00**
M2	8.96 **b** **(p)**	24.61 **b** **(p)**	21.12 **bc** **(p)**	59.07 **a** **(p)**	**28.44**
Average	**5.08**	**24.25**	**11.90**	**39.02**	(+)

Description: The (-) sign indicates there is no interaction. The average row and column followed by the same letter shows no significant difference in Duncan's Multiple Range Test of 5%.

Based on Table 10, it is known that the combination treatment of mycorrhiza application 20 g / pot + giving 20 tons / ha Peanut litter (M2B3) has the highest dry weight compared to other types of organic and mycorrhiza combination which is 59.07 grams. Application of organic matter in the soil causes the development of mycorrhiza getting better because of the availability of energy and food sources available by organic matter, while mycorrhiza can modify the physiological roots so as to excrete organic acids and acid phosphatases into the soil. The presence of mycorrhiza activity in roots, helps speed the process of mineralization of organic matter, so that organic material can be decomposed faster with the help of mycorrhiza activity.

The combination of M2B3 treatment can provide a higher dry weight of corn because the application of nut litter has the highest nutrient content compared to other organic matter (Table 2). Good quality organic material can supply the needs of plants for their metabolism. Nitrogen functions as a constituent of amino acids, a protein component of chlorophyll pigments that are important in the process of photosynthesis. According to the research of Yetti, et al (2012) the application of organic matter in the form of mixed compost showed better dry weight of the plant (97.75%), followed by rice straw (91.22%), long bean stover (70.95%), stover Corn (53.82%) when compared to sawdust compost 26.53%. Mycorrhiza infection causes plants to get nutrients more easily than without mycorrhiza, because they have external hyphae that function as root expansion and shorten the distance of nutrient diffusion, especially P elements that are immobile in the soil, so the diffusion process becomes faster. According to Musfal's research (2008) and Kabirun (2002) reported that plants infected with MVA can absorb higher P elements than uninfected plants

4. Conclusion

Application of mycorrhizal dosage has an effect on increasing soil C-Organic, soil cation exchange capacity, and dry weight of plants, but does not affect the levels of P-Available, Ca dd and Mg dd. Application of various types of organic matter has an effect on increasing P-Available, C-Soil Organic, Soil Cation Exchange Capacity, and dry weight of plants, as well as reducing soil pH (H2O) and Ca dd levels, but does not affect Mg dd. Giving mycorrhizal doses and kinds of organic matter interact in increasing the dry weight of plants aged 6 MST and there is no interaction with P-Available, pH, C-Organic, CEC, and Ca & Mg in the soil.

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