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Preface

Over the past decades, rapid growth of global economic has lifted millions of people out of poverty. In line with rising population, rapid urbanization, and industrialization, it has also led to increase consumption of resources and generate of waste almost beyond the limits of the ecological carrying capacity.

The coming decades will likely witness of the increasing pressures on industries to shift to more resource-efficient and low-carbon production processes as part of global efforts to sustain growth, conserve resources and slow down the pace of climate change. Countries and regions that successfully manage this transition will get a better position to exploit the opportunities created by the shift towards a low-carbon world economy. It is green industry's initiation, a pattern of industrial development that is sustainable in economic, environment and social.

Universitas Pembangunan Nasional "Veteran" Yogyakarta in conjunction with its global partners is proud to announce the International Conference on Green Agro-Industry, to be held on November 11-14, 2013, at Yogyakarta, Indonesia. The basic aim of the conference is to contribute to the development of highly productive methods and technologies for the various segments of the agro-industries. This conference is designed to provide a forum for the presentation, discussion and debate on state-of-the-art and emerging technologies in the field of agro based industry and any issues related to sustain the environment.

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, and the Scientific and Steering Committee. We wish to thank the keynote speaker Director of PT Astra Agro Lestari Tbk and Plenary Speakers: Prof. Sakae Shibusawa (Tokyo University of Agriculture and Technology, Japan), Prof. Raj. Khosla, Ph.D. (Colorado State University, USA), Prof. Dr. Nilda Burgos (University of Arkansas, USA) Ir. Toine Hattink (Director of Department of Horticulture, HAS den Bosch, Netherlands) Prof. Dr. Endang Gumbira Sa'id (Bogor Agricultural University, Indonesia) . Nur Iswanto, PhD. (IKAGI, International Society of Sugar Cane Technologists Councillor), Prof. Wijitapure Wimalaratana. (Department of Economics, University of Colombo), Prof. Hassan M. El Shaer (Desert Research Center, Cairo, Egypt), Dr. Mofit Eko Poerwanto (UPN "Veteran" Yogyakarta, Indonesia) as well as participants for their contribution in making the International Conference on Green Agro-Industry.

We wish to thank PT Astra Agro lestari as the major sponsor and all other sponsors for their contribution in making this Conference possible. As a Chairperson, I highly appreciate the great efforts of the members of the organizing committee whose hard work made this seminar a great success.

Yogyakarta, November 11 , 2013

Sri Wuryani

Chairperson, ICGAI 2013

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DEVELOPMENT OF PURWACENG (*Pimpinella pruatjan* Molkenb) TO SUPPORT HERBS INDUSTRY AND SOIL CONSERVATION IN DIENG PLATEAU, CENTRAL JAVA

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ABSTRACT

Purwaceng is a multipurpose crop for development of green agro-industry, since it will support the demand of agroindustry of herbs as well as conserve soil from erosion. Purwaceng (*Pimpinella pruatjan* Molkenb) is a herbal plant that is popular as Indonesian herbs used as aphrodisiac, diuretic, and tonic. Its root contains substance that is believed beneficial to boost stamina and sexual endurance. Nowadays, the purwaceng get a high price due to lack of supply whilst demand from the herbs industry has never been fulfilled. Unfortunately, the plant is considered as endangered species that is endemically found particularly in Dieng Plateau. In 2013, the plant gained patent for the Dieng Plateau as Geographic Indication of purwaceng. Extensive cultivation of the plant in a wider area of Dieng Plateau and its surroundings is very promising. For the last two decades, Dieng plateau has been utilized for potato cultivation that contributed to the horrible soil erosion problem. The said farming practice is contradictive to the soil conservation rule. It is on this premise that planting of purwaceng can be very useful to counter the effect of environmental degradation issue in the Dieng Plateau. This is due to its morphological and physiological characteristics, where purwaceng may be cultivated as cover crop for bare land as well as mixed cropping under tree shading. It will reduce run off of rainfall water and increase infiltration that in turn will reduce soil erosion. This paper will discuss efforts that should be done to promote purwoceng for increasing production as well as reducing soil erosion in Dieng Plateau.

Keywords: *Pimpinella pruatjan*, herbs, agro-industry, soil conservation, Central Java.

INTRODUCTION

Dieng Plateau is one of Indonesia's tourism destinations. It is located in the border of two regencies, i.e.: Banjarnegara and Wonosobo Regency where most of the areas are developed for agricultural activities. During its development, this area has become the centre of agricultural development centre for plantation and tourism area in Central Java Province. Tourism activities itself is contributed in a significant manner of income to the farm household as this area has formerly been one of the Hindu empire in Indonesia (Saputro, 2012). Dieng Plateau is the second tourism destination in Central Java Province after Borobudur temple (Yuwana, 2010).

On the other hand, due to its physical environmental characteristics this area has been also developed as the agricultural production centre for vegetables and potato production in Central Java. Dieng has been popular as center of potato cultivation since 1990s. Area of land planted with potatoes was expanded tremendously, even occupied forest land. According to Rudiarto & Doppler (2013), deforestation in this area is mainly caused by land clearance as many local people have been expanded their farmland up to the higher-level area. It is also confirmed from the field survey that deforestation was seriously taking place and hence increasing the risk of land degradation, which may accelerate soil erosion.

In addition, some practices of potato cultivation are contradictive to soil conservation rule. Several researchers reported a high rate of soil erosion that exceeded the tolerable soil loss. Rudiarto & Doppler (2013) reported the annual soil loss rate changed from 0 until 1096 tons/ha/year for the year 1991 and 0 up to 1063 tons/ha/year in 2006. From the results of actual soil loss, afterwards, the classification has been made to show different erosion hazard levels, which more than 40% area included as very high hazard severity.

Currently, the hegemony of potato cultivation is declining. Beside of its negative impact to the environment, many farmer households faced with fund deficit. Actually, potato cultivation is very expensive. It required a high input of capital. At present, many farmers have switched to cultivate many other horticulture crops, such as carrot, cabbage, cauliflower, and leek. Some of them were back to develop local specific crop, i.e. carica, kemar, and purwaceng. All the three crops are usually processed for drink, syrups or refreshment. They are popular as specific souvenir for Dieng Plateau visitor.

Considering economic value as well as environmental benefit, development of those local crops is very promising. Presently, it is still in the stage of promotion to motivate the local people/farmer to be interested in developing carica, kemar, and purwaceng as the re-emerged commodities from Dieng Plateau. This paper is authored by the research and development team for community service conducted in Kejajar Wonosobo, particularly the development of purwaceng crop at area of Dieng plateau and the surroundings.

General Situation of Kejajar District, Wonosobo Regency

Kejajar is a district in Wonosobo Regency which is located at the highest altitude and dominated with mountainous area. It covers 5,762 hectares or approximately similar to 5.85% area of Wonosobo Regency. Dieng Plateau is included in this district. Altitude of the

district ranges from 1,360 to 2,302 m above sea level. It has a tropical climate with two seasons in a year, i.e. dry season and rainy season. Air temperature ranges from 14 – 23 °C in the day and drop to 9 – 18 °C in the night. Annual rainfall is recorded more than 2,500 mm. This condition is favorable for the development of horticultural agriculture, as well as tourism and plantation.

The main livelihood of the community is especially from horticultural agriculture and tourism sector. It has been famous that Kejajar is area of horticulture production in Central Java. Several commodities cultivated in Dieng are potato, cabbage, carrot, and cauliflower. All those crops are cultivated very intensively using high level of pesticide application and deep soil tillage. It is very endanger the sustainability of soil and the environment. Besides, during 1990s, many farmers were illegally occupied state forest to be cleared and used as potato plantation. It happened due to the high economic return from cultivating potato. At that time, land use of Kejajar was dominated by dry agricultural land of 3,066.3 ha (53.21%) and state forest of 2,309.8 ha (40.08%).

Deforestation has resulted in barren critical land that produces very high incident of soil erosion. Most of land in Kejajar is sloping area that predominantly has steepness of 15 – 40% for 1,993ha (65% area). Agricultural land in Kejajar covers approximately 3,500 hectares including this steep land or even more than 40% steepness. This situation induces a more serious damage due to soil erosion.

Population based on census 2010 recorded that Kejajar is inhabited by 40,925 peoples, consists of 20,987 male and 19,938 female. Population density is 710 people per square meters. Population growth is 0.42% per year.

ECONOMIC POTENTIAL OF PURWACENG CULTIVATION

Sikunang is one of the villages in Kejajar district that has potential for purwaceng cultivation. It is located in the Dieng Plateau. Purwaceng has been domesticated by Mr. Mubasir since 1970s. Later, purwaceng has gained better economic value since 1981, after raised consumer need for herbal material. However, number of farmers who developed purwaceng is remain very few until now (2013).

Several constrains of purwaceng development are scarcity of seedlings. It was not extensively available the seedlings that can be gather from the wildlife. Purwaceng may only be found in the area with the altitude more than 2,000 m above sea level. Besides, harvesting time of the purwaceng is 5-8 months after planting. It is long enough for the farmer awaiting the crop to be harvested.

In fact, presently the market of purwoceng has been available, either for fresh purwoceng or dry purwoceng/simplisia. Demand of purwaceng from herb industry in Semarang has not been able to fulfilled yet. Productivity of purwaceng is 9kg fresh purwoceng per 10 square meters of land. After drying, a 10kg fresh purwoceng produces 1kg dry simplisia. Economic potential of purwaceng cultivation is very beneficial. Now, the price of fresh purwaceng is Rp 80,000/kg, while dry simplisia is Rp 600,000/kg.

Low production of the purwaceng from the study area is mainly due to less area used for cultivation, lack of seedling, and low productivity due to not intensive practice of cultivation applied. Therefore, the author team is conducting activities to overcome those three constraints.

THE USE OF PURWACENG FOR HUMAN HEALTH

Purwaceng (*Pimpinella pruatjan* Molkenb. or *Pimpinella alpina* Molk.) is one of endangered species of herb plant that is endemically found in Indonesia. Purwaceng in Wonosobo Regency has only found in Dieng Plateau with the altitude 2,000 – 3,000 meter above sea level. At present, the population is very scarce. It is categorized as critical that has to be strictly conserved (Rivai *et al.*, 1992). Besides in Dieng, purwaceng was also ever found at Gede Pangrango mountain (West Java) and in Anjasmoro mountain although presently it is not clearly traced (Darwati dan Roostika, 2006).



Figure 1. Sample of harvested purwaceng, including, flower, shoot and root.

Purwaceng is a herb plant having effect of increasing motorical activity and tonic of muscles. According to Rahardjo (2003), root of purwaceng is useful as herbs of aphrodisiac (enhancing sexual endurance and inducing erection), diuretic (facilitating urination), and also as tonic (increasing stamina) (Hernani, 2004).

At present, wild purwaceng has been become more extinct. It was due to largely sought of the plant without any regeneration. Besides, forest plundering, deforestation, and forest conversion to agricultural land have devastated habitat of purwaceng. A massive exploitation of wild purwaceng was motivated by high price of purwaceng as long as increased demand from the consumer. They did not like to cultivate the plant, but hunting to the forest and field.

Considering high rate of purwaceng extinction, therefore it is required an effort for conservation. This research is going to awaken people in Kejajar to get economic benefit from the purwaceng concurrently with conservation effort for the environment. Attempt to cultivate in situ has not been carried out by the people yet. It was due to lack of seedling availability and information about cultivation practices.

POTENTIAL OF PURWACENG FOR LAND CONSERVATION

Purwoceng plant is a shrub that may grow to cover soil surface. The plant habitus, leaf morphology, and stem structure are suitable to be used as land cover crop. The taxonomy of purwaceng is as follow (Rahardjo, 2003):

Divisio : Spermatophyta
 Sub division : Angiospermae
 Class : Dicotyledoneae
 Ordo : Apiales
 Familia : Apiaceae
 Genus : *Pimpinella*
 Species : *Pimpinella pruatjan*

It is a multiple benefit of development of purwaceng cultivation in order to get economic value of the plant, as well as conservation benefit for the plant germplasm itself and for soil conservation. From the theoretical side, reducing soil erosion by using purwaceng as soil cover crop is one application of vegetative methods for reducing soil erosion.



(a)

(b)

Figure 2. Morphology of purwaceng plant at open land (a), and shaded land (b)

Selection of purwaceng as soil cover crop is appropriate at least according to two reasons. Firstly, purwaceng has a long growth periode. It tightly covers up soil surface that protect the soil from rain water droplet. In the rainy season, it has a dense leaves. The plant can be harvested during the dry season after age of 5-8 months. Harvesting was done for the mature plant while the young plant was remained to be left. By this way, soil surface was continuously covered by the plant. Secondly, the land that has been planted with purwaceng is not need to be replanted. The plants will regenerate itself by the seed. Self regeneration is naturally occurred from the fallen seed, that especially germinating during rainy season. The seed is continuously germinating in succession, therefore it is always purwaceng plant exist covering the soil.

Regarding the existing situation captured from on field survey and interview in Kejajar, it has been prepared activities to develop purwaceng crop. The potential use of purwaceng in Kejajar district can be optimized by conducting the following efforts:

1. Production of purwaceng seedlings.

This step is the preliminary effort to boost population of purwaceng crop. Research of Syahid *et al.* (2004) showed success of tissue culture for seedling production. It can be used for mass production, in spite of conventionally technique from the seed. Seedling produced in Kejajar is shown in Figure 3.



Figure 3. Purwaceng seedling originated from seed

2. Increasing area of purwaceng planting.

Increasing cultivated area will increase production volume of purwaceng. Additional area can be gained from shaded area under stand of carica crop and kemar crop. It will be beneficial to reduce soil erosion and increase economic return upon multi cropping land.



Figure 4. Cultivation of purwaceng under shading of carica and kemar crop

3. Improvement of cultivation technique of purwaceng.

In order to avoid chemical contamination, purwaceng cultivation usually does not apply chemical fertilizer as well as pesticide. Suggestions for improving cultivation are application of organic fertilizer or growth hormone (Fathonah & Sugiyarto, 2009), and implementation of proper plant spacing. Plant spacing should consider high productivity of purwaceng crop and high impact on reducing soil erosion.



Figure 5. Performance of purwaceng from different plant spacing

CONCLUSIONS

Purwaceng is a herb plant that has economic benefit, as well as soil conservation effect. In Keajar, this crop can be developed to support either agro-industry of herbal, as well as environmental benefit in the area of Dieng Plateau.

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