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Resource Management for Sustainable Future

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The Second
International Conference on Green Agro-Industry
(ICGAI)

"Resource Management for Sustainable Future"

Conference is held on 4 – 6 August 2015
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Yogyakarta, Indonesia

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Preface

Bismilahirrahmanirrahim, Assalamu'alaikum wa rahmatulahi wa barokatuh.

Praise be to Allah who has bestowed His grace, so that the event can take place smoothly.

The Honourable Rector UPN "Veteran" Yogyakarta, The Honourable Head of Agriculture Office of Yogyakarta province, the Honourable invited speakers, Distinguished Guests, Distinguished Participants, Ladies and Gentlemen,

On behalf of The International Conference on Green Agro-Industry Organizing Committees, I am pleased and honoured to welcome all of the participants to the Second International Conference on Green Agro-Industry at Mustika Sheraton Hotel, Yogyakarta, Indonesia from 4-6 August 2015. This conference is hosted by the Faculty of Agriculture Universitas Pembangunan Nasional "Veteran", Yogyakarta, Indonesia and this event would not have been possible without the support of its global partners: Tokyo University of Agriculture and Technology, Japan, Murray State University, USA, Universiti Malaysia Sarawak, Malaysia, University of Colombo, Sri Lanka, University of Western Sydney, Australia, Royal Melbourne Institute of Technology, Australia, Tongji University, China, and Gadjah Mada University, Yogyakarta, Indonesia.

Ladies and gentlemen,

The theme of the Second International Conference on Green Agro-Industry is "Green Agro-Industry: Resource Management for Sustainable Future". Agro-industry is important not only because it can transform raw agricultural materials into value added products while generating income and employment, but it is important in the bigger picture because it contributes to the overall economic development in both developed and developing countries. In the context of trade, agro-industry provides significant impact to Indonesia's export. The government is targeting exports of the agro industry to grow up to 29% amounting to USD 40 billion this year, from USD 31 billion in 2014.

As we are all well aware, the resources available to support the development of agro-industry is not unlimited, therefore, it is crucial for us to manage the resources that we have carefully. Recently, there has been an increased pressure on agro-industries to shift to more resource-efficient and low-carbon production processes as part of the global efforts to sustain growth, conserve resources and slow down the pace of climate change. To provide a sustainable future, the development of agro-industry should not merely aim for high profit, but it should also be environmentally friendly and socially sustainable.

In furtherance of this ideal, this conference is organized with the hopes of achieving three things. First, it is held to foster and support the development of highly productive methods and technologies for the various segments of the agro-industries. Second, it is designed to provide a forum for the presentation, discussion and debate of state-of-the-art and emerging technologies in the field of agro-based industry and any issues related to sustainable agro-industry. Third it aims to promote interaction and communication among researchers, observers and practitioners to discuss and discover solutions to the problems related to the development of the agro-industry and how it can further improve welfare.

Topics of interest for the conference are divided into four major categories, namely: **Economics, Social and Business; Agronomy; Soil and Land Management; Agricultural engineering.** Our keynote speaker Prof. Lilik Soetiarso from Universitas Gadjah Mada, Yogyakarta, Indonesia will present a keynote speech entitled "*The Role of Bio-system Engineering in Green Agro-Industry*". Other invited speakers from a broad range of backgrounds including leading industry and academic experts will provide insights into sustainable agro-industry from various perspectives. In addition, the supporting papers from the participants will also enrich and liven the discussions related to the development of sustainable agro-industry.

On behalf of ICGAI Committee I would like to apologize that due to unforeseen circumstances three of our invited speakers: Assoc. Prof. Shiva Muthaly (RMIT University, Australia); Prof. (Rev). Wimalaratana (University of Colombo, Sri Lanka); and Assoc. Prof. Ping Fang (Tongji University, China) were unable to attend this conference. I am sorry for this inconvenience.

Finally, we would like to express our gratitude to the Rector UPN "Veteran", Yogyakarta for the financial support, the Dean of the Faculty of Agriculture for hosting this event, and the Scientific and Steering Committee. We would also like to convey our utmost gratitude to the keynote speaker Prof Lilik Soetiarso (Universitas Gadjah Mada, Yogyakarta), the invited speakers Prof. Sakae Shibusawa (Tokyo University of Agriculture and Technology, Japan, Mr. Marc Vanacht, MBA/ML (President, AG Business Consultants, St Louis, USA);, Mr. Jeewan Jyoti Bhagat (Managing Director-STM Projects Ltd, India); Dr. R.P. Singh (Associate Agronomist and Sugarcane Advisor for STM Projects Limited, Prof. Iin Handayani (Murray State University, USA); Dr. Partoyo (UPN "Veteran" Yogyakarta, Indonesia) as well as all the participants for their contribution in making this conference a success. We wish to also thank the sponsors of this event: PT. Bank BNI, Bank BPD, Bank BRI and Bupati Kabupaten Wonosobo, for their contribution in making this conference possible. Finally, as the Chairperson, I would like to convey my highest appreciation to the members of the organizing committee whose relentless hard work and dedication made this conference a great success.

Thank you and I wish everyone a fruitful and pleasant day ahead.

Wassalamu'alaikum wa rahmatulahi wa barokatuh

Yogyakarta, August 4, 2015

Dr. R.R. Rukmowati Brotodjojo

ICGAI Chairperson

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ERGONOMIC DESIGN OF GRASS CHOPPER MACHINE FOR WORKING SYSTEM IMROVEMENT

Dyah Rachmawati Lucitasari*, Dwi Susilo Utomo

Faculty of Industrial Technology, Department of Industrial Engineering, Universitas Pembangunan Nasional "Veteran" Yogyakarta, Indonesia

* *Corresponding author: dlucitasari@yahoo.co.id*

ABSTRACT

Grass chopping process is an exhausting job. Grass chopper machine design aims to produce a ready-feed grass and reduce worker fatigue. Grass as feed further will be improved its quality, increased its amount and produced more quickly. Workers or operators will be more comfortable and safer as well as more complaints diminished. Research results in improvement of working system, such as ergonomic working postures of workers approaching natural and neutral position. Workers can work comfortably and safely, decreases subjective complaints during the work, as well as grass feed product can be provided faster with higher amount and higher quality.

Keywords: design, ergonomics, repair work system.

INTRODUCTION

Farm is a potential field to be more developed to increase revenue. Farms are now managed by the group of people who are aiming to invest some of their property to ranchers. One of them is an etawa sheep farm in Wonokerso, Hargobinangun, Pakem, Sleman, Yogyakarta. This farm has developed very rapidly and should be maintained, particularly to improve its working system mainly on the comfort of grass chopper worker. Yet every day, workers have to chop grass in several quintals to feed as many as 25 sheep etawa. Grass chopping workers in their activities have still using a machete (long and flat knife). The chopper tool was only produced a little amount of chopped grass with high energy expended. In addition, musculoskeletal complaints had been quickly felt by workers.

These conditions had lead to premature fatigue on workers. Unsafe and unnatural working attitude can lead to disturbances and complaints on a subjective system (Granjean,1988). According to Setyaningrum (2004), the long time squatting position will put pressure on the nerves, blood vessels, and muscles on foot, and lead to the frequent tingling feeling. Components of physical work and physical fitness are determined by the muscle strength, muscle endurance and cardiovascular endurance. Suharno (1993) and Nala (2001) states that muscle strength is the ability of muscles skeletal or skeletal muscle contraction or tension in accepting the maximum load, hold or move the load while performing activity or employment. According to Stevenson

(1987), fatigue that occurs as a result of repetitive activity (repetitive lifting) will increase the risk of pain in the spine (back injury), and may lead to cumulative trauma injuries or repetitive strain injuries. Lifting and displacement activities are the influential factors of the incidence of back pain (back injury), that frequently encountered in some industries (Nurmianto, 1996).

Hopefully with this grass chopper machine design, grass ready for feed could be produced and the complaints perceived by workers could be overcome as quickly as possible. The production would be increased, and its quality would be higher than using a machete, as well as more operators comfortable in working because of complaints that had been perceived could be reduced. It was necessary to improve the working system by means designing the machine for making easy in chopping grass. The design of this tool in terms of the economy was much cheaper than the previous tools, in addition to affordable prices for farmers also spent much speed although different machines used by means of a dynamo. Reasons in designing the machine were to relieve graziers in grass chopping and an affordable price. Grass chopper machine design could chop grass more amount and more quickly without involving excessive manpower.

The issues to be addressed in this study was how to design grass chopper machine ergonomically to improve the work system thus reducing the perceived musculoskeletal complaints of grass chopper workers, and workers could work safely and comfortably\

MATERIALS AND METHODS

Research was conducted in etawa sheep farm located in Wonokerso, Hargobinangun, Pakem, Sleman regency, Yogyakarta province. Primary data was collected directly at the farm by observing or by interviewing the supervisor or employee. Data collected in this study were: 1) Information on work systems and work attitude in the grass chopper of etawa sheep farm, 2) Workers pulse prior and after working, 3) Information on workers subjective complaints (musculoskeletal). The tools used in this study were stop watch, digital camera, the length measurement to measure the dimensions of the work station.

Anthropometric data (Figure 1, 2, 3, 4) were then processed with uniformity test. Uniformity test was conducted to make the control map. The control map was intended to provide an indication that the data came from the same system. To express the relationship between the energy at the speed of the heartbeat, the equation of Y = 1.80411 - 0,0229038X + 4,71711.10-4.X2 was used. Where Y = energy (kcal / min), X = heart rate (beats / min). Once the magnitude of the speed could be compared in terms of energy, the energy consumption for a particular job could be written in the form of equation KE = Et –Ei. Where KE = energy consumption (kcal / min), Et = energy expenditure during certain working time (kcal / min), Ei = energy expenditure in resting position (kcal / min)

RESULTS AND DISCUSSION

From the results of the identification of several grass chopper workers found to the problems faced by the grass chopper that were: 1) Grass chopper tool was not in accordance with the dimensions of body size of grass chopper workers, 2) Grass chopper workers required exertion to giving emphasis during the grass chopping. The expectation of designing this machine was revising the working position from a sitting position into a standing position but adjusted with workers anthropometric.

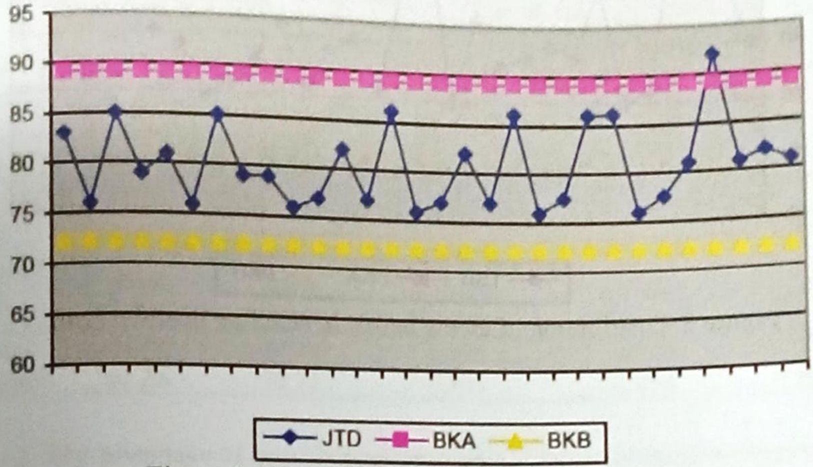

Figure 1. Distribution of forwarded reach arm

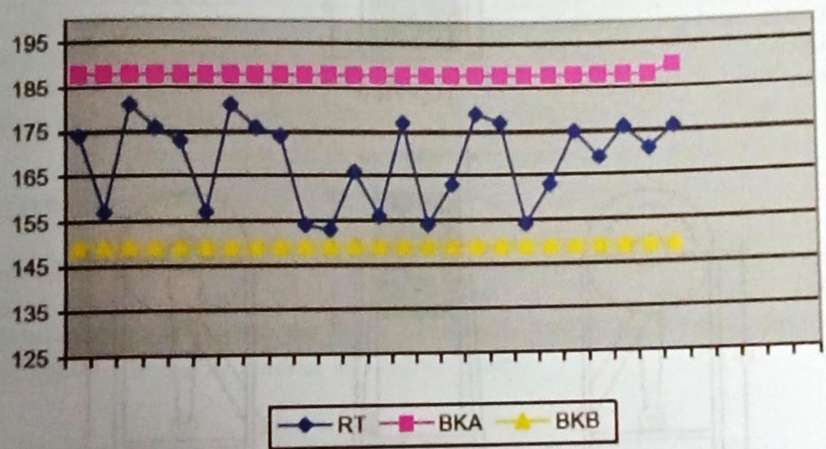

Figure 2. Distribution of arm span (cm)

Subjective complaints of the workers when using manual chopping tool was on: back, legs, left arm, shoulder, arms and waist bottom. The calculations show that the average range of forwarded reach arm was 80.69 cm (Figure 1.), mean of arm span was168.48 cm (Figure 2.), so that the new tool should be adapted to the arm span. To determine the height of the chopping machine (Figure 4.), height from the ground up to incorporate grass funnel chopping machine should be as height as workers standing elbow height dimension (Figure 3.). 50th percentile was used to the calculation of the average standing elbow height workers (80 cm). The height of the machine would be more comfortable because it was according to 50% the average of anthropometric data of Indonesian people in a state of standing.

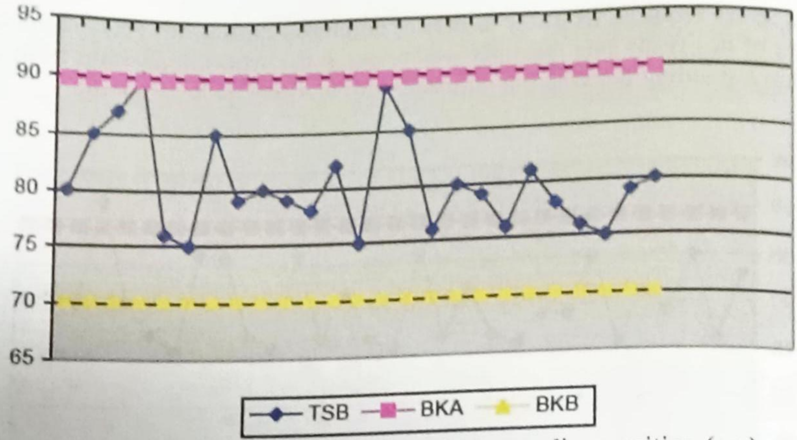

Figure 3. Distribution of elbow height in standing position (cm)

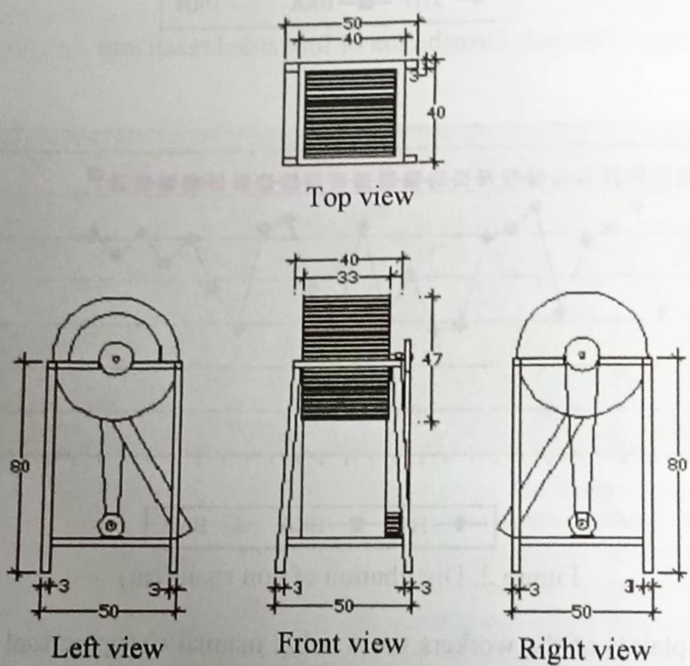

Figure 4. Prototype of chopping machine

Structuring the workplace and the equipments as well as the position on the working will be very influential in creating a well integrated working system. Through the simultaneous improvements, an industry will run effectively and efficiently. An appropriate working attitude will reduce compliments of grass chopper workers. Preliminary survey obtained that most of the workers were more pleased with the position of sitting on the floor than sitting on the chair. This working position gave workers space to move freely and produce more and faster. This position had lead to fatigue in the legs because the legs bear the weight of the body for a long time. Sitting position on the chair did not provide sufficient space for workers to move freely. This position had been slow down the chopping process. The low energy consumption of the workers with the use of the machine (Table 1.) was resulting an increased production (Table 2.). Production before the use of the machine was 150 kg with a working duration of 1.5 hours or 5 quintals in 5 hours. By using the machine, for the same production quantity, only took 100 minutes (Table 2.)

Table 1. Average of human energy consumption in using manual & machine chopping tool

Chopping tool	Heart pulse/mt		Y prior working (Kcal/mt)	Y after working (Kcal/mt)	KE (Kcal/mt)
	Prior working	After working			
Manual	61.86	105.00	2.193	4.510	2.317
Machine	61.86	70.71	2.193	2.493	0.297

Table 2. The advantage of new chopping machine compare to manual chopping tool

Item	Chopping tool	
	Manual	Machine
Size of chopping product	15.0 cm	2.0 cm
Working duration of chopping 150 kg grass	90 minute	30 minute
Working duration of chopping 100 kg grass	60 minute	20 minute
1 working day for chopping 500 kg grass	300 minute	100 minute

CONCLUSION

Grass chopper machine was able to improve working attitude by reducing compliments of grass chopper workers. Workers were able to work comfortably and safely. Subjective complaints during the work decreased, and grass feed product could be provided faster with higher amount and higher quality.

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