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ICTAFF 2018

**International Conference
on Tropical Agrifood, Feed, and Fuel**
Sustainability of Food, Feed, and Fuel Tropical Resources for Quality Future

PROCEEDING

**Samarinda, 13-14 November 2018
MESRA Bussines Hotel**

PROCEEDING

INTERNATIONAL CONFERENCE ON TROPICAL AGRIFOOD, FEED, AND FUEL (ICTAFF) : SUSTAINABILITY OF FOOD, FEED, AND FUEL TROPICAL RESOURCES FOR QUALITY FUTURE

Samarinda, 13-14 November 2018



Publisher

**Department of Agricultural Products Technology
Agriculture Faculty, Mulawarman University
Samarinda**

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Publisher

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PREFACE

The greatest regards should be expressed only to God the Almighty, Allah SWT. We have finished the Proceeding book of International Conference on Tropical Agrifood, Feed, and Fuel (ICTAFF) after the conference which was held on 13-14 November 2018 in Mesra bussines Hotel Samarinda.

The conference takes "Sustainability of Tropical Food, Feed, and Fuel Tropical Resources for Quality Future" as the main theme. This international conference is aimed at resolving problems and bringing together scientists, researchers, professionals, and students from multidisciplinary agriculture-related fields to share the latest findings or ongoing research activities.

There are 6 sub themes emphasized in the ICTAFF 2018, including halal, safe, and healthy food, improving quality food and nutrition, security and sustainability food and agriculture, innovation in feed technology to increase animal production, sustainable and renewable fuels based on tropical resources, and empowering of agribusiness based on community.

We would like to thank all keynote speakers for their contributions to the Conference, they are Asst. Prof. Dr. Somsak Maneepong from Walailak University Thailand, Prof. Xuming Huang from South China Agricultural University, Prof. Irwandi Jaswir from International Islamic University Malaysia (IIUM), Prof. Ali Agus from Gadjah Mada University, Dr. Dadan Rohdiana from Research Institute of Tea and Cinchona Indonesia, and Widi Sunaryo, Ph.D from Mulawarman University Indonesia.

Finally, we would like to thanks all of the proceeding team who have dedicated their constant supports and countless time to bring these scratches into a book. The ICTAFF 2018 proceeding is a credit to a large group of people, and everyone should be proud of the outcome.

Editors

Welcome Speech

Welcome Note From ICTAFF 2018 Committee



Assalamu'alaikum Warahmatullah Wabarakatuh

I would like to express the greatest regard to the Almighty God, Allah Subhanallahi Wa Ta'ala, for the Successful of International Conference of Food, Feed and Fuel 2018. I also would like to welcome all the audiences to Samarinda Kota Tepian.

Food security is very important to strengthen and support sustainable development in agriculture. Food, not only from plant but also from animal, should be available for all resident of Indonesia. It is urgent to provide quality feed to support food animal development to fulfill people needs of nutrition.

We would like to report that about sixty participants are attending the conference. Researcher and lecturer from some universities and research institutions will disseminate their research in this conference. This number is beyond our expectation when we were arranging the conference.

This conference will present international speakers from Wailailak University, Associate Professor Somsak Maneepong, Prof. Irwandi Jaswir from International Islamic University of Malaysia, Prof Xuming Huang from South China Agricultural University, Prof Ali Agus from Gadjah Mada University, Dr. Dadan Rohdiana from Research Institute of Tea and Cinchona Indonesia, and last but not least, Widi Sunaryo, Ph.D from Mulawarman University.

The morning session is designed to keynote speeches and the afternoon session is for parallel sessions. The parallel sessions will be focused into six topics: Halal, safe and healthy food; Security and sustainability of food and agriculture; Innovation in feed technology to increase animal production; Sustainable and Renewable fuel based on tropical resources; and Empowering of agribusiness based on community.

Faculty of Agriculture as conference organizer would like to thank Agrivita, the Journal of Agricultural Science on an agreement for publication of the selected papers from ICTAFF participants, and special thank Dr. Havaludin for helping our communication to the agreement. I also would like to thank to STIPER Kutai Timur, especially Prof. Juraemi, for cooperation in organizing and special thanks to PT. Kaltim Prima Coal and PT. Pupuk Kaltim for strong support to this conference.

We hope you will enjoy the tropical climate as long as staying in Samarinda. Thank you

Wassalamu'alaikum Warahmatullah Wabarakatuh

Committee,

Aswita Emmawati
Chairman

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DAILY CONSUMPTION OF GREEN TEA REDUCED FREE RADICALS IN MODERATE SMOKERS

Rosyanne Kushargina^{a*}, Rimbawan Rimbawan^b and Budi Setiawan^b

^a*Department of Nutrition, Faculty of Medicine and Health, University of Muhammadiyah Jakarta, Indonesia.*

^b*Department of Community Nutrition, Bogor Agricultural University. Indonesia*

*Corresponding author : rosyannekushargina@gmail.com

ABSTRACT

Smoking can elevate free radicals in blood plasma. Many previous studies proved that antioxidants in tea could reduce free radicals. Green tea is known to have a higher antioxidant capacity than black tea. This study aimed to analyze the effect of green tea on the reduction of free radicals in moderate smokers, using a pre-post experimental design. Green tea infusions were prepared with commercially available dried tea leaves (Green Tea Gamboeng Series) from the Research Institute for Tea and Cinchona in Gambung, West Java. Nine moderate smokers (11-21 cigarettes/day) aged 30-45 years were instructed to drink 200 ml of green tea three times a day for four weeks. Total Antioxidant Capacity (TAC) of the blood serum was measured at baseline and after the 4-week intervention period. The subjects' mean TAC increased significantly from 1.18 mmol/L to 1.34 mmol/L after four weeks of intervention ($P=0.000$). These results indicate that drinking 200 ml of green tea three times a day for four weeks has a significant benefit in reducing free radicals of the moderate smokers.

Keywords : antioxidant, green tea gamboeng series, men, polyphenol, total antioxidant capacity

INTRODUCTION

The eating behavior including unhealthy habits will have an impact on nutritional status. One of the unhealthy habits is smoking. Long-term and short-term smoking significantly increase oxidative damage (Diken et al., 2000). Each cigarette smoke contains 10^{14} free radicals, 8-20 mg nicotine, and 800 ppm nicotine oxide which can react with the peroxide generated by inflammatory cells to form free radicals. These free radicals cause oxidative damage which eventually makes the immune system work harder (Dietrich et al., 2002). The cigarette smoke inhaled contains many chemicals that can cause health problems. One of the harmful compounds in cigarettes is nicotine.

Nicotine is a toxic chemical element in cigarettes. It may damage the heart and blood circulation. A cigarette usually contains 8-20 mg of nicotine depending on the type and brand of the cigarette. The body absorbs 1 mg of nicotine in each cigarette smoking. The more nicotine consumed, the higher the risk of smoking-related diseases. These diseases are caused by the nicotine which can accumulate in the liver, kidneys, fat, and lungs. Nicotine is toxic to nerve tissue. It also causes increased systolic and diastolic blood pressure, increased heart rate, increased contraction of the heart muscle, increased oxygen consumption, increased blood

flow in the coronary vessels, and vasoconstriction of peripheral blood vessels. Nicotine increases LDL cholesterol and blood clotting cell aggregation (Sitepoe, 2000b). Long-term and short-term smoking significantly reduce blood oxidative status (Diken et al., 2000).

The oxidative damage to blood vessels and heart tissue is associated with an increased risk of heart disease. Sitepoe (2000b) has stated that smokers have 2-3 times higher risk of heart disease than non-smokers. Smoking accelerates blood clotting which is one of the causal factors of atherosclerosis that triggers heart disease. Gupta et al. (2006) have stated that triglycerides (TG), total cholesterol (TC), and low-density lipoprotein cholesterol (LDL-c) of the smokers are higher than non-smokers due to the effects of nicotine. The nicotine in cigarettes causes the oxidation of LDL-c. Chattopadhyay and Chattopadhyay (2007) proved that there was an increase in TG, TC, and LDL-c in rats receiving 3.5 mg/kg BW nicotine intervention for 15 days. Nicotine is toxic to nerve tissue. The increased TG, TC, and LDL-c can trigger atherosclerosis and increase the risk of heart disease. Smoking can also trigger diabetes mellitus (DM). Nicotine in cigarette smoke will reduce insulin sensitivity (Dias et al., 2013).

The negative effects have not been able to reduce smoking. The number of smokers tends to

increase year after year. The prevalence of male population aged over 10 years who smoked every day was 23.7% (MoH, 2008). In 2010, the prevalence of male population aged over 15 years who smoked every day was 28.2% (MoH, 2010). This number increased once again in 2013. The prevalence of male population aged over 10 years who smoked every day was 29.8% (MoH, 2013). The increasing number of smokers is also followed by an increasing average number of cigarettes smoked. In 2010, the average consumption of cigarettes was 10 cigarettes/day (MoH, 2010). This number increased in 2013 to 12.3 cigarettes/day (MoH, 2013).

Regarding the heart disease, the data of 2013 Basic Health Research (BHR) also indicated that there was an increase in the prevalence of the disease. The prevalence of heart disease increased from 0.9% in 2007 to 1.5% in 2013 (MoH, 2013). The increased number of smokers followed by the increased prevalence of heart disease may trigger an increased risk of other degenerative diseases which will lead to metabolic syndrome.

One of the efforts to overcome the free radicals from cigarette smoke and the degenerative diseases that may occur due to smoking is by using phytotherapy. The phytotherapy or therapy using plants has long been known, especially in Indonesia that has high biodiversity. One of the plants that can be used for phytotherapy is tea. Tea is a drink derived from the extract of tea (*Camellia sinensis*) leaves. It can stimulate nerves and provide a refreshing effect. The strong aroma, delicious taste, and beneficial for improving health are factors that make tea being a popular drink in the world. There are several types of tea. According to Dias et al. (2013), tea can be classified into four types based on the production process and its quality characteristics; i.e., white tea, green tea, oolong tea, and black tea.

Reviews of several studies have shown the benefits of green tea in cardiovascular disease, obesity, and type 2 DM (Dias et al., 2013). Catechins, especially EGCG, in green tea may act as antioxidants that can reduce oxidative stress. The positive effects of tea on health are related to its polyphenol contents, namely catechins and their derivatives. The main polyphenols in tea include epicatechin (EC), epigallocatechin (EGC), epicatechin-3-gallate (ECG), and epigallocatechin-3-gallate (EGCG). The white tea is stated to have the highest EGCG content compared to other types of tea. EGCG, catechins, and theaflavin in tea effectively reduce cholesterol absorption. Another study also proved that there was a decrease in TC, TG, and LDL-c in rats receiving EGCG supplementation (Dias et

al., 2013). Several studies on the effect of green tea on smokers have been conducted. It has been proven that there is a decrease in oxidative damage in Asian smokers who consume three glasses of green tea a day (Lee et al., 1997). The intervention using green tea as a drink also had a positive effect on smokers after two weeks of intervention (Princeet al., 1998). The free radicals caused by smoking differ depending on the type and intensity of smoking. Because of the increased number of smokers nowadays as shown by the BHR data and the many negative effects of smoking, it is necessary to conduct a study to see the effect of green tea on free radicals in moderate smokers.

MATERIALS AND METHODS

This study was conducted in March-April 2015 in Bogor. The ethical clearance for this study was obtained from the ethics committee of the Faculty of Medicine, University of Indonesia Number: 174/UN2.F1/ETIK/2015. The subjects were the employees of the Rubber Research Center in Bogor. The intervention was also conducted in the office. The selection of the intervention site and subjects in this study was conducted purposively because of the ease of access. The subjects who were centered in one place could also facilitate the technical implementation of the intervention. It also ensured the homogeneity of the sample activity and treatment and controlled the compliance.

There were several criteria that should be met to be the subjects of this study. The inclusion criteria were men, aged 30-45 years, moderate smokers (11-21 cigarettes/day) (Sitepoe 2000a), had smoked for at least six months (Gupta et al. 2006), had LDL-c levels >130 mg/dl and triglycerides >150 mg/dl (mild dyslipidemia). The exclusion criteria were as follows: did not like tea, using medications that might affect the lipid profile, undergoing treatment, consuming alcoholic beverages, and taking supplements (liquid/solid).

The subjects who met the criteria were asked to fill out the informed consent, to be willing to participate in the research, and to be fully committed to complying with the intervention protocol provided. During the study, the subjects were asked to follow the instructions. They were not to consume tea other than the tea provided, avoiding the consumption of foods containing polyphenols such as chocolate, limiting their coffee consumption to once a day (200 ml/day), drinking the tea given until the last drop (3x200 ml/day), and not to change their consumption and physical activity including smoking (keep smoking as usual).

The green tea was prepared from the infusion of green tea leaves (Green Tea Gamboeng®) obtained from the Research Institute for Tea and Cinchona (RITC), Gamboeng, West Java. A total of 2 g of green tea were brewed with 200 ml of water at a temperature of 95 °C for nine minutes (Rohdiana *et al.* 2013). During the intervention, the tea was prepared by the researchers. The tea was consumed without the addition of milk or sugar.

This study used a pre-post experimental design. Each subject was asked to drink 200 ml of green tea three times a day (at 8 a.m., 12 p.m., and 4 p.m.) for four weeks from Monday to Friday. The data regarding the subjects' dietary intakes before the intervention were collected from the 2x24-h food recall questionnaire (one typical day and one holiday). The body weight and height measurements were also performed to measure the nutritional status using a body mass index (BMI) indicator. The subjects' physical activities were also assessed before and after the intervention. The blood sampling of the subjects was also performed pre- and post-intervention. The free radicals were measured from the blood serum using the total antioxidant capacity (TAC) biomarker. The TAC analysis was performed in an accredited clinical laboratory (Prodia®).

We compared the pre- and post-intervention results of TAC, physical activity, and nutritional status (using the BMI as the indicator) measurements. The effect of green tea on TAC was analyzed statistically using a paired sample t-test. The number of cigarettes consumed in this study was collected together with the consumption data before and during the intervention and analyzed using a paired sample t-test. The tea consumption compliance data were collected using questionnaires and presented descriptively. The results were presented as mean and considered significant if $p < 0.05$.

RESULTS AND DISCUSSION

Sitepoe (2000a) has divided the smokers into three types; i.e., light, moderate, and heavy smokers. Light smokers are those who smoke about 10 cigarettes/day. Moderate smokers spend 11-21 cigarettes/day. Heavy smokers are those who smoke about 21-30 cigarettes/day. All subjects smoked the same type of cigarette, namely a filtered *kretek* (clove cigarette). Based on the raw materials, cigarettes are divided into two types; i.e., white cigarette and clove cigarette. White cigarettes are cigarettes whose raw materials or contents are only tobacco leaves that

are given a sauce to get a certain taste and aroma effect. Clove cigarettes are cigarettes whose raw materials or contents are tobacco leaves and cloves which are given a sauce to get a certain taste and aroma effect (Sitepoe, 2000a).

Cigarette consumption in Indonesia (84.31%) is dominated by clove cigarettes, either the filtered or unfiltered ones (Sitepoe, 2000a). Clove cigarettes contain around 60%-70% tobacco and 30%-40% cloves. Tar, nicotine, and carbon monoxide released from clove cigarettes are twice as high as white cigarettes (Sitepoe, 2000a). According to Nielsen's Retail Audit Survey in 2013, 92% of the cigarette market in Indonesia is dominated by clove cigarettes due to the taste and price. Besides that, the majority of people in the social environment where smokers live or work smoke with this type of cigarette. Therefore, they prefer this cigarette to other types of cigarettes.

The subjects were moderate smokers with the mean number of cigarettes smoked of 14.11 cigarettes/day before intervention and 13.56 cigarettes/day during the intervention. The results of the analysis using paired sample t-test indicated that there were no significant differences ($p > 0.05$) in the mean number of cigarettes consumed by the subjects between before and during the intervention (Table 1).

The number of cigarettes consumed in this study was collected together with the consumption data before and during the intervention. The mean number of cigarettes smoked by the subjects before or during the intervention was 14 cigarettes/day. The smokers who were the subjects in this study were active smokers and categorized as moderate smokers (smoking 11-21 cigarettes/day). An active smoker is the one who inhales the smoke from his cigarette smoke (Sitepoe 2000a). Smoking intensity significantly increases oxidative damage (Block *et al.* 2002). The more the number of cigarettes smokers, the higher the oxidative damage. The results of the analysis using paired sample t-test showed that there were no significant differences ($p > 0.05$) in the mean number of cigarettes smoked by subjects between before and during the intervention. The results in Table 1 indicated that the subjects did not change their smoking activity. The changes in the subjects' cigarette consumption before and during the intervention could affect the validity of the measured TAC value.

Table 1. Subjects' Mean Consumption of Cigarettes (Cigarette/Day) Before and During the Intervention

| Subject Number | Mean Consumption of Cigarettes | |
|----------------|--------------------------------|-----------------------|
| | Before Intervention | During Intervention |
| 1 | 14 | 13 |
| 2 | 14 | 13 |
| 3 | 15 | 16 |
| 4 | 13 | 13 |
| 5 | 16 | 14 |
| 6 | 14 | 13 |
| 7 | 14 | 13 |
| 8 | 13 | 12 |
| 9 | 14 | 15 |
| Mean | 14,11 | 13,56 |
| SD | 0,93 | 1,24 |
| | | p ^a =0,139 |

SD=Standard Deviation

^apaired sample t-test between before and during the intervention

Table 2. Subjects' Nutrient Intakes Before and During the Intervention

| Nutrients | Mean nutrient intake | | | | p |
|------------------|----------------------|-------|---------------------|-------|-------|
| | Before intervention | | During intervention | | |
| | Mean | SD | Mean | SD | |
| Fat (g) | 67,09 | 3,67 | 67,42 | 4,91 | 0,760 |
| Vitamin A (µg) | 285,40 | 79,76 | 286,79 | 77,52 | 0,349 |
| Folate (µg) | 232,52 | 59,63 | 241,73 | 3,30 | 0,647 |
| Vitamin B12 (µg) | 2,56 | 0,33 | 2,63 | 0,30 | 0,266 |
| Vitamin C (mg) | 65,18 | 8,06 | 65,60 | 7,95 | 0,205 |
| Vitamin E(mg) | 10,54 | 1,03 | 10,63 | 0,97 | 0,149 |
| Fe (mg) | 7,92 | 0,31 | 7,95 | 0,33 | 0,158 |
| Zn (mg) | 8,28 | 0,63 | 8,29 | 0,64 | 0,543 |

SD=Standard Deviation

^apaired sample t-test between before and during the intervention

The subjects also did not change their consumption before and during the intervention, as evidenced by the analysis results of paired simple t-test which were not significantly different ($p > 0.05$) (Table 2). The fat adequacy level was in the adequate category. The subjects' adequacy levels of micronutrients were also the same as the adequacy level of micronutrients during the white tea intervention. Vitamin A, folate, and Fe were in the inadequate category while vitamin B12, vitamin C, vitamin E, and Zn were in the adequate category.

The differences in nutrient intakes before and during the intervention might affect the validity of TAC. In the form of beta-carotene, vitamin A can act as an antioxidant among the smoker subjects (Kelly 2002). Vitamin C also can act as an antioxidant and can minimize oxidative stress due to cigarette smoke (Kelly 2002). In the form of α -tocopherol, vitamin E can act as an antioxidant to minimize oxidative stress in

smokers (Bashar & Mitra 2004). TAC can also be affected by Zn and Fe consumption. Zinc (Zn) is a cofactor of superoxide dismutase (SOD) which is one of the biomarkers of oxidative status. The changes occurring in the subjects' TAC must be caused by the intervention given in the absence of changes in subjects' nutrient intakes.

Several studies have proven that the consumption and adequacy levels of micronutrients in smokers belong to the inadequate category. The study by Rosiana (2012) revealed that the vitamin C adequacy level of the smokers belonged to the inadequate category. The vitamin C requirement was usually met from the supplement consumption. Similar to vitamin C, the vitamin E requirement in smokers increased. Smokers need an additional 110-125 mg vitamin E/day. However, Bashar and Mitra (2004) stated that the vitamin E consumption of smokers was less than non-smokers and the consumption was categorized as inadequate. The adequacy levels of

vitamin C and E in this study were different from the results of those studies. The results of this study indicated that the adequacy levels of vitamin C and E of the subjects were in the adequate category. The differences in subjects' characteristics allegedly caused the difference between the results of this study and the study by Bashar and Mitra (2004). In contrast to this study, the subjects in the study by Bashar and Mitra (2004) were hospital patients with cardiovascular disease who had smoking habits.

The subjects' physical activities before and during the intervention can be seen in Table 3. The physical activity measurement was conducted on the type of activity performed by the subjects and the duration of activity in a day. The PAL questionnaires were given to the subjects, and they filled out the questionnaires according to the instructions from the researchers.

Table 3. PAL values before and during the intervention

| Subject Number | Mean PAL Value | |
|----------------|---------------------|---------------------|
| | Before intervention | During intervention |
| 1 | 1.42 | 1.40 |
| 2 | 1.53 | 1.59 |
| 3 | 1.55 | 1.54 |
| 4 | 1.61 | 1.59 |
| 5 | 1.63 | 1.63 |
| 6 | 1.56 | 1.55 |
| 7 | 1.53 | 1.51 |
| 8 | 1.60 | 1.58 |
| 9 | 1.53 | 1.50 |
| Mean | 1.55 | 1.54 |
| SD | 0.06 | 0.07 |

$p^a = 0.410$

SD=Standard Deviation

^apaired sample t-test between before and during the intervention

Before the green tea intervention, the subjects' physical activities belonged to the light category with a mean of 1.55. The physical activity of the subjects during the green tea intervention was between 1.40 and 1.63 with a mean of 1.54 which also belonged to the light category. The analysis results of paired simple t-test for subjects' PAL before and during the intervention showed a non-significant difference ($p>0.05$). It was known that the subjects did not change their physical activities during the intervention, as indicated by the analysis results of independent t-test which were not significantly different ($p>0.05$).

The subjects of this study were centered in one location (i.e., Rubber Research Center in Bogor) during the intervention, and all of them were employees in the office. The location was purposively selected not only due to the ease of access but also to ensure the homogeneity of the subjects' activities. All subjects had the same working hours and working days, from 7.30 a.m. to 4.15 p.m. Indonesia Western Standard Time (IWST) every Monday to Friday. The intervention for this study was conducted on weekdays (Monday-Friday) at 8 a.m., 12 p.m., and 4 p.m. IWST. It caused the subjects' activities to be in the same category (light category), and the subjects were indeed prohibited from changing their physical activities before and during the intervention.

The physical activity data were also collected in this study because physical activity could affect oxidative status. Free radicals can be formed from oxygen consumption. A total of 5% of oxygen consumption will form free radicals that will be neutralized by antioxidants in the body. A heavy and exhausting physical activity will make oxygen consumption increase by more than 5%; thereby, the number of free radicals also increases. The number of free radicals will increase beyond the capacity of the antioxidant defense system in the body. The imbalance may cause oxidative stress. Heavy physical activities coupled with free radicals from the cigarette smoke may further reduce the oxidative status of the subjects.

Table 4. Percentage (%) of Subjects' Tea Consumption Compliance.

| Subject Number | Compliance (%) |
|----------------|----------------|
| 1 | 98.75 |
| 2 | 97.50 |
| 3 | 97.50 |
| 4 | 95.00 |
| 5 | 97.50 |
| 6 | 97.75 |
| 7 | 97.75 |
| 8 | 96.75 |
| 9 | 99.00 |
| Mean | 97.50 |
| SD | 1.16 |

SD=Standard Deviation

All subjects completed the intervention. The compliance of green tea consumption in this study was 97.5% (Table 4). The compliance of the subjects was seen from the amount of remaining tea which was observed every day. As described in the methods section, the intervention was carried out every weekday at 8 a.m., 12 p.m., and

4 p.m. Each tea glass of the subjects would be distributed during that time to the subject's workroom. The distribution was carried out by the researchers assisted by the kitchen employees in the office. There were no reported complaints or dangerous side effects in the subjects related to the intervention.

The difference in the subjects' tea consumption compliance could affect the amount of tea drunk and could be a confounding factor in the measured TAC. The percentage of compliance was higher than the previous study conducted by Khosraviet al. (2014). The percentage of green tea consumption compliance in the study by Khosraviet al. (2014) was 91%. Green tea has a fairly bitter taste. It is processed without oxidation. The tea shoots are processed directly with hot steam or pan-fried to stop the enzyme activity so that the green color persists and the tannin content is relatively high. The tannins play a role in giving a bitter taste to the tea. The tannins in green tea (1.44%) are proven to be higher than black tea (0.99%) (Dias et al. 2013).

The free radicals in this study were measured using the TAC as a biomarker. The TAC measurements were performed twice (pre- and post-intervention). The subjects' mean TAC before the intervention was 1.18 mmol/L (Figure 1).

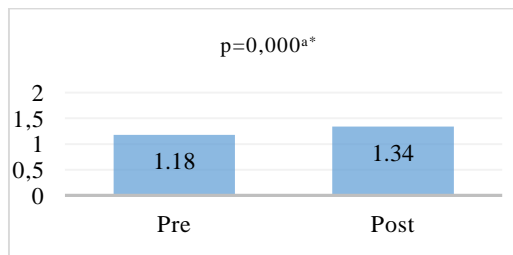


Figure 1. The analysis results of subjects' TAC before and after the intervention. *paired sample t-test: pre-intervention compared to post-intervention. *significantly different ($p < 0.05$)*

The subjects' TAC increased significantly ($p < 0.05$) after being given the green tea intervention, from 1.18 mmol/L to 1.34 mmol/L. The normal value of TAC is 1.23-2.00 mmol/L. The high level of free radicals in blood plasma represents a low level of antioxidants in the body. The free radicals in this study were measured using the TAC as a biomarker. TAC is the cumulative of several different antioxidants, either from the food consumed (exogenous antioxidants) or endogenous antioxidants. The TAC is effective for measuring phenolic-type antioxidants such as those found in tea (Prior et al. 2005).

The low/abnormal TAC shows high levels of free radicals in the blood plasma. The high levels of free radicals in the smokers' blood plasma indicate that smokers are susceptible to oxidative stress. The subjects' TAC before the intervention was low (abnormal) with a mean value that reached only 1.18 mmol/L. Many studies have proven that smoking increases oxidative stress. Smoking increases the cumulative exposure to reactive oxygen species (ROS) either from exogenous or endogenous sources; thereby, the smokers have an increased need for antioxidants (Kelly 2002). The cigarette smoke inhaled contains 4,000 types of chemicals, and it can provide health-damaging effects. One of the harmful compounds in cigarettes is nicotine. Nicotine triggers oxidative damage and the mechanism related to the decreased antioxidant defense, causing an imbalance of antioxidants in the body. More than 80% of nicotine absorbed will be metabolized to cotinine in the liver (Sitepoe 2000b) which is then excreted in the urine. The liver is an important organ that plays a role in metabolizing drugs, alcohol, and other toxic substances to be excreted from the body. The high levels of nicotine absorbed by the body along with the increasing number of cigarettes smoked can increase the risk of liver cell damage. The more nicotine consumed, the higher the risk of smoking-related diseases.

Kurku et al. (2015) stated that smokers had a lower TAC than non-smokers. The smokers in the study by Kurku et al. (2015) had a lower mean TAC (0.466 mmol/GSH) than non-smokers. The TAC value was different from the TAC in this study due to the different TAC measurement methods. The TAC in this study was measured by the TEAC method using vitamin E as a standard. Meanwhile, Kurku et al. (2015) measured the serum TAC of smokers using glutathione (GSH) as the standard. A study by Onyesom et al. (2012) also proved that smokers had a significantly lower serum TAC ($p < 0.05$) than non-smokers. The smokers in this study had a lower mean TAC (only 1.18 mmol/L) than those in the study by Onyesom et al. (2012) who had a mean TAC of 1.45 mmol/L due to the differences in the category of smokers between the two studies. Onyesom et al. (2012) observed the TAC in light smokers who smoked 1-4 cigarettes/day while the subjects used in this study were moderate smokers who smoked 11-21 cigarettes/day. The results proved that the smoking intensity significantly affected the TAC, and it was inversely proportional to the TAC. The more the cigarettes smoked, the lower the TAC.

The subjects' TAC increased significantly ($p < 0.05$) after the intervention, from 1.18 mmol/L

to 1.34 mmol/L. The results of this study were in line with the results of the previous study. The previous study (Lee et al. 1997) proved that the smokers who received green tea intervention for six months had lower oxidative damage than the smokers who did not receive green tea. The smokers who did not receive green tea had a higher SCE value (9.46 ± 0.46) than the smokers who received green tea intervention (7.94 ± 0.31). The result showed that the administration of green tea could reduce oxidative damage due to smoking. Not only in smokers, but the increase in TAC also occurred in non-smokers although it was not significant ($p > 0.05$) (Sung et al. 2005) because the oxidative stress in non-smokers tended to be lower than the smokers.

The antioxidants caused an increase in subjects' TAC after the green tea intervention in the tea. The antioxidants in tea can improve 50% of cell damage caused by cigarette smoke (Dias et al. 2013). Green tea has high flavonoid polyphenols content, especially EGCG. EGCG in the tea that enters the body will be absorbed in the small intestine. EGCG is then taken to other tissues such as liver and heart.

The high antioxidant activity in EGCG can capture the hydrogen peroxide (H_2O_2). Tea is proven to protect the body from the toxic effects of nicotine. EGCG can reduce oxidative stress with the help of laminin receptors (67LR) which causes a decrease in ROS. Only the EGCG that will directly bind to 67LR instead of other types of catechins. EGCG is more effective in reducing ROS than EC, ECG, and EGC (Wang et al. 2009). It is the largest component of tea catechins. EGCG is a final derivative of catechins containing a more stable Gallo and gallate compounds, and it contributes 32% of the antioxidant potential of tea (Rohdiana 2011). Based on the antioxidant activity, the EGCG has the highest activity (EGCG > EGC > ECG > EC > C). It makes the EGCG most prominent among other types of catechins in tea.

Table 5. Distribution of the subjects' TAC values based on BMI

| BMI category | Before | After | Δ |
|-----------------------|--------|-------|----------|
| Abnormal ^a | 1.17 | 1.31 | 0.14 |
| Normal | 1.19 | 1.41 | 0.21 |

^aThe BMI in the underweight, overweight, and obese categories

BMI is known to affect the TAC (Block et al. 2002). The distribution of the subjects' TAC values before and after the white tea and green interventions based on BMI was presented in Table 5. The BMIs included in the abnormal

category were the BMIs for underweight, overweight, and obese categories. Table 5 shows that the subjects with normal BMI have a higher mean TAC before and after the intervention. The increase in the TAC of the subjects with normal BMI after the intervention was also higher (0.21 mmol/L) than the subjects with abnormal BMI (0.14 mmol/L). The results of this study indicated that smokers with abnormal BMI had a lower TAC than those with normal BMI. These results were in line with the study by Block et al. (2002) who stated that BMI had a significant association with oxidative status. Abnormal BMIs ($> 25 \text{ kg/m}^2$ and $< 18.5 \text{ kg/m}^2$) could reduce the oxidative status.

CONCLUSIONS AND RECOMMENDATION

There was a significant increase in the subjects' mean TAC after the intervention ($p = 0.000$). This result indicates that drinking green tea three times a day for four weeks can significantly reduce free radicals in moderate smokers. This study has also proved that green tea has a positive effect on the oxidative status of smokers.

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THE CALORIES AND GLYCAEMIC INDEX OF BUBUR PEDAS, TRADITIONAL FOOD OF WEST KALIMANTAN, INDONESIA

Oke Anandika Lestari^a, Sulvi Purwayantie^{a*}

^aDepartment of Food Science and Technology, Faculty of Agriculture, Tanjung Pura University

*Corresponding author : sulvipurwayanti06@gmail.com

ABSTRACT

Bubur pedas is the one of The Ethnic Malay Food from Sambas District and it has become a culinary icon of West Kalimantan, Indonesia. Up till now, there is no health information related to *bubur pedas*. The aim of the research is to evaluate the calories and glycaemic index (GI) in order to promote healthy porridge from West Kalimantan. Data were collected from a sampling survey in 5 *bubur pedas* cafe in Pontianak, descriptive and anova analyzed. The results showed that one serving size of *bubur pedas* (432g) has sufficient energy (618.11 kcal) and protein (7.13 g/person) for breakfast food. GI value of *bubur pedas* is low (<50). This study adds to the scientific evidence *bubur pedas* in Indonesia as one of the most popular culinary ethnics in West Kalimantan for years that should be safeguarded and conserved for its outstanding value not only for traditional porridge, but also for its intangible cultures.

Keywords :culinary ethnic, energy, porridge, protein, Sambas

INTRODUCTION

Bubur pedas is a particular porridge from Malay Ethnic, Sambas District, Indonesia. It is become culinary icon from West Kalimantan and can find in anywhere. *Bubur pedas* has an original name, it is called "Bubor Paddas". Eventhough there is a word '*pedas*' (hot spicy), the porridge does not use hot pepper in ingredients. Generally, *bubur pedas* can be found in other provinces with the majority of Malay ethnic groups such as in North Sumatera and Natuna Islands including Sambas District with almost the similar word spelling to *bubur pedas*. It has a similar name but the thing which makes it different from one another in each region or provinces is the seasoning. Although it has become traditional food and icon, scientific facts related to nutrition are still unknown, considering *bubur pedas* has been consumed for a long time. This becomes an important thing to known by society (general public) or tourist who visited to know healthy food that appropriates with nutrition needs. Food labeling facts have become a requirement for most commercial products.

Because until 2017 there is no nutrient information available of *bubur pedas* in Indonesia, it is necessary to evaluate the calories and the glycaemic index. Three of the nutrition (carbohydrate, protein, fat) based on BPOM RI (2011) must be listed in labeling including the calories and glycaemic index. Currently developed countries such as Australia, Canada, UK have socialized and applied the important of

listed the glycaemic value in packaging products, as one of satisfaction of consumer need for healthy food consumption, especially very important for people with diabetes mellitus (DM). The results of this research are expected to be an important input to determine public policy related to healthy food consumption. Currently, The Government of Indonesia through The Ministry of Health Affairs and Food Security Organization has launched a program of food consumption and based on local wisdom through various national activities. Therefore, *bubur pedas* from West Kalimantan should become part of a regional or national policy similar to Manado porridge, *bintebiluhuta*, *karedok*, *gado-gado* that listed in Regulation of Ministry of Health number 41 of 2014 for The Ministry of Health Affairs and Food Security Organization to introduce/popularize *bubur pedas* started from 2018 as a healthy food that balanced diet nutrition.

MATERIALS AND METHODS

Time and Place

The experiment was conducted in the Laboratory of Food Chemistry, Faculty of Agriculture, Tanjungpura University from June 2017 to September 2017.

Methods

The study is composed of four parts: 1) a survey to collect data on *bubur pedas* in the 5 different cafe in the main street (W1, W2, W3, W4, W5) with simple sampling technique, measuring the weight of samples, record of

ingredients composition and amounts; 2) chemical analysis: protein, fat and carbohydrate crude, 3) organoleptic by hedonic test, 3) GI assessed (Lestari, 2009) and 4) calories (Sukasih and Setyadjit, 2012).

Study design of GI

Study protocols were prepared by O. A. L and who also took care of the executions of protocols. Recruitment of a representative group of volunteers was based on student in Science and Food Departement on University of Tanjungpura. In total 20 volunteers apparently, healthy students were recruited (10 men and 10 women). The volunteers did not exhibit any sign of physical, clinical mental or clinically genetic disorder and were capable of participating in the research (non-diabetes with body mass index (BMI) 18 to 24). Exclusion criterion for volunteers was age < 18 and > 23years. A total student who took the GI assessing were 16 volunteers (10 men and 6 women).

Table 1. Overview of volunteers

| Data | Characteristic |
|-----------------------------|----------------|
| Age (years) | 20.88 ± 0.62 |
| Weight (kg) | 51.86 ± 7.30 |
| Height (cm) | 157.91 ± 8.21 |
| IMT (kg/m ²) | 20.72 ± 1.81 |
| Fasting blood sugar (mg/dl) | 82.31 ± 7.76 |

The anthropometric measurements were conducted with digital weighing scales (weight), microtome (height) and fasting blood sugar puasawith digital blood glucose test meter with calibration routines (Table 1). The criteria for volunteers; BMI 18.5 to 22.9 kg/m², fasting blood sugar < 110 mg/dl and aged 18-23 years (Handayani, 2014). Measurements were carried out at Laboratorium of Food Chemical. The study was conducted according to the guidelines laid down in the Declaration of Helsinki. All procedures involving the volunteers were approved by the Medical Ethical Committees of the participating institutes (Ethical Clearance Division of Faculty of the Medicine University of Tanjungpura with Regards of The Protection of Human Right and Welfare in Medical Research). The present study is registered in Ethical Clearance No. 1971/UN.22.9/DT 2017.

Statistical methods

Data from the surveys in each of the five cafe (ingredients composition, chemical analysis, calories) are presented as descriptive values, and analysis of variance (ANOVA) was performed to organoleptic and GI assessed, the level of significance of 0,05.

RESULTS AND DISCUSSION

Calories

Calories are units that used to measure the value of energy which obtained by the body when consuming food or drink, therefore it is the amount of energy produced from the metabolism of carbohydrates, fats, and proteins. The proximate of fat, protein, and carbohydrate levels were used to calculate energy by equalizing the calorie value produced per gram; ratio of fat protein and carbohydrates are 9:4:4 kcal/g (Sukasih and Setyadjit, 2012). The calorie connected with weighing foods. The average of one serving size in sold *bubur pedas* is 432 g (Table 2).

Table 2. Weigh in sold *bubur pedas* per serving size

| Sample | Weigh/serving size (g) |
|--------|------------------------|
| W1 | 432.33 |
| W2 | 499.00 |
| W3 | 389.33 |
| W4 | 469.67 |
| W5 | 369.67 |
| Mean | 432.00 |

Table 3 shows the calorie of *bubur pedas* per 100g (143.08 kcal). Therefore, one serving size of sold *bubur pedas* has 618.11 kcal. The recommendation by Ministry Health Regulation of Republic Indonesia Number 75 of 2013, there is the energy and protein sufficiency for Indonesia's population of 2150 kcal/person/day and 57g/person/day respectively. If *bubur pedas* is consumed as a breakfast food, then the nutritional requirement/day is 15-30% of total calorie (Ministry Health Regulation of Republic Indonesia Number 41 of 2014), the calories become 322.50-645 kcal/breakfast. Thus, one serving size that sold of *bubur pedas* has met the standard with the calories produced 618.11 kcal.

Table 3 showed too that the average of protein produced from 100g of *bubur pedas* is 1.65 g (1.65%). So that, in one serving size of *bubur pedas* for breakfast weighing 432g (Table 2) contains 7.14 g protein. Nutritional adequacy especially for energy and protein-based of Ministry Health Regulation of Republic Indonesia Number 75 of 2013 for toddler and kids aged 4-9 need 35-49 g protein/day/person and 1600-1850 kcal/day/person, boys aged 10-12 need 56 g protein/day/person and 2100 kcal/day/person, women aged 19-49 need 54-55g protein/day/person and 2150-2250 kcal/day/person. Therefore, when one serving size of *bubur pedas* eating as a breakfast food it is good enough for toddler and kids, boys and women have met

the standard of nutrition diet. The problem, protein is low because 7.14 g protein for a breakfast food it is not enough met the standard of nutrition diet (if one-third of protein available from a breakfast food). Meanwhile, the mayor condiments for *bubur pedas* are fried anchovy and

fried peanut which rich protein food. In this research has not been analyzed the calorie and protein content of condiments, because it depends on hedonic of consumers. To measuring the calorie and protein content of condiments are based on Indonesian regulation standard.

Table 3. The Calorie of *Bubur Pedas* (kcal)

| Nutrition | W1 | | W2 | | W3 | | W4 | | W5 | |
|--------------|-------|-------|-------|--------|-------|--------|-------|--------|-------|--------|
| | % | Kcal | % | kcal | % | kcal | % | kcal | % | Kcal |
| Carbohydrate | 21.67 | 86.68 | 21.51 | 86.04 | 20.36 | 81.44 | 15.68 | 62.72 | 19.66 | 78.64 |
| Fat | 7.06 | 63.54 | 5.04 | 45.36 | 4.86 | 43.74 | 6.66 | 59.94 | 8.25 | 74.25 |
| Protein | 1.02 | 4.08 | 1.36 | 5.44 | 2.48 | 9.92 | 2.10 | 8.4 | 1.30 | 5.20 |
| Calorie | | 154.3 | | 136.84 | | 135.10 | | 131.06 | | 158.09 |
| Mean | | | | | | 143.08 | | | | |

Note: W = cafe of *bubur pedas*

Based of Food Security of Organization of Republic Indonesia (2011), two spoons of anchovy (25g) which could be a substitute for animal protein (the same as one piece of beef @ 50g; 95 kcal and 4 g protein) and two spoons of peanut (20g) which could be a substitute for vegetable protein (the same as one piece of Tempe; fermented soybean @ 50g; 80 kcal and 6 g protein). If the consumers eating at least one to two spoons of anchovy and peanut, thus the calories and protein-based of Ministry Health Regulation of Republic Indonesia Number 41 of 2014, increase to 87.5 to 175 kcal and 5 to 10 g protein. Total the value of protein (*bubur pedas* + condiment) has 12.14 to 17.14 g, almost one-third of the protein standard (57 g/day/person), meanwhile calories become over 645 kcal (> 30% total of the calorie as a breakfast food). Therefore, we suggesting that *bubur pedas* could eat as a breakfast food for toddler and kids to meet the standard of nutrition diet, 15-30% of total calorie and one-third of protein.

Glycaemic Index

According to Pirasath et al. (2014), glycaemic index (GI) is the measure of the increase in blood glucose level after intake of food rich in carbohydrate related to glucose and depends on the food consumed (Esfahani et al. 2011). In this research, blood sugar measurements did not use all samples from 5 of the cafe which sold of *bubur pedas* but tested with hedonic test first to find the most favorite *bubur pedas* by consumers. The result of the hedonic test (unpublished data) showed that there are 2 samples which are assessed by consumers with the highest level of hedonic and is not significantly different they are W3 and W5 samples. Therefore, samples of *bubur pedas* from

W3 and W5 were tested for their blood sugar levels rise to 16 volunteers. The result of measurement after plotted into the graph reflecting the glycaemic index can be seen in Figure 1. The GI of *bubur pedas* of West Kalimantan has low, ie 23 for W5 and 25 for W2 (Table 4).

Table 4. The Glycemic Index of *Bubur Pedas*

| Sample | Glycemic Index (GI) |
|--------|-----------------------|
| W5 | 23 ± 2,6 ^a |
| W3 | 25 ± 1,5 ^a |

Note: Different letters show significantly different values at the level of α 0.05

Table 5. The Glycemic Load (GL) of *Bubur Pedas* in various portions of consumption

| <i>Bubur Pedas</i> | Glycemic Load (GL) | | | |
|--------------------|--------------------|--------------|--------------|--------------|
| | Portion 200g | Portion 300g | Portion 400g | Portion 500g |
| W5 | 9,37 | 14,05 | 18,73 | 23,41 |
| | Low | Medium | Medium | High |
| W3 | 9,83 | 14,75 | 19,66 | 24,58 |
| | Low | Medium | Medium | High |

Based on BPOM RI (2011), GI value is low if lower than 55. There is the porridge exhibit the lowest GI such as jumbo oats porridge from UK diet with GI < 55 (Aston et al., 2008) and red millet porridge mixed with *kelen-kelen* leaves and beans/peanuts of Koubala et al. (2014) report with GI of 19.91-31.52. The results were different from corn or maize-based porridges in Botswana and Malawi of Africa that exhibits the highest GI > 80. The GI of maize meal stiff porridge, soft porridge, stiff porridge, marami and sorghum/maize porridge from Botswana has GI range between 87-93 (Mahgoub et al., 2013)

while the GI of maize flour stiff porridges from Malawi has GI range between 70-120 (Mlotha et al., 2015).

Compared with the results of this research, the GL of *bubur pedas* (serving size 300-500g) is higher than 10 (Table 5). This means to be consumed by a diabetic, the serving size of *bubur pedas* is lower than 300g. The low level of GI value of *bubur pedas* may be due primarily to the interaction of carbohydrates with phenolic compounds from seasoning. The seasoning used in *bubur pedas* has 14 kinds (*Polygonum minus* Hud. leaves, Premna sp leaves, bay leaves, turmeric leaves, onion, garlic, cumin, turmeric rhizome, galangal rhizome, candlenut, black, and white pepper, lemongrass, ginger, coriander seed). Data of the ingredients composition and amounts unpublished. Almost all the seasoning used have been reported to contain phenolic compounds (phenolic acids and flavonoids). The kind of seasoning used in *bubur pedas* has been shown to contain phenolic compounds such as *Polygonum minus* Hud. onion, Premna sp leaves, ginger, turmeric, pepper, coriander etc. as reported by Shahidi and Ambigaipalan (2015); Chistapher et al. (2015); Rekha et al., (2015); Giada et al., 2013). This is in accordance with Lin et al. (2016); Kim et al. (2015); Asgar (2013); Zhang et al. (2010) which states that one of to lower blood sugar is by the consumption of phenolic compounds. Hanhineva et al. (2010) describes the mechanism of inhibition of phenolic compounds by inhibiting carbohydrate digestion and absorption of glucose in the small intestine, stimulating insulin secretion from pancreatic beta cells, modulation of glucose secretion from the liver, activating insulin receptors resulting in glucose uptake of tissue which are sensitive to insulin, modulating intracellular signaling pathway and expression genes.

CONCLUSIONS AND SUGGESTION

The *bubur pedas* of West Kalimantan is a kind of healthy and nutritious porridge because one serving size (432 g) has a calorie 618.11 kcal, 7.14 g protein, and GI has a low value (< 50) with a safe glycaemic content consuming for the diabetic is lower than 300 g/portion. Based on breakfast standard energy, the calories *bubur pedas* has been sufficient for 15-30% of the total nutritional adequacy per person per day (without condiment; anchovy and peanut). Meanwhile, if *bubur pedas* consumed with two spoons of condiments as a breakfast food, the total calories over 645 kcal and almost on third of protein/g/day. We are suggesting that the *bubur*

pedas is very suitable for consuming as a breakfast food, generally is safe for toddler and kids aged 4-9 and for diabetics. The results of this study is expected to be part of the Ministry of Health policy of The Republic of Indonesia to be able to popularize *bubur pedas* just like other traditional foods around The Nusantara started from 2018.

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EFFECTIVENESS OF TOBACCO EXTRACTS AS BIO PESTICIDES WITH VARIOUS CONCENTRATIONS IN CONTROL OF *Dasychira inclusa*

Sri Ngapiyatun^{a*}, Nur Hidayat^a, and Fadli Mulyadi^a

^aSamarinda State Polytechnic of Agriculture, Indonesia.

*Corresponding author : ngapiyatun.77@gmail.com

ABSTRACT

Dasychira inclusa is an important pest in oil palm cultivation, because its attacks can cause loss and decrease in production. In controlling pests, farmers generally use chemical pesticides because the results are faster and more practical, the negative impacts will cause pest resistance, and environmental pollution. This study aims to determine the concentration of bio pesticides from tobacco extracts that are best in reducing the caterpillar's palatability in the laboratory and oil palm plantations. This research was conducted at the Laboratory and in the MuaraBadak oil palm plantation, the study period was 5 months starting from February 13 to July 13, 2018 using a completely randomized design consisting of 5 concentration treatments: control, 5%, 10%, 15% and 20% with 5 repetitions. The results showed that the best bio pesticides that could reduce the caterpillar's palatability were bio pesticides from tobacco extracts with a concentration of 20% which could control the palatability of fire caterpillars seen from the activity of caterpillars that were initially agile and on day 1.8 (2) dead caterpillars, and do not want to eat palm leaves from day 2 after application of bio pesticides. As for applications in oil palm plantations, caterpillars do not want to eat palm leaves that have been treated which is indicated by the absence of bites / holes in the palm leaves.

Keywords: Dasychira inclusa, Oil Palm, Tobacco Extract, Bio Vegetable Pesticides

INTRODUCTION

Consumer concerns have led to an explosion of demand for organic products and have increased policy makers' awareness of the potential benefits of organic agriculture. (Haring et. al., 2001). The core factors that strengthen the development of the organic sector are strong consumer demand combined with organized organic production chains, (Tzouramani, et al., 2008). Certified organic pesticides often do not have efficacy and lack effectiveness, so the use of more pesticide applications is needed. However, if plants that are converted to organic production are of less high value, agricultural areas can be chosen which will have a minimal impact on the environment and may offer a much higher profit potential (Wright, et.al., 2012).

Palm oil is a plantation crop commodity which has an important meaning for the Indonesian people because it is a vegetable oil-producing plant. Oil palm fruit can be processed into palm oil which is used from fruit flesh (mesocarp) and from palm kernel or endosperm. Palm oil can also be processed into ingredients for butter, cooking oil, textile, pharmaceutical, cosmetics, and various other products. In the cultivation of oil palm, there are a number of obstacles so that crop productivity is low. One factor that causes the low yield of palm fruit is

pest attack. Important pests that attack oil palm plants include fire caterpillars.

In controlling fire caterpillars, farmers / planters generally use synthetic insecticides because they are more effective, quickly find the results, and the application is relatively easy. However, the use of synthetic insecticides can cause adverse side effects, such as the emergence of resistance to target pests, main pest resurgence, secondary pest explosions, and the occurrence of environmental pollution (Oka, 1995). Therefore, it is necessary to develop more effective and environmentally friendly control methods.

The use of bio pesticides is an alternative to control insect pests. Bio insecticides are relatively easy to obtain, safe for animals not targeted, and easily decomposed in nature so that they do not cause side effects (Kardinan, 2002).

In this study, the manufacture of bio pesticide extract from tobacco to overcome the caterpillar palatability that attacks many oil palm plants based on the results of research in the first year that bio pesticides from tobacco extracts are the best in controlling the caterpillar's palatability for laboratory scale, ie caterpillars die on the day 1st after application, it is suspected that tobacco contains nicotine compounds which are poisons that can kill fire caterpillars (*Dasychira inclusa*).

According to Kardinan. A (2000), that tobacco contains a toxic substance called nicotine,

the highest nicotine concentration is found in twigs and leaf bones. Tobacco can be repellent (insect repellents), fungicides, and akarisisida which work as contact, stomach and respiratory toxins, and are systemic.

This follow-up study to see the effectiveness of vegetable pesticides that can kill fire caterpillars is by looking at the right concentration, so that further research is carried out to determine the right concentration (5%, 10%, 15%, and 20%). This research was carried out in the laboratory and field / oil palm plantation.

This study aims to determine the concentration (5%, 10%, 15%, and 20%) of bio pesticides from tobacco extracts that are best in reducing the palatability of fire caterpillars in laboratories and direct oil palm plantations.

The benefit of this research is that it can determine the proper concentration of bio pesticides in controlling the caterpillar palatability in laboratory and field scale, can produce / make environmentally friendly bio pesticides from tobacco extracts to control the caterpillar palatability in an easy and simple way, and can provide information to the wider community of environmentalists that we can make or mix bio pesticides from tobacco to reduce the palatability of fire caterpillars that often attack oil palms.

MATERIAL AND METHODS

Time and Place of Research

This research was carried out in two places, namely in the laboratory of Soil and Water Science (for the manufacture and application of vegetable pesticides), and in the Muara Badak oil palm plantation (for sampling fire and palm leaf caterpillars, as well as a place for direct application of bio pesticides in oil palm plantations). The duration of research is 5 months, starting from February 13 to July 13, 2018 which includes preparation of tools and materials, manufacturing of bio pesticides, application of bio pesticides and data collection.

Tools and Materials

The tools used in this study were glass cups, measuring cups, plastic pots, plastic boxes, homogenizers (blenders), centrifuges, dryer freezers, pipettes, office stationery, and cameras.

The materials used in this study were oil palm plants, fire caterpillars obtained from the results of breeding in the laboratory, tobacco, NPK fertilizer (urea, TSP, and KCl), distilled water, and methanol.

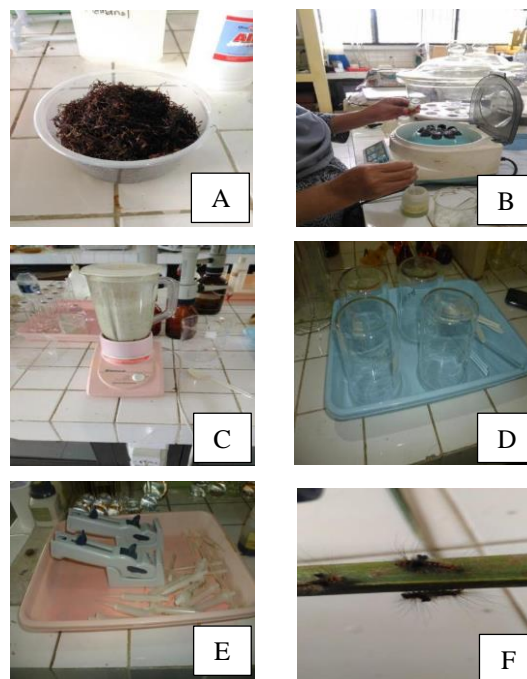


Figure 1. Research tools and materials (a. Ingredient pests, b. Centrifuges, c. Blenders, d. Glass cups, e. Pipettes, and f. fire caterpillars).

Research Procedures

Research Design

This study used a completely randomized design (CRD) consisting of 5 concentration treatments: 0% (control), 5%, 10%, 15%, and 20%, which were repeated 5 times. The parameters observed were caterpillar palatability which included: caterpillar activity, feeding activity, and the day when caterpillars died.

How to make bio pesticide extract

Fresh vegetable ingredients as much as 25 g were chopped and then extracted with 100 ml of methanol as solvent and given 20 ml of liquid detergent for 15 minutes. Extraction is done using a blender. Extraction results were centrifuged for 20 minutes at a speed of 3,000 rpm, then evaporated using a dryer freezer to a volume of approximately 1 ml, then dissolved then diluted using distilled water to a concentration of 5% and then the solution was ready for use for treatment.

Application of bio pesticide extract.

Laboratory Scale Research

The leaves of oil palm plants as much as three leaves were dipped into tobacco extract according to the concentration treatment (0%, 10%, 15%, and 20%) for 30 seconds. Then put in a plastic box measuring 14 cm x 14 cm x 5 cm. Furthermore, the leaves were infested with 1 Laboratory Scale Research Laboratory caterpillar

for each treatment, then the plastic box was closed and ventilated with gauze. The next day the leaves are replaced with new leaves, so on until 7 Days After Application (DAA). Each treatment was repeated 5 times.

Fild Scala Research

Palm oil that is not attacked by fire caterpillars was given a plant-based pesticide treatment in accordance with the best concentration in controlling fire caterpillars in laboratory-scale research by means of tobacco extract sprayed onto the leaves of oil palm plants that were not attacked according to treatment, then oil palm plants were given caterpillars. Then observations were made for 3 months

The parameters observed

The parameters observed in this study were the level of fire caterpillar palatability observed based on feeding activity, days of caterpillar die, and caterpillar activity in the period 1-7 DAA.

Fild Scala Research

The parameters observed in this study are whether or not there is an attack of fire caterpillar on oil palm leaves that can be seen from the hole or caterpillar bite marks with a duration of observation 3 months after application. , days of caterpillars die, and caterpillar activity in periods of 1-7 days after application of bio pesticides.

RESULTS AND DISCUSSION

Observe eating caterpillars

The results of the study showed that the most abundant treatment of bio pesticide concentrations was found in P0 treatment (control), that was caterpillar until 6th day, while the least caterpillar was found in P4 treatment (20% concentration), namely caterpillar eating only on day 1 after application of bio pesticides, can be seen in Table 1.

Based on the observations and variance that can be seen in Table 1 shows that the treatment of the concentration of bio pesticides applied to the palm leaf which is the most eaten by caterpillars is the treatment of P0 (control), namely eating caterpillar until the 6th day after application of bio pesticides. Based on the results of variance, treatment P0 (control) was significantly different from all treatments of bio pesticide concentration both in the treatment of P1, P2, P3 and P4 for caterpillars that eat the longest application leaves (days). It is suspected that in the control treatment or without treatment of bio pesticide concentration, palm leaves are really safe and healthy to be consumed by fire caterpillars so that the control treatment is safe in

eating the leaves so that the condition of a caterpillar remains agile and aggressive to eat leaves in meeting the life needs of the caterpillar until the end of the observation remains aggressive and appetite remains.

Table 1. Average caterpillar after vegetable pesticide application

| Treatment | Dead Caterpillar Day |
|-----------|----------------------|
| P0 | 6a |
| P1 | 4b |
| P2 | 3c |
| P3 | 2d |
| P4 | 1e |

Note : The average number followed by the same letter shows no significant difference at the 5% alpha level of Duncan test = 0.88. *P0 = control ; P1 = 5% concentration ; P2 = 10% concentration ; P3 = 15% concentration ; P4 = 20% concentration.*

The treatment of bio pesticide concentration which was applied to palm leaves which was least eaten by caterpillar was P4 treatment (concentration of 20%), namely caterpillar eating only on 1 DAA. Based on Table 1 above, P4 treatment is significantly different from all treatments both P0, P1, P2, and P3. It is suspected that P4 treatment (concentration of 20%) is the right concentration in controlling fire caterpillars where the caterpillar does not want to eat palm leaves because loss of appetite caused by the provision of bio pesticides from tobacco extracts is anti-feedant. According to Sitompul, et al (2014) that nicotine contained in tobacco is a nerve poison, contact poison, stomach poison, fumigant and can penetrate quickly into the skin, this compound is effective in controlling the aphids and other soft-bodied insects. So that if the caterpillar is exposed to or inhaling nicotine from the tobacco extract, it causes fire caterpillars to be exposed to toxins which results in caterpillars losing their appetite.

Anonymous (2012) suggests that chemical compounds in tobacco that can be extracted with water are alkaloid, saponins, diploidoid and imulin flavonoids. Alkaloid in tobacco is nicotine, norm nicotine, anabasin. Nicotine is an alkaloid active compound in tobacco which are toxic and have a bitter taste that is used as an insecticide. This is consistent with the opinion of Anggraini, et al. (2013) that tobacco filtrate contains active compounds such as terpenoids which have a bitter taste and are anti-feedant which can inhibit caterpillar eating activity, which is why tobacco extracts can cause mortality in caterpillars.

Observation of Dead Caterpillar Day After Application

The results of the study showed that the fastest treatment for killing caterpillars was P4 treatment, which was the treatment of 20% bio pesticide concentration, the average caterpillar died at 1.8 days. The slowest treatment is found at P0 (control), the caterpillar dies on the 6th day after the application of bio pesticides. Can be seen in Table 2.

Based on the results of variance showed that the fastest concentration treatment to kill / kill the fire caterpillar was the treatment of P4 (concentration of 20%) that the caterpillar died on the 1.8th day. The treatment of P4 was significantly different from all treatments both P0, P1, P2, and P3.

Table 2. Average dead caterpillar (days)

| Treatment | Dead Caterpillar Day |
|-----------|----------------------|
| P0 | 6,4a |
| P1 | 4,4b |
| P2 | 4,2bc |
| P3 | 3,2c |
| P4 | 1,8d |

Note : The average number followed by the same letter shows no significant difference at the 5% alpha level of Duncan test = 1.22. P0 = kontrol; P1= 5% concentration; P2 =10% concentration; P3= 15%concentration; P4= 20%concentration.

The treatment of P4 (concentration of 20%) is the most rapid killing of fire caterpillars compared to other treatments, this is thought at a concentration of 20% is the right concentration in killing fire caterpillars, where the concentration of 20% is the solution is more concentrated than the other concentrations, so causing fire caterpillars to die faster. This shows that the higher the concentration of tobacco extract, the higher the power to kill them.

According to Rusdy (2010) states that the higher the concentration of tobacco extracts, the higher the active ingredients they contain and the higher the power to kill them.

According to Susilowati (2005) that the higher the concentration of tobacco leaf extract affects its effectiveness as an insecticide. Nicotine in tobacco plants is a toxic material that can be used as an insecticide, fungicide, akarisisida which works in contact, the stomach, and acts as a fumigant which will evaporate and penetrate directly into the integument.

Meikawati, et al. (2013) argue that the active content of nicotine content found in tobacco leaves can kill armyworm with a certain concentration higher than in the control treatment.

The longest surviving treatment was treatment P0 (control), the caterpillar died on 6 DAA, treatment P0 was significantly different from all treatments both P1, P2, P3 and P4. This is presumably a treatment that does not provide plant-based pesticide treatment so that fire caterpillars are free to eat palm leaves to fulfill their daily needs for food so that fire caterpillars can survive until the 6th day.



Figure 2. *Dasychira inclusa* before application (a), *Dasychira inclusa* after application (b), and *Dasychira inclusa* after application (c).

Observation of Caterpillar Activity

The results of the study showed that the activity of caterpillars that remained agile and aggressive until the end of the observation was treatment P0 (control) which was both agile and aggressive until the end of the observation, while the treatment with weak activity was found in treatment P4 (concentration of 20%) the condition Caterpillars that were initially agile and then weakened after being treated, namely on the second day the caterpillar had died, can be seen in Table 3 below.

From Table 3 shows that the activity of fire caterpillars which experienced the most rapid

decline in activity was the treatment of bio pesticides from tobacco extracts with a concentration of 20%. While the longest surviving activity of fire caterpillars is good control that is the condition of caterpillars remains

healthy and agile / aggressive until the end of the observation, that is on the 6th day, said to die because the leaves are eaten out.

Table 3. Caterpillar Activity Data After Vegetable Pesticide Application

| Treat- ment | Early | | Caterpillar Activity (Day -) | | | | | |
|----------------|-----------|-----------|------------------------------|-----------|-----------|-----------|-----------|-----------|
| | Condition | Activity | 1 | 2 | 3 | 4 | 5 | 6 |
| P0 | Healthy | Agressive | Agressive | Agressive | Agressive | Agressive | Agressive | Agressive |
| P1 | Healthy | Agressive | Agile | Weak | weak | weak | die | die |
| P2 | Healthy | Agressive | Agile | Weak | weak | l weak | die | die |
| P3 | Healthy | Agressive | Agile | Weak | die | Mati | die | die |
| P4 | Healthy | Agressive | weak | Mati | die | Mati | die | die |

Description: Healthy is agile caterpillar, fresh physical appearance, bright caterpillar color and plenty of food. P0 = kontrol ; P1 = 5% concentration; P2 = 10% concentration; P3 = 15% concentration; P4 = 20% concentration.

The treatment of bio pesticides with tobacco extract with a concentration of 20% (P4) was the fastest to experience a decrease in activity, in which the fire caterpillar whose condition was initially healthy and agile / aggressive after being given direct treatment weakened and died on the 2nd day after application. This is allegedly because vegetable pesticides contain nicotine toxins so that when it comes to fire caterpillars it directly results in the condition of the caterpillar that is nicotine poisoning and has an impact on the weakening of caterpillar nerves such as breathing poison, decreasing appetite so that the caterpillar's condition weakens and will eventually die.

The lowest feeding activity was found in the treatment of bio pesticides from tobacco extract with a concentration of 20% (P4), this was allegedly due to the effect of the application of vegetable pesticides from tobacco extract with a concentration of 20%, namely concentrations that are more concentrated to palm leaves causing caterpillars do not want to eat the leaves because palm leaves have a strong scent, which makes caterpillars lose their appetite, and makes the taste of the leaves which are given bio pesticides taste bitter which consequently the caterpillars do not want to eat and will eventually die.

According to Rusdy (2010) that the higher the concentration of tobacco extract, the higher the active ingredient it contains and the higher the power to kill it. In line with Pracaya's opinion (2008) that tobacco and stem plant leaves have high nicotine, especially in the stalk and leaf bones, with high extract concentrations, the compound content is also higher. Then with a higher concentration will kill the caterpillar more quickly.

Cardinals. A (2000), states that tobacco leaves contain toxic ingredients called nicotine. The highest nicotine concentration is found in twigs and leaf bones. Tobacco can be replent. Fungicides, acaricides that work in contact, stomach and respiratory toxins, and are systemic.

The longest treatment with good activity, namely healthy and aggressive conditions until it survived until the 6th day, was a good control treatment that was the condition of caterpillar that remained healthy and agile / aggressive until the end of the observation, namely on the 6th day, said to die because of leaves the one eaten is gone. Where is the condition of healthy face fire caterpillars and caterpillar eating power that remains high and is still agile / aggressive. This is presumably because the control treatment is without giving pesticides so that the caterpillar's condition remains healthy and the appetite is maintained, which is why the control treatment persists until the end of the observation. Day 6 is said to die because the caterpillar runs out of leaves to eat so the caterpillar dies.

Pesticide Application in Palm Oil Plantation

The results of laboratory studies showed that the best treatment was P4 (concentration of 20%). The application of bio pesticides from tobacco extract with a concentration of 20% applied to oil palm plantations in accordance with the concentration treatment shows that palm leaves that were initially eaten or attacked by fire caterpillar pests after being treated with a concentration of 20% showed that palm leaves were not attacked or eaten by fire caterpillars which can be seen from the absence of fire worm bite holes or marks. It is suspected that the application of bio pesticides with tobacco extract with a concentration of 20% to oil palm plants

attacked by fire caterpillars is the right concentration in controlling fire caterpillar pest attacks so that fire caterpillars do not want to eat palm leaves caused by nicotine content found in tobacco extracts. caterpillars lose their appetite caused by bitter tastes, unpleasant smells, and contact poisons that cause caterpillars not to approach and eat the palm leaves.



Figure 3. Oil palm plants before and after the application of bio pesticides from tobacco extracts.

According to Endah and Heri (2000), the higher the concentration of tobacco extract, the existing anti-feedant terpenoid compounds are also higher, thus eating activity will decrease, in addition to the tobacco extract there are other active compounds namely nicotine which is an active compound which can kill insects. Supported by the opinion of Kardinan (2004) that nicotine works as a fumigant which will evaporate and penetrate directly into the integument of a caterpillar and will attack the caterpillar's respiratory system. Nicotine will enter the body of

the caterpillar through spiracles in the trachea system and cause the caterpillar's nervous system to be disturbed, this is what causes mortality in the caterpillar.

CONCLUSIONS

The best bio pesticides that can reduce the caterpillar's palatability are bio pesticides from tobacco extract with a concentration of 20% which can control the caterpillar's palatability seen from the activity of the initially agile caterpillar and on day 1.8 (2) the caterpillar dies, and does not want eat palm leaves from 2 days after application of bio pesticides. As for applications in oil palm plantations, caterpillars do not want to eat palm leaves that have been treated which is indicated by the absence of bites / holes on the palm leaves.

RECOMMENDATION

There needs to be research on the technique of application of vegetable pesticides directly to oil palm plantations which are attacked by fire caterpillar pests.

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A PLAIN DESIGN OF ELECTROLYSIS APPARATUS TO REDUCE AMMONIA CONTENT IN EFFLUENT FROM TOFU INDUSTRY

Muflihah^a and Sulistyo Prabowo^{b*}

^a*Chemistry Education, Faculty of Education, Mulawarman University, Indonesia*

^b*Department of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Indonesia*

*Corresponding author : sprabowo@faperta.unmul.ac.id

ABSTRACT

One of the environmental problems the tofu industries encounter the presence of an unpleasant odor due to the production of ammonia (NH₃) gas from wastewater they produce. Several previous studies have proven that electrolysis methods can breakdown this harmful gas into more environmentally friendly compounds. As the results of literature reviews and some comprehensive research, this paper comes up with a plain design apparatus useful to reduce ammonia content in wastewater using the electrolysis method.

Keywords : ammonia, electrolysis, tofu industries, waste

INTRODUCTION

One of the most crucial environmental pollution problems in Indonesia is effluent discharge from home-based industries. It is because of that almost all home industries do not practice proper wastewater treatment; instead, the effluent is frequently disposed of in free water bodies which leads to environmental detriment.

Among the real case of wastewater, discharge into waters is what occurs to some tofu industries in the city of Samarinda, Kalimantan. Initially, the effluent of tofu production processes generated in the washing process, boiling to pressing which is commonly discharged into the surrounding water bodies without proper treatment. This practice eventually causes pollution to the water by tofu liquid waste. This environmental pollution is indicated with the presence of a strong odor of ammonia gas resulting from protein decomposition of tofu liquid waste.

A number of studies have been conducted to reduce ammonia levels in liquid waste, one of which is considered rather effective is to apply the electrolysis process (Vitse et al., 2005). Electrolysis is the process of decomposition of chemical compounds by means of the electric current. Electrons flow from and to the power supply, but not between the two electrodes. Meanwhile, the cation will flow to the cathode and be neutralized by the addition of electrons (reduction) at the cathode, whereas the anion will flow to the anode and release electrons (oxidation) to become neutral. The application of electrolysis methods in wastewater treatment is unique because it depends on the reduction potential; hence, the electrolysis process can

decompose various substances. Furthermore, based on a number of research results, it is not only focused on reducing ammonia levels, but it also has come to the further stage to utilize the hydrogen gas resulting from ammonia electrolysis for the purpose of renewable fuels (Vitse et al., 2005; Hanada et al., 2010).

On the same topic, Li et al. (2014) conducted research on ammonia electrolysis using zeolite electrodes. A total of 6 – 100 mg of N/L ammonia was able to be removed within 1 – 7 hours under study conditions. Furthermore, the application of electrolysis in a wastewater treatment plant has succeeded in reducing ammonia levels from 27.8 mg N/L to 0.5 mg N/L after 1.5 hours of electrolysis. Likewise, Riwayati and Ratnawati (2010) also conducted research and came to the conclusion that electrolysis techniques are very likely to be commercially applied in reducing ammonia levels. Yet, various variables have to be taken into accounts, such as the type of electrode, pH, catalyst and electric current being used. Muflihah and Tindangen (2015) found that the voltage used in the pure ammonia electrolysis process is linearly proportional to the conversion of pure ammonia. Meanwhile, Noor and Nurlaili (2015) also revealed that increasing KOH concentration as a catalyst in pure ammonia electrolysis was directly proportional to the increase in pure ammonia conversion.

Using the same principle, the application of electrolysis methods in the treatment of liquid waste generated from tofu production is expected to reduce ammonia content; thus, the levels are safer for the environment. In their study, Muflihah et al. (2015) revealed that electrolysis can reduce

ammonia levels in tofu liquid waste by a conversion rate of up to 82.60%.

However, one of the constraints of the above studies is that they still utilize commercial sources of electricity, resulting in high total cost in the wastewater treatment process. Therefore, this present study is aimed at finding the more economical electrolysis method in wastewater treatment by using more affordable sources of electricity. Instead of using commercial sources, the electrolysis process is designed to utilize electricity generated by solar panels to overcome the high operational cost. This plain design of the prototype is expected to be used as a model in processing tofu industrial wastewater at a laboratory scale.

LITERATURES REVIEW

Tofu production always generatestofu sludge as solid waste and a considerable amount of liquid waste. While a solid waste of tofu (sludge) is usually used as a source of other processed food or animal feed, it is not for the liquid waste generated through the process of washing, boiling, pressing and tofu molding. Most part of the liquid waste is immediately discharged into the river without going through proper wastewater treatment. It is certainly hazardous for the environment since the liquid contains a number of harmful chem

icals, one of which is ammonia or NH_3), as well as other hazardous substances, such as organic matter which causes high BOD and COD. In addition, the temperature of liquid waste is considered quite high compared to the free water bodies' temperature.

In a thesis containing study report conducted by Sani (2006), she revealed that most of the sources of liquid waste generated by tofuf-making industries are thick liquids which are separated from lumps of tofu called 'whey'. This liquid waste is often disposed of directly without proper treatment prior to discharge; thus, in time it will produce a foul odor and pollute the river water. Furthermore, still in the same reference, she presented the characteristics of liquid waste as shown in Table 1.

In addition to the parameters listed in the table above, it is found that there is also a considerable amount of ammonia in the tofu liquid waste. Husni and Esmiralda (2016) in their study on tofu wastewater found that industrial wastewater of tofu production contains ammonia for up to 2.21 – 16 mg/L. Similarly, research's finding of Christin (2015) also found the figure of 5.29 mg/L of ammonia content. Given this value, it is very far exceeding the ideal level as stated in

Government Regulation of the Republic of Indonesia Number 82 the Year 2001 about the Management of Water Quality and Control of Water Pollution, in which, it is stipulated that maximum limit of ammonia is 0.5 mg/L. In fact, for some species of fish, the ammonia content should not even be more than 1 mg/L for their sustainable living.

Table 1. Characteristics of industrial effluent of tofu.

| Parameter | Maximum value | Maximum permissible limit |
|-------------|---------------|---------------------------|
| Temperature | 38°C | - |
| BOD | 150 | 3 |
| COD | 275 | 5.5 |
| TSS | 100 | 2 |
| pH | | 6.0 – 9.0 |

Source: Sani, 2006

Given the fact that the tofu wastewater produced is directly discharged into the river, it becomes a great concern for the environment. Furthermore, the dumping location is also very close to the settlement, particularly to the residents around Karang Mumus River. When used for domestic purposes, the polluted river water cause a great impact on health since the content of the pollutants exceed the value of the maximum permissible level. During dry season, the decrease in water discharge turns the water black and gives off unpleasant odors to the surrounding. This foul air can be caused by ammonia evaporation which the river water contains since its concentration may reach 4.56 mg/L.

Albeit ammonia is a hazardous substance for life, it has the potential of being used as a renewable energy source. This is due to the fact that ammonia consists of hydrogen atoms which are known to be very environmentally friendly fuels. As such, when the hydrogen-based fuels are combusted, it will decompose into the water as a byproduct. The utilization of ammonia as a new renewable energy source has been carried out by some researchers, such Botte from Russ College of Engineering and Technology (Vitse et al., 2005). In his research, Botte used an electrolysis process to produce Hydrogen gas fuel cells from wastewater containing ammonia.

Likewise, in Indonesia, electrolysis of wastewater containing ammonia has also been carried out by some researchers. However, the process ends up to the decomposition of ammonia to Nitrogen and Hydrogen gas with the aim of reducing wastewaterharmful effect without taking advantages from the components decomposition

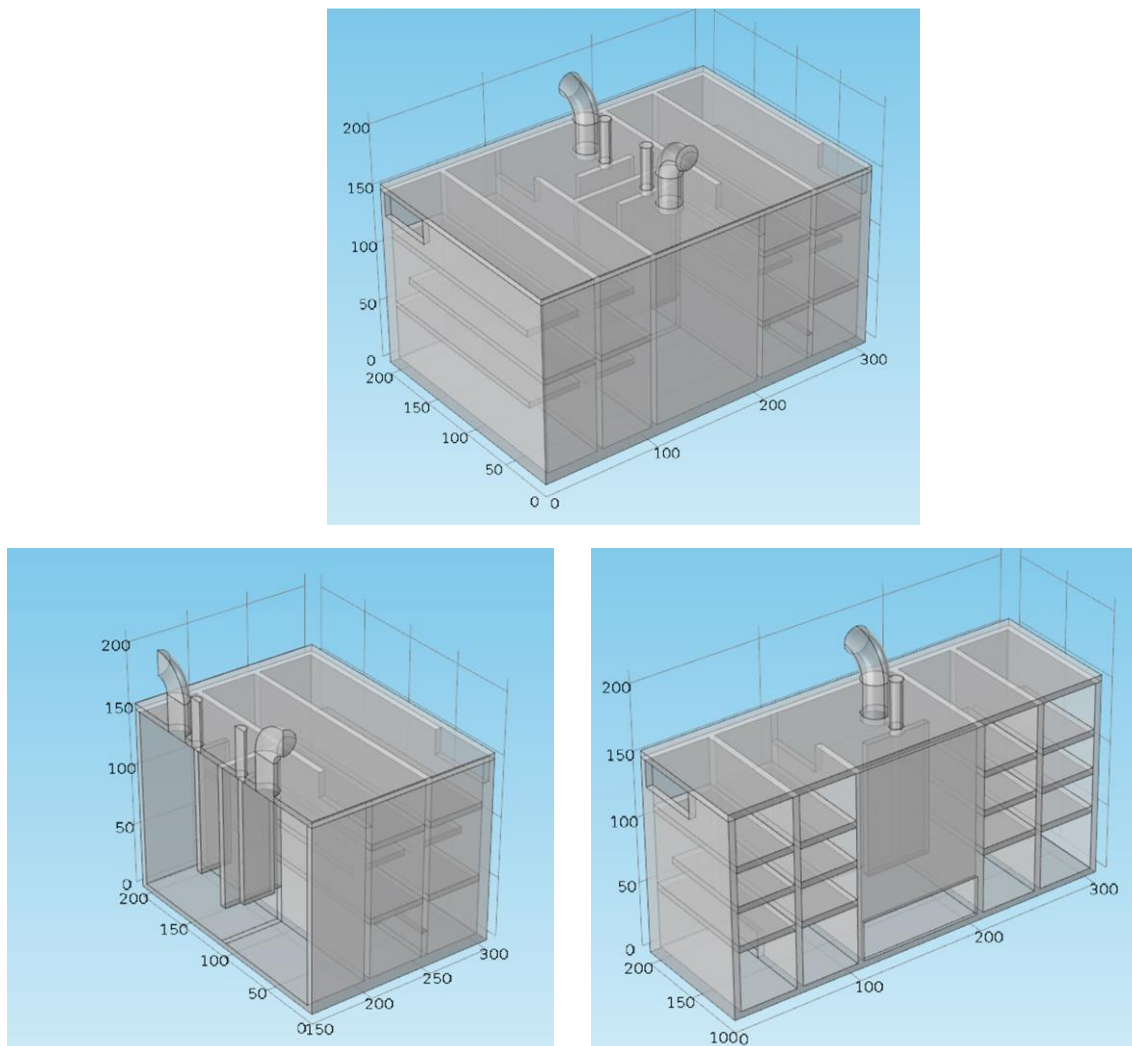


Figure 1. Laboratory scale design of ammonia wastewater treatment apparatus

of wastewater. On the other hand, the process of electrolysis has been carried out to produce Hydrogen gas from ammonia. Yet, the ammonia being used is in high purity, rather than decomposed materials from wastewater treatment which contains ammonia.

Similar research has also been carried out by Muflihah et al. (2015) to determine the effect of different voltages on pure ammonia concentration. It comes to the conclusion that the decrease in ammonia levels in the liquids linearly proportional to the voltage used in the electrolysis process. In other words, it can be inferred that the higher the voltage used, the more pure ammonia is converted. A study on the same topic was conducted by Nurlaili and Noor which showed that the use of different concentration of KOH as a catalyst in the electrolysis process also affected pure ammonia levels it produced. Using a higher concentration of KOH, the more pure ammonia

was yielded. When applied to liquid waste, the electrolysis method can convert ammonia to 73.66% (Muflihah et al., 2015).

DESIGN OF AMMONIA WASTEWATER TREATMENT APPARATUS

One of the methods of ammonia wastewater treatment being developed in this present study is based on the process of electrolysis. The design of the apparatus is presented in the following figure (Figure 1). The plain design of apparatus consists of tubs arranged in series which can be added according to the results of ammonia removal in each tub.

The process of ammonia reduction can be carried out through a continuous or batch system. In this study, the wastewater which contains ammonia flows into tub I. Each tub consists of three compartments. The first and third compartments are labyrinths that function to stir

the liquid which flows in. The second compartment is an electrolysis cell which is made airtight but can be opened for cleaning and electrode replacement purposes. At the top of each electrode is facilitated with an exhaust channel for gases produced during the electrolysis process. The liquid flow from the electrolysis cell will be drained out to the next tub and will undergo repeated processes as in the first bath. In the batch system process, the liquid flow from the last tub is pumped back into the first tub until the ammonia level reaches a safe limit and can be released into free water. On the other hand, a continuous process can be carried out by modifying the variables which affect the rate of electrolysis, for instance, by increasing the number of tubs and optimizing the variable of electrodes, voltage source, temperature or other variables.

Finally, the electrode cells are connected to a power source of electricity generated by solar panels. Electrolysis is the process of converting electrical energy into chemical energy with the aim of converting chemical substances by oxidation or reduction; thus, the desired products are formed. Through the electrolysis process, ammonia in wastewater can be reduced by converting the ammonia into Nitrogen and Hydrogen gas.

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GLYCEMIC INDEX AND FUNCTIONAL PROPERTIES OF JELAI (*Coix lacryma-Jobi L*)

Bernal Saragih^{a*}

^aDepartment of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Indonesia

*Corresponding author : saragih_bernatal@yahoo.com

ABSTRACT

Jelai (*Coix lacryma-Jobi L*) is a kind of cereal for animal feed, malt producer, and as a health food. Jelai is a member of the grain tribe (Poaceae). Jelai plants can grow in all types of soil, starting from a height of 0 m above sea level to 1,500 m above sea level. The purpose of this study was to determine the jelai glycemic index and functional properties from various reference sources. Jelai obtained from Loa Kulu, Kutai Kartanegara Regency East Kalimantan. Jelai seeds are cooked in a ratio of 500 ml of water and 500 g of jelai seeds with a method of cooking with rice cookers. The results of the analysis obtained jelai has a glycemic index of 54.69 (low category). These results indicate that jelai is potentially hypoglycemic and from the reference source obtained jelai (coix) can reduce cholesterol, anti-proliferation of cancer cells, cytotoxicities, anti-oxidant, anti-allergic, anti-obesity, anti-tumor effects.

Keywords: jelai, glycemic index, diabetes, cholesterol

INTRODUCTION

Public attention to food needs is increasing and accompanied by healthier food needs are also increasingly high. Food sources from carbohydrates are generally rice, cassava, corn, sago and so on. Research on foodstuffs, especially the source of carbohydrates is increasing, because many opinions show that high consumption of carbohydrates is more than 55% of daily energy needs, being one of the causes of diabetes in humans. Changes in eating behavior, with the tendency to consume fast food also become the public's attention. Public awareness of healthy food encourages researchers and the food industry to continue to seek, develop new food innovations

One type of food that has not been widely developed in Indonesia and in East Kalimantan is jelai (*Coix lacryma-jobi L.*) in the case of this plant has long existed in Indonesia and East Kalimantan. Usually, these plants are planted in addition to rice or outside the land of rice plants with the aim that disturbing pests such as birds are deceived, because of the similarity of stems and leaves with rice. The use of this plant from seeds is also used as handicrafts or souvenirs in the form of bracelets, necklaces and so on. Jelai at the birthplace of the author of Simalungun Regency, North Sumatra, was named sikkorung, singkorung (Tapanuli), and cingkeru (Karo). In East Kalimantan with the name jelai. There are two main varieties of the species, one wild and one cultivated. The wild variety, *Coix lacryma-jobi* var. *lacryma-jobi*, has hard-shelled pseudocarps-very hard, pearly white, oval

structures used as beads for making rosaries, necklaces, and other objects. The cultivated variety of *Coix lacryma-jobi* var. *ma-yuen* is harvested as a cereal crop, has a soft shell, and is used medicinally in parts of Asia (Arora, 1977). Seed coix is otherwise called as barley-coix because of its size and appearance with Barley. Plant coix is also like Maize plant. Coix may be both perennial and annual in nature. Its plant is widely used as nutritive forage and medicine (Ching-Chuan, 2012).

Information about the benefits of jelai is growing, along with the amount of research carried out. One of our concerns about energy sources, especially carbohydrates, is its relationship to the increase in glucose after consuming these foods. Information about jelai glycemic index is very important to study, especially those that grow in Loa Kulu East Kalimantan and reviews related to jelai function.

RESEARCH METHODS

Time and place

The study was conducted at the Processing Technology Laboratory and Quality Control of Agricultural Products, Faculty of Agriculture, Mulawarman University. In March 2017.

Materials and tools

The material in this study was Jelai PJ-SR rice from Mr. Gunawan from Loa Kulu village, Kutai Kartanegara District, as many as 3 packs for Glycemic Index, glucose and aquades. The tools used are rice cookers, lancets, alcohol strips, accuchecks active

Research procedure

Rice is obviously cooked in a rice cooker with a ratio of 500 ml of water with 500 g of barley rice. After cooking the glycemic index was tested at 9 respondents. As standard food pure glucose is given. Glycemic index analysis. Test of blood glucose response of selected cereal with jelai rice comparison done on 10 subjects students who have normal blood glucose. Jelai rice produced is by giving blood glycemic response portion (50g) to volunteers who had under gone fullfasting except for water during the night (around 20:00 to 08:00). Volunteers are individuals who used normal, no diabetes, as many as 9 people, the method used to determine the glycemic response (Miller *et al.*, 1996) the blood sampling interval of 30 minutes 5 times (minutes to 0, 30, 60, 90 and 120) were 50 µl (finger-prick capillary blood samples method). Then the 3-day interval of the same is done by giving 50 g of glucose (standard) this is done to compare the blood glucose response between the jelai rice produced by the glucose.

RESULT AND DISCUSSION

Glycemic Index

The results showed a difference in the increase in blood glucose after consumption of jelai rice and glucose as standard food. The increase in blood glucose after consuming 30 minutes is higher than the consumption of barley rice (Figure 1). The increase in blood glucose after consumption of 30 minutes was higher in commercial cereals 39.83 mg/dL compared with cereal product research that is 13.42 mg/dL. A decrease in blood glucose after consumption of 60 minutes subjects was higher in commercial products 31.84 mg / dL, while cereal product research to 4.67 mg / dL. These results indicate that cereals these results slower release of blood glucose, so the potential for food in diabetic patients (Saragih *et al.*, 2017).

The results of the Jelai PJ-SR glycemic index (IG) analysis were determined by an incremental area under the blood glucose response curve (IAUC)/Kit Glucose / Accu Check, obtained 54.69 (low IG). These results indicate that jelai is very potential for food for diabetic patients. Study of Saragih *et al* (2013) showed that differences in reduction of blood glucose levels also found in volunteers who consumed black adaninstant rice by 14.2 mg/dL, where as the provision of a reference food (pure glucose) of 71.5 mg/dL, this indicates that the reference food provides a rapid rise in glucose levels and decreased back toward normal as well

with a fast time. Instead of instant rice functional blackad an provide availability of blood glucose in the blood longer available (slow release).

Jelai (*Coix lachryma- Jobi L.*) is a kind of traditional medicinal and edible grain resources. In recent years, studies have shown that it has anti-oxidant, anti-allergic, anti-obesity, anti-tumor effects and so on (Kim *et al.*, 2012; Hsia *et al.*, 2009; Du *et al.*, 2007).

Reviews Functional Properties of Jelai

Nutrition

Jelai contains the nutritional composition in every 100 g, with a protein content of 15.4 g, Carbohydrate 65.3 g, Ca 25 mg, p 435 mg, Fe 5 mg, B1 0.28 mg, B2 0.19 mg, and Niacin 4.3 mg (Tajalifar, 2018). Active ingredients of jelai which have been found are mainly CoixanA, B, C, neutral glucan 1-7, acidic polysaccharides CA-1 and CA-2, coixenolide, coixol, lignans, phenols, unsaturated fatty acids, benzoxazine ketones, triterpenoids open ring compounds such as squalene, sterols, adenosine and amino acids (Lifeng *et al*, 2014).

Diabetes/Hypoglycemics

A water extract of the oriental crude drug “yokui-nin” (coix seeds), *Coix lachryma-jobi* var, *ma-yuen* seeds, disclosed a marked hypoglycemic action when administered to mice. Fractionation of the extract, by monitoring the pharmacological activity, led to the isolation of three glycans, coixans A, B and C. These components elicited remarkable hypoglycemic effects in normal and hyperglycemic mice treated with alloxan (Takahashi *et al*, 1986). Studies of Cho *et al* 2014), showed prospective studies consistently showed a reduced risk of diabetes with high intakes of cereal fiber or mixtures of whole grains and bran. Study of Gilmore *et al*, 2014, showed that test the accuracy and precision of the intake-balance method to estimate EI during weight gain induced by overfeeding, showed the intake-balance method can be used to estimates of energy intake (EI) during a period of weight gain as a result of 40% overfeeding in individuals who are inpatients or free-living with only a slight underestimate of actual EI by 0.2–3.8%. In addition to the consumption of sugar and fat, meat and food process may also affect health. Coix is suitable for relieving muscle spasm and blood sugar regulations (Oka *et al.*, 2001; Yeh *et al*, 2006).

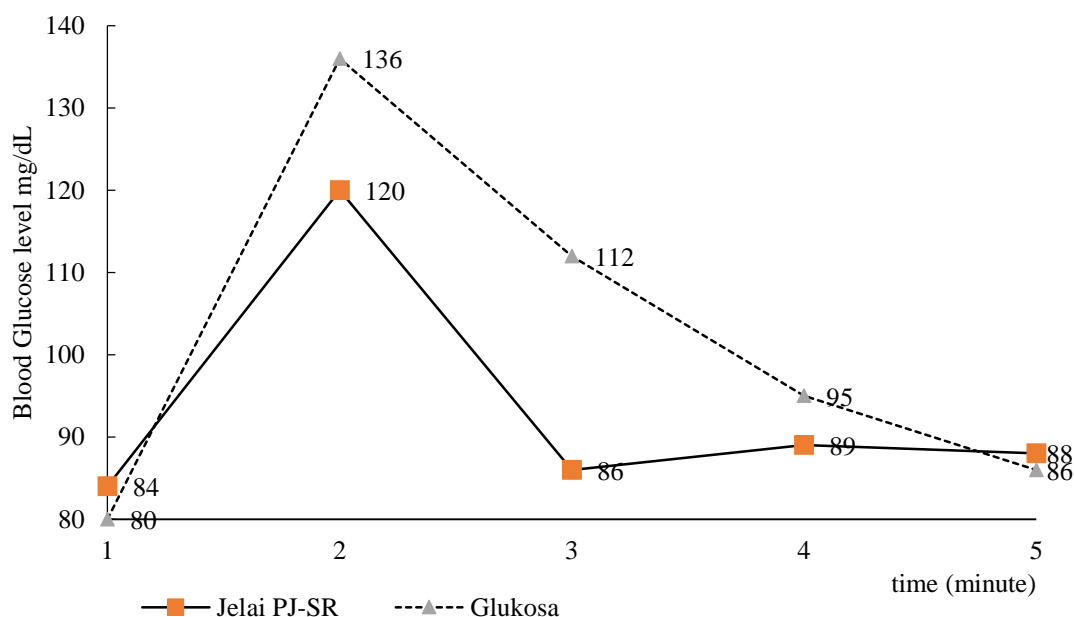


Figure 1. Blood glucose respon after consumption of jelai rice compare with glucose (standard)

Anti-tumor and cancer

Extract of the Coix plant is used in Chinese medicine for the treatment of cancer (Woo et al., 2007). Chang et al (2003) reported that adlay, which has anti-tumor properties, can inhibit sarcoma-180 tumors in mice. Methanol extracts of adlay husks have been shown to have anti-proliferative effects in U937 leukemia cells (Kuo et al, 2001) and in A549 lung cancer cells (Chang et al., 2003). Even though the total polyphenol content of jelai bran has been assessed, there is no evidence on the content ratio between the free and the bound polyphenols (Liang et al., 2009). In addition, Hidaka et al (1992), research has shown that consumption of adlay extracts can significantly enhance the activity of the body's T cells, then form the ability of natural killer cells. Besides these, adlay seed extracts can effectively suppress the generation of NO and oxygen free radicals by activating macrophages (Seo et al., 2000). Several studies have shown that Job's tears may have an anti-tumor effect. Some bioactive compounds in Job's tears, especially coixenolide, inhibited tumors, prevented cancer and protected against viral infection (Hung and Chang, 2003). Reduced colonic transit time has been implicated in a reduction in the incidence of colon cancer, as evidenced by populations consuming diets rich in fiber (Read, 1986).

Cholesterol

Jelai consumption effectively decreases serum cholesterol, triglycerides, and low-density lipoprotein cholesterol, increases high-density

lipoprotein cholesterol, lowers liver lipids, prevents fatty liver, and increases lipid excretion (Du et al., 2007). Polyphenol extract jelai exhibited a hypocholesterolemic action, inhibited of formation lipid peroxidation product and enhanced the activities of antioxidant enzymes and antioxidant capacities of serum and liver hypocholesterolemic rats (Lifeng et al., 2012). Whole grains such as jelai, may contribute to supply significant antioxidants to prevent oxidative stress, as grains are used as a staple food. Results could have a direct impact on grain consumption by increasing consumer awareness of the health benefits of grains (Huang et al., 2005).

Allergic

Jelai bran extract reduced the release of histamines and cytokines and suppressed the production of Akt. These combined effects influenced the signal transduction in RBL-2H3 cells, thereby revealing the mechanisms of the anti-allergic effects of adlay (Chen et al, 2012). Another study by Mouming et al, 2012. Jelai bran effect on allergic immune-regulatory on an OVA-immunized mice allergic model. Other Disease

Jelai is well known for their health benefits due to its rich antioxidant and high fiber content. Its plant is used for the treatment of abdominal bloating, constipation, diarrhea and also has anti-allergic properties (Yogendra, 2008). Study Fei Yu et al (2017) showed antioxidant activities of selected cereal phenolic extracts and mechanisms underlying the protective effects of adlay phenolic

extracts on H₂O₂-induced oxidative stress in human erythrocytes. Groups of mice were pre-fed with different diets, followed by feeding with NNK-containing drinking water for 8 months. The results indicated that feeding with a diet containing 30% of powdered adlay seed reduced the number of surface lung tumors by 50%. Taken together, these results indicate that the components of adlay seed exert an anticancer effect in vitro and in vivo and may be useful for the prevention of lung tumorigenesis (Chang et al., 2003). Lifeng et al (2014) research showed that the adlay extracts by different varieties had obvious anti-proliferative effects to tumor cells, and adlay samples themselves had no cytotoxicity in the tested experimental concentration range. Besides, adlay extracts inhibited the proliferation of HepG2 cells by regulating the cell cycle mediated by DNA polymerases adjustment factors such as PCNA and p21.

CONCLUSION

Jelai has a glycemic index of 54.69 in the low category and is good for diabetic patients. Jelai is very potential to be used as food, both as an energy source and as a healthy food. Barley can function as an antidiabetic, anti-cancer, blood glucose-lowering, anti-allergic and so on. Bioactive components of barley such as CoixanA, B, C, neutral glucan 1-7, acidic polysaccharides CA-1 and CA-2, coixenolide, coixol, lignans, phenols, unsaturated fatty acids, benzoxazine ketones, triterpenoids open ring compounds such as squalene, sterols, adenosine and amino acids are very potential to be extracted and further investigated the benefits for health

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THE ANTIOXIDANT ACTIVITY OF KARAMUNTING FRUIT AS A NATURAL DYES AND PRESERVATIVE FOODS

Elly Jumiati^{a*}, and Amarullah^b

^aDepartment of Agribusiness, Faculty of Agriculture, Borneo University, Indonesia

^bDepartment of Agrotechnology, Faculty of Agriculture, Borneo University, Indonesia

*Corresponding author : elly.j.husaini@gmail.com

ABSTRACT

The development of the food industry was currently progressed very rapidly. This was influenced by the level of public demand for food needs which increased at any time. Demand for these food needs was not offset by the safety of food consumed, because the product expired and has been infected with harmful microorganisms or the used of chemicals or synthetic substances that was harmful as dyes food. This was because there were not many food industry players who are aware of the negative impact of using chemicals, they are still thinking and looking for additional ingredients that are cheap and practical in order to get a profit. Seeing the existing phenomena, a solution was needed to find additional ingredients in the food industry that are safe, easily obtainable, and the priced was affordable by the public by utilizing materials. One wild plant that was easily available and has the potential to be used in the food industry was karamunting (*Melastoma malabathricum*). In the field of food, it has been widely reported about the used of cultivated plants that were used as natural dyes food such as pandanus and katuk leaves, but for wild plants, there were still very few used in the food industry. The purposed of this study was to determine the antioxidant activity of karamunting fruit as natural dyes and preservative foods. In making karamunting fruit extract using maceration method. The purposed of maceration was to extract phytochemical compounds contained in the sample. The maceration process was carried out in ethanol for 72 hours and evaporated at 50 ° C to reduce the boiling point of the solvent so that the solvent would evaporate below its normal boiling point and so that the phytochemical compounds contained in the extract were not damaged due to excessive heating. The results of the antioxidant activity of karamunting fruit showed: 1) The test results of phytochemicals of fresh fruit and dried fruit of karamunting were; a. Anthocyanin in fresh fruit was 0.65 mg CGE / g DW and dried fruit 0.5 mg CGE / g DW b. Total phenol in fresh fruit was 15.05 mg GAE / g DW and dried fruit by 13.61 mg GAE / g DW c. The total fresh fruit flavonoids was 15.15 mg RE / g DW and dried fruit by 13.43 mg RE / g DW. 2) Antioxidant capacity in karamunting fruit from laboratory test results were; a. Fresh DPPH karamunting fruit extract of 2.95 mg RE / g DW b. Dry karamunting fruit extract was 2.54 mg RE / g DW

Keywords: antioxidant activity, karamunting, dyes, preservative

INTRODUCTION

The development of the food industry is currently progressing very rapidly. This is influenced by the level of public demand for food needs which are increasing at any time. Demand for food needs was still not accompanied by the safety of food consumed, because the product expired and has been infected with harmful microorganisms or the use of hazardous chemicals or synthetic as dyes food. This was because there were not many food industry players who are aware of the negative impact of using chemicals, they are still thinking and looking for additional ingredients that are cheap and practical in order to get a profit. Seeing the existing phenomena, a solution is needed to find additional ingredients in the food industry that are

safe, easy to obtain, and affordable for the public. One of the wild plants that have the potential to be used in the food industry was karamunting (*Melastoma malabathricum*).

The underlying matter was the result of the phytochemical test of karamunting plants. In karamunting plants, after phytochemical testing, there were several chemical compounds such as flavonoids, alkaloids, steroids, anthocyanins, and saponins found in the roots, stems, leaves, flowers, and fruit (Jumiati et al. 2007). Where as we all know that these compounds can function to prevent and cure various diseases. In previous studies, studies have been conducted on the benefits of karamunting plant leaves as a drug for diabetes mellitus and hyperkolestrol, and as a result karamunting leaves have the same ability as

chemical drugs (glibenclamide) given to experimental animals (Jumiati et al. 2008). After trying to use karamunting leaves, in this study we tried to use karamunting fruit based on the content of flavonoids and saponins contained in them as natural and antimicrobial dyes in food and as a source of antioxidants. Based on the flavonoid content of kamunting fruit, this fruit has the potential to be used as a natural dye in foods and as a source of antioxidants.

The red substances that are widely found in nature were grouped into two groups, namely carotenoids and anthocyanins. Anthocyanins are classified as pigments called flavonoids which are generally soluble in water. The color of the anthocyanin pigment is red, blue, violet and is usually found in flowers, fruits, and vegetables. The appearance of purple karamunting fruit shows that there are natural dyes contained therein. One of the flavonoid compounds contained in karamunting fruit is anthocyanin. Anthocyanins are known to function as antioxidants (Jordheim, 2006) so that research on antioxidant activity in karamunting fruit is needed. Antioxidants are substances that can counteract or prevent oxidation reactions from free radicals (Chang, et al., 2002). Oxidation is a chemical reaction that transfers electrons from one substance to an oxidizing agent. Oxidation reactions can produce free radicals and trigger chain reactions, causing cell damage in the body. Free radicals are very dangerous because they can damage body tissues that can cause degenerative diseases such as cancer, high blood pressure, coronary heart disease, diabetes mellitus, cataracts, premature aging, and others (Shivashankara, et al., 2004). Aside from being a natural dye, when viewed from the content of phytochemical compounds, this fruit can also act as a natural source of antioxidants.

The aim in this study was to determine the antioxidant activity of karamunting fruit that can be used as a natural dye and preservative foods.

MATERIALS AND METHODS

This study involved several processes and successive stages ranging from material preparation, observation of extract phytochemicals, screening of free radical capture activities, and antioxidant activity test extract. The preparation stage of the material includes the collection of ingredients of karamunting fruit, cleaning, crushing, and drying of the ingredients followed by material extraction. Plant material obtained from Tarakan, North Kalimantan. The preparation stage of the material includes collecting karamunting fruit, cleaning,

knitting, and drying. Plant material was obtained from Tarakan, North Kalimantan followed by sample testing at the Agricultural Product Technology Laboratory. Furthermore, washing, drying, and crushing of ingredients are carried out followed by material extraction.

Phytochemical observations of karamunting fruit extract include examining phenol, flavonoids, and anthocyanins. Making extracts is done by maceration. Maceration used a macerator with methanol: water (9: 1) for 6-12 hours. After filtering, the residue was re-macerated with methanol: water (1: 1) (2-3 times maceration). Monitored the content of compounds in the filtrate with phytochemical screening methods. The first and second macerates were combined and then evaporated together (concentrated) with a rotary evaporator until concentrated extract was obtained and continued with evaporation over the water bath until almost all of the methanol evaporated to obtain a thick extract. The extract was then fractionated with liquid-liquid extraction method with n-hexane, ethyl acetate, and water solvent to obtain the water fraction, ethyl acetate fraction, and n-hexane fraction. Each fraction obtained was then thickened again by evaporating the solvent.

Phytochemical screening of extracts was carried out such as phytochemical screening of materials including examination of phenol, flavonoid, and anthocyanin content. Qualitative tests of antioxidant activity in extracts and fractions were carried out with the principle of the dynamolisa method. The thick sample (extract and fraction) was first diluted into a petri dish, then the axis was given so that the diluted fraction or extract will move up. Let it expand to form a circle until the filter paper dry. Then sprayed DPPH reagent 0.1% b / v.

A quantitative test of antioxidant activity in extracts and fractions was determined by UV-Visible spectrophotometry at the maximum wavelength (λ_{max}) 515.5 - 517 nm by determining the EC50 value which was the concentration of the test material which can reduce the radical intensity of DPPH by 50%. The price of EC50 was obtained from linear regression calculations from the comparison curve between the concentration of the test sample and the magnitude of the DPPH radical reduction. As a comparison, the quercetin solution was used in methanol.

The isolation circuit starts from the Gravity Column Chromatography for the fraction which has the smallest EC50 value. Gravity column chromatography used gradient eluents starting from a mixture of n-hexane-ethyl acetate (100: 0) to n-hexane-ethyl acetate (0: 100)

followed by eluent ethyl acetate: methanol (100:0) to ethyl acetate: methanol (0:100). Then the results obtained were monitored by thin layer chromatography and 0.2% DPPH spraying in methanol. The selected subtraction is then purified by preparative chromatography. Then the isolates were tested for purity by two-dimensional thin layer chromatography. Pure isolates were characterized by thin layer chromatography by spraying 0.2% DPPH solution in methanol and using other spray reagents.

RESULTS AND DISCUSSION

The raw material used in this study was karamunting fruit obtained from the city of Tarakan. The karamunting fruit used is physiologically ripe fruit. In making karamunting fruit extract using maceration method. The purpose of maceration was to extract phytochemical compounds contained in the sample. The maceration process was carried out in ethanol for 72 hours and evaporated at 50 °C to reduce the boiling point of the solvent so that the solvent would evaporate below its normal boiling point and so that the phytochemical compounds contained in the extract were not damaged due to excessive heating. Total phenol, flavonoids, anthocyanins and antioxidants (DPPH) in karamunting fruit. The content of phenols, flavonoids, anthocyanins, and antioxidants in plants was related to their antioxidant activity because redox properties play a role as reducing agents, hydrogen donors and singlet oxygen quenchers (Chang et al., 2001). The following were the results of laboratory test;

Table 1. Total phenols, flavonoids, and anthocyanins in karamunting fruit

| Component | Information | Total |
|------------------|--------------------|-------------------|
| Anthocyanins | <i>Fresh fruit</i> | 0.65 mg CGE/g DW |
| | <i>Dried fruit</i> | 0.50 mg CGE/g DW |
| Total Phenols | <i>Fresh fruit</i> | 15.05 mg GAE/g DW |
| | <i>Dried fruit</i> | 13.61 mg GAE/g DW |
| Total Flavonoids | <i>Fresh fruit</i> | 15.15 mg RE/g DW |
| | <i>Dried fruit</i> | 13.43 mg RE/g DW |

Source: Primary Data (Laboratory Test Results, 2017)

Based on the results of the analysis of total phenol in fresh karamunting fruit at 15.05 mg GAE / g DW and dried fruit by 13.61 mg GAE / g DW. Phenol is a compound that has an aromatic ring with one more hydroxyl group. Phenol includes various compounds derived from plants. Phenolate compounds contained in this plant have

antioxidant activity because these compounds can capture peroxide radicals and can chelate iron metals that catalyze fat peroxide. Usually, the compounds that have antioxidant activity are phenol compounds which have substituted hydroxy groups in ortho positions and to -OH groups and -OR (Andayani et al. 2008).

The results of the analysis of flavonoid content in fresh karamunting fruit were 15.15 mg RE / g DW and on dried fruit was 13.43 mg RE / g DW. Flavonoids are phenolic components found in fruits, vegetables that act as a good reservoir for hydroxyl radicals and superoxide by protecting membrane lipids against damaging oxidation reactions. (Lee et al, 2003). Phenolic compounds are known to have antioxidant activity which was beneficial for the body as an antidote to free radicals and singlet oxygen stabilizers. Kahkonen et al. (1999) stated that plants that contain high phenolic compounds tend to increase nutritional value and quality, and phenolic compounds contribute to the color, bitter taste, and taste, odor, and antioxidants (Kartika et al 2007). Classification of phenolic compounds according to Vermerris and Nicholson (2006) based on the number of carbon atoms, including simple phenolic classes, phenolic acids, flavonoids, and lignans. The antioxidant capacity of karamunting fruit can be seen in the following Table 2

The antioxidant activity found in fresh karamunting fruit was 2.95 mg RE / g DW and in dried fruit 2.54 mg RE / g DW. Antioxidant activity was measured based on the ability of antioxidants to reduce purple DPPH through the mechanism of donating hydrogen atoms and causing DPPH color reduction from purple to yellow because the DPPH reaction with antioxidants would neutralize free radicals from DPPH and form reduced DPPH. The DPPH method is chosen because it is simple, easy, fast, and sensitive and requires only a few samples. At this stage, measurements of DPPH absorbance were carried out at 3 wavelengths, namely 495, 515, and 535 nm so that the measurement results obtained were more accurate than measurements of antioxidant activity at one wavelength. From the calculated absorbance data, DPPH attenuation is obtained. To state the antioxidant activity of karamunting fruit extract, IC50 values are used as parameters because IC50 shows concentration values that can reduce 50% DPPH free radicals (Molyneux, 2004). The smaller the IC50 showed the greater dampening power.

Table 2. Antioxidant capacity in karamunting fruit

| Information | DPPH radical scavenging capacity (mg RE/g DW) | FRAP (mg TE/g DW) | ORAC (mmol TE/g DW) | O2- radical scavenging capacity (mg AE/g DW) |
|-------------------------------------|---|-------------------|---------------------|--|
| The fresh karamunting fruit extract | 2.95 | 8.01 | 308.18 | 9.77 |
| The dried karamunting fruit extract | 2.54 | 8.73 | 302.14 | 9.65 |

Source: Primary Data (Laboratory Test Results, 2017)

Testing of antioxidant activity with FRAP (ferric reducing antioxidant power) method was based on the ability of antioxidant compounds to reduce iron (III) -tripyrindyl-triazine compounds to iron (II) - tripyrindyltriazine at pH 3.6. The test results obtained FRAP value for fresh fruit is 8.01 mg TE / g DW and on dried fruit 8.73 mg TE / g DW. Antioxidants are very important for health and beauty and maintain the quality of food products. In the food industry, antioxidants can be used to prevent oxidation processes that can cause damage, such as rancidity, changes in color and aroma, and other physical damage (Tamat et al., 2007). Antioxidants are very important as lipid peroxidation inhibitors so they can be used to prevent the occurrence of lipid peroxidation in food. Lipid peroxidation is a chemical reaction that often occurs in foods that produce acid, unpleasant odors and toxic during the processing and storage processes that affect the quality and safety of food products. (Heo et al., 2005). From the results of testing of fresh fruit and dried fruit does not show a significant difference, in other words, the use of karamunting fruit as an antioxidant can use fresh fruit and dried fruit.

CONCLUSIONS

Based on the results and discussion can be concluded:

- The tested results of phytochemicals of fresh fruit and dried fruit of karamunting were;
 - Anthocyanin in fresh fruit was 0.65 mg CGE/g DW and dried fruit 0.5 mg CGE/g DW
 - Total phenol in fresh fruit was 15.05 mg GAE/g DW and dried fruit by 13.61 mg GAE / g DW
 - The total fresh fruit flavonoids were 15.15 mg RE / g DW and dried fruit by 13.43 mg RE/g DW
- Antioxidant capacity in karamunting fruit from laboratory tested results were;
 - Fresh DPPH karamunting fruit extract was 2.95 mg RE / g DW
 - Dry karamunting fruit extract was 2.54 mg RE / g DW

The phytochemical content and antioxidant capacity of fresh fruit and dried fruit were almost the same, so that both ingredients can be used as raw material for processing karamunting fruits for dyes and preservative foods.

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DESIGN OF SOFT JELLY CANDY WITH ADDITION OF EDIBLE BIRD NEST (*Collocalia Sp.*) AS FUNCTIONAL FOOD RICH IN SIALIC ACID

Krishna Purnawan Candra^{a*}, Firza Sarwani^a, and Muhammad Hasan^a

^aDepartment of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Indonesia

*Corresponding author : candra@faperta.unmul.ac.id

ABSTRACT

We have previously demonstrated a design of soft jelly candy using mix of fish and bovine bone gelatine (1:3) to promote the use of halal gelatine and with the addition of rosella calyx extract to construct functional food rich in antioxidants. In this report, we made further development of the product by adding edible birds nest (EBN) to construct the jelly rich in sialic acid (*Sia*). Strawberry essence was applied to reduce gelatinflavour. The *Siaplaysan* important role in brain development, anti-cancer and cell rejuvenation. This experiment was arranged in a completely randomised design with the factor of the addition of EBN 0-24 % w/v in the gelatine sol containing rosella calyx extract. The result showed that addition of EBN between 6-18% w/v gave the best characteristic of hedonic sensory (rather like), with quality hedonic characteristics of red in colour, the taste of mild strawberry, and a mild in chewiness.

Keywords: fish gelatine, bovine gelatine, brain development, anti-cancer, cell rejuvenation

INTRODUCTION

Jelly candy is very popular among children, which then attract people to design functional food based on candy. Recently we have developed Roselle soft jelly candy, which produced from the mixture of fish bone and bovine bone gelatine added by Roselle calyx extract to design functional candy and promote the using of halal gelatine. In this report, we made advance developed on the Roselle soft jelly candy by adding edible birds nest (EBN).

EBN is collected from the nest of *Collocalia* sp., which is produced from their saliva. The EBN is commonly consumed as soup in the Chinese community. It is reported rich in substances showing the activity of antioxidant (Yida, Imam, & Ismail, 2014), and shows bone strength improvement, skin rejuvenation, epidermal growth factor activity and cell proliferation (Chua & Zukefli, 2016), as well as anticancer (Rashed & Wan Nazaimoon, 2010) and autoimmune (Haghani et al., 2016). Sialic acid (*Sia*) is found about 1.5% in EBN (Norhayati, Azman, & Wan Nazaimoon, 2010). *Sia*, a carbohydrate with 9 atom C posses a negative charge, is responsible as the bioactive on the activities (Ma & Liu, 2012). It is inline with the report that *Sia* is found in a significant amount in mother milk, which is the only food available for an infant (Carlson, 1985).

There were reported that addition of carbohydrate in gelatinsol would increase the

hardness of the jelly (Haug, Draget, & Smidsrød, 2004). This research aimed to study the addition of EBN on sensory characteristics of Roselle soft jelly candy. This study will explore the potency of EBN in designing a functional food, as until now the EBN only exported from Indonesia to Asian countries especially to China as raw material (Chairul, 2015). Indonesia as the largest producer of edible birds nest (EBN) in the world should develop the EBN potency as industrial and pharmaceutical material (Zhang, Lai, Liu, Li, & Li, 2013).

MATERIALS AND METHODS

Materials

The edible birds nest (EBN) obtained birdhouse in East Kalimantan, rosella flowers obtained from local farmers around Samarinda city, and giant featherback fish bones collected from the waste of amplang industry in Samarinda city. Sugar, bovine gelatin, high fructose sugar (HFS), guar gum, flavours, and potassium sorbate were obtained from a local market in Samarinda city.

Experimental design

A single factor experiment (addition of EBN) arranged in Completely Randomized Design was conducted in this research. The EBN was added at 0, 8, 16 and 24 g into 100 g of material. Each treatment was replicated three

times, and sensory characteristics for aroma, colour, taste and texture were observed.

Experimental procedure

Preparation of fish bone gelatin and roselle-calyx extract

Fishbone gelatine was prepared from giant feather back fish (*Chitalopsis*) bone obtained from the industrial waste of Amplang in the city of Samarinda. Degreasing of fat from the bones and extracted the gelatine using acid solution was done as suggested by (Yuliani, Agung, Marwati, & Candra, 2018). Rosellacalyx extract was prepared by extracted of 6 g dried roselle calyx in 400mL of boiling water for 15 minutes then filtered (Yuliani et al., 2018).

Preparation of EBN

The EBN for soft jelly candy was prepared in three steps. Firstly, the EBN was washed in running water for three times each of 30 sec. Brushing the EBN was applied on the first washed to remove the rest of the eggshell, faeces and feathers (Susilo, Latif, & Ridwan, 2013). Secondly, the washed EBN was soaked in hot water (1:10 w/v) at 80°C for 10 minutes to remove the rest feathers attached on the nests followed by rinsing and reducing the size (\pm 2-3cm²). The clean EBN then dried in an oven at 60°C for 6 h. Thirdly, the dry clean EBN were soaked (1:10 w/v) in warm water (55°C) for 90 min. followed by EBN puree preparation. The EBN puree was prepared by crushing the soaked EBN with the addition of flake ice (1:2 w/w) and filtered the mixture to remove the ice (allowed to melt to water at room temperature).

Soft jelly candy preparation

Soft jelly candy was prepared according to Yuliani et al. (2018). Three grams of HFS and 26.25 g of sugar were poured into 50 mL of Roselle calyx extract and cooked at 80-85°C. After 1 min., 9 g of mixture-gelatine of giant feather back fish and bovine bone gelatine (1: 3) was added to the extract mixture step by step while stirring to prevent clotting. As the sol formed, 3g of guar gum and an amount of EBN puree (0-24 g) was added step by step while stirring until the sol is mixed evenly. The temperature process was maintained at 80-85°C for 3 min then the heating was stopped, and 0.05 g of potassium sorbate and 5 drops of strawberry essence were added as a preservative and flavour while stirred for 2 min. The sol mixture then formed by cooling at 15°C for 2 hours.

RESULT AND DISCUSSION

The addition of EBN puree until 24 % in Roselle soft jelly candy affected significantly on the hedonic sensory characteristics for colour, aroma, texture, and taste. The all performance of hedonic sensory characteristics are shown in Table 1.

Table 1. Effect of edible birds nest (EBN) on hedonic sensory of *Sia Jelly Candy*

| EBN content (%) | All performance |
|-----------------|-----------------|
| 0 | 3,94±0,29 b |
| 6 | 3,83±0,38 b |
| 12 | 3,78±0,37 b |
| 18 | 3,31±0,36 a |
| 24 | 3,16±0,35 a |

Note: Hedonic sensory scores (avg ± sd) were derived from all attributes (colour, aroma, texture and taste, each 30 data). Data were analysed by Friedman test continued by Tukey test. Data followed by different letter show significantly different (p<0.05). Sensory hedonic score 1-5 for very disliked to like very much.

Addition of EBN puree more than 12% will reduce the acceptance of the Roselle soft jelly candy containing EBN added as a puree. Protein is the main content of EBN, about 60%, besides it contains until 1.5% sialic acid (*Sia*) (Norhayati et al., 2010). The *Sia* is found in the form of glycoprotein, glycolipid, and oligosaccharide (Corfield & Schauer, 1982). We expect that the carbohydrate content of EBN (You et al., 2014) was responsible for the changes of panellist acceptance on the sensory hedonic characteristics as it was reported that the mixture of some types of carbohydrate, like agar (Somboon, Karrila, Kaewmanee, & Karrila, 2014) and carrageenan (Eveline, Santoso, & Widjaja, 2011; Haug et al., 2004; Pranoto, Lee, & Park, 2007) affects gel characteristics of gelatin.

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THE EFFECT OF FORMULATION OF BAUNG FISH MEAT (*Mystus nemurus*) AND WHITE OYSTER MUSHROOM (*Pleurotus ostreatus*) ON CHEMICAL AND SENSORY CHARACTERISTICS OF AMPLANG

Marwati^{a*}, Yahuda Keristian^a, Yuliani^a and Hamka^b

^aDepartment of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Indonesia

^bDepartment of Agricultural Technology, Samarinda State Polytechnic of Agriculture, Indonesia

*Corresponding author : marwatiwawa.unmul@gmail.com

ABSTRACT

Amplang is one of the traditional snacks made from fish and is widely produced in East Kalimantan. Amplang processing using Baung fish and white oyster mushrooms is one form of modification in amplang processing. The aim of this study was to determine the effect of baung fish and white oyster mushroom formulations on chemical and sensory properties of amplang and to obtain the right formulation. The study used a Completely Randomized Design using a formulation of meat formulations of baung fish and white oyster mushrooms consisting of (100:0), (90:10), (80:20), (70:30), (60:40) and (50:50) and repeated three times with proximate test and organoleptic test parameters. The results showed that the formulation of baung fish and white oyster mushroom significantly affected the moisture content, ash content, fat content, protein content, and carbohydrate content. Treatment with meat formulations of baung fish and white oyster mushrooms on 90:10 concentration gave the best results on moisture, ash, protein, fat, and carbohydrate contents are 1.38%, 20.86%, 33.05%, 43.37% in mg/100 g of ingredients, respectively. Meanwhile, a sensory test of color, flavor, texture, and taste are white cream (very like), slightly aromatic of baung fish (like), crunchy texture (like) and a slight taste of baung fish (like).

Keywords: baung fish, white oyster mushroom, amplang

INTRODUCTION

Amplang is one of the traditional snacks made from fish by adding tapioca flour and herbs that are widely produced in East Kalimantan. Generally processed from belida fish and mackerel fish. The use of other types of fish can also be used like baung fish. Baung fish is a fish native to Indonesian waters that are found on the Mahakam river. The characteristics of baung fish have a taste that is tastier and more savory with fairly high nutrient content, especially in proteins of 18.43% and low-fat content of 4.93% (Mesomya, et al., 2002). In addition, it is necessary to process envelopes by adding vegetable ingredients as a form of food diversification. Vegetable material that can be used is white oyster mushroom as a form of modification in the processing of envelopes. White oyster mushroom is one source of vegetable protein that has organoleptic characteristics with a savory flavor that has been applied in cracker processing (Nuraini, et al 2015). The aim of this study was to determine the effect of the formulation of baung fish and white oyster mushroom on the chemical and sensory properties of the envelope and to obtain the right formulation.

MATERIAL AND METHODS

Materials and tools

Materials for making amplang consisted of baung obtained from Tenggarong sub-district, Kutai Kartanegara district, white oyster mushrooms obtained from farmers in Samarinda City, tapioca flour, chicken eggs, garlic, salt, sugar, powdered pepper, baking soda, and cooking oil. Chemicals for H₂SO₄, NaOH, Na₂S₂O₃, zinc granules, H₃BO₃, indicators of methyl red and blue, HCl, petroleum ether, NaOH, and ethanol 96%. Chemicals for analysis such as H₂SO₄, NaOH, Na₂S₂O₃, zinc granules, H₃BO₃, indicators of methyl red and blue, HCl, petroleum ether, NaOH, and 96% ethanol were obtained from Riedel Haen.

The equipment for making amplang used consists of knives, basins, pans, blenders, stirrers, pans, stoves and analytical scales. Protein measurements using Kjeldahl, water content using an oven (Sanyo model MOV-212F, Japan), ash content using furnaces and soxhlet apparatus for fat analysis.

Research design

The study used a single factor study which was compiled in a Completely Randomized

Design (CRD) with six levels of treatment and repeated three times. These factors are the formulation of baung fish with white oyster mushrooms in making envelopes with levels (100:0), (90:10), (80:20), (70: 30), (60:40) and (50:50)) The observational parameters consisted of chemical properties including water content, ash content, protein content, fat content (Sudarmadji et al., 2010), carbohydrate levels (Winarno, 1997) and hedonic sensory properties and hedonic quality for color, aroma, texture, and taste (Susiwi, 2009). Data for chemical properties were analyzed using variance followed by the Smallest Significant Difference test at α 5%, for treatment of each parameter that showed significant differences while for data sensory properties through the measure of data concentration using mode.

Research procedure

Preparation of Baung Fish Meat

Baung fish meat is prepared by washing with running water and continued by separating the contents of the stomach, head, and bones. Baung fish meat is given orange juice to remove fishy odor then wash again until clean. Followed by smoothing using a blender.

Preparation of White Oyster Mushrooms

Fresh white oyster mushrooms are cleaned by washing running water then boiling for 5 minutes at 90°C. Oyster mushrooms are cut and then mashed with a blender.

Processing of Amplang

Amplang processing is done by mixing baung fish and white oyster herbs and adding 1 g of salt, 20 g of sugar, 0.5 g of pepper powder, 5 g of garlic, 36 ml of water, 25 g of egg, and 0.25 g of baking soda stirred and add 200 g tapioca flour until it mixes into a smooth mixture. The dough is printed elongated and cut to \pm 5 cm in size. Frying was done at 120°C for 30 minutes with a volume of 1 L cooking oil.

RESULT AND DISCUSSION

Chemical Characteristics of Amplang

The formulation of baung fish and white oyster mushroom in envelope processing has a significant effect on all chemical parameters. The chemical characteristics of amplang are presented in Table 1.

Table 1. Effect of baung and white oyster mushroom meat formulations on chemical characteristics of amplang.

| Baung fish meat formulation: white oyster mushroom (g) | Parameter (%) | | | | |
|--|-------------------|-------------------|--------------------|--------------------|--------------------|
| | Moisture | Ash | Protein | Fat | Carbohydrate |
| (100:0) | 1,27 \pm 0,01 d | 1,22 \pm 0,01 d | 19.81 \pm 0,68 a | 34,85 \pm 0,26 a | 42.83 \pm 0,88 d |
| (90:10) | 1,33 \pm 0,02 d | 1,38 \pm 0,03cd | 20.86 \pm 0,31 a | 33,05 \pm 0,93 b | 43.37 \pm 0,68 d |
| (80:20) | 1,64 \pm 0,04 c | 1,53 \pm 0,04 c | 16.63 \pm 0,88 b | 31,92 \pm 1,37 b | 47.89 \pm 1,67 c |
| (70:30) | 1,83 \pm 0,05 b | 1,77 \pm 0,07 b | 13.13 \pm 0,88cd | 32,14 \pm 0,26 b | 51.11 \pm 0,96 b |
| (60:40) | 2,30 \pm 0,07 a | 2,08 \pm 0,08a | 14.00 \pm 0,88 c | 30,31 \pm 0,24 c | 51.29 \pm 0,98 b |
| (50:50) | 2,33 \pm 0,11 a | 2,16 \pm 0,24 a | 12.25 \pm 0,88d | 28,85 \pm 0,10 d | 54.38 \pm 0,77 a |

Description: data on the same lane, followed by the same letter shows no significant difference based on the smallest real difference test (LSD) at the level of α 5%

Moisture content

The highest water content in the envelope was in the formulation treatment of baung and oyster mushroom (50:50) fish which was 2.33 \pm 0.11. Increased water content tends to rise along with the number of white oyster mushrooms used in the formulation. The increase in water content was caused by white oyster mushrooms having a high fiber content of 39.8% (Sumarsih, 2015) which can absorb water because it is hydrophobic (Surono et al, 2016). This is in line with Iqbal (2017), that the amplang made from African catfish with the addition of seaweed will produce high fiber content which affects the increase in

water content in amplang products. Based on the quality and safety requirements of the fish envelope (SNI 7762-2013) the maximum fish water content of the fish envelope is 4%. This shows that the amplang water content of the formulation of baung and white oyster mushrooms all treatments have met the SNI standard for fish species (1.27 \pm 0.01-2.33 \pm 0.11%).

Ash content

The results of the analysis show that the ash content is higher along with the number of white oyster mushrooms formulated in making amplang. The lowest ash content was obtained

from the formulation of baung and oyster mushroom (0: 100), which was 1.22 ± 0.01 and the highest in the formulation (50:50) of $2.16 \pm 0.24\%$. This is consistent with the statement of Astuti et al. (2016) that ash content tends to increase with the increasing number of oyster mushrooms added to the processing of crackers with the formulation of white oyster mushrooms and tapioca. This is supported by Suriawiria (2002) which states that the oyster mushroom ash content is 9.3%, greater than the ash content of baung which is only 0.59% (Mesomya et al, 2002). Based on the quality and safety requirements of fish amplang (SNI 7762-2013) the maximum fish ash content is 5%. This shows that the amplang ash content of the formulation of baung and white oyster mushrooms in the treatment of all treatments met the SNI standard for fish species (1.22 ± 0.01 - $2.16 \pm 0.24\%$).

Protein Levels

The highest protein content in the amplang is in the formulation of white baung and oyster mushroom meat (90:10) which is $20.86 \pm 0.31\%$ which is not significantly different from the treatment (100: 0) which is $19.81 \pm 0.68\%$. These protein levels tend to fall along with the number of white oyster mushrooms used in the formulation. This is caused by the level of baung fish protein 18.43% (Mesomya et al, 2002) greater than the level of white oyster mushroom

protein (10.5%), Suwito (2006). Based on the requirements of the quality and safety of the fish envelope (SNI 7762-2013) the minimum level of fish envelope protein is 7%. This shows that the levels of envelope protein formulations of baung and white oyster mushrooms in the treatment of all treatments met the SNI standard for fish species (12.25 ± 0.88 - $19.81 \pm 0.68\%$).

Fat level

The fat content produced on the envelope with the formulation of white baung and oyster mushroom meat ranged from 28.85 ± 0.10 to $34.85 \pm 0.26\%$. Based on the results of the analysis, fat levels tend to decrease along with the increasing number of white oyster mushrooms used in the formulation. This is caused by the content of the raw material of white oyster mushrooms having a lower fat content of 1.70% (Sumarmi, 2006) compared to baung which has a higher fat content of 4.93% (Mesomya, et al., 2002). . Based on the requirements of quality and safety of fish envelope (SNI 7762-2013) the maximum fish fat content is 35%. This shows that the level of envelope fat in the formulation of baung and white oyster mushrooms in all treatments met the SNI standards for fish (28.85 ± 0.10 - $34.85 \pm 0.26\%$).

Table 2. Effect of baung and white oyster mushroom meat formulations on the sensory characteristics of amplang.

| Sensory characteristics | Baung fish formulation: white oyster mushroom (g) | | | | | | |
|-------------------------|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|----------|
| | 100:0 | 90:10 | 80:20 | 70:30 | 60:40 | 50:50 | |
| | Modus/ Persentase (%) | Modus/ Persentase (%) | Modus/ Persentase (%) | Modus/ Persentase (%) | Modus/ Persentase (%) | Modus/ Persentase (%) | |
| Hedonic | Aroma | 4(46.67) | 4(50.67) | 4(56.00) | 4(45.33) | 4(45.33) | 4(52.00) |
| | Color | 4(46.67) | 5(50.67) | 4(41.33) | 3(41.33) | 3(44.00) | 3(37.33) |
| | Texture | 4(40.00) | 4(48.00) | 3(42.67) | 4(36.67) | 3(41.33) | 3(36.00) |
| | Taste | 4(38.67) | 4(53.3) | 4(45.33) | 4(48.00) | 4(46.67) | 4(49.33) |
| Hedonic quality | Aroma | 4(48.00) | 4(49.33) | 3(48.00) | 3(40.00) | 2(41.33) | 1(36.00) |
| | Color | 5(74.67) | 5(92.00) | 4(70.67) | 3(37.33) | 3(38.67) | 2(33.33) |
| | Texture | 4(40.00) | 4(45.33) | 4(42.67) | 3(38.67) | 3(37.33) | 3(36.00) |
| | Taste | 2(58.67) | 4(57.33) | 4(52.00) | 4(42.67) | 4(38.67) | 4(36.00) |

Description: Hedonic scale score, 5:Very like, 4:like, 3:Rather like, 2:Don't like, 1:Very not like it; Hedonic quality scale scent score, 5: Bearoma Fish baung, 4:A little scented fish baung, 3:Neutral, 2:Scented with mushrooms oysters, 1:A little flavorful oyster mushroom; Hedonic quality scale score, 5:White Cream, 4:A little brown young, 3:Rather brown, 2:Chocolate, 1:Very brown; Hedonic quality scale texture score, 5:Very crispy, 4:crispy, 3:somewhat crispy, 2:No crispy, 5:Very not crunchy; Hedonic quality scale taste score, 5:Fish taste baung, 4:Somewhat taste baung fish, 3:Neutral, 2:Mushroom, taste oysters, 5:A little taste baung fish.

Carbohydrate Levels

Carbohydrate levels based on the calculation by the difference obtained the highest results in the treatment of formulations of fish baung and oyster mushroom (50:50) of $54.38 \pm 0.77\%$ while the lowest was obtained in the formulation (0: 100) which was 42.83 ± 0.88 . The high carbohydrate content in the formulation of baung and white oyster mushroom (50:50) is caused by the number of white oyster mushrooms added more compared to other treatments. In accordance with Sumarmi (2006) which states that white oyster mushrooms contain carbohydrates which are quite high at 56.6%.

Sensory characteristics of Amplang

The sensory characteristics of amplang are one of the parameters to find out that the received power is subjectively tested by panelists through hedonic testing and hedonic quality. The results of statistical tests through the measure of data concentration using the mode are presented in Table 2.

Aroma

Based on the hedonic test results and the hedonic quality of the amplang aroma with the formulation of baung and white oyster mushroom meat from all the treatments the panelists favored. Panelists gave the highest response to the treatment of formulations of baung and oyster mushrooms (80:20) with a percentage of 56%. The aroma produced through the hedonic quality test is neutral with a percentage of 48% mode.

Color

The color of the envelope is one of the main sensory characteristics and is the first consideration in choosing a product. Based on the results of the hedonic test, the highest response of the panelists to the envelope was in the formulation of white baung and oyster mushroom fish (90:20), which were very fond of the percentage of 50.67% with a creamy white hedonic quality value of 92.00%. This is due to the least addition of white oyster mushrooms. The higher the number of oyster mushrooms added to each formulation, the more the color will turn brown. The brown color is formed because there is a Maillard reaction due to a reaction between reducing sugars and amino acids during the heating process.

Texture

The hedonic value of the texture that gives the highest level of acceptance of the envelope is in the formulation of white baung and oyster mushroom (90:10) i.e. liking (4) of 48% with hedonic quality on the crispy scale (4) with a percentage of 45%.

This is influenced by the moisture content of the resulting amplang. Amplang tends to be high in water content with higher fungi added to each formulation. According to Muchtadi et al (1988), the high water content in the material will hinder the product development process, so the resulting texture becomes less dry and less crispy.

Taste

The highest response of the panelists to the taste of the envelope was in the formulation of baung and oyster mushroom fish (90:10) on the liking scale (4) with a percentage of 53.33% with a hedonic quality value of oyster mushroom flavor (4). The addition of oyster mushrooms will produce a more preferred taste because white oyster mushrooms contain glutamate amino acid which is 0.94% bb (Tjokrokusumo, 2008). Natural glutamic acid in mushrooms gives the same delicious taste like meat.

CONCLUSIONS

The results showed that the formulation of baung and oyster mushroom fish had a significant effect on water content, ash content, protein content, fat content, and amplang carbohydrate content. Formulations of baung and oyster mushroom (90:10) provide the best results based on organoleptic testing and meet SNI standards with water content $1.33 \pm 0.02\%$, ash content $1.38 \pm 0.03\%$, protein content $20.86 \pm 0.31\%$, fat content $33.05 \pm 0.93\%$, carbohydrate content $43.37 \pm 0.68\%$. The hedonic assessment of aroma, texture, and taste is like and color is very like with the quality of hedonic rather scented with baung, creamy white, crunchy texture and the taste of oyster mushrooms.

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EFFECT OF EXTRACTION TIME ON CHARACTERISTIC OF PECTIN DERIVED FROM KAPAS BANANA (*Musa Sp.*) PEELS

Yuliani^{a*}, Diah Sri Lestari^a, and Anton Rahmadi^a

^aDepartment of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Indonesia

*Corresponding author : yulianicandra482@gmail.com

ABSTRACT

Kapas banana (*Musa Sp.*) is one of the local banana varieties from East Kalimantan, which are usually processed into crackers or fried banana. However, the peels of this banana are still not used. Peel banana is rich in pectin, and its characteristic depends on its sources besides its extraction method. In the food industry, pectin is used as thickening agent, stabilizer and emulsifier. This research aimed to determine the effect of extraction time (70, 80 and 90 min.) in chloric acid solution on a characteristic of pectin from Kapas banana peels. A completely randomized design was applied in this experiment, and each treatment was repeated three times. Data were analyzed by ANOVA continued by Tukey test at α of 5% for treatment, which showed a significant difference. The results showed that extraction time in a chloric acid solution of pH 2.0 at 60°C affected insignificantly on water content and viscosity of the pectin. However, it affected significantly on yield, ash content, equivalent weight, methoxyl content and degree of esterification. Pectin extracted from Kapas banana peels by this method belongs to low methoxyl (3.86-6.34%), which has low esterification degree (5.14-5.87%).

Keywords: low methoxyl pectin, low esterification degree pectin, thickening agent, emulsifier

INTRODUCTION

In the food industry, pectin is used as a thickening agent, stabilizer and emulsifier (May 1999). Commercial pectin is galacturonoglycans, i.e. poly (β -D-galactopyranosyl uronic acids), with various contents of methyl ester. Native pectins are more complex molecules found in cell walls and intercellular layers of all land plants. Commercial pectins are obtained by acid extraction of citrus peel (contain 20-30% pectin) and apple pomace (contain 10-15% pectin), both by-products of juice manufacturing. For pectin production, citrus peel is extracted with water of pH 1.5-3.0 at 60-100°C. The extract is filtered, and pectin is precipitated by addition of isopropanol. Properties of pectin vary with the source, the processes used for handling and drying of the peel, the type of extraction, and subsequent treatment (Whistler & BeMiller, 1999).

Kapas banana (*Musa Sp.*) is one of the local banana varieties from East Kalimantan, which are usually processed into crackers or fried banana. The banana peels from this process are still not used. Meanwhile, banana peels contain pectin as shown by (Yuliani, Simbolon, & Murdianto, 2017) using Mauli banana and Castillo-Israel et al. (2015) using Saba banana. They used different pectin extraction method to yield the optimum mass of pectin from each type of banana peels. This research was aimed to

determine the effective extraction method of pectin from Kapas banana peels.

MATERIAL AND METHODS

Materials

A physiological ripped kapas banana fruit showed by the green color with 10 % of yellow color the peels (Srimuliyati, 2005) was used as raw material. The banana was collected from Loa Kulu sub-district, Kutai Kartanegara district, Indonesia. HCl, NaOH, Red phenol and phenolphthalein purchased from Merck (Germany), ethanol 95% from PT. Jayamas Medica Industry (Indonesia) and commercial pectin from CV Nura Jaya (Surabaya, Indonesia).

Experimental Design

The completely randomized design was applied in this single factor experiment (extraction time in HCl pH 2.00), with three levels of treatment (70, 80 and 90 min), each repeated for three times. Data were analyzed by ANOVA continued by Tukey test at α of 5% for treatment, which showed a significant difference.

Pectin Extraction

Kapas banana peels were prepared by blanching (steaming) the banana. After 10 min. The banana was peeled following cooled at room temperature. The blanched banana peels dried by

the oven at 70°C for 12 h and powdered by blender (Phillip, Indonesia).

Pectin extraction was prepared by the method as described by (Yuliani et al., 2017) with light modification. The pH of HCl used in this research was developed by the preliminary study. Extraction at 80°C for 80 min in HCl solution of a series pH (1.00-2.00) affected insignificantly on the yield, and water content of Kapas banana peels pectin.

Fifty grams of dried banana peels were macerated in 200 mL HCl pH 2.00 solution at 60°C for 70, 80 and 90 min in water bath (Techne Cole Palmer, USA). After maceration, the filtrate was collected and added by ethanol 95% (1:1 v/v) to precipitate the raw pectin. The pectin was then washed by ethanol 95% followed by aquadest, each once. The washed pectin then was dried in an oven (Sanyo model MOV-212F, Japan) at 40°C for 10 h and powdered by blender (Phillip, Indonesia).

Assays

The yield, water content, and viscosity were determined as described by (Cahyadi, 2008), Sudarmadji, Haryono, & Suhardi (2010), and Yazid (2007), respectively. The equivalent weight, methoxyl content and degree of esterification were determined using the method as described by (Ismail, Ramli, Hani, & Meon, 2012).

RESULT AND DISCUSSION

Extraction time (70 to 90 min) in HCl solution pH 2.00 at 60°C affected significantly ($p < 0.05$) on yield, equivalent weight, methoxyl content and degree of esterification of pectin from Kapas banana peels. However, it affects insignificantly on the water content and viscosity of the pectin (Table 1.)

Table 1. Effect of extraction time on yield and characteristic of pectin from Kapas banana peels.

| Yield and pectin characteristics | Extraction time (min.) | | |
|----------------------------------|------------------------|---------------|---------------|
| | 70 | 80 | 90 |
| Yield (%) | 3.65±0.37 a | 2.67±0.39 b | 2.74±0.37 b |
| Water content (%) | 15.13±0.81 | 14.99±0.20 | 14.8±1.03 |
| Equivalent weight (mg) | 854.21±1.68 a | 765.30±1.78 b | 695.42±3.49 c |
| Methoxyl content (%) | 3.86±0.02 c | 5.08±0.01 b | 6.34±0.01 a |
| Degree of esterification (%) | 5.14±0.02 c | 5.56±0.01 b | 5.87±0.01 a |
| Viscosity (cP) | 2.28±0.18 | 1.85±0.31 | 2.07±0.17 |

Note: Data ($\bar{x} \pm sd$) were calculated from 3 replications. Data were analysed by Anova continued by Tukey test. Data within the same row followed by a different letter are significantly different ($p < 0.05$).

The pectin yield decrease along with the increasing of the extraction time. More extraction time in acid solution can increase the hydrolysis the methyl ester group (de-esterification) (El-Nawawi & Heikal, 1995). This makes the decreasing of the pectin yield and also decreasing the equivalent weight (Ismail et al., 2012).

On the other hand, the methoxyl content and degree of esterification of the pectin increase. It means that the length of extraction time increase the quality of the pectin produced even it decrease the yield. The pectin from Kapas banana peels belongs to low-methoxy (LM) pectin (BeMiller & Huber, 2008). It is suitable for dietetic and pharmaceutical products, e.g. cosmetic product, dietary fiber enrichment and emulsion stabilization (Herstreith & Fox, 2012), and some processed food like low-sugar jams, jellies and marmalades (BeMiller & Huber, 2008).

CONCLUSIONS

Extraction time (70, 80, and 90 min.) in a chloric acid solution of pH 2.0 at 60°C affected insignificantly on water content and viscosity of the pectin. However, it affected significantly on yield, ash content, equivalent weight, methoxyl content and degree of esterification. Pectin extracted from kapas banana peels by this method belongs to low methoxyl (3.86-6.34%), which has low esterification degree (5.14 -5.87%).

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CHEMICAL AND SENSORY PROPERTIES OF WET NOODLES FROM FORMULATION OF WHEAT (*Triticum sp.*) AND BARLEY (*Coix lacryma-Jobi*) FLOUR

Hudaida Syahrumsyah^{a*}, Maulida Rachmawati^a, and Yulian Andriyani^a

^aDepartment of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University, Indonesia

*Corresponding author : rachmawati.maulida@yahoo.co.id

ABSTRACT

Wet noodles is one of the most popular wheat-flour-based products, especially in Asian countries. The high demand of wheat flour can be reduced by changing the main ingredient with other carbohydrate sources from local commodity such as barley flour. Barley, one of the local commodities in Indonesia, could be used as nutrition sources. The aim of this research was to investigate the influence of the formulation of wheat flour (TT) and barley flour (TJ) the chemical and sensory properties of wet noodles, and to determine the best formulation between wheat (TT) and barley (TJ) flour for producing wet noodles. This research used completely randomized design non factorial with 6 treatments, in which are formulation of wheat flour (TT) and barley flour (TJ) (100:0, 90:10, 80:20, 70:30, 60:40, and 50:50 gram), with 3 replications. The data was processed by analysis of variance (ANOVA), for sensory test result was processed using the Friedman test. If there are significant differences at the level of α 5%, a further test will be carried out by the Tukey test. The ANOVA test results showed that the different formulations significantly affected the water, ash, and crude fiber content of wet noodles. However, the protein was not significantly different. The formulation of wheat flour and barley flour significantly affected the hedonic and hedonic quality for the color, flavor, aroma and texture of the wet noodles but have no significant effect on the hedonic quality of the aroma. The best hedonic formulation was wet noodles with 80 g of wheat flour and 20 g of barley flour which produced moisture content of 55.97%, ash content of 1.49%, protein content of 7.84% and crude fiber of 1.20%, this formulation provides a texture of wet noodles that can be accepted by panelists with the properties are rather rubbery with hedonic taste very like, texture like, aroma rather like and hedonic quality creamy whitish color and rather taste barley.

Keywords: chemical characteristic, sensory, wet noodle, barley flour

INTRODUCTION

Noodles are generally made from wheat flour with or without the addition of other permitted food ingredients and food additives. Noodle is one of the most popular and acceptable flour-based products because they are easy to prepare, and are a good sources of carbohydrate as rice substitution. However, use of wheat flour for making various flour-based-food products increases the demand of imported wheat flour. Recently, The United State Department of Agriculture (USDA) reported that wheat imports reached 9.5 million tonnes in June 2017. The high dependency of wheat flour can be reduced with substitution with other carbohydrate sources from indigenous crops. In addition, utilization of local commodities could also develop its economic value.

Barley is a major cereal grain belonging to Family of Poaceae. Barley is one of the commodities that is a good source of nutrition. However, in Indonesia barley is grown in less

fertile and poor lands and is usually used as a livestock feed (Juhaeti, 2015). Comparing to wheat, barley contains a higher nutrient values such as phosphorus, iron, fat, protein, vitamin B and calories (USDA, 2017). There is no study regarding the use of barley flour in wet noodles formulation, therefore

There is no information on the use of barley flour as a formulation material in making wet noodles, so there is a need for research on the manufacture of wet noodles made from barley flour. Formulation of wheat flour with barley flour is utilizing local food for food diversification, creating noodles with low gluten levels, increasing nutrient content in wet noodle products and learning about the chemical and sensory properties of making wet noodles using barley flour. The purpose of this study was to determine whether there was an influence of barley flour and wheat flour formulations on the chemical and sensory properties of wet noodles and to find out the best treatment in the

formulation of barley flour and wheat flour in the manufacture of wet noodles.

MATERIAL AND METHODS

Materials

The material used in this study was barley obtained in the Loa Kulu Tenggara area of Kutai Kartanegara. Other materials used were water, kitchen salt (NaCl), eggs, cooking oil, and wheat flour. The equipment used in this study consisted of pots, stoves, basins, stirrers, scales, 80 mesh sieves, noodle machines, knives, measuring cups, and chemical analysis equipment.

Research Methods

The study was conducted using a single factor experimental design made in Completely Randomized Design (CRD). The study consisted of 6 treatments with 3 replications. Each treatment was processed in 100 g of ingredients. For the treatment of flour (TT) and Barley Flour (TJ) formulations consisting of 6 treatments, namely: p1 (100:0); p2 (90:10); p3 (80:20); p4 (70:30); p5 (60:40); p6 (50:50).

Barley flour and wheat flour were formulated to make wet noodles by weighing the ratio of wheat flour (TT):barley flour (TJ) 100:0, 90:10, 80:20, 70:30, 60:40 and 50:50 in 100 g. Each formulation was mixed with additives such as 2 g salt, 20 g eggs (yellow and white), and 40 mL water, then manually kneading for 15 minutes to get a smooth mixture. The dough was flattened

using the noodle mold with a thickness of 1.5 mm, the noodles were boiled in water for 2 minutes. To prevent being sticky in a room temperature, 4 mL of cooking oil were added then were cooled at room temperature. The chemical analysis was done including water content, ash content, protein, and crude fiber (Sudarmadji et al., 2010), while sensory tests observed were color, texture, aroma, and taste.

Data analysis

The data obtained was processed by analysis of variance (ANOVA), for sensory data processed using the Friedman test. If there are significant differences at the level of α 5%, a further test will be carried out by the Tukey test.

RESULT AND DISCUSSION

The results of the average chemical test on the wet noodles produced are shown in Table 1. The moisture content contained in various wet noodle formulations ranged from 54.37 to 60.31%. The ANOVA test results showed that wheat flour and barley flour formulations significantly affected the moisture content of wet noodles. The lowest water content was obtained at p1 (54.37%) and the highest moisture content at p6 (60.31%). The ash content of the ANOVA test results showed that wheat flour and barley flour formulations significantly affected the ash content of wet noodles. Ash content ranges from 1.15 to 1.67% which meets the wet noodle quality standard (SNI-2987-1992) by 3%.

Table 1. Average of chemical test results on the resulting wet noodles

| Chemical characteristic | 100 TT | 90 TT:10 TJ | 80 TT:20 TJ | 70 TT:30 TJ | 60 TT:40 TJ | 50 TT:50 TJ |
|-------------------------|------------|-------------|-------------|-------------|-------------|-------------|
| Moisture content (%) | 54,37±1,33 | 55,29±1,9 | 55,97±2,39 | 57,15±0,19 | 58,28±1,40 | 60,31±1,7 |
| Ash content (%) | 1,15±0,41 | 1,22±0,26 | 1,49±0,33 | 1,56±0,38 | 1,59±0,12 | 1,67±0,31 |
| Protein (%) | 8,00±0,30 | 7,98±0,39 | 7,84±0,30 | 7,79±0,11 | 7,79±0,41 | 7,82±0,19 |
| Crude fiber (%) | 0,46±0,10 | 1,07±0,23 | 1,20±0,16 | 1,71±0,57 | 2,21±0,19 | 2,37±0,23 |

Protein content of wet noodles had no significant effect on each treatment. The protein content of noodles ranges from 7.82-8.00% and has met the quality standards of wet noodles (BSN, 2015) SNI 01-2987-2015 which is equal to 6% for cooked wet noodles. The results of the analysis of wheat flour and barley flour formulations significantly affected the crude fiber content of wet noodles. Crude fiber content ranges from 0.46-2.37%. The highest crude fiber content was obtained in the treatment of p6 which was 2.37% while the lowest yield was obtained at p1 which was 0.46%. The hedonic and hedonic quality test results (Tables, 2) on the color, taste

and texture parameters showed a significant effect, except flavour.

Formulations of wheat flour and barley flour significantly influence the moisture content of wet noodles, these results indicate that the higher the addition of barley flour in each treatment, the higher the water content contained in wet noodles. Water content of wet noodle formulation of wheat flour and barley flour meets wet noodle quality standards (SNI 01-2987-2015) for a maximum of 65% for mature wet noodles. This is because water content is influenced by fiber contained in food that has high water absorption. Wibowo et al. (2014) states that the water content is influenced by the fiber contained

in the material, the higher the fiber contained in the material, the higher the water content produced.

Ash content in wet noodles formulation of flour and barley flour tends to increase, the higher the formulation of barley flour is given, then the ash content in wet noodles also increases. The

increase in ash content in each treatment shows that the ash content of barley flour is higher than wheat flour so that can increase the ash content of wet noodle products. Ash content is the amount of mineral content in food which is influenced by the amount of minerals in food which is influenced by the amount of minerals in the food.

Table 2. Average of hedonic sensory test results and hedonic quality of wet noodle formulation of wheat flour and barley flour

| Characteristic sensory | Parameter | Formulasi TT (g) : TJ (g) | | | | | |
|------------------------|-----------|---------------------------|---------|--------|---------|--------|-------|
| | | 100:0 | 90:10 | 80:20 | 70:30 | 60:40 | 50:50 |
| Hedonic Test | Color | 4,16a | 3,85abc | 3,62ab | 3,33bcd | 2,93cd | 2,70d |
| | Flavour | 3,74a | 3,45abc | 3,60ab | 3,42bcd | 3,28cd | 3,12d |
| | Taste | 4,48a | 3,72b | 3,80c | 3,49cd | 2,94d | 2,74d |
| | Textsure | 4,14a | 3,84a | 3,50b | 3,36b | 2,33c | 1,78c |
| Hedonic Quality | Color | 2,86c | 3,16bc | 3,21bc | 3,33bc | 3,81ab | 4,14a |
| | Flavour | 2,32 | 2,32 | 2,40 | 2,32 | 2,34 | 2,33 |
| | Taste | 2,09e | 2,82d | 3,13c | 3,34bc | 3,57ab | 3,66a |
| | Texture | 4,40a | 4,32a | 4,36a | 2,52b | 2,24bc | 1,78c |

Note : Hedonic score 1-5 (very dislike, dislike, somewhat like, like, very like, hedonic quality score 1-5 color: (beige, somewhat beige, whitish cream, somewhat white, white), aroma: (very not barley flavor, not barley flavor, somewhat barley, barley, very barley flavor), taste: (very not barley, not barley, somewhat barley, barley, very barley), texture: (weak, somewhat weak, hard, somewhat hard, somewhat chewy). Each sensory score was obtained from 75 samples using Friedman test at 5%. Data in the same line and followed by the same alphabet showed non significant results (tukey α 5%). TT = Wheat Flour (g), TJ = Barley Flour (g).

The protein content produced has met the minimum quality standards of wet noodles (SNI 01-2987-2015) of at least 6.0%. The greater the formulation of barley flour used, the higher the level of crude fiber of wet noodles produced. The fiber content in barley flour is included in the class of water insoluble fibers. Fiber cannot be digested by the body, but has a good function in the digestive tract such as preventing constipation and facilitating digestion. Fiber also inhibits the absorption of cholesterol, fat and re-absorption of bile acids (Kusharto, 2006) so that barley flour can be an alternative food source that is rich in fiber.

Noodles produced without formulation between wheat flour and barley flour have a very favorite level of color. This is because the color of the wet noodles produced has a more dull color. Especially wet noodles with formula 50 TT: 50 TJ has a color that looks dull (rather creamy). The dull color arises because the wet noodles get the most added barley flour. The acceptance of the hedonic test on the aroma of wheat flour formulation and the resulting wet noodle barley flour is rather like being followed by un-scented hedonic quality. From the results of the hedonic value of the taste of wet noodles, formulations of wheat flour and barley flour can still be accepted

by panelists because they have a taste similar to the taste of wet noodles in general.

The hedonic results and hedonic quality of the panelists on the texture of wet noodles formulation of flour and barley flour maximum is 80TT: 20TJ. Noodles with higher levels of barley flour formulation have a texture that is rather soft and not chewy compared to noodles without formulation of barley flour. This results in a 50TT formulation: 50TJ has a softer and easier breaking wet noodle structure so that the panelist's preference level decreases.

CONCLUSIONS

The formula of wheat flour and barley flour significantly affected the chemical properties of wet noodles such as moisture content, ash content and crude fiber content in wet noodles but did not significantly affect protein content. Formulations of wheat flour and barley flour significantly influence the sensory properties of the hedonic test for color, taste, aroma and texture of wet noodles. While the sensory properties of hedonic quality formulations of wheat flour and barley flour significantly influence color, taste and texture but do not significantly affect aroma. The best wet noodle formulation is 80TT: 20TJ which produces 55.97% moisture content, 1.49% ash

content, 7.84% protein content and 1.30% crude fiber, this formulation provides a texture of wet noodles that can be accepted by panelists with the properties are rather rubbery with hedonic taste very like, texture like, aroma rather like and hedonic quality creamy whitish color and rather taste barley. Further research is needed on how to process wet noodles from raw materials of barley flour and the addition of natural colors with a more complete analysis and shelf life of wet noodles.

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NUTRITIONAL CONTENT ANALYSIS OF INSTANT DRINK FROM AVOCADO SEEDS (*Persea americana* Mill)

Ummu Aimanah^{a*}, and Vandalisna^a

^a*Agricultural Extension College, Gowa, Indonesia*

*Corresponding author : ummuitpn_unhas@yahoo.co.id

ABSTRACT

Utilization of avocado seed as an instant drink that rich in nutrition. The nutritional content of the avocado seed is a Polyphenol, Triterpenoid Flavonoid, Quinone, Tannin, Monoterpenoid, and sesquiterpenoid compounds. The aim of this research is to know about the sugar tradition concentration from avocado seed as an instant drink and to know the analysis of flavonoid, starch, and organoleptic test of color and taste from avocado seeds' instant drink. Parameters of instant drink research by comparison 1 : 2, The parameters of this study with comparisons of instant beverages 1: 2, handling A. 500 grams of sugar + 500 avocado seeds that have been mashed and the extract was taken and B. 650 grams of sugar + 30 grams of cocoa powder + 500 avocado seeds and then the content was analyzed. Instant drink result from avocado seed that obtained is analyzed the flavonoid content using a spectrophotometer with A handling that is 0,31%, B handling that is 0,37 %. From the polyphenol analysis the result that obtained for the A handling = 41%, B handling = 44%. From the carbohydrate analysis, the result that obtained for the A handling = 73% while for the B handling = 81%. Organoleptic test on panelist preference level after brewing the instant drink of avocado seed for the color, taste, and aroma of the B handling is very liked by the panelist compared with the A handling. The conclusion is the result of all the handlings have no real different to all the handlings and the B handling was added with the cocoa powder so the panelist really likes it.

Keywords: avocado seed, instant drink and analysis

INTRODUCTION

Indonesia with all the abundant crops, still underutilized as a food or drink. the exist plant can be used from the fruits, stems, leaves, and so on. For the waste that is wasted from peels and seeds can be reprocessed become another product. in general, if the peels and the seeds were not consumed it usually only as a waste. An avocado a flesh of fruit has a delicious taste usually can be directly eaten, it can even be processed by adding sugar or milk so that the juice or drinks that taste savory and sweet was obtained. According to the consideration that the avocado fruit is abundant in the community, the price is cheap and the seeds have not been used maximally, then research is needed about the avocado seeds. Beside that the avocado seeds extract has a function in other fields, that is as anti-diabetic medication. (Ade zuhrotun 2007).

The avocado seed has a quite high oil content so it can be used as biodiesel raw material that is economical and environmentally friendly. For the content of avocado seeds are as follows: the content of avocado seeds, Polyphenol, Flavonoid, Triterpenoid, Quinine, Tannin, Monoterpenoid, and Sesquiterpenoid compounds content. Avocado is a fruit with a lot of benefits.

Some of the benefits of avocado fruit are: 1. Additional food ingredients, 2. Cosmetic ingredients, 3. Control weight, 4. Source of antioxidants, 5. Prevent strokes, 6 Maintain eye health, 7. The raw material of biodiesel (Wahyu hidayat et al., 2007). This research aims to know the concentrate of the sugar addition from avocado seeds as an instant drink and to know the analyzed of flavonoid, starch, and organoleptic test to the color, taste from the avocado seed instant drink and the benefit of this research is to give an information that the waste of avocado seeds can be processed as an instant drink so it can be an added value in income. Give a knowledge about the nutritional content from avocado seed instant drink.

MATERIAL AND METHODS

The implementation of this research was conducted in April to August 2017, which is housed in a Processing Product Laboratory of Sekolah Tinggi Penyuluhan Pertanian (STPP) Gowa and Processing Product Laboratory of Hasanuddin University and Fajar University in Makassar. Tools used in this research are a blender, knife, pan, stove, bottle packaging tools. Ingredients used in this research are avocado

seeds, sugar, water, flavonoid analysis ingredients, and starch analysis ingredients.

The implementation of this research was done with Completely Randomized Design (CRD) with three times replication for each handling. Nutritional content analysis from avocado seeds, flavonoid, and starch.

How to make it can be seen as follows :

1. Avocado seeds are washed and take the parts that are still good.
2. After washing then mashed it by blender with 1-litre water addition and then the avocado seeds was filtered.
3. The extract of avocado seeds was cooked then added sugar with handling :
 A = 500 grams sugar and 500 grams avocado seeds comparison
 B = 650 grams sugar + 30 grams cocoa powder + 500 grams avocado seeds comparison
4. After being cooked until crystallized, obtained drink powder that ready to be brewed using hot water or by using a spray dryer.

After that analyzed the flavonoid, polyphenol, and carbohydrate content. Organoleptic test to the instant drink from avocado seeds.

Flavonoid Analysis

1. 1 gram of extract that already dissolved into 95% ethanol was taken as much as 25 ml.
2. Mixed for 3 hours and then the avocado seeds extract drink was filtered.

The making of Standard Curve

1. A series of quercetin solution in ethanol was made with 2,5 $\mu\text{g/mL}$, 5,0 $\mu\text{g/mL}$, 7,5 $\mu\text{g/mL}$, 10,0 $\mu\text{g/mL}$, 12,5 $\mu\text{g/mL}$, 15,0 $\mu\text{g/mL}$ concentration, 0,5 ml solution was taken mixed with 1,5 ml ethanol, 0,1 ml aluminum chloride 10%, 0,1 ml acetic acid 1M and 2,8 ML distilled water.
2. Incubated at room temperature for 30 minutes.
3. Spectrophotometer UV -vis absorption was measured at a wavelength of 438 nm and a standard curve was made

Polyphenol Content

Make a curve with gallic acid which is expressed by percent gallic acid (EAG). To measure the curve is made by dissolving standard gallic acid with 10 $\mu\text{g/mL}$, 15,0 $\mu\text{g/mL}$, 20,0 $\mu\text{g/mL}$, 25,0 $\mu\text{g/mL}$, 25,0 $\mu\text{g/mL}$, 30 $\mu\text{g/mL}$ concentration. From the curve, the regression

equation is obtained. Avocado seeds instant drink extract was extracted with 50 grams methanol sample weight dissolving into 50 mL methanol concentration made. Sample weight dissolving into 50 mL methanol. Each sample mixed with 1 mL solution of DPPH keep it 30 minutes and count by using spectrophotometer at a 517 nm wavelength.

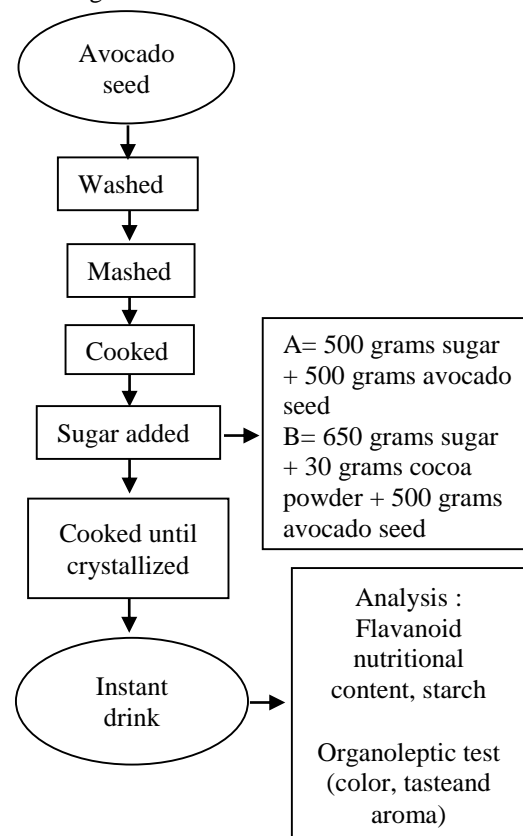


Figure 1. Flow chart

Carbohydrate Content

Luff Scroll method which determines the content of starch in food.

1. Weigh 5 grams material than put it in 500 ml Erlenmeyer.
2. Add 200 ml HCL 5% solution and then boil for an hour.
3. Chill then neutralized with 30%NaOH and add 3 % acetic acid.
4. Then transferred into a measuring flask, diluted with flute, shake and strain.
5. Then 10 ml filtrate extract pipette into Erlenmeyer adds 25 ml luff Schroll and 10 ml distilled water.
6. Heated and then cooled in an ice container then added 20% KI solution and 25% sulfuric acid titrated with 0,1 N thiosulfate Na until the yellow color disappears, add a little 1% starch solution then titrated until the blue color disappears.

The result of the handling that obtained continued with an organoleptic test for the color, taste, and aroma from avocado seeds instant drink. An organoleptic test was carried out using 30 panelists who tested the level of preference on color, taste, and aroma from the avocado seeds instant drink.

The score given in the testing of organoleptic test on panelist's preference are: 4 (really like), 3 (like), 2 (quite like), 1 (do not like).

RESULTS AND DISCUSSION

Flavonoid Content

The result that obtained can be seen by using spectrophotometer on A handling for 500 grams sugar + 500 grams avocado seed with B handling for 650 grams sugar + 30 grams cocoa powder + 500 avocado seed, can be seen that on B handling that is 0,37% and for the A handling that is 0,31%. This shows that the flavonoid on B handling is higher because more of the concentration of sugar and the added of cocoa powder which is chocolate contains a lot of flavonoid according to the opinion that flavonoid is an active compound that consists in cocoa powder. The flavonoid function is as antioxidants, this component of flavonoid is a compound that has 15 C carbon atoms which consist of two benzene rings connected to a carbon chain (Wahyudi, et al, 2008)

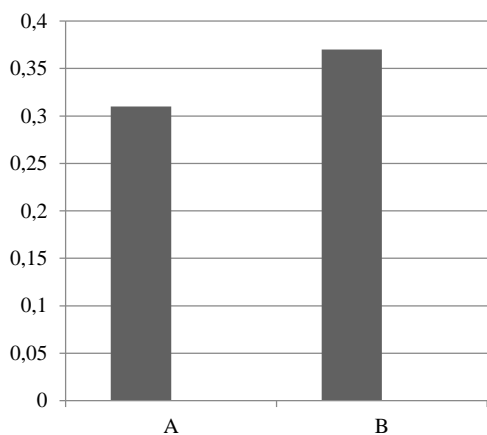


Figure 2. Flavonoid Result Content of Instant Drink from Avocado Seed

Polyphenol

The result that obtained for the B handling = 44%, but for the A handling = 41%, this is because of a lot of polyphenol content in the cocoa powder that added on the B handling so the polyphenol increase. But on the A handling also

consist of the amount obtained only from the avocado seed content. Antioxidant on the avocado seed is tannin that consists of a polyphenol compound that has free radical scavenging activity (Liberty et al., 2012).

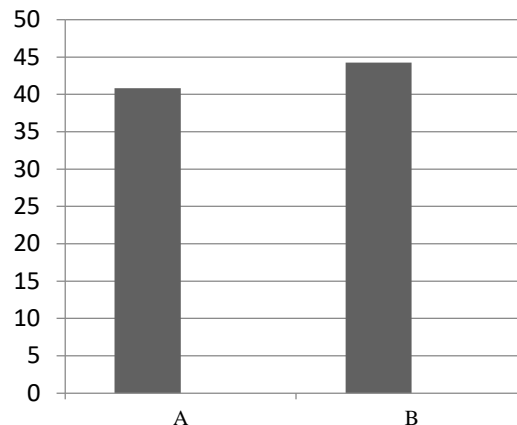


Figure 3. Poliphenol Result of Instant Drink

Carbohydrate

The results that obtained this research of the carbohydrate content are on the A handling = 81% while for the B handling = 73%. This shows that for the A handling, the carbohydrate content is higher because avocado seed rich of starch and then sugar was added as the carbohydrate as a simple compound is a small molecule that consists of one monosaccharide or two monosaccharides that bind together called complex carbohydrate (Winarno et al., 1980).

According to Linda, (2008), that the avocado seed is a food reserve for plants other than fruit, stems, and roots. Starch is a D-glucose polymer and found as a saving carbohydrate in the plant. Starch consists of two different polymers, straight chain, and amylose compounds and branched components, amylopectin. According to Aulia. et al. (2014) That the 23% high starch content of avocado seeds allows avocado seeds as an alternative starch source according to the journal in making dodol from avocado seeds.

Color

B handling that is 17 panelists really like with the adding of cocoa powder because this instant drink has a bright color if compare with the A handling which is the obtained color is white if dissolved in water will turn turbid so this color doesn't like by the panelists.

Taste

B handling that is avocado seeds instant drink added by cocoa powder according to the preference level of the taste of this avocado seeds instant drink gave a taste that really liked by the

panelists. The adding of this chocolate flavor affect the taste buds of the panelists. In addition to the sweet taste, the taste of chocolate in this instant drink can be felt and really liked by the highest 16 panelists. chocolate flavor and the sweet taste from sugar that disguise the senses of the tongue to taste, not to get the unwanted taste of avocado seeds.

Aroma

Panelist really likes the aroma of the avocado seeds instant drink for the handling with the adding of cocoa powder because the distinctive taste of this chocolate is so sharp so the panelist likes the aroma with the B handling which the panelist who really likes it are 18 people. The sense of the nose directly caught the sharp aroma of cocoa powder so that many panelists were really like with that aroma (Winarno, 1980).

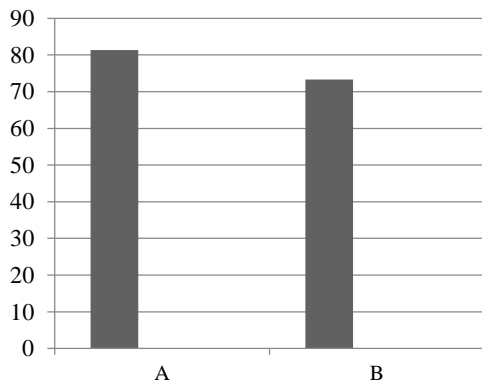


Figure 4. Carbohydrate Content of Instant Drink

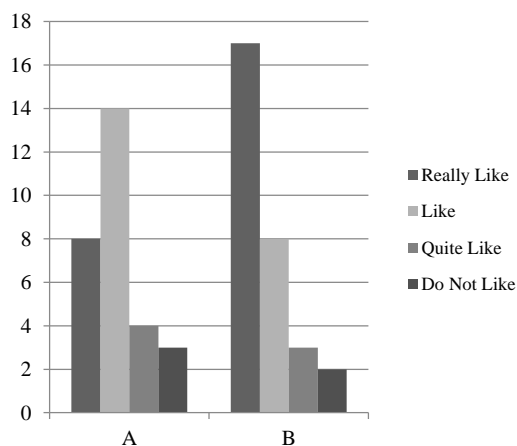


Figure 5. Instant drink's color from avocado seeds to the preference level

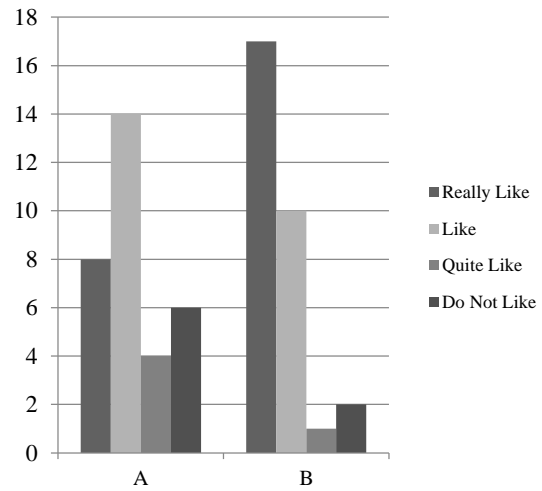


Figure 6. Organoleptic test's result of the taste of avocado seeds instant drink

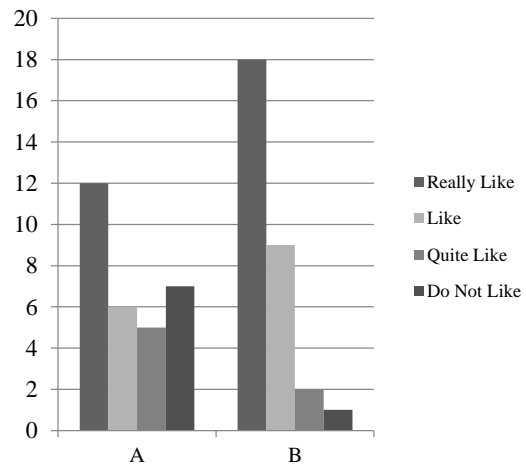


Figure 7. Organoleptic test's result of preference level on the aroma of avocado seeds instant drink.

CONCLUSIONS

The conclusion of this research are 1. Sugar concentration used in the making of avocado seeds instant drink are 1: 2 and 2. Bioactive component from the avocado seeds instant drink are flavonoid, polyphenol, carbohydrate from the analysis of variance not significantly different bot A and B handling and then the organoleptic test according to the preference level from panelist of taste, color, and aroma of the avocado seeds instant drink for the addition of sugar and addition of cocoa powder really liked by the panelist. Recommendation Its better to do further research to test the storability of avocado seeds instant drink and microbiological tests of the avocado seeds instant drink.

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EARLY MATURITY OF BLACK RICE CEMPO M4 SELECTION RESULT GAMMA IRRADIATION 200 GRAY

Eveline^a, Nandariyah^{a*}, and Parjanto^a

^aDepartment of Agrotechnology, Faculty of Agriculture, Sebelas Maret University, Indonesia

*Corresponding author : nandariyah@staff.uns.ac.id

ABSTRACT

Black rice is one of the food crops with high economic and nutritional value because of its high anthocyanin, fiber, protein, and iron content compared to white rice so that it can be used as medicine. Development of black rice is constrained by long harvest age and the excessive plant height compared to common white rice plant. One way to improve the properties is through mutation breeding using gamma-ray irradiation. The purpose of this study was to obtain short-lived black rice, short stem, and higher productivity. This research was conducted at DukuhTaru, Tempel Village, Gatak Sub-district, Sukoharjo District with M4 seedling (irradiation result of gamma rays 200 Gray of M3). Selection method used was pedigree selection method of 11 lines (M4-02-53, M4-02-54, M4-02-56, M4-02-57, M4-02-68, M4-02-69, M4-02-71, M4-02-72, M4-02-73, M4-02-74, and M4-02-75) with agronomic characteristics of fast harvest age and short stem (15 days faster (66 days) than control (81 days) and the height difference of 50 cm shorter than the shortest control plant (128 cm)). There are 5 M4 lines of gamma-ray irradiation of 200 grays (M4-02-53, M4-02-68, M4-02-69, M4-02-72, and M4-02-73) with the fast maturity category, short-stemmed, and higher productivity compared to control plants.

Keywords: Oryza sativa L., Mutation Breeding, Pedigree Selection, Lines

INTRODUCTION

One of the food crops which currently has high economic value is black rice. According to Purwasasmita and Alik (2014), black comes from the bran (aleurone) layer and the rice kernel which contains anthocyanin pigments. Black rice is considered to have fiber content (7.6970%), protein (8.1635%), iron (0.391 mg/ml) (Juwita 2016), and anthocyanin levels of 50-600 mg / 100 g (Kristantini et al. 2014) higher than white rice. Black rice has deficiencies, which are long plant life (> 145 days) and higher posture (> 150 cm) (Abdel and Ali 2006). Ways that can be done to correct these weaknesses through breeding mutations using gamma-ray irradiation. Gamma rays can be used to improve the genetic properties of plants (Jan et al. 2012). Mutation breeding can create genetic diversity (Putri et al. 2013) and produce mutants which are then selected from the target mutant offspring to obtain suitability with the desired character (Benny et al. 2015). This study aims to obtain superior M4 mutant plants especially in the nature of the plant age, plant height, and yield power to be used from the population of M5.

MATERIAL AND METHODS

The study was conducted in March to September 2017 on land in Dukuh Taru, Tempel, Gatak, Sukoharjo, Central Java. The black rice

planted was descended from M4 from 200 Gy gamma-ray irradiation and control without radiation. This research on the selection of black rice from the Cempo M4 variety was carried out using the pedigree selection method to select the desired plant properties, namely shorter harvest age, shorter plant height, and higher crop productivity. The variables observed were flowering age, plant height, number of productive tillers, panicle length, number of seeds per panicle, panicle density index, the weight of 100 seeds, and seed yield per plant.

The observational data in the form of quantitative data were analyzed descriptively compared to control plants using one sample t-test (One sample t-test) and then selected to select plants that have the desired properties.

RESULTS AND DISCUSSION

The general condition of the location of the study

The research location is located in Hamlet Taru, Desa Tempel, Kecamatan Gatak, Sukoharjo Regency, Central Java. The geographical location of Kecamatan Gatak Sukoharjo Regency is 7 ° 32'17"- 7 ° 49'32" LS and 110°42'06.79"- 110°57'33.7" BT. Gatak Subdistrict has boundaries in the North of Kartasura District, in the East of Baki District, in the South of Wonosari District, Kab. Klaten, and west of Sawit District,

Kab. Boyolali. BPS (2017) stated that the total area of Kecamatan Gatak was recorded at 1,947 ha with a technical irrigated rice field area of 1,209 ha, while in Desa Tempel itself the area of rice fields was 68 ha. Desa Tempel has a harvest area of 202 ha and rice field production is 1,466 tons. Based on these data, it can be seen that Desa Tempel has the potential to be planted with black rice (BPS Sukoharjo 2017). The research location used was 2000 m².

Flowering age and harvest age

Plant age can be seen from the age of flowering and age of harvest. One of the superior properties of rice plants is having early maturity. The age of rice plants can be classified as follows: (1) Deep (> 151 days after planting), (2) Medium (125-150 days after planting), (3) Early (105-124 HST), (4) Very early (90-104 HST), and (5) Rapid Ultra (<90 HST) (2015 Rice Research Center).

Table 1. Flowering Age and Harvest Age of Black Rice Generation M4 Results of 200 Gy Gamma Ray Irradiation

| Line | Selected Individuals (plants) | Range Flowering Age (HST) | Range Harvest Age (HST) |
|----------------|-------------------------------|---------------------------|-------------------------|
| M4-02-53 | 5 | 62-66 | 101-103 |
| M4-02-54 | 3 | 62 | 99-101 |
| M4-02-55 | 4 | 55-62 | 99 |
| M4-02-56 | 8 | 55-66 | 85-101 |
| M4-02-57 | 2 | 49-55 | 91-94 |
| M4-02-58 | 1 | 55 | 99 |
| M4-02-68 | 8 | 62-66 | 103 |
| M4-02-69 | 4 | 65 | 103 |
| M4-02-70 | 2 | 65 | 103 |
| M4-02-71 | 3 | 65 | 103 |
| M4-02-72 | 1 | 66 | 103 |
| M4-02-73 | 1 | 66 | 103 |
| M4-02-74 | 2 | 66 | 103 |
| M4-02-75 | 1 | 66 | 103 |
| CONTROL | 30 | 81 | 110 |

Note: Control (black rice cempo ireng variety without irradiation)

Table 1 shows that the strains that have the shortest flowering age are the M4-02-57 strain, which has two individual plants whose flowering age is 49 days after planting and 55 HST. The longest flowering age is 66 HST, of which the flowering age is shorter than the control (81 HST) which is 15 days shorter than the control. According to Pramudyawardani et al. (2015), flowering age correlates with early maturity characters. The shortest flowering age of irradiated black rice is 32 days shorter than the control plant (81 HST) and the shortest age for irradiation of black rice is 25 days shorter than the control plant (110 HST). Based on table 1, the black rice produced by 200 gy gamma irradiation produces a very early maturity of 90-104 HST (Center for Rice Research 2015). Research by Haris et al. (2015) producing a radiation dose of 200 gy is a potential dose to produce mutants that can have a shorter and faster harvest life.

Plant height

Plant height is the result of plant growth and development. Growth requires protein synthesis and is a non-reversible process (Gardner et al. 2008). Measurement of the height of black rice is based on the time after the entry of the generative phase, ie the plant height will not increase (stable). Makarim and Suhartatik (2009) in his book stated that in early maturing varieties, the extension of the segment begins around the initiation of panicle primordia (early flowering).

Table 2 shows the black rice plant height from the shortest 200 gm gamma-ray irradiation, ie individual plants in the M4-02-57 strain. In the M4-02-57 strain, there are two individual plants that have short stems, namely M4-02-57 (C11) 78 cm and M4-02-57 (G7) 87 cm. Black rice plant height from the shortest 200 gy gamma-ray irradiation has a difference of 50 cm shorter than the shortest control plant (128 cm). Harding et al. (2012) stated that increasing the dose of irradiated

gamma rays from 0 - 300 Gy had an impact on decreasing plant height. The results of the T-tests One Sample test result in lines M4-02-53, M4-02-54, M4-02-56, M4-02-57, M4-02-68, M4-02-69, and M4-02-71 significant <0.05 so that H₀ was

rejected and H₁ was accepted which means that the black rice plant height from 200 gm gamma-ray irradiation on the strain was smaller or significantly lower than the control plant height average.

Table 2. Height of Black Rice Plant Generation M4 Results of 200 Gy Gamma Ray Irradiation

| Line | Selected Individuals (plants) | Range Plant Height (cm) | Average Plant Height (cm) |
|----------------|-------------------------------|-------------------------|---------------------------|
| M4-02-53 | 5 | 112-130 | 120,8 ± 7,82 |
| M4-02-54 | 3 | 124-129 | 126,33 ± 2,52 |
| M4-02-55 | 4 | 103-141 | 120,25 ± 15,69 |
| M4-02-56 | 8 | 84-122 | 109,63 ± 14,72 |
| M4-02-57 | 2 | 78-87 | 82,5 ± 6,36 |
| M4-02-58 | 1 | 120 | 120 |
| M4-02-68 | 8 | 113-132 | 122,75 ± 6,34 |
| M4-02-69 | 4 | 129-138 | 132,5 ± 4,04 |
| M4-02-70 | 2 | 113-132 | 122,5 ± 13,44 |
| M4-02-71 | 3 | 122-129 | 124,67 ± 3,79 |
| M4-02-72 | 1 | 129 | 129 |
| M4-02-73 | 1 | 128 | 128 |
| M4-02-74 | 2 | 116-122 | 119 ± 4,24 |
| M4-02-75 | 1 | 115 | 115 |
| CONTROL | 30 | 128-149 | 137,27 ± 6,31 |

Note: Control (black rice cempo ireng variety without irradiation)

Number of productive tillers

The number of productive tillers produced is a picture of the maximum number of tillers produced before. Husna and Ardian (2010) stated that the maximum number of tillers was very influential on the number of productive tillers which subsequently affected the grain yield.

The number of productive tillers of black rice produced by 200 gy gamma-ray irradiation (table 3) is the lowest 4 productive tillers and the highest is 19 productive tillers. There are 4 strains of M4 generation black rice from 200 gm gamma-ray irradiation which have an average number of productive tillers under the control plants namely M4-02-54, M4-0-56, M4-02-57, and M4-02-58 strains. Based on the t-test of one sample (One Sample T-test) one direction resulted in a significance of <0.05, namely in lines M4-02-54, M4-02-56, M4-02-68, and M4-02-69 so that H₀ was rejected and H₁ was accepted which means that the number of productive tillers of black rice produced by the 200 gy gamma-ray irradiation was significantly greater than the average number

of productive tillers of the control plants. Gamma-ray radiation at high doses causes increased sterility in seeds so that the seeds produced from saplings are seedless and the seedlings are categorized as unproductive tillers. This is confirmed by the statement of Sasikala and Kalaiyarasi (2010) stating the percentage of seed fertility decreases with increasing radiation doses on rice. Degwy (2013) states that the dose of gamma radiation has a very significant effect on fertility where treatment without gamma radiation is the most fertile.

Panicle length

The measurement of panicle length is done by measuring from the lowest panicle segment to the far end of the panicle. The panicle length depends on cultivated rice varieties which will also affect the number of seeds per panicle (Kumar 2015). Juriah et al. (2013) classified panicle length into several criteria, namely short panicles (<20 cm), medium panicles (20-30 cm), and long panicles (> 30 cm).

Table 3. Number of Productive Puppies of Black Rice Generation M4 Results of 200 Gy Gamma Ray Irradiation

| Line | Selected Individuals (plants) | Range of Productive Puppies (strands) | Average Number of Productive Puppies (strands) |
|----------------|-------------------------------|---------------------------------------|--|
| M4-02-53 | 5 | 8-14 | 11 ± 2,24 |
| M4-02-54 | 3 | 7-8 | 7,33 ± 0,58 |
| M4-02-55 | 4 | 4-13 | 9,5 ± 3,87 |
| M4-02-56 | 8 | 4-10 | 7,13 ± 1,89 |
| M4-02-57 | 2 | 4-6 | 5,00 ± 1,41 |
| M4-02-58 | 1 | 8 | 8 |
| M4-02-68 | 8 | 7-16 | 11,25 ± 3,11 |
| M4-02-69 | 4 | 9-10 | 9,75 ± 0,5 |
| M4-02-70 | 2 | 11 | 11 |
| M4-02-71 | 3 | 11-17 | 13,67 ± 3,06 |
| M4-02-72 | 1 | 16 | 16 |
| M4-02-73 | 1 | 13 | 13 |
| M4-02-74 | 2 | 13-19 | 16 ± 4,24 |
| M4-02-75 | 1 | 13 | 13 |
| CONTROL | 30 | 3-16 | 8,93 ± 3,22 |

Note: Control (black rice cempoireng variety without irradiation)

The length of panicle produced from 200 gm gamma-ray irradiation in the m4 generation black rice plant in Table 4 is the longest, which is found in the line of M4-02-53 along 33.2 cm which is 8.34 cm longer than the average control plant and the shortest is found in the M4-02-57 line, which is 22 cm. Based on the results of the one-way T-test (one sample t-test), a significance of <0.05 was obtained, namely in the lines M4-

02-53, M4-02-54, M4-02-55, M4-02-56, M4-02-57, M4-02-58, M4-02-68, M4-02-69, M4-02-70, M4-02-71, M4-02-72, M4-02-73 and M4-02-74 so H0 is rejected and H1 is accepted, which means that the panicle length on the black rice lines resulting from 200 gy gamma-ray irradiation is significantly greater or longer than the average panicle length of the control plant.

Table 4. Length of Black Rice Panels Generation M4 Results of 200 Gy Gamma Ray Irradiation

| Line | Selected Individuals (plants) | Range Panicle Length (cm) | Average panicle length (cm) |
|----------------|-------------------------------|---------------------------|-----------------------------|
| M4-02-53 | 5 | 28-33,2 | 30,00 ± 1,88 |
| M4-02-54 | 3 | 28,5-31,2 | 30,16 ± 0,92 |
| M4-02-55 | 4 | 24-30 | 27,89 ± 1,79 |
| M4-02-56 | 8 | 25,3-31,5 | 29,17 ± 1,41 |
| M4-02-57 | 2 | 22-29 | 27,13 ± 2,60 |
| M4-02-58 | 1 | 25,9-28,8 | 27,70 ± 1,57 |
| M4-02-68 | 8 | 26,4-32,6 | 30,03 ± 1,51 |
| M4-02-69 | 4 | 27,2-31,5 | 29,60 ± 1,39 |
| M4-02-70 | 2 | 24,5-27,2 | 26,08 ± 0,98 |
| M4-02-71 | 3 | 26,2-30,4 | 28,48 ± 1,32 |
| M4-02-72 | 1 | 27,3-28,7 | 28,17 ± 0,76 |
| M4-02-73 | 1 | 26,9-29,3 | 27,97 ± 1,22 |
| M4-02-74 | 2 | 27,6-32 | 29,77 ± 1,48 |
| M4-02-75 | 1 | 25,7-28,6 | 27,23 ± 1,46 |
| CONTROL | 30 | 16,5-29,2 | 24,86 ± 2,31 |

Note: Control (black rice rice cempo ireng variety without irradiation)

Table 5. Number of seeds per black rice pan M4 generation results of 200 Gy gamma ray irradiation

| Line | Selected Individuals (plants) | Range of seeds per panicle (grain) | Average number of seeds per panicle (cm) |
|----------------|-------------------------------|------------------------------------|--|
| M4-02-53 | 5 | 214-372 | 283,80 ± 44,70 |
| M4-02-54 | 3 | 210-430 | 325,44 ± 64,13 |
| M4-02-55 | 4 | 131-308 | 225,83 ± 55,08 |
| M4-02-56 | 8 | 95-343 | 222,67 ± 65,45 |
| M4-02-57 | 2 | 118-202 | 171,00 ± 34,96 |
| M4-02-58 | 1 | 143-210 | 173,33 ± 33,95 |
| M4-02-68 | 8 | 170-350 | 266,33 ± 39,32 |
| M4-02-69 | 4 | 200-300 | 251,17 ± 35,82 |
| M4-02-70 | 2 | 133-250 | 195,00 ± 46,80 |
| M4-02-71 | 3 | 219-354 | 283,22 ± 49,74 |
| M4-02-72 | 1 | 280-309 | 297,33 ± 15,31 |
| M4-02-73 | 1 | 224-247 | 237,33 ± 11,93 |
| M4-02-74 | 2 | 216-342 | 282,67 ± 48,90 |
| M4-02-75 | 1 | 159-190 | 177,00 ± 16,09 |
| CONTROL | 30 | 62-316 | 184,90 ± 58,07 |

Note: Control (black rice cempo ireng variety without irradiation)

Number of seeds per panicle

The number of seeds per panicle is one of the important yield components. The number of seeds per panicle depends on plant activity during the reproductive phase. Jubleam et al. (2016) say that the number of panicles that are too much will reduce filling to one panicle for the other panicles, the limited number of nutrients will increase the number of empty panicles

The average number of seeds per panicle of black rice produced by 200 gray gamma-ray irradiation was above the control and some were under control. Table 5 displays the results of 200 gray gamma-ray irradiation resulting in the highest data average number of seeds per panicle, 325, 44 grains on the M4-02-54 line. The strain also has individuals whose highest number of seeds per panicle is 430 grains. Strains that have an average number of seeds per panicle below the average control plant are found in M4-02-57 lines (171 grains), M4-02-58 (173.33 grains), and M4-02-75 (177 grains). The results of one-way T-test (one sample t-test) produced a significance of <0.05 on lines M4-02-53, M4-02-54, M4-02-55, M4-02-56, M4-02-68, M4-02-69, M4-02-71, M4-02-72, M4-02-73 and M4-02-74 so that H₀ is rejected and H₁ is accepted which means the number of seeds per panicle of black rice lines resulting from 200 gamma-ray irradiation gy is greater or more significantly on the average number of seeds per panicle of control plants.

Index of Panicle extension

The ideal rice plants are rice plants that have long, dense panicles where there is a large amount of grain. The determination of the panicle index of rice plants is by calculating the number of seeds per panicle divided by panicle length. The higher the total grain number per panicle, the higher the panicle thickness index (Mursid 2006). Black rice strains resulting from 200 gy gamma-ray irradiation (table 6) which produced the highest panicle thickness index were found in M4-02-54 lines of 10.79. This is in line with the average panicle length and the average number of seeds per panicle also has the highest data compared to other strains. The lines that have a panicle extension index below the index of the panicle of the control plants have 3 lines of plants, namely M4-02-57, M4-02-58, and M4-02-75. This is in line with the data on the average panicle length and data on the average number of seeds per panicle of these lines which are lower than other strains. The results of one-way t-test in one direction resulted in a significance of <0.05 on lines M4-02-53, M4-02-54, M4-02-68, M4-02-69, and M4-02-71 so that H₀ is rejected and H₁ is accepted, which means that the thickness index of the black rice strain pan results from 200 gy gamma-ray irradiation is significantly greater than the average index of control panicle panicles.

Table 6 Strength Index of Black Rice Panels Generation M4 Results of 200 Gy Gamma Ray Irradiation

| Line | Selected Individuals (plants) | Average panicle length (cm) | Average number of seeds per panicle (cm) | Panicle Strength Index |
|----------------|-------------------------------|-----------------------------|--|------------------------|
| M4-02-53 | 5 | 30,00 | 283,80 | 9,46 |
| M4-02-54 | 3 | 30,16 | 325,44 | 10,79 |
| M4-02-55 | 4 | 27,93 | 225,83 | 8,09 |
| M4-02-56 | 8 | 29,17 | 222,67 | 7,63 |
| M4-02-57 | 2 | 27,13 | 171,00 | 6,30 |
| M4-02-58 | 1 | 27,70 | 173,33 | 6,26 |
| M4-02-68 | 8 | 30,03 | 266,33 | 8,87 |
| M4-02-69 | 4 | 29,60 | 251,17 | 8,49 |
| M4-02-70 | 2 | 26,08 | 195,00 | 7,48 |
| M4-02-71 | 3 | 28,48 | 283,22 | 9,94 |
| M4-02-72 | 1 | 28,17 | 297,33 | 10,55 |
| M4-02-73 | 1 | 27,97 | 237,33 | 8,49 |
| M4-02-74 | 2 | 29,77 | 282,67 | 9,50 |
| M4-02-75 | 1 | 27,23 | 177,00 | 6,50 |
| CONTROL | 30 | 24,86 | 184,90 | 7,44 |

Note: Control (black rice cempo ireng variety without irradiation)

Weight 100 seeds

The weight of 100 seeds is influenced by the process of filling the seeds, namely photosynthesis which forms carbohydrates and grain shape and size. According to James et al. (2017) states that water is an important reagent in photosynthesis and hydrolytic processes. Light seeds are caused because the food produced in the photosynthesis process is also small, consequently, the grain formed becomes small and lean.

Table 7 shows the highest average weight of 100 seeds in the M4-02-68 line, which is equal

to 2.54 g. There were 2 m4 lines from the 200 gm gamma-ray irradiation which had an average weight of 100 seeds lower than the control plants, namely M4-02-58 (2.02 g) and M4-02-75 (2.31 g). Based on the one-way T-test (one-sample t-test) there was a significance of <0.05 on lines M4-02-53, M4-02-54, M4-02-56, and M4-02-68 so that H₀ was rejected and H₁ was accepted which means that the weight of 100 seeds of black rice lines resulting from 200 gy gamma-ray irradiation was significantly greater than the average weight of 100 seeds of control plants.

Table 7. The weight of 100 Black Rice Seeds M4 Generation Results of 200 Gy Gamma Ray Irradiation

| Line | Selected Individuals (plants) | Range Weight 100 Seeds (g) | Average Weight of 100 Seeds (g) |
|----------------|-------------------------------|----------------------------|---------------------------------|
| M4-02-53 | 5 | 2,34-2,61 | 2,50 ± 0,12 |
| M4-02-54 | 3 | 2,42-2,44 | 2,43 ± 0,01 |
| M4-02-55 | 4 | 2,17-2,61 | 2,48 ± 0,21 |
| M4-02-56 | 8 | 2,40-2,65 | 2,50 ± 0,08 |
| M4-02-57 | 2 | 2,24-2,61 | 2,42 ± 0,26 |
| M4-02-58 | 1 | 2,02 | 2,02 |
| M4-02-68 | 8 | 2,44-2,67 | 2,54 ± 0,09 |
| M4-02-69 | 4 | 2,16-2,63 | 2,46 ± 0,22 |
| M4-02-70 | 2 | 2,39-2,66 | 2,53 ± 0,19 |
| M4-02-71 | 3 | 2,21-2,65 | 2,50 ± 0,25 |
| M4-02-72 | 1 | 2,29 | 2,39 |
| M4-02-73 | 1 | 2,22 | 2,36 |
| M4-02-74 | 2 | 2,43-2,63 | 2,45 ± 0,03 |
| M4-02-75 | 1 | 2,31 | 2,31 |
| CONTROL | 30 | 1,82-2,81 | 2,33 ± 0,22 |

Note: Control (black rice cempo ireng variety without irradiation)

Table 8. Results of Seeds per Black Rice Plant Generation M4 Results of 200 Gy Gamma Ray Irradiation

| Line | Selected Individuals (plants) | Range of Seed Results per Plant (g) | Average Seed Results per Plant (g) |
|----------------|-------------------------------|-------------------------------------|------------------------------------|
| M4-02-53 | 5 | 34,83-65,4 | 47,55 ± 11,52 |
| M4-02-54 | 3 | 31,12-43,8 | 35,82 ± 6,94 |
| M4-02-55 | 4 | 11,27-49,89 | 34,91 ± 16,98 |
| M4-02-56 | 8 | 16,23-40,07 | 28,02 ± 9,08 |
| M4-02-57 | 2 | 13,31-26,8 | 20,06 ± 9,54 |
| M4-02-58 | 1 | 18,86 | 18,86 |
| M4-02-68 | 8 | 29,37-76,23 | 51,88 ± 16,53 |
| M4-02-69 | 4 | 30,92-53,04 | 42,60 ± 9,56 |
| M4-02-70 | 2 | 44,55-66 | 30,13 ± 7,94 |
| M4-02-71 | 3 | 43,77-79,24 | 57,23 ± 19,22 |
| M4-02-72 | 1 | 72,85 | 72,85 |
| M4-02-73 | 1 | 44,69 | 44,69 |
| M4-02-74 | 2 | 53,04-76,23 | 62,25 ± 18,48 |
| M4-02-75 | 1 | 36,91 | 36,91 |
| CONTROL | 30 | 5,51-42,29 | 25,00 ± 8,69 |

Note: Control (black rice cempoireng variety without irradiation)

Seed yield per plant

Seed yield per plant is the weight of the whole seed in one clump of plants that come from productive tillers. Rice productivity is influenced by the time of plant growth which is characterized by flowering time (Wei et al. 2015). According to Elly et al. (2015), there was a close positive correlation between seed weight per clump and panicle length, 100 seeds weight and a number of filled grains so that it was used as a parameter to show rice yield quality. The highest seed yield per plant in table 8 was in individual plants found in the M4 strain -02-71 which is equal to 79.24 g.

The yield of seeds per plant that has a value below the control is 2 strains, namely lines M4-02-57 and M4-02-58. This is in line with a large number of seeds per panicle in both strains, which also have lower values than controls. The results of the T-test (one sample t-test) in one direction with a significance of <0.05 were found in lines M4-02-53, M4-02-68, and M4-02-69 so that H₀ was rejected and H₁ was accepted which means that the yield of seeds per plant of black rice strains the results of 200 gy gamma-ray irradiation were significantly greater than the average seed yield per control plant. Research conducted by Ilyas and Naz (2014) resulted in a dose of 200-300 gy of gamma-ray irradiation as an effective dose to increase crop yields, the rest will reduce yield.

CONCLUSIONS

The conclusion in this research are there are differences in agronomic characteristics between M4 lines resulting from 200 gray gamma-ray irradiation compared to control plants based on the characteristics of flowering age, harvest age, plant height, number of productive tillers, panicle length, number of seeds per panicle, panicle intensity index, weights of 100 seeds, and seed yield per plant; there are 19 individual plants in 5 M4 lines resulting from 200 gray gamma-ray irradiation (M4-02-53 (J6, O8, D6, J8, I8), M4-02-68 (A1, A2, B1, A4, N18, H8, F12, J10), M4-02-69 (B11, C5, C15, C7), M4-02-72 (B4), and M4-02-73 (D2)) the results of one sample t-test (one sample t-test) one-way with early maturing, short-trunked, and productivity categories significantly higher than the control plant average.

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**TECHNICAL EFFICIENCY ANALYSIS OF LOWLAND RICE FARMING (*Oryza sativa* L.)
RICE FIELDS IN BUKIT RAYA VILLAGE TENGGARONG SEBERANG SUBDISTRICT
KUTAI KARTANEGARA REGENCY**

Erma Dwi Lestari^a, Tetty Wijayanti^{a*}, and M. Erwan Suriatmaja^a

^a*Faculty of Agriculture, Mulawarman University, Indonesia*

*Corresponding author : tettywijayanti_akbar@yahoo.com

ABSTRACT

The main crop of agriculture in Indonesia is rice. Rice is a food crop that produces rice as a staple food source for most of the Indonesian population. Kutai Kartanegara Regency is one of the Regencies in East Kalimantan Province which has an area of 27,263.10 km² with a population of 626,286 inhabitants. Production of lowland rice plants in Kutai Kartanegara in 2014 amounted to 180,811 tons of DUP. Tenggarong Seberang District is one of the districts in Kutai Kartanegara District with a total harvested area of 7,620 ha with a production of 47,326 tons (Badan Pusat Statistik of the Kutai Kartanegara Regency, 2015).

Bukit Raya Village is a village that is included in the Tenggarong Subdistrict District in an area of 10.10 km². Most of the residents of Desa Bukit Raya have a livelihood as farmers, the agricultural commodities produced include paddy rice, pulses, and vegetables. The simplicity of thinking and limited intellectual power due to low education causes the use of production factors to appear varied because they do not know the level of use of the right production factors. The need for efficiency analysis is to identify the production factors used by farmers in farming so as to increase farmers' income.

Keywords: environmental law, quality standard, genetic

INTRODUCTION

The main crop of agriculture in Indonesia is rice. Rice is a food crop that produces rice as a staple food source for most of the Indonesian population. Kutai Kartanegara Regency is one of the Regencies in East Kalimantan Province which has an area of 27,263.10 km² with a population of 626,286 inhabitants. Production of lowland rice plants in Kutai Kartanegara in 2014 amounted to 180,811 tons of DUP. Tenggarong Seberang District is one of the districts in Kutai Kartanegara District with a total harvested area of 7,620 ha with a production of 47,326 tons (Badan Pusat Statistik of the Kutai Kartanegara Regency, 2015).

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MATERIAL AND METHODS

This research was conducted in April to July 2018 in Bukit Raya Village, Tenggarong Seberang Subdistrict the Kutai Kartanegara Regency. There are two methods of data collection in this study, namely primary data and secondary data. The sampling method in this study was a proportional stratified random sampling with 41 respondents. Data analysis using the Frontier software 4.1 programs.

RESULT AND DISCUSSION

The result of research in the field shown by the table below: It is known that the t value of the land area is greater than the value of t table, this shows that the factor of production of the planted area has a significant effect on production. while the factors of seed production, labor, fertilizer, and medicine have no significant effect indicated by the value of t count that is smaller than the value of t table.

The level of efficiency achieved by 41 respondents ranged from 0.66 to 0.89. The average level of efficiency is 0.82, this is in accordance with the study of Hidayah et al. (2013), that is the average level of technical efficiency of wetland rice is 0.869 (range 0.684-0.967), which means that farmers can still

increase productivity. This value is a high enough efficiency value where the efficiency value ranges

from 0 to 1 which means that if it gets closer to one, the efficiency gets bigger (Sukiyono, 2004)

Table 1. Estimated Results for Frontier Production Function Parameters for rice farming rice fields in Bukit Raya Village with the MLE Approach

| | MLE (Maximum Likelihood Estimation) | | |
|-----------------------------|-------------------------------------|------------|---------|
| | Coefficient | Std. Error | t count |
| Intercept | 7.78 | 1.31 | 5.92 |
| Land area | 0.87 | 0.27 | 3.13 |
| Seed | -0.08 | 0.17 | -0.52 |
| Labor | 0.01 | 0.35 | 0.05 |
| Fertilizer | 0.01 | 0.09 | 0.09 |
| Medicine | -0.01 | 0.09 | -0.08 |
| $t_{table} (\alpha = 5\%)$ | 1.68 | | |
| $t_{table} (\alpha = 10\%)$ | 1.30 | | |

Resource: Primary Data (processed), 2018

Table 2. Distribution of Frequency of Technical Efficiency achieved by lowland rice farming in Bukit Raya

| No. | Efficiency Level | Total(Person) | Persentase(%) |
|-----|------------------|---------------|---------------|
| 1. | <0.71 | 3 | 7.32 |
| 2. | 0.71 – 0.75 | 3 | 7.32 |
| 3. | 0.76 – 0.80 | 9 | 21.95 |
| 4. | 0.81 – 0.85 | 14 | 34.14 |
| 5. | >0.85 | 12 | 29.27 |
| | Total | 41 | 100.00 |

Resource: Primary Data (processed), 2018

CONCLUSIONS

The results showed that the formulation of baung and oyster mushroom fish had a significant effect on water content, ash content, protein content, fat content, and amplang carbohydrate content. Formulations of baung and oyster mushroom (90:10) provide the best results based on organoleptic testing and meet SNI standards with water content $1.33 \pm 0.02\%$, ash content $1.38 \pm 0.03\%$, protein content $20.86 \pm 0.31\%$, fat content $33.05 \pm 0.93\%$, carbohydrate content $43.37 \pm 0.68\%$. The hedonic assessment of aroma, texture, and taste is like and color is very like with the quality of hedonic rather scented with baung, creamy white, crunchy texture and the taste of oyster mushrooms.

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RESPONSE OF PALM OIL SEEDLINGS (*Elaeis guineensis* Jacq.) ON THE TREATMENT OF VARIOUS TYPES OF FERTILIZATION AND TRICHODERMA COMPOST AT PRE NURSERY

Yetti Elidar^{a*}

^aDepartment of Agroecotechnology, Faculty of Agriculture, Mulawarman University, Indonesia

*Corresponding author : elidaryetti@gmail.com

ABSTRACT

The objective of this research was to investigate the effect of various types of fertilization (POC Nasa and urea) and Trichoderma compost to the growth of the best oil palm seedlings in the pre-nursery. The research was conducted in the Integrated Laboratory of the Faculty of Agriculture, Mulawarman University, Samarinda in 2018. This research consisted of two experiments in which each experiment used a Completely Randomized Design (CRD) with 4x4 factorial experiments and repeated 3 times.

The first experiment was conducted by applying dose variations of Trichoderma compost (T) which consisted of 4 levels, namely: t0 = control; t1 = Trichoderma 20 g plant-1; t2 = compost 20 g plant-1; t3 = compost 20 g, Trichoderma 20 g plant-1 and variations in the dosage of liquid organic fertilizer Nasa (S) consisting of 4 levels: s0 = control; s1 = 50 ml plant-1 solution; s2 = 100 ml of plant-1 solution; s3 = 150 ml of plant-1 solution. Meanwhile, the second experiment was conducted by applying the dose variations of Trichoderma compost (T) which consisted of 4 levels: t0 = control; t1 = Trichoderma 20 g plant-1; t2 = compost 20 g plant-1; t3 = compost 20 g, Trichoderma 20 g plant-1 and variations in the concentration of urea fertilizer (N) consisted of 4 levels: n0 = control; n1 = 1 g of L-1 water; n2 = 2 g L-1 water; n3 = 3 g of L-1 water. Fertilization in this experiment was given through a planting medium with a dose of 10 ml of plant-1.

The Observed variables were: plant height, midrib ring, number of midribs and midrib lengths. Data were analyzed using variance and if there were significant effects it would be continued with LSD test at the significance level of 5%.

The results of the first experiment on the treatment of Trichoderma compost showed significant differences on plant height aged 30, 60 and 90 days after planting (DAP) but differed not significantly on midrib ring, number of midribs and midrib lengths on 30, 60 and 90 days after planting. The treatment of Trichoderma 20 g, compost 20 g plant-1 (t3) showed the highest 90 DAP plant height, which was 26.48 cm. Although the treatment of doses of Nasa liquid organic fertilizer solution showed no significant difference to all observation variables, but it tended to increase the growth of oil palm seedlings in the pre nursery.

Whereas the results of the second experiment on the treatment of concentrated urea and Trichoderma compost showed significant differences on plant height aged 30, 60 and 90 days after planting (DAP) and the length of leaf midrib aged 90 DAP but not significantly different on midrib ring, number of midribs and midrib length aged 30 and 60 DAP. On the first experiment, the best result in plant height and leaf midribs on 90 DAP aged plant was shown by the treatment of Trichoderma 20 g, compost 20 g plant-1 (t3), respectively 29.13 cm and 18.32 cm and on the second experiment, the best result in plant height and leaf midribs on 90 DAP aged plant was shown by the treatment of urea fertilizer concentrate 3 g L-1 water dose 10 ml plant-1 (n3) through the planting medium with two-week intervals, respectively 29.44 cm and 18.45 cm

Keywords: palm oil, trichoderma compost, fertilization, pre nursery

INTRODUCTION

The province of East Kalimantan is one of the provinces in Indonesia which is the center of oil palm cultivation. As in 2012, it had 50,345 ha

land area with a production of 103,117 Ton and 2,048 kg.ha⁻¹ productivity; while in 2013 it has 42,554 ha land area with a production of 51,982 Ton and 1,222 kg.ha⁻¹ productivity. As in 2014, the land area reached 787,512 ha which consisted

of community plantations covering an area of 8,042 ha, government-owned plantations covering 438,039 ha, and private property covering 341,437 ha; meanwhile in 2015 the area of East Kalimantan oil palm plantations reached 896,081 ha with a production of 1,687,421 tons and the of productivity of 1,883 kg. Ha-1 (Directorate General of Plantation of Indonesia, 2016). The fact that there are many palm plants which is over 25 years old is the cause of the oil palm plants productivity regression in East Kalimantan Therefore, in order to increase the productivity of oil palm in East Kalimantan, it is necessary to rejuvenate the oil palm plantations without having to open new plantations. The decline in productivity of oil palm plants in East Kalimantan Province is due to the fact that many oil palm plants are over 25 years old. Therefore, to be able to increase the productivity of oil palm in East Kalimantan, rejuvenating the oil palm plantations without having to open new plantations is necessary and can be done through the nursery stage.

In order to obtain a quality growth and high productivity yields, seeds that have been planted in the pre-nursery or main nursery need to be properly maintained. it is also necessary to carry out maintenance on oil palm plants, one of which is by providing treatments such as the provision of Trichoderma compost and fertilization, so that a high-quality seeds can be obtained. The application of Trichoderma compost can accelerate plant growth and development. Furthermore, It also has abilites to increase healthy root production and increase the depth of roots (deeper below the surface of the soil). Moreover, Trichoderma compost does not only function as a decomposer for organic matter, but also can control the pest-infecting organisms (OPT). It is necessary to give Trichoderma compost to oil palm plants as a solution to prevent stem rot disease since palm oil plants are one of the plants that are often attacked by stem rot disease caused by Ganoderma mushroom.

Trichoderma sp. as decomposers, can also be used as biological agents and plant growth stimulators. Trichoderma fungi culture in applicative media can be given to the planting area and applies as a biodecomposer, decomposing organic waste into quality compost and can also be used as biofungicide. It can inhibit the growth of several fungi that cause harm to plants, for example, Rigidiforus lignosus, Fusarium oxysporum, Rhizoctonia solani, Sclerotium rolfsii, etc. (Masparry, 2011).

Providing nursery with Trichoderma compost could prevent pests and diseases as early

as possible. In addition, it is a long term low cost control and environmentally friendly.

The use of compost in the medium of oil palm nursery is needed to overcome the limited availability of organic matter in nature. Provision of compost in oil palm nurseries can improve chemical, physical and biological properties as a planting medium. Compost is an organic material that has undergone a decomposition process by decomposing microorganisms that can provide nutrients to plants, increase the activity of organisms in the soil, improve structure and increase the absorption of soil against water.

In the initial nursery fertilization is needed to spur vegetative growth, especially the provision of urea fertilizer which is a chemical fertilizer containing high levels of Nitrogen (N). Nitrogen can help plant metabolism, while NASA's liquid organic fertilizer is a fertilizer that has a low level of nutrient solubility in the soil which serves to improve the physical properties and biology of nutrient soils in the soil will be maintained and can be easily absorbed by plants so that the nutrient needs will be fulfilled with land

Based on the description above, it is important to conduct research to determine the effect of giving Trichoderma compost and fertilization (urea and Nasa) to the growth of oil palm seedlings at Pre Nursery. The objective of this research was to investigare the effect of Trichoderma compost and fertilization (urea and Nasa) to the growth of oil palm seedlings at Pre Nursery.

MATERIAL AND METHODS

Location

This research was carried out in the Integrated Laboratory Laboratory of the Faculty of Agriculture, Mulawarman University, Samarinda in 2018.

Materials and Tools

The material used in the study was oil palm sprouts from PT. London Sumatra (Lonsum) Samarinda Seberang District, Trichoderma compost, compost, urea, Nasa POC, top soil, SP-36 fertilizer, NPK fertilizer, water, and Dhitane M-45. While the tools used are 14x22 cm polybags, ruler, hand sprayer, measuring cup, wooden sticks, sickles, hoes, knives, scissors, trays, straps, buckets, loose, paralon, calculators, stationery and documentation tools

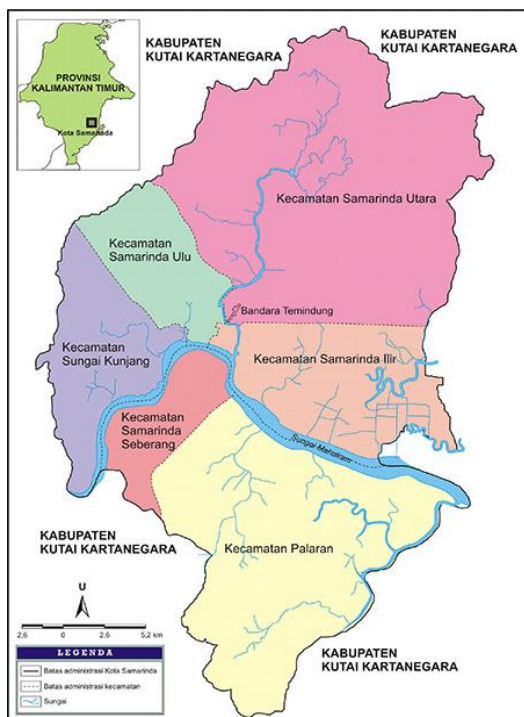


Figure 1. Research Location in the Integrated Laboratory Nursery of the Faculty of Agriculture, Mulawarman University, Samarinda

Procedures

Planting Media

In this research, Planting media that were used were in the form of 1 m³ of soil mixed with 500 g of SP-36 fertilizer dissolved in 10 L water. 2 Kg of planting media was put into of 14x22 cm polybags and given 2.5 grams of NPK fertilizer each.

Planting Palm Oil Sprouts at Pre Nursery

Palm oil sprouts which obtained from PT. Lonsum is removed from the plastic bag and stored with a tray of 1 g of Dithane 45 in 1 L of water. Sprouts were planted with conditions that were not exposed by direct sunlight. Sprouts were planted at a depth of 2 cm or 1 finger segment, the radicals were at below and the plumule were on the above. One oil palm sprout were planted per polybag and the watering process were conducted after. The nursery is given shade by using paranet which consists of 2 layers (50% light intensity) and reduced to 1 layer at the age of 2.5 months.

Fertilization

Trichoderma compost was given according to the treatment at the time of planting. The concentration of urea fertilizer is given in accordance with the treatment in which each plant is given 10 mL through soil media on plant seeds at intervals of 2 weeks. Furthermore, NASA organic liquid fertilizer in a concentration of 3 cc

L-1 was also given every 2 weeks regarding to the treatment.

Maintenance

Maintenance includes watering carried out every morning and evening. In addition, weeding were conducted on weeds which grew among oil palm seedlings in the pre nursery.

Observation parameters

Data taken includes:

- Plant height (cm) age 30, 60 and 90 days after planting (DAP)
- Midrib ring (cm) aged 30, 60 and 90 DAP
- Number of midribs aged 30, 60 and 90 DAP
- Length of midribs aged 30, 60 and 90 DAP

Data analysis

This study uses a Completely Randomized Design (CRD). The first experiment was conducted by applying dose variations of Trichoderma compost (T) which consisted of 4 levels, namely: t₀ = control; t₁ = Trichoderma 20 g plant⁻¹; t₂ = compost 20 g plant⁻¹; t₃ = compost 20 g, Trichoderma 20 g plant⁻¹ and variations in the dosage of liquid organic fertilizer Nasa (S) consisting of 4 levels: s₀ = control; s₁ = 50 ml plant⁻¹ solution; s₂ = 100 ml of plant⁻¹ solution; s₃ = 150 ml of plant⁻¹ solution. Meanwhile, the second experiment was conducted by applying the dose variations of Trichoderma compost (T) which consisted of 4 levels: t₀ = control; t₁ = Trichoderma 20 g plant⁻¹; t₂ = compost 20 g plant⁻¹; t₃ = compost 20 g, Trichoderma 20 g plant⁻¹ and variations in the concentration of urea fertilizer (N) consisted of 4 levels: n₀ = control; n₁ = 1 g of L-1 water; n₂ = 2 g L-1 water; n₃ = 3 g of L-1 water. Fertilization in this experiment was given through a planting medium with a dose of 10 ml of plant⁻¹.

There were 16 treatments which repeated 3 times each, so the number of seeds used was 96 seeds.

The results of the research data were analyzed by variance test and if there were significant differences in the treatment then proceed with the Least Significant Difference (LSD) test at 5% significance level.

RESULT AND DISCUSSION

The Effect of Trichodherma Compost and Liquid Nasa Organic Fertilizer on Palm Oil Seed Growth

The effect of Trichodherma Compost on Palm Oil Seed Growth

The results of the first experiment on the treatment of Trichoderma compost showed significant differences on plant height aged 30, 60

and 90 days after planting (DAP) but differed not significantly on midrib ring, number of midribs and midrib lengths on 30, 60 and 90 days after planting. The effect of Trichoderma compost on

the average plant height, midrib ring, number of midribs, and midrib lengths can be seen in Table 1.

Table 1. The effect of Trichoderma Compost on average plant height, midrib ring, number of midribs, and midrib lengths

| Trichoderma Compost | Plant Height | | | Midrib Ring | | | Number of Midribs | | | Midrib Lengths | | |
|---------------------|--------------|---------|---------|-------------|--------|--------|-------------------|--------|--------|----------------|--------|--------|
| | 30 DAP | 60 DAP | 90 DAP | 30 DAP | 60 DAP | 90 DAP | 30 DAP | 60 DAP | 90 DAP | 30 DAP | 60 DAP | 90 DAP |
| | * | * | * | tn | tn | tn | tn | tn | tn | tn | tn | * |
| t ₀ | 13.04b | 17.57c | 22.50c | 0.53 | 0.58 | 2.29 | 2.17 | 2.50 | 3.92 | 10.22 | 13.30 | 15.80 |
| t ₁ | 14.82a | 20.37b | 24.26b | 0.51 | 0.57 | 2.27 | 2.08 | 2.75 | 4.17 | 10.40 | 11.33 | 14.02 |
| t ₂ | 14.55a | 19.22ab | 26.30ab | 0.46 | 0.60 | 2.32 | 2.00 | 2.75 | 4.00 | 10.07 | 11.62 | 15.05 |
| t ₃ | 16.43a | 21.08a | 26.48a | 0.52 | 0.61 | 2.34 | 2.08 | 2.50 | 3.75 | 11.39 | 13.02 | 15.77 |

Note: The average number followed by the same letter shows no significant difference in the 5% LSD test.

Based on the results of the LSD test at 5% significance level, the treatment of Trichoderma compost on plant height aged 30 days showed that treatment t₀ was significantly different with t₁, t₂ and t₃, while treatment t₁, t₂ and t₃ showed no significant difference. The highest average plant height was shown in treatment t₃, which was 16.43 cm and the lowest was shown in treatment t₀ which was 13.04 cm.

Based on the results of the LSD test at 5% significance level, the treatment of Trichoderma compost on plant height 60 years old showed that treatment t₀ was significantly different with t₁, t₂ and t₃. The treatment of t₁ was significantly different from t₀ and t₃ showed no significant difference with t₂. The t₃ treatment was significantly different with t₀ and t₁ showed no significant difference with t₂. The highest average plant height was shown in treatment t₃ which was 21.08 cm and the lowest was shown in treatment t₀ which was 17.57 cm.

Based on the results of the LSD test at 5% significance level, the treatment of Trichoderma compost on plant height aged 90 days showed that treatment t₀ was significantly different from t₁, t₂ and t₃. The treatment of t₁ was significantly different with t₀ and t₃ but was not significantly different with t₂. The t₃ treatment was significantly different with t₀ and t₁ was not significantly different with t₂. The highest average plant height was shown in treatment t₂ which was 26.48 cm and the lowest was shown in treatment t₀ which was 22.50 cm.

The treatment of Trichoderma compost had a significant effect on plant height aged 30, 60 and 90 days after planting. It was that Trichoderma sp. in compost can help the process

of absorption of nutrients in quantities suitable for the growth of oil palm seedlings. According to Gultom (2008), Trichoderma sp. is a fungus that has benefits such as decomposers which help the process of making compost and bokashi, as biological agents, as activators for other microorganisms in the soil and as stimulators of plant growth.

Furthermore Syahri (2011) suggested that Trichoderma sp. has the ability to increase the formation of growth hormones in plants such as auxin and cytokinin. Association between Trichoderma sp. with roots can also help plants absorb minerals from the growing medium of plants given Trichoderma sp. can improve soil structure, increase macro and micro nutrients, facilitate the growth of plant roots, increase the biological activity of beneficial soil microorganisms and as a control of plant disrupting organisms (OPT) of land-borne diseases.

Siagian (2011) added that the benefits of Trichoderma sp. as follows: 1) Contains macro and micro nutrients, 2) Improving soil structure, 3) Facilitating plant root growth and being able to hold water.

The Effect of Liquid Nasa Organic Fertilizer on Palm Oil Seed Growth

Based on the results of the variance of the treatment of liquid organic fertilizer, it has no significant effect on plant height, hump circumference, number of midribs and midrib lengths at all plant ages.

The effect of giving liquid organic fertilizer to the average plant height, midrib ring, number of midribs and midrib lengths can be seen in Table 2.

Table 2. The Effect of Liquid Nasa Organic Fertilizer on Plant height, midrib ring, number of midribs, and midrib lengths

| POC Nasa | Plant Height | | | Midrib Ring | | | Number of Midribs | | | Midrib Lengths | | |
|----------------|--------------|-----------|-------|-------------|------|------|-------------------|------|------|----------------|-----------|-------|
| | 30 | 60 | 90 | 30 | 30 | 60 | 90 | 30 | 30 | 60 | 90 | 30 |
| | DAP | DAP | DAP | DAP | DAP | DAP | DAP | DAP | DAP | DAP | DAP | DAP |
| | tn | tn | tn | tn | tn | tn | tn | tn | tn | tn | tn | tn |
| s ₀ | 13.90 | 18.4 2 | 23.73 | 0.52 | 0.57 | 2.18 | 2.08 | 2.50 | 3.83 | 10.22 | 12.6 8 | 15.47 |
| s ₁ | 14.98 | 18.7 5 | 24.20 | 0.52 | 0.60 | 2.38 | 2.08 | 2.92 | 4.08 | 10.53 | 11.8 5 | 14.52 |
| s ₂ | 14.76 | 20.0 0 | 25.16 | 0.48 | 0.52 | 2.34 | 2.08 | 2.50 | 4.00 | 10.53 | 12.3 7 | 14.40 |
| s ₃ | 15.20 | 21.0 6 | 26.46 | 0.51 | 0.57 | 2.31 | 2.08 | 2.58 | 3.92 | 10.80 | 12.3 7 | 16.24 |

The application of liquid Nasa organic fertilizer has no significant effect on plant height, midrib ring, number of midribs, and midrib lengths. It was suspected that the availability of nutrients was low so that plant growth was not maximal and nutrients in the planting media were not absorbed perfectly by plants for the process of cell division and extension so that growth ran slowly. Nasa liquid organic fertilizer contains elements of N 0.12%, P₂O₅ 0.03%, K 0.31%, Ca 60.4 ppm, Mn 2.46 ppm, Fe 12.89 ppm, Cu 0.03 ppm, minerals, vitamins, organic acids, and stimulants growing Auxin, Giberilin, and Cytokines (Anonymous, 2005).

The absorption of Nasa liquid organic fertilizer by plants is influenced by the amount of nutrient availability in the soil because the nature of liquid organic fertilizer is needed in very large quantities to be able to meet nutrient requirements (Elidar, 2018). Furthermore, it was explained that the dosage of Pasa Nasa solution must match the capacity of soil media in polybags for fertilizer efficiency. POC Nasa with a dose of 100 ml solution in a 14x22 cm size polybag solution will be useless since it will be wasted. Giving POC Nasa 10-20 ml L-1 water will provide the best growth in the height of oil palm plants in the pre nursery.

The increase in the number of midribs showed no significant difference, presumably due to the concentration of Nasa POC given at the age of the young plants where the root conditions of plants were not widespread so that they were not able to absorb nutrient content properly.

The suspected cause of insignificant result of Nasa POCs presumably due to the macro and micro nutrients found in Nasa POC had not been able to be absorbed by oil palm seeds for plant leaf growth. According to Pranata (2005), explained that nutrients for plants have a correlation with the formation of new shoots and leaves for the absorbed nutrients will help the continuity of

photosynthesis tissue such as the formation of new leaves.

The number of oil palm seedlings showed no significant difference, presumably due to the influence of high air temperature so that the stomata on the leaves closed and the liquid fertilizer provided could not be absorbed into the leaves. This is explained by Novizan (2007) who stated that plants water evaporation is regulated by the stomata in order the flow of water from the roots can reach the leaves. When the air temperature is too hot, the stomata will be closed and the plant will not experience drought. Besides, it is not recommended to spray leaf fertilizer at high temperatures, because it will cause damage to the leaves. Novizan (2007) also states that it is not recommended to spray leaf fertilizer when the air temperature is hot because the concentration of the fertilizer solution that reaches the leaves quickly increases so that the leaves increase rapidly so the leaves can burn.

According to Suryana (2008), a plant will grow best if the suitable from of nutrients provided can be absorbed roots and in sufficient circumstances. Yellowing leaves of plants causes chlorophyll to decrease and photosynthate production decreases due to the decreasing of photosynthesis (Gardner, 2006). However, if there is N nutrient deficiency, the leaves become light green, especially the leaves that are old, then turn yellow. Furthermore, the leaves started to dry from the bottom to the top (Lingga and Marsono, 2008). Likewise, potassium elements are also critical in photosynthesis (Damanik et al, 2010).

The Interaction of Trichoderma Compost and Liquid Liquid Organic Fertilizer on Palm Oil Seed Growth

Based on the results of the variance of the interaction between the treatment of Trichoderma compost and liquid organic fertilizer it has no significant effect on plant height, midrib ring, number of midribs, and midrib lengths at all plant

ages. According to Steel and Torrie (1993), if two factors do not show influence, it can be concluded that the two factors acting freely do not influence each other.

The Effect of Trichoderma Compost and Urea Fertilizer on the Growth of Palm Oil Seedlings

The Effect of Trichoderma Compost on Palm Oil Seed Growth

Based on the results of variance, the treatment of Trichoderma compost had significant effect on plant height aged 30, 60 and 90 days after planting (DAP) and midrib length aged 90 DAP old but did not significantly affect midribs ring, number of midribs, and midrib

lengths on plants aged 30 and 60 days after planting.

The effect of Trichoderma compost on the average plant height, midribs ring, number of midribs, and midrib lengths presented in Table 3.

Based on the results of the LSD test on 5% significance level, it was found that the treatment of Trichoderma compost on plant height of plants aged 30 dap showed that treatment t0 was significantly different from t1, t2 and t3, while treatment t1, t2 and t3 showed insignificant difference. The highest average plant height was shown in treatment t3 which was 17.08 cm and the lowest was shown in treatment t0 which was 13.00 cm.

Table 3. The effect of Compost Trichoderma on average plant height, midribs ring, number of midribs, and midrib lengths.

| Tricho- derma Compo st | Plant Height | | | Midrib Ring | | | Number of Midribs | | | Midrib Lengths | | |
|---------------------------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-------------------|-----------------|-----------------|-----------------|-----------------|----------------|
| | 30 DAP * | 60 DAP * | 90 DAP * | 30 DAP tn | 60 DAP tn | 90 DAP tn | 30 DAP tn | 60 DAP tn | 90 DAP tn | 30 DAP tn | 60 DAP tn | 90 DAP * |
| t ₀ | 13.00 b | 19.76 c | 25.17 c | 0.53 | 0.70 | 2.42 | 2.08 | 2.83 | 4.08 | 11.18 | 12.32 | 15.18 c |
| t ₁ | 16.50 a | 21.05 b | 26.53 b | 0.55 | 0.70 | 2.53 | 2.00 | 2.92 | 4.08 | 11.59 | 12.81 | 16.27 b |
| t ₂ | 16.92 a | 23.37 ab | 28.71 ab | 0.75 | 0.75 | 2.49 | 2.08 | 2.92 | 4.00 | 12.31 | 13.60 | 18.32 a |
| t ₃ | 17.08 a | 23.69 a | 29.13 a | 0.68 | 0.68 | 2.30 | 2.17 | 2.50 | 3.83 | 13.04 | 14.39 | 16.45 ab |

Based on the results of the LSD test on 5% significance level, it was found that the treatment of Trichoderma compost on plant height of plants aged 60 dap showed that treatment t0 was significantly different from t1, t2 and t3. The treatment of t1 was significantly different from t0 and t3 but was not significantly different from t2. The t3 treatment was significantly different from t0 and t1 but insignificantly different with t2. The highest average plant height was shown in treatment t3 which was 23.69 cm and the lowest was shown in treatment t0 which was 19.76 cm.

Based on the results of the BNT test level of 5%, it was found that the treatment of Trichoderma compost on plant height of plants aged 90 dap showed that treatment t0 was significantly different from t1, t2 and t3. The treatment of t1 was significantly different from t0 and t3 but was not significantly different from t2. The t3 treatment was significantly different from t0 and t1 but insignificantly different with t2. The highest average plant height was shown in treatment t3 which was 29.13 cm and the lowest was shown in treatment t0 which was 25.17 cm.

The effect of giving Trichoderma compost to the mean of midrib length presented in Table 3.

Based on the results of the LSD test on 5% significance level, it was found that the treatment of Trichoderma compost on the midrib length of plants aged 90 dap showed that treatment t0 was significantly different from t1, t2 and t3. The treatment of t2 was significantly different from t1 but was not significantly different from t3. The average length of the best midrib was shown in treatment t2 which was 18.32 cm and the lowest was shown in treatment t0 which was 15.18 cm.

Trichoderma treatment 20 g, compost 20 g (t3) gave the highest plant growth of plants aged 30, 60 and 90 dap, while also gave the highest length of leaf midrib aged 90 daps. This is because Trichoderma can accelerate plant growth because it increases healthy root development and acts as a decomposer of organic matter so that nutrients are available for plants to be used in photosynthesis which produce photosynthates and function in cleavage, enlargement and elongation of cells at growing points which affect vertical growth on roots and plant height and length of leaf midribs.

With the availability of compost, it can overcome the limitations of organic matter in the growing media. Compost is an organic material

that has undergone a decomposition process by decomposing microorganisms and plays a role in increasing the activity of decomposing organisms so that it can provide nutrients needed by plants.

According to Purwantisari (2009), besides acting as a decomposing organism, *Trichoderma* sp. also functions as a biological agent which act on antagonistic mechanism. That ability of the *Trichoderma* sp. fungus makes it possible to parasitize the antagonistic fungi of plant pathogens.

In addition, *Trichoderma* sp. has the ability to increase the formation of growth hormones in plants such as auxin and cytokinin. Association between *Trichoderma* sp. with roots can also help plants absorb minerals from the growing medium of plants given *Trichoderma* sp. can improve soil structure, increase macro and micro nutrients, facilitate the growth of plant roots, increase the biological activity of beneficial soil

microorganisms and as a control of plant disrupting organisms such as: *Sclerotium* sp., *Phytium* sp., *Fusarium* sp., *Phytophthora* sp. and *Rhizocotonia* sp. Besides being decomposers, *Trichoderma* sp. can also function as biological agents and plant growth stimulators. Moreover, it can also prevent the occurrence of *Ganoderma*-mushrooms -caused stems rotten disease in oil palm plants, (Syahri, 2011).

The Effect of Urea Fertilizer on Palm Oil Seed Growth

Based on the results of the variance of the treatment of urea fertilizer it has a significant effect on plant height of plants aged 30, 60 and 90 dap and midribs length of plants aged 90 dap but has no significant effect on midrib rings, number of leaves and midrib length of 30 and 60 dap old plants. The effect of urea fertilizer on the average plant height shown in Table 4.

Table 4. The Effect of Urea Fertilizers on Average Plant Height, midrib ring, number of midribs and midrib lengths.

| Urea Fertilizers | Plant Height | | | Midrib Ring | | | Number of Midribs | | | Midrib Lengths | | |
|------------------|--------------|------------|------------|-------------|--------|--------|-------------------|--------|--------|----------------|--------|------------|
| | 30 DAP | 60 DAP | 90 DAP | 30 DAP | 60 DAP | 90 DAP | 30 DAP | 60 DAP | 90 DAP | 30 DAP | 60 DAP | 90 DAP |
| | * | * | * | tn | tn | tn | tn | tn | tn | tn | tn | * |
| n ₀ | 14.92 c | 19.62 c | 24.50 c | 0.53 | 0.68 | 2.33 | 2.00 | 2.83 | 3.83 | 11.79 | 12.42 | 15.01 c |
| n ₁ | 15.71 b | 21.45 b | 26.00 b | 0.58 | 0.73 | 2.55 | 2.08 | 2.75 | 4.08 | 11.16 | 13.29 | 16.16 b |
| n ₂ | 16.42 ab | 22.65 b | 27.67 b | 0.58 | 0.72 | 2.42 | 2.25 | 2.92 | 4.17 | 12.18 | 13.57 | 16.54 b |
| n ₃ | 16.46 a | 23.82 a | 29.44 a | 0.61 | 0.71 | 2.43 | 2.00 | 2.67 | 3.92 | 12.98 | 14.19 | 18.45 a |

Based on the results of the LSD test on 5% significance level, it was found that the treatment of urea fertilizer on plant height of 30 dap old plant showed that the treatment of n₀ was significantly different from n₁, n₂ and n₃. The treatment of n₁ was significantly different from n₃ but was not significantly different from n₂. The n₂ treatment was not significantly different with n₃. The highest average plant height was shown in treatment n₃ which was 16.46 cm and the lowest was shown in treatment n₀ which was 14.92 cm.

Based on the results of the LSD test on 5% significance level, it was found that the treatment of urea fertilizer on plant height of 60 dap old plant showed that the treatment of n₀ was significantly different from n₁, n₂ and n₃. The treatment of n₁ was not significantly different with n₂ but was significantly different from n₃. The n₂ treatment was significantly different from n₃. The highest average plant height was shown

in treatment n₃ ie 23.82 cm and the lowest was shown in treatment n₀ which was 19.62 cm.

Based on the results of the LSD test on 5% significance level, it was found that the treatment of urea fertilizer on plant height of 90 dap old plant showed that the treatment of n₀ was significantly different from n₁, n₂ and n₃. The treatment of n₁ was not significantly different with n₂ but was significantly different from n₃. The n₂ treatment was significantly different from n₃. The highest average plant height was shown in treatment n₃, which was 29.44 cm and the lowest was shown in treatment n₀ which was 24.50 cm.

The effect of urea fertilizer on the mean length of midrib presented in Table 4. Based on the results of the LSD test on 5% significance level, it was found that the treatment of urea fertilizer on the midrib length of 90 dap old plant showed that the treatment of n₀ was significantly different from n₁, n₂ and n₃. The treatment of n₁

was different not real with n2 but was significantly different from n3. The n2 treatment was significantly different from n3. The average length of the highest midrib was shown in treatment n3 which was 18.45 cm and the lowest was shown in treatment n0 which was 15.01 cm.

The application of urea fertilizer has a significant effect on plant height and midrib length of 90 days old plant. This is because the roots of oil palm have started to form perfectly so that the given urea fertilizer has been absorbed by the oil palm plantations to the top of the leaves. The function of element N is to stimulate the formation and growth of vegetative parts of plants such as leaves and stems (Sutedjo 2008). Lingga and Marsono (2008) state that the main role of N is to accelerate overall growth, especially stems and leaves. Oil palm plants that obtain sufficient amounts of nitrogen will have wide leaves, and are dark green in color, because they contain a lot of chlorophyll so that it will spur rapid growth by increasing plant height and stimulating leaf growth.

Nutrient N plays a role in photosynthesis to produce photosynthate in the form of carbohydrates, proteins, and other organic compounds that can be used in the process of division, enlargement, and differentiation of plant cells at the growth point so that the availability of N nutrients can increase plant growth (Lingga and Marsono, 2008).

Pranata (2005) further stated that nitrogen is a constituent of chlorophyll, with nitrogen being able to carry out photosynthesis to increase the amount of carbohydrates, proteins, and other organic compounds. Carbohydrates and proteins are then used for cell division which in turn will increase the growth of plant hump diameter. The vegetative growth of plants is associated with three important processes, namely cleavage, cell elongation, and the first stage of cell differentiation. These three processes require carbohydrates, because carbohydrates formed by nitrogen compounds to form protoplasm at growing points will affect the increase in plant height and the length of the midrib.

The effect of Interaction between Trichoderma Compost and Urea Fertilizers on Palm Oil Seed Growth

Based on the results of the variance of the interaction between the treatment of Trichoderma kompos and urea fertilizer there was no significant effect on plant height, midrib ring, number of midribs and midrib lengths at all plant ages.

According to Steel and Torrie (1993), if two factors do not show influence, it can be concluded that the two factors acting freely do not influence each other.

CONCLUSION

Based on the results of this research, conclusions can be taken as follows:

1. The treatment of Trichoderma compost (T) in the first experiment showed significant differences in plant height of 30, 60 and 90 dap plants, while also gave significant differences on midrib length of 90 dap plants. The treatment of Trichoderma compost (t3) gives the highest plant height to 90 dap plants, which was 26.48 cm.
2. The treatment of the dosage of POC Nasa (S) solution in the first experiment showed no significant difference in all parameters.
3. The treatment of Trichoderma compost (T) in the second experiment showed significant differences in plant height of 30, 60 and 90 dap plants, while also gave significant differences on midrib length of 90 dap plants. The use of Trichoderma 20 g, compost 20 g plant-1 (t3) showed the best plant height on 90 dap plants and the best midribs length of 90 dap, respectively 29.13 cm and 18.32 cm.
4. The treatment of urea (N) concentrations in the second experiment showed significant differences on plant height of 30, 60 and 90 dap plants while also gave significant differences on midrib length of 90 dap plant. The addition of urea fertilizer with concentration of 3 g L⁻¹ water dose 10 ml plant-1 (n3) through the medium of plants with two-week intervals showed that 90 dap plants got the best plant height and midribs length, respectively 29.44 cm and 18.45 cm.

SUGGESTION

Based on the results of the study it is suggested to get the best growth of oil palm seedlings in the pre nursery, it is recommended to use Trichoderma compost at a dose of 20 g and compost 20 g of plant-1. Giving urea fertilizer with a concentration of 3 g L⁻¹ of water with a dose of 10 ml of plant-1 through the planting medium with a two-week interval is recommended because it can provide the best growth of oil palm seedlings in the pre-nursery.

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THE DETERMINATION OF NITROGEN (N) STATUS IN LEAF TISSUES TO MAKE A FERTILIZER RECOMMENDATION AND PREDICT MANGOSTEEN YIELD

Odit F. Kurniadinata^{a*}, Roedhy Poerwanto^b, and Anas D. Susila^b

^aMulawarman University, Samarinda, Indonesia.

^bBogor Agricultural University, Bogor, Indonesia.

*Corresponding author : odit.ferry@gmail.com

ABSTRACT

Mangosteen (*Garcinia mangostana* L.) knows as one of the most delicious fruit in the word, it's call as "Queen of fruits". The problems in mangosteen culture are low productivity and low fruit quality due to less developed technical culture, especially on fertilizer. There is a little information available on mangosteen fertilizer recommendation standards based on scientific experiment. Nitrogen fertilizer increased growth especially in vegetative stage of mangosteen. Nitrogen increases the amount of flowers and fruits set. It also decreases number of flowers and fruits drop, with linear response. It indicates mangosteen trees absorb nitrogen (N) to increase the vegetative growth and support production. Fertilizers increase N concentrations in leaf tissues. Leaf tissues analyses showed status of Nr status, This status has a correlation to the yield. The higher the nutrients concentration in the leaf tissues, the higher the mangosteens yield in the next harvest.

Keywords: Xylem, Leaf, Tissue analysis, Production, Flowers.

INTRODUCTION

Mangosteen (*Garcinia mangostana* L.) is called as the Queen of Tropical Fruits. Mangosteen has a high economic value to be developed on a large scale (Poepenoe 1974; Cox 1988; Indriyani et al. 2002). Currently mangosteen fruit is a major commodity in the export of Indonesian horticultural products to foreign countries. But the average mangosteen productivity in Indonesian are still low (Abdillah 2008; Poerwanto 2003; Liferdi 2007). The important problem in the cultivation of mangosteen in Indonesia is the low production and quality of mangosteen. The high level of consumer demand for mangosteen fruit has not been followed by an increase in the maximum production of mangosteen. Of the total mangosteen production in Indonesia, only 7.8% included export quality (Poerwanto 2000). While the low quality is related to the size of the fruit which is not uniform.

The low production and quality of mangosteen fruit is closely related to the availability of macro and micro nutrients for mangosteen (Marschner 1995). Fertilization techniques and doses of fertilizer are one of the main factors causing the low production of mangosteen in Indonesia (Safrizal 2007). Most mangosteen plants in Indonesia are not currently fertilized, but only rely on nutrient supply from the soil. In addition, the technique of fertilizing mangosteen plants used is still not developed. There is a limitation on the latest information

regarding proper fertilization techniques and doses of fertilizer because fertilization is done without scientific study or the results have not been proven scientifically.

Plant tissue analysis was carried out to determine the status of nutrient in the mangosteen plant tissues (Ryugo 1988; Marschner 1995). Nutrient status in plant tissues is also reflect the nutrient status in the soil. This technique can be the basis for determining the right dosage and fertilizer time. So there is a need for research to get more practical examples of mangosteen leaves but have a high level of correlation with mangosteen production. In this study determination of leaf samples based on tribus age and terminal leaf position on tribus is expected to be a more practical and appropriate method in determining the adequacy of mangosteen plant nutrients and predicting mangosteen production.

METHODOLOGY

Place dan Times

The study was conducted in CengalDesa, Karacak, Kecamatan Leuwiliang, Kabupaten Bogor, Bogor, Indonesia. The research location is located at an altitude of 390-398 m Above Sea Level (ASL). The study lasted for 13 months from preparation to data collection.

Research methods

The experiment was carried out using a Randomized Block Design (RBD), consisting of five levels of treatment with six replications. Each

treatment level consists of one plant so that 30 productive mangosteen trees are needed (approximately 20 years of age and have fruited) that are relatively uniform in each experiment.

Nitrogen Fertilization (N)

Nitrogen fertilizer fertilization experiments consisted of five levels, namely: without fertilizer N (N0); 300 g N / plant / year (N1); 600 g N / plant / year (N2); 900 N / plant / year (N3) and 1200 g N / plant / year. Fertilization is given in three stages, the first stage is at dorman stage (not flowering), as much as 50% of the prescribed dose; the second stage is given when it is approaching flowering stage (the beginning of the rainy season), as much as 20% of the prescribed dose; while the third stage was given when the mangosteen fruit diameter was about 2 cm, as much as 30% of the prescribed dose. In each experiment the basic fertilizer was given in the form of 600 g P₂O₅ / plant / year and 800 g K₂O / plant / year.

Leaf samples based on fertilizer application time and harvest time

Leaf samples taken from the four corners of plant growth (North, South, East and West)

with leaf criteria have reached maximum development. The number of samples was taken as much as 2 sheets for each corner. Leaf samples were taken in four stages, each stage of leaf sampling was as follows: Before the first stage of fertilizer application; Before the second stage fertilizer application; Before the third stage fertilizer application; and After harvest.

RESULTS AND DISCUSSION

Effect of Nitrogen Fertilization

Nitrogen content in leaves

Nitrogen content in leaf tissue was observed four times (Table 3). Increasing nitrogen reserves in the terminal leaves of mangosteen plants collected in the dormant stage until after harvest (Table 3). The analysis of terminal leaves is carried out in the dormant stage until after each harvest represents a leaf that has been obtained five months since the flush. Liferdi (2007) explained that leaves receiving five months were the leaves that had the best relationship between leaf nutrient content and the relative yields, when compared to leaves at other ages.

Table 1. Nitrogen content in the terminal leaf tissue of mangosteen at four times observation.

| Nitrogen (g) | Dorman stage | Approaching flowering | Fruit diameter was about 2 cm | Post harvest |
|--------------|--------------|-----------------------|-------------------------------|--------------|
| |%..... | | | |
| 0 | 0,88 | 1,40 | 1,25 | 1,43 |
| 300 | 0,80 | 1,47 | 1,27 | 1,45 |
| 600 | 0,75 | 1,33 | 1,36 | 1,46 |
| 900 | 1,12 | 1,47 | 1,40 | 1,47 |
| 1200 | 0,99 | 1,54 | 1,44 | 1,30 |

Source: Laboratory of the Department of Soil Science and Land Resources, IPB

Increased and decreased content in growth by the physiological processes of mangosteen in its growth. The change in plant physiology can be seen when increasing the ratio of nitrogen when the plants have not flowered when compared to the dormant stage, then the nitrogen content decreases when the plant activates the generative phase which is combined with flowers and fruit, then rises again after harvest. Fluctuations in nutrient reserves occur explaining photosynthate and assimilate allocation in plant source networks including nitrogen. Nitrogen as a constituent of important enzymes for plants and cars, is utilized optimally in every phase of growth and production of mangosteen plants. Sutejo (2002) states that dry matter consists of organic and inorganic materials, and nitrogen is one of the most ingredients contained in plants after carbon, hydrogen and oxygen. The amount of nitrogen reserves in these materials shows the

importance of nitrogen in supporting plant growth and production.

However, the nitrogen content of leaf terminals for each arrangement shows a relatively similar percentage, this explains the nutrient content in the leaves according to the phase of plant growth and is designed by the genotypic nature of the mangosteen plant. Collings (1955) stated that nitrogen is needed by plants to support plant growth, specifically for vegetative growth. Nitrogen in the plant's body will be converted into organic forms such as amino acids, proteins, constituents of chlorophyll, and growth regulators. This organic form of nitrogen will be used in the physiological processes of mangosteen plants, including supporting the translocation of assimilates and photosynthates in mangosteen leaves and other plant parts.

Nitrogen Fertilization of Crop Productivity

Nitrogen fertilization treatment has an effect on the variables of plant growth and production observed, namely the length of the

trubus, leaf length, leaf width, number of flowers, number of flowers and fruit loss, number of fruit harvests and fruit production per tree, but does not affect the amount trubus (Table 2)

Table 2. Effect of Nitrogen on the amount of flowers, the amount of flowers and fruit fall, the amount of fruits harvested and fruit production / tree.

| Nitrogen doses (g/tree) | The amount of flowers / tree (flowers) | The amount of flowers and fruit fall/ tree (flowers and fruits) | The amount of fruits harvested / tree (fruits) | Fruit production/ tree (kg/ tree) |
|-------------------------|--|---|--|-----------------------------------|
| 0 | 59,67 | 27,83 | 31,83 | 2,89 |
| 300 | 100,00 | 40,00 | 60,00 | 5,89 |
| 600 | 103,83 | 45,83 | 58,00 | 6,02 |
| 900 | 128,50 | 53,83 | 74,67 | 8,04 |
| 1200 | 132,00 | 52,33 | 79,67 | 8,75 |
| F test | ** | ** | ** | ** |
| Response patterns | L** | L** | L** | L** |

Note: F test to see the mangosteen response to nitrogen fertilization; Response patterns are tested with orthogonal polynomials; L = linear; * = real at 5% test level; ** = real at 1% test level; tn = not real.

Orthogonal tests show a linear effect on the number of flowers, number of fruits harvested and fruit production per tree. These results illustrate that nitrogen nutrients are needed by mangosteen plants in supporting their growth and productivity. However, the administration of nitrogen nutrients turned out to have a linear effect on the number of flowers and fruit loss, along with an increase in the number of flowers per tree due to nitrogen fertilization. This is caused by an increase in the amount of nitrogen which encourages vegetative growth of plants, including leaf growth such as the length and width of leaves which then causes photosynthate accumulation which is useful for growth and increases the production of mangosteen plants, so that more flowers are formed, and indirectly make interest and the fruit that falls out is getting bigger. However, based on the percentage of deciduous flowers and fruit, it can be explained that the increase in nitrogen apparently decreases the number of flowers and fruits that fall out. In the treatment without nitrogen fertilization (n0) flower and fruit loss occurred 46.64%, while the nitrogen fertilizer treatment at 1200 g / plant / year decreased the percentage of flowers and fruit loss to 39.64%. Therefore an increase in the number of flowers and fall fruit is thought not to be directly affected by the administration of nitrogen, but due to an increase in the number of flowers formed. Poerwanto (2003) explained that fruit and flower loss is caused by the influence of rain, dry conditions, extreme heat and competition among growing plant organs, this is supported by Rai (2004) and Siau (2006) in his research which illustrates that there is no direct effect of

administering nitrogen on the fall of flowers and fruit.

The decrease in the percentage of flowers and fruit loss due to the administration of nitrogen will increase the amount of fruit that can be harvested, so that the increase in vegetative growth is very important in efforts to increase crop production, with good vegetative growth fruit production is optimal (Laegreid et. al. 1999; Black 1968).

Optimum dose of N fertilizer for mangosteen

The results of the mangosteen plant showed a linear response to Nitrogen fertilizer application (Figure 1). These results indicate that the mangosteen plant has a positive response to nitrogen fertilizer with increasing crop yields.

The response of the mangosteen plant is linear, so to determine the optimum fertilizer requirements for maximum production, the relative yield value of 80% is taken. Without Nitrogen fertilization application, the relative yield of mangosteen was 34,304 % respectively.

Recommendations for Nitrogen fertilization on mangosteen plants

This research showed that nitrogen fertilization application have an influence on the growth and production of mangosteen. However, to make a recommendation, a review of the economic aspects is needed, especially related to the price of fertilizer and the results that will be obtained by the mangosteen farmers. There are several alternative recommendations that can be made based on the relative yield data of mangosteen production.

Based on several alternative recommendations for Nitrogen fertilization on mangosteen that can be given, the best nitrogen fertilization recommendation to get optimum

results (80%), need more than 1020 g N / mangosteen tree / year.

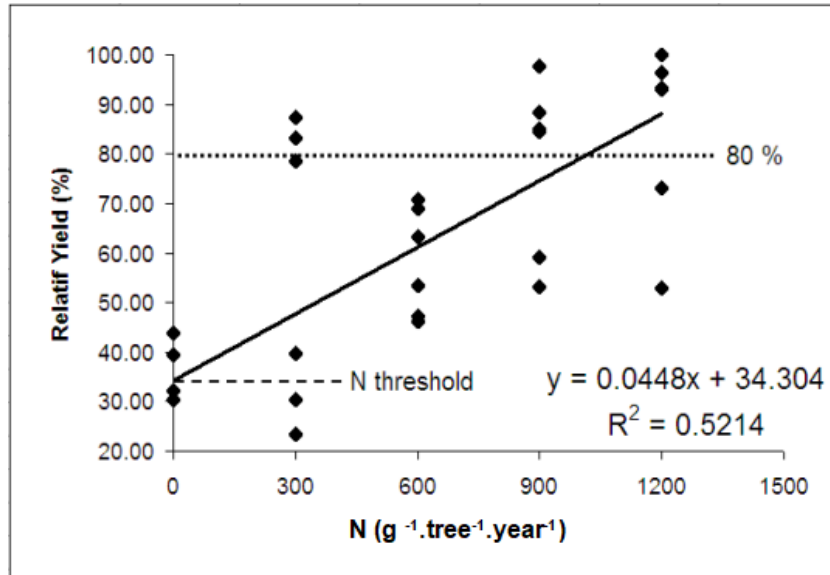


Figure 1. Relative yield of mangosteen fruit at Nitrogen Fertilization

CONCLUSION

Nitrogen fertilization application has an effect on the components of mangosteen productivity. The results of the mangosteen plant showed a linear response to fertilizing treatment. This shows that the mangosteen plant has a positive response to nitrogen fertilizer with increasing crop yields. The best nitrogen fertilization recommendations are on the optimum yield (80%), is around 1020 g N/ mangosteen tree / year. The threshold value showed that without nitrogen fertilization application, the relative yield of mangosteen plants was 34,304 % respectively.

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THE EFFECT OF ADDITION MANGROVE FRUIT EXTRACT (*Sonneratia Sp*) ON ORGANOLEPTIC QUALITY AND ANTIOXIDANT ACTIVITY OF PASTEURIZATION COW'S MILK

Arif Ismanto^{a*} and Nisa Ulkarimah^a

^a*Faculty of Agriculture, Mulawarman University, Indonesia*

*Corresponding author : arifismanto9@gmail.com

ABSTRACT

The objectives of this study were to determine the effect of the addition of mangrove fruit extracts in dairy products to antioxidants level and consumer preferences. This research using Completely Randomized Design (RAL) which 4 treatments group (mangrove fruit concentration extract 0%, 5%, 10% and 15%) and 5 replication. Parameters measured in this study were hedonic scale, hedonic quality (color, flavor, and taste) and antioxidant activity on the product. The data were analyzed used Kruskal Wallis for hedonic scale and quality as well as the Least Significant Difference test (LSD) for antioxidants. This research shows that quality and hedonic scale (flavor and aroma) give significant effect with value $P < 0,05$. While on the quality test and hedonic scale (color) and antioxidant activity did not give a significant effect. The addition of 5% mangrove fruit concentration extract on cow pasteurized milk was preferred by panelists. The result of hedonic quality tested analysis produce white color with a favorite value of 2,1 (like to rather like), sweet taste with favorite value 2 (like) and slightly mangrove-scented with favorite value 2,26 (like to rather like). The results show that the highest antioxidant activity was shown in the addition of mangrove fruit extract concentration of 15%, that is 25,7% compared to cow pasteurized milk without the addition of mangrove fruit extract that has a lower antioxidant activity that is 7,77%.

Keywords: mangrove fruit extract, pasteurization milk, organoleptic quality, antioxidants quality

INTRODUCTION

Fresh milk contains complete and balanced food substances such as proteins, fats, carbohydrates, minerals and vitamins that are needed by humans. The high nutritional value of milk causes milk to be a medium that is highly sought after by microorganism for its growth and development. The microorganisms that develop in milk are also the final part. Handling improper milk can also help to be faster and cheaper, so processing and preservation need to be done. Processing and preservation of milk are carried out with the aim of the shelf life month (Jamila, 2006).

Dairy products with various types have been widely distributed in Indonesia, some examples of processed milk are: Ultra High-Temperature milk (UHT), pasteurized milk, powdered milk, sweetened condensed milk, and ice cream. Some time ago the use of natural ingredients is a trend in milk processing.

Mangrove is one of the many natural ingredients in East Kalimantan. East Kalimantan has a mangrove forest of 883,379 ha (Dammayanti, 2011). Many studies have developed to test the efficacy and usefulness of consuming *Sonneratia Sp*. Antioxidants are one

of the focuses of research that is often done in mangrove plants. Antioxidants in mangroves in plant adaptation to abiotic and biotics (Vranova et al., 2002). The antioxidants produced by plants are secondary metabolites that can be used as simple and complex phenolic compounds (Dixon and Paiva 1995). Besides having an important role in plants, antioxidants also have benefits for humans. Benefits that can be relied upon by eye organs, lung function, and neural network function (Dickinson 2002). Research related to the utilization of mangrove fruit (*Sonneratia sp*) in dairy products is still relatively small. This research is to produce healthy beverage products that are rich in antioxidants with raw materials of pure cow's milk and fortified with mangrove fruit extract.

MATERIAL AND METHODS

This research was conducted in October-December 2017. Preparation of pasteurized cow milk with the addition of mangrove fruit extract and the organoleptic test was carried out at the Laboratory of Animal Husbandry Production and Technology, Department of Animal Husbandry, Faculty of Agriculture, Mulawarman University. Antioxidant activity tests have been carried out in

the Chemical Laboratory of the Department of Agricultural Product Technology, Faculty of Agriculture, Mulawarman University.

The materials used in this study were: pure cow's milk, mangrove fruit, DPPH (1,1-diphenyl-2-picrylhydrazyl) reagent, tissue, filter paper, 96% ethanol, aquades, and mineral water. The tools used in this study are basin, knife, blender, beaker glass, spectrophotometer, vortex, micropipette, stove, test tube, analytic scale, pan, stirrer, measuring cup and aluminum foil.

The design used in this study was a completely randomized design (CRD) with four treatments and six replications.

Treatment 1: Cow's milk without mangrove extract

Treatment 2: Cow's milk by adding mangrove extract as much as 5%.

Treatment 3: Cow milk with the addition of mangrove extract as much as 10%.

Treatment 4: Cow's milk with the addition of mangrove extract as much as 15%.

Research Procedure

Preparing Milk and Mangrove Samples

The cow's milk sample used in the study came from Holstein Friesian Cattle in PESAT Livestock PT KPC Sangatta East Kalimantan. The mangrove fruit samples used came from Tanjung Laut, Bontang City, East Kalimantan.

Making mangrove fruit extracts.

Making mangrove fruit extract begins with the collection of material (mangrove) after the mangrove is separated between leaf branches and fruit petals so that only fruit remains after which the mangrove is washed, the washing process aims to make the mangrove fruit clean and hygienic. After washing, weighing as much as (2 kg) of mangrove is then carried out and then added 2 liters of water and blended. After that, the mangrove fruit that has been destroyed is filtered using filter paper and mangrove fruit extract is obtained (Diantoro et al., 2015).

Making pasteurized milk with the addition of mangrove fruit extract

Fresh cow's milk was added by mangrove fruit extract as much as 5%, 10%, 15% and fresh milk without being given mangrove fruit extract as a control. Then the mixture of the solution is added as much sugar (10%), then pasteurized by the method of LTLT (Low-Temperature Long Time) with a minimum temperature of 60 0C for 30 minutes.

Organoleptic Test

The evaluation criteria tested were in the form of color, taste, aroma, and preference. Organoleptic tests consisted of 25 semi-trained panelists (Kartika et al., 1999). Indicator scales assess color, taste, aroma, and preference (1-5) (Setyaningsih et al., 2010)

Table 1. Hedonic Quality Test

| No | Colour | Taste | Flavor |
|----|--------------------|----------------|---------------------------------|
| 1 | White | Fresh milk | Very flavorful milk |
| 2 | Yellowish white | Rather sweet | Scented milk |
| 3 | White rather cream | Sweet | Not flavorful |
| 4 | Yellow | Sweet and sour | A little scented with mangroves |
| 5 | Cream | A bit bitter | Scented mangrove fruit |

Table 2. Hedonic Scale Test

| No | Colour | Taste | Flavor |
|----|----------------|----------------|----------------|
| 1 | Really like | Really like | Really like |
| 2 | Like it | Like it | Like it |
| 3 | Rather like it | Rather like it | Rather like it |
| 4 | Do not like | Do not like | Do not like |
| 5 | Very dislike | Very dislike | Very dislike |

Antioxidant Test

Antioxidant tests were carried out using the DPPH method (Kubo et al., 2002). Measurements of antioxidant activity were carried out using the DPPH (1,1-diphenyl-2-picrylhydrazyl radical-scavenging) free radical method. The milk formula consisting of four

treatments was used as a sample for testing antioxidant activity. The antioxidant activity of milk was calculated based on its equivalence with the antioxidant activity of ascorbic acid expressed in ppm AEAC (Ascorbic Acid Equivalent Antioxidant Capacity). The antioxidant test procedures are explained below

Sample dilution

The material is weighed as much as 1 g in glass beaker then added with 95% ethanol as much as 10 ml and divots (10-1), then the mixed sample is taken as much as 5 ml and added 96% ethanol as much as 5 ml and vortex (10-2), and repeat until you get the 6th test (10-6).

DPPH dilution: 0.004 g DPPH added 50 ml of 95% ethanol (DPPH 0.2 mM concentration) stored in a dark room.

Blank: 2 ml of DPPH which has been diluted added 2 ml of 95% ethanol. Samples at 10-6 dilutions are taken 2 ml. Added 2 ml of DPPH (and checked) to close the test tube using aluminum foil. Let stand for 30 minutes at a dark room temperature. The absorbance is measured at 517 nm. State Antioxidant Activities in DPPH radical inhibition percentage (scavenging activity)

$$\% \text{ inhibition} = \frac{\text{DPPH absorbantion} - \text{sample absorbantion}}{\text{DPPH absorbantion}} \times 100$$

Data Collection Method

Data retrieval method used in this study milk that has been processed using mangrove extract was tested for antioxidant activity, as well as an organoleptic test (color, aroma, taste, preference) to find out the right amount of mangrove extract and liked by consumers.

Data Analysis

The data obtained in this study were processed using Variance Analysis based on a complete randomized design (CRD) (Gaspersz, 1991) with 4 treatments 6 replications.

RESULTS AND DISCUSSION

Hedonic scale test and Color Hedonic Quality

Pasteurized milk is processing milk by using a heating process with a certain length and temperature. The addition of mangrove fruit extract to pasteurized milk can affect the quality of organoleptic milk. Organoleptic testing of pasteurized milk with the addition of mangrove fruit extracts was carried out on 25 randomly selected panelists. Assessment is done using number 1 as the highest value (very preferred) up to number 5 as the smallest value (very disliked).

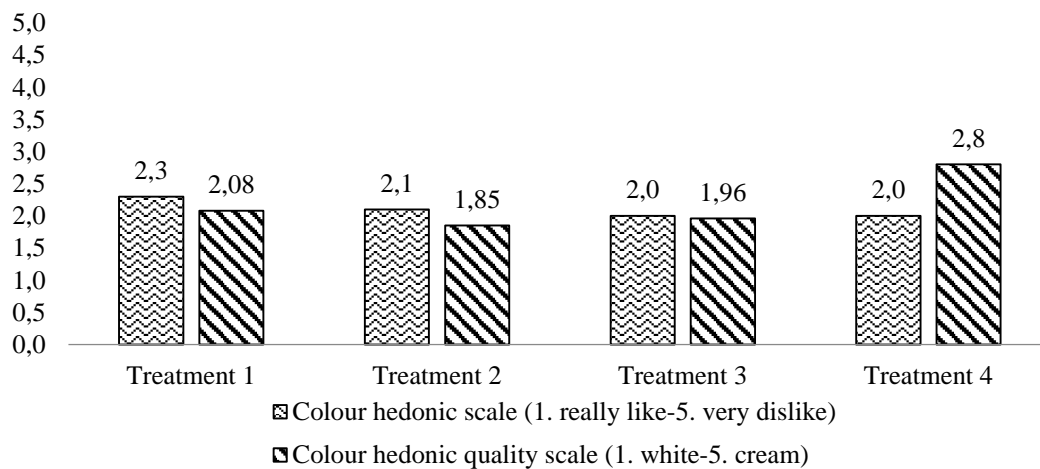


Figure 1. Color Hedonic Scale Test and Color Hedonic Quality in Pasteurized Cow Milk with Addition of Mangrove Fruit Extract (Information: Treatment 1 = Without the addition of mangrove fruit extract; Treatment 2 = Addition of mangrove fruit extract as much as 5%; Treatment 3 = Addition of mangrove fruit extract as much as 10%; Treatment 4 = Addition of mangrove fruit extract as much as 15%)

The results of statistical analysis on the hedonic scale test and hedonic color quality on pasteurized milk added with mangrove fruit extract showed no significant difference (P> 0.05). The extract produced from mangrove fruit does not have a striking color so the addition of mangrove fruit extract does not change the color of milk. Figure 1 shows that the panelist color hedonic scale test prefers P3 and P4. In the color

hedonic quality test, there is the best mean value in the P4 group of 2.8 (yellowish white to white cream). This is inversely proportional to the mean value in the P2 group where the resulting hedonic quality test is equal to 1.85 (white to yellowish white intensity). So that in Figure 3 the best treatment of scale and hedonic quality of color is found in P4 (with the addition of 15% mangrove extract in pasteurized milk).

Color plays an important role in the reception of food. Color can give clues about chemical changes in food (Kartika et al., 1988), color is a characteristic of a material that is thought to originate from the spread of the spectrum of light. someone's a sensory sensation because of the stimulation of a beam of radiation energy that falls into the eye or retina of the eye. If a product has an attractive color, it can cause someone's appetite to try the food. Fennema (1985) adds color to be the most important quality attribute, even though a product has high nutritional value, good taste, and good texture but if the color is less attractive it will cause the product to be less desirable. Color is the first parameter that decreases the level of consumer acceptance of a product. Subjective research with vision is still very decisive in organoleptic testing of color (Fennema, 1985).

Test of Aroma Hedonic Scale and Aroma Hedonic Quality

The results of statistical analysis on hedonic scale scent and hedonic aroma quality

were significantly different ($P < 0.05$). Figure 2 shows that panelists prefer P1 which is a control (without the addition of mangrove fruit extract). In the hedonic quality test, the aroma has the best average value, namely at P4 (pasteurized cow milk with the addition of 15% mangrove fruit extract) of 2.82 (milk-flavored to non-flavorful). The change in the aroma in milk pasteurisation is caused by mangrove fruit extract which has an acidic aroma because the pH is very low (acid) which is 3.3. This causes the higher addition of mangrove fruit extracts, it will reduce the fishy aroma of milk.

The flavor is a smell that can be observed with the smell of smell. Odor or aroma testing is one of the important tests because it can provide the results of an assessment of the product's acceptability (Kartika et al., 1998). Aroma has an important function in food products because before consuming usually the aroma of food is smelled by the senses of the nose, if the aroma of the product is too stinging or seem tasteless it will make consumers not interested in consuming.

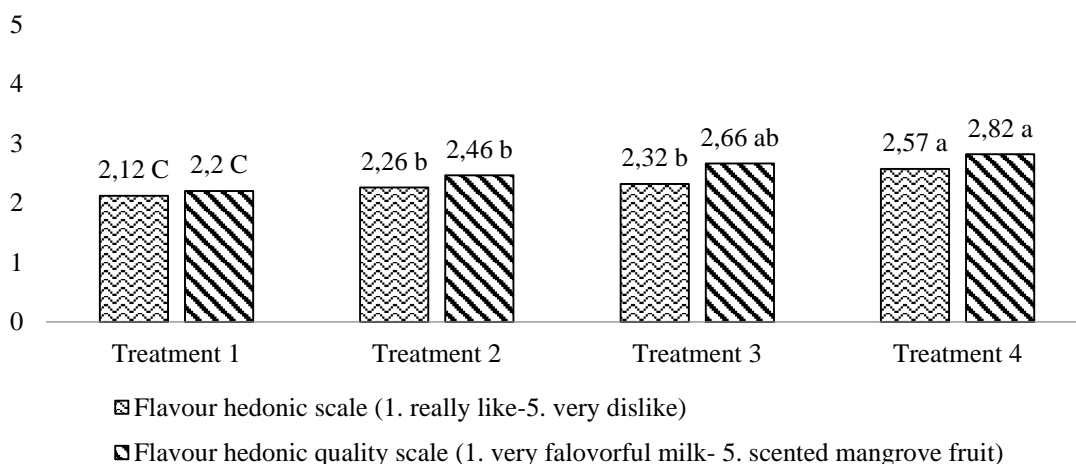


Figure 2. Scales of Aroma Hedonic Test and Hedonic Quality of Scents in Pasteurized Cow Milk with Addition of Mangrove Fruit Extract. *Information: Treatment 1 = Without the addition of mangrove fruit extract; Treatment 2 = Addition of mangrove fruit extract as much as 5%; Treatment 3 = Addition of mangrove fruit extract as much as 10%; Treatment 4 = Addition of mangrove fruit extract as much as 15%*

Test of Hedonic Scale Taste and Hedonic Quality of Taste

The results of the statistical analysis on the hedonic scale test of taste and hedonic taste quality (Appendix 2) were significantly different ($P < 0.05$). Figure 3 shows that panelists prefer P2 which is pasteurized cow milk with 5% addition of mangrove extract. In the hedonic quality test, there is the best mean value at P4 (pasteurized cow milk with the addition of 15% mangrove fruit extract) of 3.51 (sweet to sweet and sour). The

low pH of mangroves is very influential on milk so that the higher the concentration of mangrove extracts, the milk will feel sourer. The second treatment of P2 (pasteurized cow's milk with the addition of 5% mangrove extract) became the most preferred by the panelists because the ration was not too acidic but also felt the addition of extracts. The hedonic quality test results on the untreated pasteurized milk will not taste sour while the higher the treatment, the milk will feel sour even at the fourth treatment (P4) with a

concentration of 15% extract the milk feels slightly bitter. Taste is something that is very much considered in making a product. Taste is a

stimulus caused by the material eaten, especially felt by the taste buds.

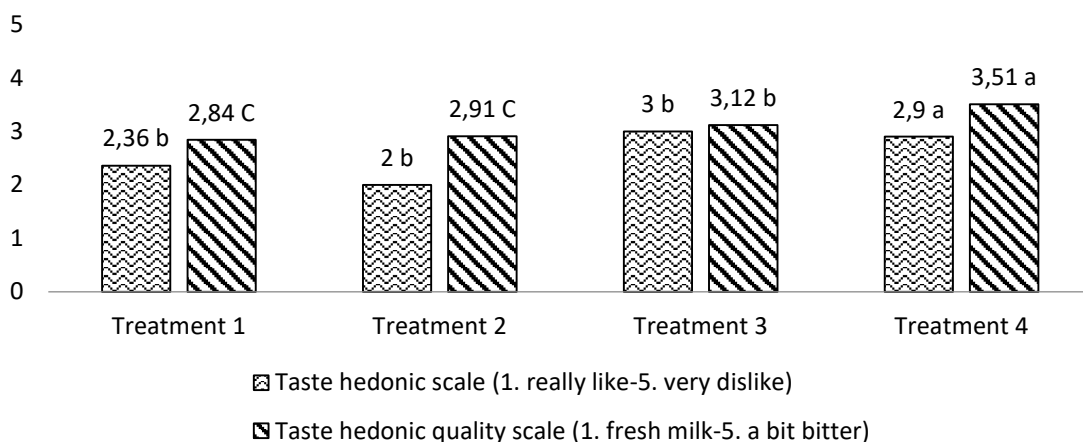


Figure 3. Hedonic Test Scale for Taste and Hedonic Quality of Flavor in Pasteurized Cow Milk with Addition of Mangrove Fruit Extract Information: *Treatment 1 = Without the addition of mangrove fruit extract; treatment 2 = Addition of mangrove fruit extract as much as 5%; treatment 3 = Addition of mangrove fruit extract as much as 10%; treatment 4 = Addition of mangrove fruit extract as much as 15%.*

Antioxidants Activity

The results of statistical analysis of pasteurized cow's milk with the addition of mangrove fruit extract (attachment 3) were not significantly different ($P > 0.05$). Figure 4 shows that pasteurized milk with the highest antioxidant activity is pasteurized milk with the addition of 15% mangrove extract which is equal to 25.7%

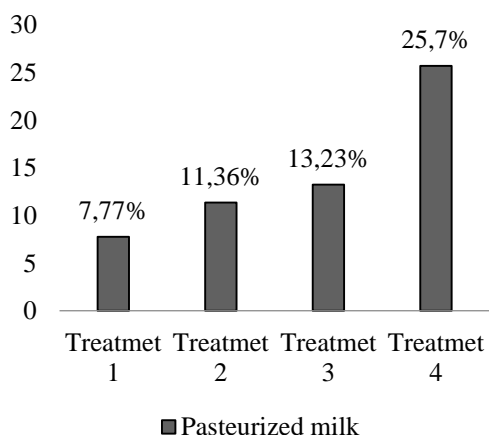


Figure 4. Graph of antioxidant activity in pasteurized cow milk with the addition of mangrove fruit extract. Information: *treatment 1 = without the addition of mangrove fruit extract; treatment 2 = addition of mangrove fruit extract as much as 5%; treatment 3 = addition of mangrove fruit extract as much as 10%; treatment 4 = addition of mangrove fruit extract as much as 15%.*

Analysis of antioxidant activity was carried out using the DPPH method. There are two main types of antioxidants namely primary and secondary antioxidants which are different in their mechanism of action. Primary antioxidants bind free radicals and give a hydrogen or electron atom to stabilize free radicals. On the other hand, secondary antioxidants work by suppressing the formation of free radicals which then prevents oxidative damage (Hue et al., 2012).

DPPH is free radicals at room temperature and accepts radical electrons and hydrogen to become stable molecules. This method has been used to analyze antioxidants such as polyphenols. DPPH is given hydrogen by polyphenols, forming a reduced DPPH. Then the color changes from purple to yellow after reduction, which can be measured by decreasing absorbance at a wavelength of 517 nm (Subramanian, 2013).

Levine et al. (1995) stated that vitamin C is a non-enzymatic antioxidant that is soluble in water. Some forms of antioxidants include vitamins, minerals, and phytochemicals. Vitamins C and E as antioxidants can stop free radical chain reactions. First vitamin E will capture free radicals, but vitamin E then turns into vitamin E radical so that it requires help of vitamin C. Vitamin C together with vitamin E can inhibit oxidation reactions by binding to vitamin E radicals formed in the process of breaking free radical reactions by vitamins E becomes free vitamin E which functions again as an antioxidant (Pavlovic et al. 2005).

Mangroves have a vitamin C content of 56.74 mg in 100 g of mangrove (Salamah, 2013).

Mangroves also function as antioxidants that can capture hydroxy radicals and superoxide then neutralize free radicals so that they protect cells and maintain the integrity of cell and tissue structures and can protect lipid membranes against damaging reactions (Robinson, 1995).

CONCLUSIONS AND SUGGESTION

The addition of mangrove fruit extract to pasteurized cow's milk has a significant effect on the quality and hedonic scale of aroma and taste but has no significant effect on the quality and color hedonic scale. Adding mangrove fruit extract to pasteurized cow's milk can increase antioxidant activity. The highest antioxidant activity was aimed at the addition of 15% mangrove fruit extract which was equal to 25.7% compared to pasteurized cow milk without the addition of mangrove fruit extract which had a lower antioxidant activity of 7.77%.

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POTENTIAL OF COVER CROPS AS FORAGE IN POST COAL MINING LAND

Muhammad Rizki Fadillah^{a*}, Iin Susilawati^a and Budi Ayuningsih^a

^a*Department of Animal Nutrition, Faculty of Animal Husbandry, Padjadjaran University*

*Corresponding author : fadelfadillah1514@gmail.com

ABSTRACT

The aims of this research were to know the potential of cover crops as forage in post-coal mining lands reclaimed and post-coal mining lands revegetated. This research was conducted on post-coal mining land Jupiter PT. Kaltim Prima Coal (KPC) Kutai Timur and oil palm plantation Cahaya Purnama at Bengalon Kutai Timur. The design of this research used a purposive sampling method with used post-coal mining land reclaimed (was planted by cover crops) and post-coal mining land revegetated (was planted by pioneer plants) and oil palm plantation land, with each used 1 hectare. The data were analyzed including of identification of forage types, forage production, and carrying capacity. The results of this research, on post-coal mining land reclaimed found 12 types of cover crops with dry forages potential 1.665 kg/year and carrying capacity 0,74 Animal unit, on post-coal mining land revegetated found 19 types of cover crops with dry forages potential 1.050 kg/year and carrying capacity 0,46 animal unit, on oil palm plantation land, found 15 types of cover crops with dry forages potential 885 kg/year and carrying capacity 0,40 animal unit.

Keywords: utilization, reclamation, revegetation, identification of forage, beef cattle

INTRODUCTION

The development of beef cattle in Kalimantan Timur continue to increase in every year. Known the level of the population of beef cattle in 2011 amount to 83,661 and increased up to 110,097 in 2015, one of the cause is there was procurement program of beef cattle in Kalimantan Timur by the government program in 2014. However, the high amount of beef cattle is not the same as the amount of the land farm or revegetated land for cattle. The lack of farmland or revegetated land was caused by land use change to a residential area or industrial area. Therefore, the government as policy maker had made the development program of cattle that raised in another area that has potential, like post-coal mining lands, that known to have potential as forage land or as revegetated land for livestock. The integration of beef cattle in post-mining coal land in Kalimantan Timur is the largest program in Indonesia, which that program has implemented in 680 hectares since 2015 until now (Department of Animal Husbandry Kalimantan Timur Province, 2018).

Based on data by the Ministry of Energy and Mineral Resources total of coal in Indonesia is estimated at 105 billion tons with estimated coal reserves of 21 billion tons and there were 5940 mining business licenses which were declared not clean and clear, while 4624 licenses were declared clean and clear (Ariansyah, 2016). The amount of Indonesian coal production in 2013 was 489 Mt (ranked 4th in the world), but in the coal export

category, Indonesia was ranked 1st as it was the largest exporter in the world, with as much as 426 Mt of coal (Kodir et al, 2017). Kalimantan and Sumatra are the two regions that have the largest coal reserves in Indonesia, but compared to Sumatra, Kalimantan is a region's dominant coal exploration, especially East Kalimantan (Suharto et al, 2015). Generally, Kalimantan island has coal reserves amount to 51,9 billion tons or about 49,6% from coal reserves in Indonesia. Known that in Kalimantan Timur have coal reserves amount to 37,5 billion tons or about 35,7% from national coal reserves and is the most active and progressive province in coal mining compared to other provinces (Subarudi et al, 2016). Coal land area in Kalimantan Timur reaches 4,4 million hectares, consist of 3,1 million hectares for 1.212 mining business licenses and 1.3 million hectares for 33 special licenses. The potential of mining materials in East Kalimantan (especially coal) is quite large and accounts for 45.83% of regional income (Hidayanto et al, 2014). Finally, from these data, it can be concluded that coal mining land with a large amount can be used as farmland or revegetated land for livestock.

However, post-coal mining land is marginal land that must be repaired. Mining of coal both surface and subsurface causes enormous damage to the flora, fauna, hydrological relations and soil biological properties of the systems (Kumar & Pandey, 2013). Therefore, the government through the decision of the Minister of Forestry Indonesia 146/Kpts-II/1999 which states that every mining company is obliged to

conduct land reclamation and rehabilitation. Steps in improvement land process consist of soil conservation, sediment management, land management and planting of cover crops and pioneer plants (revegetation). The first step in the process of planting plants in reclamation is to plant types of cover crops which has functioned as a ground cover that spreads between rows of plants, cliffs protectors, shrubs protectors, is a fence, or as fertilizer, examples like *Centrosema pubescens*, *Calopogonium mucunoides*, *Pueraria javanica*, *Crotalaria anagyroides*. After that process, the land is planted with a type of pioneer plant (revegetation) example like *Acacia* sp, *Gliricidia sepium*, *Leucaena leucocephala*, *Albizia chinensis*, *Sesbania* sp, and others (Zulkifli, 2014).

Post coal mining land that has been reclaimed and revegetated have the opportunity to be used for livestock, especially as a provider of forage land or revegetated land because the types of cover crops planted can also be used as forage. The integration system of livestock on post-coal mining land can be a symbiosis of mutualism because the presence of livestock on post-coal mining land is able to provide benefits such as contributors to organic fertilizers which have an impact on soil improvement and livestock can utilize existing forage.

Based on that, the purpose of this study was to determine the potential of cover crops as forage which analyzed from the type of forage, the quantity of forage, and the capacity of livestock on post-coal mining land, then compared to other integrated systems.

MATERIAL AND METHODS

Study Area and Materials

The materials used in this study is cover crops which are located on post-coal mining land reclamation and post-coal mining land revegetated and also cover crops on oil palm plantation land (as a comparison). This study was conducted at post-coal mining land of Jupiter PT. Kaltim Prima Coal (KPC) Kutai Timur and oil palm plantation Cahaya Purnama at Bengalon Kutai Timur, with each used 1 hectare.

Sampling Process

The process of cover crops sampling used quadrat frame plot size 1 x 1 meter, with a total of 40 observation plots in 1 hectare. The distance between the observation plots 10 meters in one line and the distance between lines is 10 meter (Syarifuddin, 2011). The cutting process of cover crops is ± 5 centimeters from the surface ground after then the cover crops are identified and weighing on each observation plots.

Data Analysis

The design of this research used a purposive sampling method with used post-coal mining land reclaimed (was planted by cover crops) and post-coal mining land revegetated (was planted by pioneer plants) and oil palm plantation land, with each used 1 hectare. The data were analyzed including of identification of forage types, forage production, and carrying capacity.

Vegetation Analysis

Vegetation analysis was conducted on types of vegetation found in land consist of importance value index (IVI), dominance index, biodiversity index of Shannon Wiener (H'), Margalef richness index, and index of evenness (E).

The importance value index was calculated only at the cover crops in this study.

$$IVI = \text{Relative density} + \text{Relative frequency}$$

The formulas used in data analysis are as follows:

1. Density
Density = (Number of species)/(Total area sampled)
2. Relative density
Relative density = (Density of species) / (The number density of all the species) $\times 100\%$
3. Frequency
Frequency = (number of plots in which a species occur) / (Total area sampled)
4. Relative frequency
Relative frequency = (Frequency of species) / (Total frequency of all species) $\times 100\%$
5. Biodiversity index of Shannon-Wiener (H') using the formula :
 $H' = -\sum P_i \ln(P_i)$
where $P_i = (n_i/N)$, n_i = important value index of i th species, N = important value index of all the species.
6. Dominance index using the formula :
Dominance index = $\sum_{i=1}^n (n_i/N)^2$
where $P_i = (n_i/N)$, n_i = important value index of i th species, N = important value index of all the species.
7. Species richness index using the formula
Species richness = $((S-1)/(\ln(N)))$
where S = total number of species and N = total number of individuals.
8. index of evenness (E) using the formula.
 $E = H'/\ln(S)$
Where, E = index of evenness, H' = biodiversity index of Shannon - Wiener and S = total number of species

9. Production of Forages

The process of calculating fresh weight is done after the process of cutting plants on the observation plots. Before the process of calculating dry matter, the samples are dried first with drying oven at temperate 65oC during 48 hours until the weight of samples is stable (Daru et al. 2014). The process of calculating dry matter of samples used formula Somanjaya (2015).

Note :

P = Production of forages (Kg of dry matter absorbed/year)

10 = Total number of process cutting of forage per year

AP =Average of production per quadrant plots (m²)

30% = Average value by dry matter of forages

50% =Digestibility in the form of dry matter

Carrying Capacity

Calculation of capacity is calculated based on forage production (hectare/year) divided by the amount of necessary forage per unit of livestock (hectare/year).To find out the necessary forage per unit of livestock, it can be known for calculating the minimum necessary of forage (Somanjaya, 2015).

Note :

K =The minimum necessary of forages for one AU (tons of dry matter absorbed/year)

3,5% =The minimum necessary of amount forage on body weight

50% = Average value of digestibility by forages

365 = Number of days in a year

350 = Body weight for one AU

Tabel 1. Total types of cover crops found in post-coal mining land reclaimed post-coal mining land revegetated, and oil palm plantation land.

| Species | Families | Palatability | |
|-------------------------------|------------------------|--------------|---|
| | | + | - |
| <i>Paspalum conjugatum</i> | <i>Poaceae</i> | + | |
| <i>Fimbristylis maliacea</i> | <i>Cyperaceae</i> | + | |
| <i>Melastomamalabathricum</i> | <i>Melastomataceae</i> | - | |
| <i>Borreria latifolia</i> | <i>Rubiaceae</i> | + | |
| <i>Ageratum conyzoides</i> | <i>Asteraceae</i> | + | |
| <i>Centrosema pubescens</i> | <i>Fabaceae</i> | + | |
| <i>Brachiaria decumbens</i> | <i>Poaceae</i> | + | |
| <i>Cyperus Difformis</i> | <i>Cyperaceae</i> | + | |
| <i>Chromolaena odorata</i> | <i>Asteraceae</i> | - | |
| <i>Desmodium ovalifolium</i> | <i>Fabaceae</i> | + | |
| <i>Mimosa pudica</i> | <i>Fabaceae</i> | + | |
| <i>Ludwigia octovalvis</i> | <i>Onagraceae</i> | - | |
| <i>Mikania micrantha</i> | <i>Asteraceae</i> | + | |
| <i>Solanum ferrox</i> | <i>Solanaceae</i> | - | |
| <i>Lygodium microphyllum</i> | <i>Schizaceae</i> | - | |
| <i>Nephrolepis biserrata</i> | <i>Dryopteridaceae</i> | - | |
| <i>Imperata cylindrica</i> | <i>Poaceae</i> | - | |
| <i>Polygala paniculata</i> | <i>Polygalaceae</i> | - | |
| <i>Lycopodium cernuum</i> | <i>Lycopodiaceae</i> | - | |
| <i>Ottchloa nodosa</i> | <i>Poaceae</i> | + | |
| <i>Lygodium circinatum</i> | <i>Schizaceae</i> | - | |
| <i>Clidemia hirta</i> | <i>Melastomataceae</i> | - | |
| <i>Lindernia crustacea</i> | <i>Linderniaceae</i> | - | |
| <i>Setaria sp</i> | <i>Poaceae</i> | + | |

Remarks: Available as forage feed; (-) Not available as forage feed.

RESULTS AND DISCUSSION

Vegetation Analysis

The results of identification types of cover crops in post-coal mining land reclaimed, post-coal mining land revegetated, and oil palm plantation land found amount to 24 types from 13 families, with a total number of types available as forage feed, was 12 types (Table 1). Identification types of cover crops in post-coal mining land reclaimed found 12 types of cover crops by 8 families with

the species of *Paspalum conjugate* has the highest result of Importance Value index IVI amount to 78,38 % (Table 2), in post-coal mining land revegetated found 19 types of cover crops by 10 families with the species of *Fimbristylis maliacea* has the highest result of Importance Value Index (IVI) was 48,19 % (Table 3), and in oil palm plantation land found 15 types of cover crops by 9 families with the highest result of Importance was the species of *Paspalum conjugatum* with number 92,54 % (Table 4).

Table 2. Total types of cover crops found in post-coal mining land reclaimed.

| Species | Families | Total number of individuals (N) | Relative Density | Relative frequency | IVI |
|--------------------------------|-----------------|---------------------------------|------------------|--------------------|-------|
| | | | % | | |
| <i>Paspalum conjugatum</i> | Poaceae | 490 | 49,70 | 28,68 | 78,38 |
| <i>Fimbristylis maliacea</i> | Cyperaceae | 125 | 12,68 | 15,50 | 28,18 |
| <i>Melastoma malabathricum</i> | Melastomataceae | 115 | 11,66 | 20,93 | 32,59 |
| <i>Brachiaria decumbens</i> | Poaceae | 113 | 11,46 | 6,98 | 18,44 |
| <i>Cyperus difformis</i> | Cyperaceae | 76 | 7,71 | 10,08 | 17,79 |
| <i>Choromolaena odorata</i> | Asteraceae | 20 | 2,03 | 4,65 | 6,68 |
| <i>Mikania micrantha</i> | Asteraceae | 12 | 1,22 | 2,33 | 3,54 |
| <i>Lygodium microphyllum</i> | Schizaceae | 9 | 0,91 | 3,88 | 4,79 |
| <i>Lycodium cernuum</i> | Lycopodiaceae | 8 | 0,81 | 1,55 | 2,36 |
| <i>Nephrolepis biserrata</i> | Dryopteridaceae | 7 | 0,71 | 1,55 | 2,26 |
| <i>Centrosema pubescens</i> | Fabaceae | 6 | 0,61 | 3,10 | 3,71 |
| <i>Mimosa pudica</i> | Fabaceae | 5 | 0,51 | 0,78 | 1,28 |

Table 3. Total types of cover crops found in post-coal mining land revegetated.

| Species | Families | Total number of individuals (N) | Relative Density | Relative frequency | IVI |
|--------------------------------|-----------------|---------------------------------|------------------|--------------------|-------|
| | | | % | | |
| <i>Fimbristylis maliacea</i> | Cyperaceae | 460 | 32,30 | 15,88 | 48,19 |
| <i>Paspalum conjugatum</i> | Poaceae | 370 | 25,98 | 17,06 | 43,04 |
| <i>Melastoma malabathricum</i> | Melastomataceae | 286 | 20,08 | 20,59 | 40,67 |
| <i>Centrosema pubescens</i> | Fabaceae | 147 | 10,32 | 12,35 | 22,68 |
| <i>Desmodium ovalifolium</i> | Fabaceae | 55 | 3,86 | 8,24 | 12,10 |
| <i>Ludwigia octovalvis</i> | Onagraceae | 23 | 1,62 | 3,53 | 5,14 |
| <i>Choromolaena odorata</i> | Asteraceae | 15 | 1,05 | 4,71 | 5,76 |
| <i>Imperata cylindra</i> | Poaceae | 12 | 0,84 | 1,18 | 2,02 |
| <i>Brachiaria decumbens</i> | Poaceae | 11 | 0,77 | 1,18 | 1,95 |
| <i>Mikania micrantha</i> | Asteraceae | 10 | 0,70 | 4,71 | 5,41 |
| <i>Mimosa pudica</i> | Fabaceae | 10 | 0,70 | 2,94 | 3,64 |
| <i>Cyperus difformis</i> | Cyperaceae | 7 | 0,49 | 1,76 | 2,26 |
| <i>Nephrolepis biserrata</i> | Dryopteridaceae | 6 | 0,42 | 1,76 | 2,19 |
| <i>Ottochloa nodosa</i> | Poaceae | 5 | 0,35 | 0,59 | 0,94 |
| <i>Lindernia crustacea</i> | Linderniaceae | 2 | 0,14 | 1,18 | 1,32 |
| <i>Setaria sp</i> | Poaceae | 2 | 0,14 | 0,59 | 0,73 |
| <i>Agetarum conyzoides</i> | Asteraceae | 1 | 0,07 | 0,59 | 0,66 |
| <i>Lygodium microphyllum</i> | Schizaceae | 1 | 0,07 | 0,59 | 0,66 |
| <i>Solanum ferox</i> | Solanaceae | 1 | 0,07 | 0,59 | 0,66 |

Table 4. Total types of cover crops found in oil palm plantation land.

| Species | Families | Total number of individuals (N) | Relative Density | Relative frequency | IVI |
|--------------------------------|------------------------|--|---------------------|-----------------------|-------|
| | | | | % | |
| <i>Paspalum conjugatum</i> | <i>Poaceae</i> | 1660 | 65,51 | 27,03 | 92,54 |
| <i>Borreria latifolia</i> | <i>Rubiaceae</i> | 464 | 13,18 | 16,89 | 30,07 |
| <i>Ageratum conyzoides</i> | <i>Asteraceae</i> | 200 | 5,68 | 12,16 | 17,84 |
| <i>Choromolaena odorata</i> | <i>Asteraceae</i> | 58 | 1,65 | 4,73 | 6,38 |
| <i>Melastoma malabathricum</i> | <i>Melastomataceae</i> | 50 | 1,42 | 11,49 | 12,91 |
| <i>Centrosema pubescens</i> | <i>Fabaceae</i> | 28 | 0,80 | 5,41 | 6,20 |
| <i>Brachiaria decumbens</i> | <i>Poaceae</i> | 26 | 0,74 | 4,05 | 4,79 |
| <i>Solanum Ferox</i> | <i>Solanaceae</i> | 13 | 0,37 | 3,38 | 3,75 |
| <i>Mimosa pudica</i> | <i>Fabaceae</i> | 12 | 0,34 | 5,41 | 5,75 |
| <i>Polygala paniculata</i> | <i>Polygalaceae</i> | 9 | 0,26 | 3,38 | 3,63 |
| <i>Lygodium circinatum</i> | <i>Schizaceae</i> | 4 | 0,11 | 2,70 | 2,82 |
| <i>Fimbristylis maliacea</i> | <i>Cyperaceae</i> | 4 | 0,11 | 1,35 | 1,46 |
| <i>Lygodium microphyllum</i> | <i>Schizaceae</i> | 3 | 0,09 | 0,68 | 0,76 |
| <i>Clidemia hirta</i> | <i>Melastomataceae</i> | 2 | 0,06 | 0,68 | 0,73 |
| <i>Ottlochloa nodosa</i> | <i>Poaceae</i> | 1 | 0,03 | 0,68 | 0,70 |

Based on the data of a total number of types cover crops from each land, that know the highest of total number was found at post-coal mining land revegetated. This result proves that there was shade effect in this study. The sunlight intensity of post-coal mining land revegetated range 50 %- 70 %, and the sunlight intensity of oil palm plantation land range 30 % - 90%. The species of cover crops found in post-coal mining land revegetated such as *Paspalum conjugatum*, *Ottlochloa nodosa*, and *Desmodium ovalifolium* is the types that can resistance of highest shade (<40 %), and types such as *Imperata cylindrica*, *Centrosema pubescens* that was the types can resistance of normal shade (40-60%) (Purwantari, 2016). Based on the results of vegetation analysis at all the lands used, it showed that the highest

Importance Value Index (IVI) was a type of *Paspalum conjugatum* at oil palm plantation land (92,54 %). *Paspalum conjugatum* was type has a high tolerance that can survive and grow in various ages of oil palm (Ramdani et al, 2017). In this study, it was also known that *paspalum conjugatum* dominated on post coal mining land reclaimed and post coal mining land revegetated. Research by hilwan et al. (2013), found *Paspalum conjugatum* has importance Value Index (IVI) of 90.51% under *Enterolobium cyclocarpum* plants and under has Importance Value Index of 87,71 % under *Samanea saman* plants in post coal mining land, it concluded that *Paspalum conjugatum* has a high tolerance level for influential environmental factors, especially shade and land.

Table 5. The Results of Biodiversity Index of Shannon-Wiener (H'), Dominance index, Species richness index, and index of evenness (E).

| Types of Land | Biodiversity index Shannon- Wiener (H') | Dominance Index | Species richness index | Evenness index (E) |
|-----------------------------------|---|--------------------|------------------------------|---------------------------|
| Post coal mining land reclaimed | 1,86 | 0,43 | 1,60 | 0,75 |
| Post coal mining land revegetated | 2,11 | 0,47 | 2,48 | 0,72 |
| Oil palm plantation land | 1,79 | 0,35 | 1,79 | 0,66 |

Table 6. The results of Production of forages and Carrying capacity in post-coal mining land reclaimed post-coal mining land revegetated, and oil palm plantation land.

| Type lands | Production of forages (kg/year) | Carrying capacity (Animal Unit) |
|-----------------------------------|------------------------------------|------------------------------------|
| Post coal mining land reclaimed | 1. 665 | 0,74 |
| Post coal mining land revegetated | 1.050 | 0,47 |
| Oil palm plantation land | 885 | 0,40 |

The calculation's results of Biodiversity index of Shannon-Wiener (H') and Species richness index, showed that on post-coal mining land revegetated has a higher level than results on post-coal mining land reclaimed and oil palm plantation land. In classification, If the value of $H' < 2$, the value of H' is relatively low, if the value of $H' = 2-3$ is classified as moderate, and if the value of $H' > 3$ is high, and If the value of Species richness is $< 3,5$ indicates relatively low, if value is $3.5 - 5.0$ show that species richness is moderate, and if the value is 5.0 indicates that species richness relatively high (Hilwan et al, 2013). Value of dominance index and Evenness index on post-coal mining land revegetated and post-coal mining land reclaimed showed the highest results than oil palm plantation land. The value of dominance index from all results indicates is relatively low results (< 1), and the results of Evenness index showed the highest results from all type lands (if $E > 0,6$ is high).

Production of Forages

The Calculation's result of the forages production, that found on post-coal mining land reclaimed has higher potential production (1.665 kg/year) than results on post-coal mining land revegetated (1.050 kg/year), and on oil palm plantation land (885 kg/year) (Table 6).

This different results due to shade factors. Forages on post-coal mining land reclaimed have the highest result caused by high levels of sun exposure to forages, while different with the forages on post-coal mining land revegetated and oil palm plantation land, where solar radiation is limited by shade factors. The lack of light intensity causes disruption of photosynthesis, and a decrease in the rate of metabolism and synthesis of plant carbohydrates, so that the dry weight of the forages produced will decrease (Fanindi and Sutedi, 2014; Handriawan et al, 2016). Photosynthesis is the process of cooking in leaves that requires the basic ingredients in the form of organic matter, water, and sunlight. The process of photosynthesis is an important factor in plant growth, where the number of leaves on high can accept a high sunlight anyway, so that makes the results of increased photosynthesis, then the photosynthetic compounds were circulated to all the organs of the plants that need and cause dry matter of plants to increase (Fatimah & Handarto, 2008). The low production of forages on oil palm land caused the age of palm, which gets older, the plant gets taller. In the old oil palm, midribs and leaves widen, so that the light penetrates into the less and affect the production of forages that grow under the oil palm (Daru et al, 2014; Ramdani et al, 2017). In this research, used was 5 years old,

according to research by Daru et al, (2014), found that the forage production on oil palm plantation that is 3 years old was greater than forage production on oil palm plantation that is 5 years old.

Carrying Capacity

The calculation result of carrying capacity in this study, on post-coal mining land reclaimed found the carrying capacity 0,74 AU/hectare (Animal Unit), on post-coal mining land revegetated found carrying capacity 0,47 AU/hectare (Animal Unit), and on oil palm plantation land found carrying capacity 0,40 AU/hectare (Animal Unit) (Table 6). The result of carrying capacity of post-mining land is higher than oil palm plantation land, although the results of each land are equally low. The low results of carrying capacity caused the number of revegetated livestock in this land, so that the plants do not have time for regrowth, generally, tropical pasture land stakes 70 days of rest after 30 days of revegetated, however, the presence of livestock can indirectly increase the spread of forage species because forage seeds are carried by livestock through feces (Daru et al, 2012). The carrying capacity is a reflection of the productivity of a revegetated land, the high productivity of forages making the higher carrying capacity (Sawen & Junaidi, 2011). the low capacity is related to decreasing forage production because the older the age of the plant, make the canopy close so that the light intensity is less (Purwantari et al, 2015). There is an influence from the age of the lands. The result of carrying capacity on oil palm plantation land, it known that the lower result than the result of research by Daru et al (2014) found that the carrying capacity on oil palm plantation that is 6 years old was 0,71 AU/hectare (Animal Unit) and on oil palm plantation land that is 3 years old was 1,44 AU/hectare (Animal Unit). In younger oil palm plantation land produce the high production of forages that it can support the optimum number of livestock (Purwantari et al, 2015).

CONCLUSIONS

The post-coal mining land reclaimed and the post-coal mining land revegetated has the potential of land that can be used as forage land or as livestock revegetated land, with higher results (forages production and carrying capacity) than oil palm plantation land.

It is necessary to research the qualities analysis of forages post-coal mining land and the impact on livestock grazing on post-coal mining land.

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SEMEN AND SPERM CHARACTERISTICS OF NUNUKAN ROOSTER

Fikri Ardhani^{a*}

^aAnimal Science Department, Agriculture Faculty, Mulawarman University

*Corresponding author(s), e-mail: fikri_ardhani@faperta.unmul.ac.id

ABSTRACT

The objective of this study was to characterize the sperm and semen of nunukan rooster. Twenty roosters were examined in this study for quality characteristics. Semen was collected twice a week by dorso-abdominal massage method. Parameters evaluated were volume, concentration, motility, live/dead ratio, and abnormality percentage. Data were analyzed descriptively for each parameter. The result of this study showed that the semen was white-milk in color, spermin in the smell, and thick in consistency. The semen had an average pH of 7.2 ± 0.1 . Furthermore, the mean value measurement for volume was 0.21 ± 0.15 mL, sperm concentration was $3.68 \pm 0.53 \times 10^9$ sperm/mL, the percentage of sperm motility was 80.00 ± 0.50 %, the percentage of live sperm was 82.55 ± 16.51 %, and percentage of abnormal sperm was 18.20 ± 10.40 %. The seminal plasma in every 100 mL contained 2.1 g protein, 4 mg fructose, 8 mg sorbitol, 319 mg sodium, 60 mg potassium, 8 mg calcium, 12 mg magnesium, and 138 mg chloride.

Keywords: semen, sperm, nunukan rooster

INTRODUCTION

Nunukan chicken is one of the germ-plasma livestock East Kalimantan, which has its own characteristics and advantages of the potential genetic to be preserved and developed. The characteristics of nunukan chicken, among others, males and females have brown fur as a base color, plain fur for color pattern, flickering golden fur, and smooth complexion feather. Another characteristic of nunukan chicken is the slow growth of feathers on the wings and tail, very short or even not grow at all (Sartika *et al.*, 2006). The weight of the original nunukan chicken can reach 4 to 5 kg's, 20-30% heavier than other local chickens and the egg production could reach 182 per year with the average egg mass of 47.5 grams (Wafiatiningsih *et al.*, 2005).

However, in the conventional breeding that does not have a good breeding program, a number of males are very limited, unbalanced proportion if it is compared with the number of females. It can lead to the low overall productivity of the nunukan chicken. Although the contribution of male (sire) in livestock productivity was limited to the sperm, the availability that will be a regenerative material from the male form of the sperm is needed.

Assessment of semen quality based on its characteristics gives an excellent indicator of poultry productive potential. The quality of semen leads to succeeding in fertility and hatchability of eggs. However, there are many differences in

semen quality depend on the strain, age, body size, nutrient feed, temperature environment as well as types of chicken (Almahdi *et al.*, 2014). So far, no comprehensive studies have been carried out to evaluate the nunukan rooster's semen so that ensuring the quality from their characteristics is needed to know their reproductive potential.

The effort in improving the productivity of the offspring can be done by Artificial Insemination (AI) program. Mating with AI method requires a number of males were much less, depending on sperm production and sperm needed by the female to maintain productivity and the development of nunukan chicken. Both male and female contribute significantly to the level of chicken fertility. Therefore, the quiet information about characteristics and quality of sperm and semen of nunukan chickens is considerably available in order to improve the productivity of nunukan chicken.

RESEARCH METHOD

Animals

This study used twenty nunukan roosters weighing 3-4 kg's per head, aged 30-35 weeks. Each rooster was placed in an individual cage, 50 x 50 x 75 cm³. The commercial feed was given twice per day as much as 100-150 g/day which drinking water provided ad libitum. Vaccination programs, provision of deworming and vitamin conducted regularly.

Semen Collection

Semen was collected by using massage or sorting on the dorso-abdominal gently from the back to the base of the tail and cloaca until the roosters aroused and shown with a raised tail. The massage was done with a certain pressure until the white sperm discharge from the cloaca and collected using the large-scale tube. Prior to semen collection, the part around the cloaca cleaned with tissue paper that had been sprayed with physiological Sodium Chloride solution.

Semen Evaluation

Evaluation of the semen quality includes observation and measurement of the volume, pH, color, and density as well as a microscopic examination to determine the concentration, motility, viability and morphology abnormality. The volume of the semen was carried out by the scale on the tube. The degree of acidity (pH) was measured using pH indicator paper (BTB, scale 6.4-8.0) and observation of color are made directly to a shelter before the semen was inserted into the tube shelters, then density was determined at the making of semen from the tube.

In addition, microscopic observation was made after dilution. Observation of individual spermatozoa movements was performed to see the activity of the progressive movement of spermatozoa per unit. Observations were carried out by dropping the semen which had been diluted, then covered with a lid glass, and then observed under a microscope with a magnification of 40x objective lens. The observation of progressive spermatozoa movements was conducted subjectively in ten different fields of view in the range of 0-100 % with 5% interval scale.

Furthermore, sperm concentration was counted using hemocytometer with Neubauer counting chamber. The collected semen was taken using micropipette in 1: 200 in NaCl 0.9% as much as 10 μ L. Later on, each 10 μ L of semen was dropped on cover glass side and the semen spread out under whole cover glass side until counted chamber was filled. The calculation on the counted chamber was done on 5 boxes. The sperm concentration is the number of sperm multiplied by dilution factor and hemocytometer factor.

$$\text{Concentration} = \text{dilution factor} \times 50.000 \times N \text{ cell /mL}$$

The calculation of live sperm and abnormal sperm percentage was counted by using a combination of eosin and nigrosin staining and the object was observed under a microscope with a magnification of 40x. One part of 4% eosin (4 g

eosin was dissolved in 96 mL of 2.9% sodium citrate and three parts of 8% nigrosin and 8 g nigrosin dissolved in 92 mL of 2.9% sodium citrate). The indicator to determine the life sperm and dead sperm can be seen from the sperm's color. The life sperm will not absorb color while the dead will absorb the color. The percentage of abnormality was determined by counting the sperm that has abnormal forms. The calculation was performed up to 100 cells.

Analysis of Chemical Composition of the Seminal Plasma

The chemical composition of the seminal plasma which includes fructose, sorbitol, and citric acid was determined using the method of High-Performance Liquid Chromatography (HPLC), while the determination of protein, sodium, calcium, potassium, magnesium, and chloride used methods Analytical Absorption Spectrophotometry (AAS).

Data Analysis

Research conducted was an exploratory study. Data were analyzed descriptively and confirmatively with the measured variable was the average obtained from each of the variables measured. The results obtained are presented as mean \pm standard deviation.

RESULT AND DISCUSSION

The dorso-abdominal massage method can be used for the collecting of semen in poultry. Semen collections of nunukan rooster take vary depending on the individual with a range of 10-30 minutes.

Characteristics of Fresh Semen

The evaluation of semen was conducted by macroscopic and microscopic observation. The macroscopic evaluation includes semen volume, color, acidity, and consistency, while the microscopic evaluation includes mass and individuals' movements, progressive motility, concentration and degree of abnormality. Generally, the characteristics of nunukan rooster semen collected shown in Table 1.

Semen Volume

The nunukan roosters' semen volume obtained at an average of 0.21 ± 0.15 mL. Generally, the semen volume of poultry is lower than mammalian semen volume, but on the other hand the sperm concentration of poultry higher than mammalian. This is in accordance with the fact that poultry does not have accessory glands,

so as not to produce seminal plasma (Mulyadi, 2007). As an indigenous rooster, the semen volume obtained was lower than other indigenous roosters. Iskandar *et al.* (2006) reported the rooster has about 0.30 ± 0.07 mL of semen, higher than Mulyadi (2007) report of 0.10 ± 0.01 mL. According to Toelihere (1993), the roosters have semen volume normally ranges between 0.3-1.5 mL.

Several factors can affect the volume of semen during semen collection which includes age, level of arousal, ejaculation frequency, and quality of feed given (Jonhson *et al.*, 2000). The laying hens weighed sexual maturity at the age of 24-26 weeks (Toelihere, 1993) and young individuals within a species produce a low semen volume. The age of the male was good to collect the semen is at the age of 1-1.5 years (48-72 weeks) (Sastrodihardjo and Resnawati, 2003) that a local chicken male age 40-80 weeks is the best semen producers. Age of the roosters used in this study ranged from 30-35 weeks so that the alleged production of spermatozoa was not optimum level yet.

Table 1. Semen characteristic of nunukan rooster

| Characteristic | Average (n = 20) |
|--|-------------------|
| Volume (mL) | 0.21 ± 0.15 |
| Color | White-creamy |
| Smell | Spermin |
| Consistency | Thick |
| pH | 7.2 ± 0.1 |
| Motility | +++ |
| Sperm motility (%) | 80.00 ± 0.50 |
| Viability (%) | 82.55 ± 16.51 |
| Dead Sperm | 17.60 ± 2.17 |
| Sperm concentration ($\times 10^9$ /mL) | 3.68 ± 0.53 |
| Sperm/ejaculation ($\times 10^9$) | 6.01 ± 0.19 |
| Normal sperm morphology (%) | 80.50 ± 13.40 |

Acidity (pH), Color and Consistency of the Semen

The pH degree obtained was 7.2 ± 0.1 . This pH is lower than Isnaini (2000) report with a pH of 7.4 ± 0.2 . The low degree of acidity was also suspected because of the ambient temperature around the enclosure maintenance reached up to 33-34 °C, this is according to research by Mulyadi (2007) which states that the high temperature will boost the rate of metabolism of spermatozoa in the epididymis that describes fructose in anaerobic condition so that will form lactic acid in large quantities in semen resulting in an instance of decreasing the pH degree. The low degree of acidity can also affect

the viability of spermatozoa. The pH of the nunukan rooster semen ranged between 7.0-7.6 so that precautions can be considerably done is by natural mating or semen collection regularly to prevent the disintegration of fructose and the formation of lactic acid more from the metabolism of spermatozoa. The pH degree of the semen can also be affected by contamination and a number of dead spermatozoa contained in the semen as a trigger the formation of ammonia.

Based on the results of visual observation, in the nunukan chicken semen was obtained milky white with medium to thick consistency. Colors can be polluted by chicken semen mixed with feces, dirt, or blood. The consistency of semen correlated with sperm concentration. The more the number of sperm cells in semen, the more viscous consistency considering that there is no chicken semen seminal plasma.

Sperm Mass Movement

The mass movement is a movement made by a group of spermatozoa together form wave. The results showed a mass movement nunukan chicken spermatozoa relatively good (+++) is by revealing big waves, relatively thick and actively move.

Free moving spermatozoa groups in forming the wave depend on the concentration, motility and abnormality rate (Mosenene *et al.*, 2009; Pratama, 2011). The higher concentration of spermatozoa is increasingly allowing spermatozoa to move together to form waves. The process of egg fertilization in the infundibulum not just rely on one spermatozoon only, but also many spermatozoa was first in charge of opening the zone pellucid membrane vitellin with the enzyme hyaluronidase and acrosin contained in the sperm acrosome.

Motility and Individual Movement of Spermatozoa

Motility is an indicator of the ability of sperm to move properly towards an egg so that the migration of spermatozoa is also being one indication of successful fertilization. The average sperm motility obtained from this research was $80.00 \pm 12.50\%$. The rate of sperm motility may be affected by internal and external factors. The motion of motile is caused by flagellum (tail) of spermatozoa so that their secondary abnormality (tail part) hinders the movement of spermatozoa.

Movements of individual spermatozoa correlated with the mass movement of spermatozoa were observed. According to Mulyadi (2007), motility of spermatozoa arises because individual spermatozoa moving randomly in all directions, free, without

interdependence with each other. In this study, the individual motions of spermatozoa relatively good with the average score of 2 – 4, so that the mass movement of spermatozoa shown relatively good as well (+++).

Sperm Concentration

The concentration of spermatozoa shows the number of sperm per mL of semen ejaculated. Spermatozoa of poultry are higher than the concentration of spermatozoa other livestock because the birds do not have glands in mammal accessories such as plasma producing cement, so that even though the cement produced lower but it has more sperm concentration. The average concentrations of the spermatozoa of this study were at $3.68 \pm 0.53 \times 10^9$ / mL, lower than the results of studies of other chickens.

Several factors affect the concentration of spermatozoa ranging from the amount of ejaculate volume, frequency of shelter, stud and environmental conditions (Prastowo, 2008). The volumes of the ejaculate produced in this study were moderate at 0.21 ± 0.15 mL, showed that the concentration of spermatozoa was also lower. The frequency of semen shelters in nunukan chickens are also thought to influence the concentration of spermatozoa, because the frequency of an organized collection can increase libido, thus spurring spermatogenesis in the testes. Besides, per individual physiological conditions also need to be considered related to the level of stress due to the changes in differences in environment and reproductive conditions.

Semen Characteristic

Similar to other chickens, nunukan rooster's semen has complex compounds including protein, fructose, sorbitol, sodium, potassium, calcium, and magnesium (Table 2).

Table 2. Comparison of Characteristics of Nunukan's Rooster Semen with Local Rooster

| Component | Nunukan rooster | Local rooster*) |
|-----------|-----------------|-----------------|
| | (mg/100mL) | |
| Protein | 2.1 | 1.8-2.8 |
| Fructose | 4 | 4 |
| Sorbitol | 8 | 0-10 |
| Sodium | 319 | 352 |
| Potassium | 60 | 61 |
| Calcium | 8 | 10 |
| Magnesium | 12 | 14 |

*) *Garner & Hafez (2000)*

The seminal plasma is not required at the time of fertilization but essential for natural mating in which plasma is needed as carrier fluid spermatozoa. Apart from being a carrier (transport medium), the seminal plasma also provides nutrients (e.g. fructose and sorbitol) and protective factors (buffer) to keep fixed semen alkalis while the acidic vaginal fluids. Keeping the seminal plasma motility is important in order to improve the viability of spermatozoa and to increase the resistance of swine sperm membrane damage due to cold shock (Barrios *et al.*, 2000).

Sperm Morphology

The spermatozoa of poultry generally have parts in common with other mammals' livestock spermatozoa but different forms of their fowl. Poultry spermatozoa have a cylindrical head with the acrosome on endpoint, the middle of a short and a longer tail (Etches, 2000). The Spermatozoa of chicken have a slightly curved head that consists of acrosome and nucleus. The tail consists of the neck, mid-piece (middle) and the main part of the tail (Nuryadi, 2001). The head of rooster's spermatozoa is simpler than others because of the acrosome sac was not until the equatorial segment as well as mammalian spermatozoa (Etches, 2000).



Figure 1. Nunukan rooster's semen shows that the live spermatozoa do not absorb the red color in Eosin Nigrosin staining 100x

This study showed that the average nunukan rooster had abnormal spermatozoa at $18.20 \pm 10.40\%$. The parameters in determining male fertility based on the morphology of spermatozoa can be seen from the level of its abnormality (Aditya, 2008). High spermatozoa abnormalities can affect fertility (Yudi *et al.*, 2010). Spermatozoa abnormalities caused by several factors such as disease, heat stress

management (maintenance), cryopreservation process, differences in race and strain chicken, and season. In addition, the rate of abnormalities also can be caused by post-collection preservation and staining.

The high ambient temperatures reached up to 33-34 °C is expected to affect the formation of spermatozoa in the testes, which are generally impaired spermatogenesis produce primary abnormality or abnormalities in the head. According to Gunawan and Sihombing (2004), a high temperature of about 25-31 °C can reduce the productivity of reproduction in commercial laying hens and presumed maximum limit for broilers higher based on adaptability. At the high temperatures, chicken or rooster need more energy for the regulation of body temperature, thereby reducing the availability of secondary energy for reproduction and hormonal metabolism.

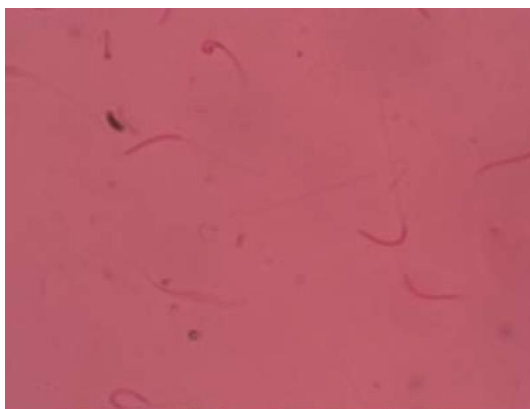


Figure 2. Some of abnormal spermatozoa forms found; spermatozoa with circular tail and the cytoplasmic droplet in proximal, head without tail, tail without head, and head and tail curve (coiled)

Abnormalities of spermatozoa are classified into two; primary and secondary abnormalities (Barth and Oko, 1989). Primary abnormality may occur due to abnormalities in the process of spermatogenesis that occurs in the tubules seminiferous. Then, secondary damage of spermatozoa abnormalities during its passage through the epididymis, during the phase of ejaculation, or after ejaculation occurs include excessive heating process, cooling fast, contamination with water, urine, and antiseptic (Yudi *et al.*, 2010). Primary abnormality occurs in the head, had a double tail, curled tails (around the head), drop out or be split into two. Meanwhile, secondary abnormalities include head without a tail, the central part of the fold, their cytoplasmic

granules and a proximal or distal sheath detached acrossome (Hafez and Hafez, 2000).

CONCLUSION

The nunukan rooster semen was white-milk in color, spermin in smell, and thick in consistency with an average of pH of 7.2±0.1. Each parameter measured was the mean value for sperm volume of 0.21±0.15 mL, sperm concentration was 3.68±0.53x10⁹ sperm/mL, the percentage of sperm motility was 80.00±0.50 %, percentage of live sperm was 82.55±16.51 %, and percentage of abnormal sperm was 18.20±10.40 %, respectively. Meanwhile, the chemical compositions in every 100 mL of the seminal plasma contained 2.1 g protein, 4 mg fructose, 8 mg sorbitol, 319 mg sodium, 60 mg potassium, 8 mg calcium, 12 mg magnesium, and 138 mg chloride. Nunukan rooster had relatively the same values of these substance concentrations compared to other domestic roosters.

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CONTRIBUTION OF HOUSEHOLD INCOME TO ACCELERATE OIL PALM REPLANTING INDEPENDENTLY AT PASER REGENCY, EAST KALIMANTAN

Mariyah^{a*}, Yusman Syaukat^b, and Anna Fariyanti^c

^a*Department of Agribusiness, Faculty of Agriculture, Mulawarman University*

^b*Departement of Resource and Environmental Economics, Faculty of Economics and Management, Bogor Agricultural University*

^c*Departement of Agribusiness, Faculty of Economics and Management, Bogor Agricultural University*

*Corresponding author : ademariyah81@gmail.com

ABSTRACT

Replanting of old and unproductive plants must be done to maintain the sustainability of oil palm production and household income flows. This study aims to determine the contribution of oil palm income, to know the economic ability for replanting, and to identify factors that affect the economic ability for replanting. The study was conducted in Paser Regency with a total sample of 113 households that cultivate oil palm with a plant age of 21-33 years. Data were analyzed using the ratio of oil palm income to total household income, the ratio of income surplus to replanting costs, and multiple regression analysis. The results showed that the contribution of oil palm income to total household income was 67.33 percent. The household ability to replanting independently is 57.60 percent. The economic ability of household for replanting were affected by oil palm land area, total household income, age, household size, expenditure per capita, and repayment of credit. The implication of this research is household still needs financial assistance from external sources. To accelerate the replanting of oil palm independently, it is necessary to encourage household financial planning to save from the oil palm income and regulating the pattern of household expenditure for productive activities

Keywords: oil palm, replanting independently, household

INTRODUCTION

Oil palm farming is a source of income in the plantation sub-sector for the population in East Kalimantan. The average growth in the area in the period 2001-2013 was 19.62 percent and the average productivity growth was 27.29 percent. The number of oil palm farm households based on 2013 Agricultural Census data was 38,271 households in 10 regencies/cities and the most in Paser Regency, namely 14,608 households (38.17% of the total households).

A large number of smallholder plantations cultivated by plantation households can cause problems when oil palm plants reach a stage of decline productivity and replanting efforts need to be carried out. The existence of old plants or damaged plants will affect oil palm production. Kotagama et al. (2013) stated that replanting is an effort to replace old plants with new plants and is an annual crop management practice to maximize and stabilize income. Replanting is strategic to improve oil palm productivity (Omar et al. 2001). Productivity achieved by smallholder oil palm plantations in East Kalimantan in 2014 was 14.75 tons/ha lower than state plantation productivity of 17.28 tons/ha and private plantation productivity of 20.67 tons/ha. Oil palm area in East

Kalimantan including old plants or damaged plants is 3,984 ha. Old plants or damaged plants in Paser Regency is 1,807 ha (45.36 percent of total old plants or damaged plants in East Kalimantan). Anwar et al. (2014) in three regions in East Kalimantan, namely Kutai Timur, Kutai Kartanegara and Paser Regencies showed that the achievement of Fresh Fruit Bunches (FFB) oil palm productivity was 78.96 percent of the potential productivity of FFB in S3 land class.

Income from oil palm farming is expected as a main source of capital in oil palm replanting. Susila (2004) research shows that oil palm farming contributes 63% to the total farm household income in Sumatra. Sandker et al. (2007) which simulates the use of oil palm land in Malinau District shows that oil palm development has the potential to improve household income between 60-150%. However, household consumption stimuli can divert income allocation from productive activities to other activities.

The delay in the oil palm replanting is due to lack of funds for replanting. Lack of funds for replanting is caused by the inability of farm households to establish capital from oil palm farming income. This result is in line with Anggreany's research on Jambi. Anggreany et al. (2016) in Jambi stated that Economic factors are

one of the causes of the low participation of farmers in oil palm replanting. The ability of farmers to allocate their income for replanting saving is important to be identified. The inability of households to save affects the level and sustainability of capital formation (Obayelu 2012).

Replanting savings can be obtained from a surplus of household income. Surplus income is obtained from total household income minus total household expenditure. Surplus income is a potential capital for replanting savings. Socioeconomic factors affect the surplus of household income for household saving. Osondu et al. (2015) show that factors influence saving behavior and investment are income levels, number of household members, education, age, access to credit, the experience of farmers, type of farming and size of farming. Other research, Nwibo and Mbam (2013) state that savings and investments are also affected by inadequate income, high consumption, the risk of capital loss, lack of savings agents, high administrative costs, lack of information, literacy (education), market structure, and the nature of agricultural products.

This study aims to determine the contribution of oil palm farming income to total household income, to know the economic ability

of households to do replant based on surplus income on replanting costs and identify factors that affect the economic ability of household for replanting.

MATERIAL AND METHODS

This research was conducted in Paser Regency, East Kalimantan Province. Paser Regency is the southern region of East Kalimantan Province. The type of data used is cross-section data in 2016. The data source used is primary data and secondary data. Primary data were obtained through direct interviews with respondents, i.e. oil palm farmers, using a structured questionnaire. The primary data was collected from the selected farm household. During interview questionnaires were administered and filled by asking personal, demographic, socioeconomic status, income, saving and investment, expenditure, and related questions. Secondary data were collected from various related institutions such as Paser Central Statistics Agency, Agriculture and Plantation Office of Paser Regency, East Kalimantan Provincial Plantation Office, PTPN XIII East Kalimantan Province, and KUD Sawit Jaya Long Ikis.

Sampling was collected using purposive sampling. The number of respondents is 113 farm households based on the age of oil palm between 21-33 years. To analyze the contribution of oil palm income on household income using the formula as follows:

$$\text{Contribution of Oil Palm Income} = \frac{\text{income of oil palm}}{\text{Household income}} \times 100\% \quad (1)$$

To analyze the surplus of income using the formula as follows:

$$\text{Surplus of income} = \text{Household Income} - \text{Household Expenditure} \quad (2)$$

Economic ability of replanting based on ratio of surplus of income on replanting cost as follows:

$$\text{Economic Ability of Replanting} = \left(\frac{\text{Surplus of Income}}{\text{Replanting Cost}} \right) \times 100 \quad (3)$$

To analyze factors that affect the economic ability of replanting using multiple regression as follows:

$$Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + a_7X_7 + a_8X_8 + a_9X_9 + e \quad (4)$$

where:

- Y = Economic ability for replanting (percent)
- X₁ = Age of respondent (year)
- X₂ = Education of respondent (year)
- X₃ = Household size (person)
- X₄ = Oil palm land area (hectare)
- X₅ = Number of plot with variation of age plant (plot)
- X₆ = Total Household Income (IDR million per year)
- X₇ = Expenditure per capita (IDR million per year)
- X₈ = Household loan for non purpose replanting (IDR million)
- X₉ = Payment of Credit (IDR per month)

RESULTS AND DISCUSSION

The summary statistic of farm household characteristic is presented in Table 1. The average age of respondents was 51 years. This age belongs to the productive category. The average formal education of respondents is 6 years or elementary school. The average number of family members are 3 peoples (29.20 percent). Farm households have an average land area of 5.02 hectares. The area of oil palm owned by farm household affects the ability to replant independently. Most farm households have 1-4 hectare of oil palm land area of 67.26 percent. Farm households have >4-10 hectare of oil palm land area of 23.00 percent. Farm households have above 10 hectares of oil palm land area of 9.73 percent. Distribution of respondent by land area of oil palm owned are presented in Table 2.

The oil palm productivity is 17.89 ton per hectare per year. The sources of farm household income can be from oil palm farm, non oil palm farm and off-farm activities (Table 3). On average the farm household income is IDR 105.48 million per year. The Oil palm farm contribution is 67.33 percent of total household incomes, while non-farm activities contribute around 18.89 percent. This indicated that oil palm is the main sources of income to farm households in Paser Regency. The contribution of oil palm farming income increases with the increasing age of the oil palm. The contribution of oil palm income decreased at the age of the plant for over 30 years. The contribution of oil palm income to total household income with a plant age of between 21-30 years is 71.02 percent. The contribution of oil palm income to total household income with a plant age over 30 years is 66.22 percent. The decreasing contribution of oil palm income to household income on household income with a plant age over 30 years shows that there is a need for replanting.

Farm household expenditure is for food consumption (53.78 percent), for nonfood consumption (19.86 percent), for health (14.63 percent), for education (1.37 percent), and others (8.42 percent). Total expenditure of household is IDR 41.78 million per year (Table 4). The share of household expenditure is still large for food expenditure. This indicates that basic needs are still a priority for meeting household needs. The share of household expenditure between households with a plant age of between 21-30 years and households with a plant age above 30 years is relatively different. Households with a plant age of between 21-30 years show that household expenditure on non-food and health is

relatively higher than the expenditure of households with a plant age of over 30 years.

Oil palm replanting requires a high cost. Replanting costs can be obtained from the income surplus. The higher the income surplus, the ability of households to provide replanting costs independently will increase. The average household income surplus is IDR 63.69 million per year with 3.94 hectares of land to be replanted. The need for replanting costs is IDR. 29.54 million per hectare. The average ability of households to provide replanting costs independently is 57.60 percent (Table 5). The results also show that households with a plant age of 21-30 years have a higher ability to independently replant compared to households with a plant age of over 30 years. The average ability of households with a plant age of 21-30 years to provide replanting costs independently of 58.85 percent, while the average ability of households to provide replanting costs independently for households with a plant age above 30 years is 56.19 percent. This is related to the productivity of oil palm. Oil palm productivity decreases when production reaches the maximum point of production. The decline in production affects the income and contribution of oil palm income to total household income.

Improving the economic ability of households for oil palm replanting independently is influenced by socio-economic factors. Multiple regression analysis was used to determine the effects of socio-economic factors on the economic ability for replanting. The dependent variable was the economic ability for oil palm replanting. The output of the regression was presented in Table 6. Table 6 showed that the coefficient determination (R^2) was 0.7811 which signified that about 78.11 percent of total variation observed in the dependent variable was explained by the explanatory variables. The overall significance of the model was depicted by the F-statistics that is significant at 1% of significance level. The economic ability for oil palm replanting (Y) is influenced by oil palm land area (X_5), total household income (X_7), age of respondent (X_1), expenditure per capita (X_8), number of plot with variation of age plant (X_6), household size (X_3), and payment of credit (X_9).

Oil palm land area (X_5) was positively signed and statistically at a 1 percent level of significance. The small area of land is a factor of the inability of households to save for replanting. The more productive the area of oil palm, it will contribute to the total household income. Replanted oil palm land does not provide income for households. If the household has a large area

of oil palm, it can provide a source of income during the waiting period before production.

Total household income (X7) was positively signed and statistically at a 1 percent level of significance. The ability to save depends on the level of income. The results of a study by Adlaida et al. (2015) shows that total income from various sources, land area and dependency ratio are factors that influence the ability of households to finance household and rejuvenation needs. Non oil palm income and non-farm incomes provided an important share of total household incomes.

Age of respondent (X1) was positively signed and statistically at 10 percent level of significance. Farmers with old age have a precautionary motive. The life-cycle hypothesis suggests that there is a relationship between age and savings rate.

Expenditure per capita (X8) was negatively signed and statistically at a 1 percent level of significance. Expenditure per capita tends to be high along with the increase in oil palm production. This expenditure pattern is difficult to change. According to Iyan et al. (2014), the pattern of household consumption also influences the economic ability of households for replanting. Total income of household and size of landholdings were increased the household saving, while children's educational expenditures, family size, liabilities to be paid, marital status, and value of house reduced the household saving (Rehman et al. 2010). Households must have other sources of income to finance household needs. This makes the income that is supposed to be for replanting savings used for consumption.

A number of the plot with a variation of age plant (X6) was negatively signed and statistically at 1 percent level of significance. The existence of land plots with varying ages is a source of buffer income for households when part of the land is rejuvenated. But different plant ages will provide different production and income. Variation in income causes the amount saved for rejuvenation to be different.

Household size (X3) was negatively signed and statistically at a 5 percent level of significance. Household size related to expenditure per capita. Households have larger size tend to have higher expenditures in the form of educational expenditures, health expenditures and other forms of expenditures.

Payment of credit (X9) was negatively signed and statistically at 20 percent level of significance. Households that have loans will allocate their income to repay loans. Rogg (2000) noted that increased access to credit induces borrowers to shift their savings from traditional assets to deposits accounts with positive returns

CONCLUSION AND SUGGESTION

Based on the study, there are some sources of farm household income (oil palm farm, non oil palm farm and off-farm), and the oil palm farm income is the main source. The contribution of oil palm income on total household income was 67.33 percent. Households are able to provide replanting costs from a surplus of household income by 57.60 percent. Households with larger land ownership and high total household income have the economic ability to independently replant. Age has a positive effect on the ability of households to save. Conversely, a large number of household size, the number of land plots with varying plant ages, high per capita expenditures, and the repayment of credit reduce the ability of households to replant independently.

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ANALYSIS OF BEEF CATTLE BUSINESS IN SWAMP LAND IN KECAMATAN KOTA BANGUN KABUPATEN KUTAI KARTANEGARA

Mursidah^{a*}, Taufan Purwokusumaning Daru^b, and Syahnur Alhusna^a

^a *Department of Agribusiness, Faculty of Agriculture, Mulawarman University, Indonesia*

^b *Department Animal Husbandary, Faculty of Agriculture, Mulawarman University, Indonesia*

*Corresponding author : mursidah.spm@gmail.com, mursidah@faperta.unmul.ac.id

ABSTRACT

Livestock development is currently constrained by land availability. Kota Bangun has widespread swamp land, utilization of swampland by local community as cattle grazing area due to lack of availability of dry land in the coastal river. This study aims to determine the extent of swamp land that is utilized and the profit of beef cattle farming in swamp land. The sources of data in this study are primary and secondary data, then they were analyzed and calculated the area of land used for beef cattle business, the amount of costs, revenue and profits obtained.

The swamp land used by the farmers as a whole for beef cattle business ranges from 5-10 ha for each farmer. The profit of beef cattle business in swamp land is Rp. 36,543,430, - / respondent/ year and R / C ratio obtained at 1.99. The value is greater than 1, so that economically business beef cattle in Kecamatan Kota Bangun feasible.

Keywords: Swamp Land, Beef Cattle, Profit, R / C Ratio

INTRODUCTION

Land can not be used as feed for ruminant breeders as well as a roaming space. Kota Bangun is one of the districts located in the middle of Kutai Kartanegara Regency. Kota Bangun has a large swamp area, an area utilized by the local community as a livestock breeding area due to lack of land on the river plains. Most of the beef cattle are from Bali Cow and also some of the cross cattle.

Currently there is no profit found in the cattle business in the swamp area in Kecamatan Kota Bangun Kabupaten Kutai Kartanegara. Doing so requires research In Kecamatan Kota Bangun Kabupaten Kutai Kartanegara.

The purpose of this study were:

1. To know the area of swamp land that is used as a business of beef cattle.
2. To know the profit of farmers who use swamp land.

MATERIALS AND METHODS

This study was conducted from July 2017 until September 2017 in Kecamatan Kota Bangun Kabupaten Kutai Kartanegara. The determination of research location used purposive sampling technique (criteria deliberately), criteria, and others; 1) the survey location has a large population of cattle, 2) the chosen site is a swampland located in an agricultural area called breeding ground for beef cattle. Kecamatan Kota Bangun has 21 villages, named 3 villages,

namely; a) Sebelimbangan Village, b) Liang Village, c) Liang Ulu Village.

The determination of the number of respondents is done by proportional random sampling method using Slovin formula according to Hoddi *et al.*, (2011). The number of samples used as the respondents were 34 respondents, because the non-homogeneous population is the number of different breeders can be taken proportional samples (proportional random sampling).

The sources of data in this study are primary and secondary data, then they were analyzed and calculated the area of land used for beef cattle business, the amount of costs, revenue and profits obtained.

RESULTS AND DISCUSSION

Cattle are generally maintained cow Bali, because Bali cattle easily can adapt to the environment. This is in line with the opinion Mahdi *et al.*, (2013) states that Bali cattle easily adapt in a bad environment and not selective to food. In addition, Bali cows are quick to bear, benign, easy to control and have good digestibility of food.

An overview of the business of beef cattle farms in swamplands

Utilization of swamp land by farmers in Kecamatan Kota Bangun due to the geographical condition of existing land in the research site is

tidal swamp land, which experienced annual floods in every May or June, for 3-4 months.

When the river water recedes, the livestock will be maintained on an extensive system, i.e the cattle will be released freely and allowed to feed themselves on the grasslands or in places where there are many sources of feed. Livestock was given a guardrail because of the condition of wet grazing land and the availability of grass is still small and aimed for livestock not too far away when it will be released freely and still be known to exist. In these circumstances breeders are still routinely watching the livestock and when the pasture is completely dry, the farmers will release their livestock from the guardrail. When this situation happens, farmers only visit the cattle two to four times a week.

The maintenance of semi-intensive system of farmers in Kota Bangun District is done by the farmers when the river water condition starts to rise (overflow). At this time, the livestock that was previously released will be put into the stage cage (Kalang). In the cowshed they will be separated by sex. In other words, the bulls and cows are separated. Cattle that are still small and mature will also be separated unless the calf is still feeding from its mother. At this time breeders should perform routine activities including cleaning the cage, collecting dirt, providing green feed, giving additional feed and drinking water.

According to Suryana (2009), the cage can be made in the form of double or single, depending on the number of cows owned. In single-type cages, the placement of cows is done on one row or one row, while the double-type enclosure is placed on two opposite or opposite ranks. Between the two ranks a path is usually made for the road.

The types of cages used at the research site are Stage Cage (Kalang) and Floating Cage. The material enclosure on walls, floors and poles are made of wood. On the roof of the cage, the material is in the form of a tin roof or tarpaulin. Inside the cage barriers are made to separate the parent and child, male and female. At this time, the cows are in semi-intensive cage, in the stage cage the condition is more easily watched and noted. The treatment of livestock will be easy to do during the flood season because the livestock that had been released already in the cage.

Area of respondent's business

The land area becomes one of the factors that affect the livestock business. The area of land used by respondents for livestock business ranges from 0.5-2 ha. This land is used for cages and fences in livestock business. As for the land of

herding, breeders use 5-10 ha of land. In each village farmers generally use free land for their livestock business.

Production costs, revenues and revenues

Production costs for beef cattle breeding in swamp land include fixed costs and variable costs (Table 1)

Table 1. Details of production cost of beef cattle farm in swamp land in Kecamatan Kota Bangun Kabupaten Kutai Kartanegara Year 2017

| Production Cost | Cost (Rp/Respondent/year) |
|---|------------------------------|
| Fixed Cost | |
| Cowshed Depreciation | 485,294 |
| Equipment Depreciation | 103,787 |
| Variable Cost | |
| Cost of Cattle in the beginning of the year | 28,000,000 |
| Straw Costs | 250,000 |
| Labor Costs | 1,040,901 |
| Aditif Costs | 703,059 |
| Health Costs | 141,667 |
| Operational Costs | 6,386,765 |
| Total Production Cost | 36,774,217 |

Source: created from Primary Data, 2017

Fixed costs consist of the cost of depreciation of the pen and the cost of depreciation of the equipment. The cage is a floating cage and a stage cage. The materials used for the manufacture of cages mostly use wood for the wall, floor, and building framework. The roof of the cage uses a tin roof and tarpaulin. Deposits cost of Rp.485,294, - / respondent / year.

The equipment used in this beef cattle business is shovels, buckets, ropes, water pumps, and machetes. Depreciation cost of equipment is Rp.103,787, - / respondent / year.

Fixed costs are costs that are affected by production, including the value of livestock at the beginning of the year, the cost of straw purchases, labor costs, additional feed costs, health costs, and operational costs (transportation).

The value of livestock at the beginning of the year of beef cattle business is Rp.28,000,000,- / respondent/year.

Purchasing Straw is a cost incurred by farmers when the cattle are ready to be mated through Artificial Insemination technology. The cost incurred by a petenak for Artificial

Insemination is Rp.250,000, - / respondent / year. There are 4 respondents who do Artificial Insemination technology. Generally breeders use natural mating for productive female cows.

Labor costs incurred are the cost of feeding, maintenance costs and the cost of cleaning the cage. Labor costs are calculated using HOK with wages of Rp. 75,000, - / day for feeding and maintenance, while the wage for cleaning the cage is Rp.50,000, - / hari. Labor costs of Rp.1,040,901, - / respondent / year.

Additional feed given by breeders in the form of salt. The cost of the farmer for additional feed is Rp.703,059, - / respondent / year.

The cost of livestock health consists of the cost of livestock treatment when ill and the provision of vitamins performed by animal mantris. Costs incurred for animal health are Rp.141,667, - / respondent / year.

Operational costs are the costs incurred for livestock feed during the flood season. Operating expenses incurred amounting to Rp.6,386,765,-/respondent/year.

Revenue in beef cattle farms includes year-endcattleandlivestocksales.

Table 2. Revenue of Beef Cattle Farm in Kecamatan Kota Bangun Kabupaten Kutai Kartanegara Year 2017

| No | Type of Revenue | Revenue (Rp/respondent/year) |
|----|-----------------------|---------------------------------|
| 1 | Year End Cattle Value | 50.294.118,- |
| 2 | Revenue | 23.023.529,- |
| | Total | 73.317.647,- |

Source: created from Primary Data, 2017

Revenue from 34 respondents of beef cattle farming in the amount of Rp. 73.317.647/ respondent/year.

Table 3. Income of Beef Cattle Business in Kecamatan Kota Bangun Tahun 2017

| No | Income Details | Income (Rp/respondent/year) |
|----|-----------------|--------------------------------|
| 1 | Revenue | 73.317.647,- |
| 2 | Production Cost | 36.774.217,- |
| 3 | Income | 36.543.430,- |

Source: created from Primary Data, 2017

The income of beef cattle farm business in swamp land in Kecamatan Kota Bangun is Rp.36,543,430, -.

R / C Ratio

Value R / C Ratio of beef cattle business is 1.99, meaning that every addition of 1.00 expenses incurred by the breeders will generate revenue of 1.99. The value is greater than 1, so that economically business beef cattle in Kecamatan Kota Bangun feasible.

CONCLUSION

From the results of the analysis and discussion above it can be concluded that:

1. Tidal swamp land area used by farmers for beef cattle business is 0.5-2 ha used for cage and fence in each responder while for joint land use 5-10 ha.
2. The amount of business income from beef cattle farming from 34 respondents in Kecamatan Kota Bangun Kutai Kartanegara Regency is Rp.36.543.430 / responden and R / C Ratio is ratio that is ratio between total revenue and total production cost from 34 respondent is equal to 1,99.

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THE LEVEL OF FARMERS GROUP MEMBER PARTICIPATION IN RDK AND RDKK PREPARATION

Midiansyah Effendi^{a*}, Firda Juita^a, and Adi Darmanto^a

^a*Agribusiness Department, Faculty of Agriculture, Mulawarman University, Indonesia*

*Corresponding author : emdiansyah@gmail.com

ABSTRACT

Participation can be interpreted as the involvement of mental, mind, emotion, or someone's feeling in a group situation that encourage to contribute to a group in goal to achieve something and responsible with the business concerned they faced. The purpose of this study was to know the level of farmers group member participation and the problem they faced in preparation of definitive plan needs (RDK) and definitive plan group needs (RDKK) case study on Suka Maju Farmers group in Sumber Sari Village Babulu District PanajamPaser Utara Regency. This study was held in 3 months started from April to June 2018. Sampling was taken from Suka Maju Farmers group member in a total of 42 respondents. Sampling was done by way of the census. Data analysis was using Likert scale measurement method and tabulated in the shape of scoring in descriptive qualitative. The result of study showed that the level Suka Maju Farmers Group Member Participation in preparation of RDK and RDKK which are, Participation in planning with score 11,43 in middle category, participation in implementation with score 12,5 in high category, participation in result utilization with score 5,52 in high category and participation in evaluation with score 8,67 in middle category. The level of whole farmers group member participation in the preparation of RDK-RDKK in Sumber Sari Village Babulu District Panajam Paser Utara Regency is in middle category with an average score of 38,12.

Keywords: participation, farmers group, RDK, RDKK

INTRODUCTION

Farming development is one of the most important pillars in national growth which aim to increase people prosperity, the succeed of farming development also determined by the role of farmer participation and his family in implementing his farming. Farmers participation and his family could be increase through extension in the hope to increase at once realize the change on the farmers.

The intended transformation is the transformation in the field of knowledge mastery, skill and attitude in utilizing his own farming technology, so farming activity can be expected and guided to increased income and prosperity of the family. Participation of organization or community leader. Organization and community leader participation whose hold the rule of an area and culture in one is very critical in developing farming's development, to achieve farming's development the extension program is needed to unite in farming's development and to be the guidelines for field officer extension.

The government trough minister of agriculture hoping to fulfill farmers needs which are a seed, fertilizer, pesticide in order for farming continuity as well as a manifest condusive climate for the supply of fertilizer, to make it easier for farmers to get their supply of fertilizer trough

preparation of RDK and RDKK. In that condition farmers oftenly find it hard to find fertilizer because of it's unavailable in the store. This situation is very disturbing for the continuity of production and causing food security and agribusiness development unable to increase. The growing assumption says that this caused the preparation of RDK and RDKK not involving farmers or just made by local extension officer or local department of agriculture. Every kind of farming's activity always involving related parties, one of that was the preparation of RDK and RDKK. Preparation of RDK and RDKK manage in permentan number 237 the year 2007. The process of preparation held by farmers group companied by officer and community leader.

Department of agriculture and East Borneo province crops explained that this whole time farmers group often undisciplined when filling in the farmer's group definitive plan needs (RDKK) so the needs of farmers unable to realized, causing the scarcity of subsidized fertilizer and that's happened because the provider no longer has any available stock. All this time, there's an indication that the filling of RDKK has been done by the side whose doesn't know the situation in the field.

A total number of assisted farmers group in each agriculture extension center (BPP) in the region of Panajam Paser Utara Regency with the total number of 379 consisted of beginner class

farmers group, advanced classes farmers group, medium class farmers group, and main class farmers group does not exist yet.

The reason this class hasn't exist yet caused by the dynamic of group activity still not running as it should be, most of member and participant have yet interesting to carry out their activity corresponding with five-technique of farmers group that recommended in each guided farmers group of their area.

The preparation of RDK and RDKK in Babulu District that has been materializing in 13 Village in the year 2018 one of it was Sumber Sari Village. The preparation program of RDK and RDKK expected to increase teamwork between farmers group, agriculture extension, Village government along with involving side. Sumber Sari Village included in the region of Babulu District Panajam Paser Utara Regency has 16 farmers group one of that is Suka Maju farmers group.

Suka Maju farmers group was established in the year 1996 with a total of 42 members. Suka Maju farmers group included in the advanced class group between 16 other farmers group in Sumber Sari Village Babulu District Panajam Paser Utara Regency. The preparation of RDK and RDKK program was held with involving all members of farmers group whether it central and regional level, each responsible with the goals or success of RDK and RDKK preparation

Implementation of participation activity from the member is very important and also one of the factor to determine the success of preparation of RDK and RDKK. good participation from a member if most of Suka Maju farmers group members have participated in planning, implementation, utilization and evaluating to do their responsibility and implementing their members rights responsibly.

One of the obstacles faced by Suka Maju farmers group individually that is the limitations in preparation of RDK and RDKK. demands from farmers group member that is arranged RDK and RDKK whether it's fertilizer and pesticide channeled smoothly in the field, in this matter the filling of RDK and RDKK still hold by the distributors who don't know the farmer needs. Research Objectives to know the level of Suka

Maju farmers group participation in preparation of the definitive group plan (RDK) and Rencana Definitif Kelompok needs (RDKK) in Sumber Sari Village Babulu District Panajam Paser Utara Regency and to know the problem faced by Suka Maju farmers group in preparation of definitive group plan (RDK) and Rencana Definitif Kelompok needs (RDKK) in Sumber Sari Village Babulu District Panajam Paser Utara Regency.

MATERIAL AND METHODS

Time and Place

This research was held from April to July 2018 in Sumber Sari Village Babulu District Panajam Paser Utara Regency.

Data Retrieving Method

Data retrieving method used in this study was Prime and Secondary data. Prime data was obtained from a research location through a direct interview on a farmers group member (respondents) using questionnaire. Meanwhile, secondary data obtained through literature based on a research topic, obtained from relevant agencies that are Sumber Sari, Agricultural Extension Center, farmers group, extension worker and community leader as well others literature.

Sampling Method

The sampling method used in this research was survey method. Location determination was done purposively. Using the census sampling method. determination of farmers group chose to be the respondent was picked purposively on Suka Maju farmers group considering sample taking from Suka Maju farmers group member with a total of 42 respondents.

Data analysis method

Data analysis was using minimum scoring data to maximum scoring data, to get the level of participation started from low, middle and high. Those indicators described in questionnaire with the scoring method. In measuring the level of participation can be done by (a) participation in planning ; (b) participation in Implementation ; (c) participation in utilizing result ; (d) participation in evaluation or judgment (Suparman,1990).

Table 1. Maximum and Minimum score from participation level indicators

| No | Indicators Participation | Minimum Score | Maximum Score |
|--------|-----------------------------------|---------------|---------------|
| 1 | Participation in planning | 5 | 15 |
| 2 | Participation in Implementation | 5 | 15 |
| 3 | Participation in utilizing result | 2 | 6 |
| 4 | Participation in evaluation | 4 | 12 |
| Amount | | 16 | 48 |

Source: Sugiyono (2018)

In determining the interval of the class can be done through Likert Scale formula as follows:

$$C = \frac{X_n - X_i}{K}$$

C = class interval
K = amount of class

X_n = maximum score
X_i = minimum score

The result of the calculation above can be used to create the level of participation category as follows: class interval of farmers group participation level

Table 2. Class Interval of Farmers Group Participation Level

| No | Class Interval | Participation Level |
|----|----------------|---------------------|
| 1 | 16,00 - 27,00 | Low |
| 2 | 27,01 - 39,00 | Medium |
| 3 | 39,01 - 48,00 | High |

Source: Suparman (1990)

The examination to know whether three low indicators, middle and high against the level of farmers group participation can be done through qualitative descriptive data processing. (Siegel, 1990). Data obtained then grouped based on its indicators and separated based on statement number and then added up. The obtained value from average result withdrawn the conclusion whether the level of Farmers group participation is low, middle and high in preparation of RDK and RDKK in Sumber Sari Village Babulu District Panajam Paser Utara Regency (James and Dean, 1992).

RESULTS AND DISCUSSION

The Level of Members Participation

Participation can be defined as a special form of interaction and communication related to the division of authority, responsibility, and advantage. Participation is a kind of cooperation between the group and their members in planning, implementation, result utilization and evaluation. Because of that participation is the most important factor in supporting the success or development of the program.

A program whether in its progress or running the whole activity absolutely needing the participation from the whole layer of its members and other supporting instance

Trough participation, every related aspect with the implementation of accomplishment can be materialized. participation, in this case, refers to the participation of members in preparation of RDK and RDKK, play an active role in decision making and participated in running every activity. High and low members participation influenced by members knowledge of function and duty as a member of the farmer's group.

The level of Suka Maju Farmers group member participation in the preparation of RDK and RDKK in Sumber Sari Village Babulu District Panajam Paser Utara Regency classified as a middle category. Table 9 showed that middle score acquisition of Suka Maju farmers group member participation in the preparation of RDK and RDKK in Sumber Sari Village Babulu District Panajam Paser Utara Regency in the middle category. There are many factors that influenced farmers group member lacked participation, such as lack of understanding for preparation of RDK-RDKK, no motivation for working the task that has been become their common interest, totally submit to others member they considered more understand and lack socialization for RDK-RDKK meeting preparation.

Table 3. The Level of Suka Maju Farmers group member Participation in Preparation of RDK and RDKK in Sumber Sari Village Babulu District Panajam Paser Utara Regency.

| No | Participation Indicators | Average Score | Actual Score | Category |
|--------|--------------------------|---------------|--------------|----------|
| 1 | Planning | 11,43 | 2,3 | Medium |
| 2 | Implementation | 12,50 | 2,5 | High |
| 3 | Result Utilization | 5,52 | 2,8 | High |
| 4 | Evaluation and Judgement | 8,67 | 2,2 | Medium |
| Amount | | 38,12 | 9,8 | Medium |

Source: Data processing, (2018)

The Level of Suka Maju Farmers Group Member Participation in Preparation of RDK and RDKK in Sumber Sari Village

Participation is a special form of interaction and communication related to division of authority, responsibility, and benefit (Verhangen in Mardikanto, 2012). Participation is a cooperation between citizen and government in solving, implementing, conserve and develop growth (Soetrisno in kali, 2012). therefore participation is a very important factor in support the success or development of a program. A program whether in its development or running whole activity absolutely needing the participation from the whole layer of its member and other instance.

Trough participation, whole related aspect with the implementation of the activity could be achieved, participation, in this case, refer to the participation of members in preparation of RDK and RDKK guided by babulu District Central of Agriculture Extension. High and low members participation influenced by members knowledge to function from the targeted achievement and planned

Preparation of RDK and RDKK program is a plan that arranged per crop season in a year and in groups to obtained support and subsidy from the government as group plan in running its farming. Preparation program in farmers group level is for the data given in the preparation of RDK and RDKK is match with the data in the field. A farmers group member can cooperate in planning and implementing the preparation activity of RDK and RDKK, later on, can be used as a reference for their group and members.

Based on the research result the participation level of Suka Maju farmers group member in Sumber Sari Village Babulu District Panajam Paser Utara Regency is in high category with a total score of 1.601 with average while score 38,12. Participation from total indicators showed that farmers group members classified as a middle category in preparation of RDK and RDKK. The assessment of farmers group member participation level in preparation of RDK and RDKK based on four indicators planning, implementation, result utilization and evaluation as reference or guideline determination of assessment. That matter corresponding by Kaho said in Kali, (2011) that the level of participation obtained in four dimensions or form to materialized participation, those are participation in form of planning, implementation, utilization result, and last evaluation or assessment.

Participation in Planning

Members participation in planning activity seen in form of planning that becomes the first step systematically would become guidelines to activity implementation continuity. Trough planning, trough planning, all activity implementation will run structured according to the working plan. Members low participation in planning activity with score 11,43 and actual score 2,3. The actual score obtained from average score divided with total members of the group, with middle category seen from lack participation in a group meeting, socialization, presence, decision making, and preparation.

Based on five forms of statements in the questionnaire, there is a middle and high category in group participation. Members participate in the preparation of RDK and RDKK in the middle category with 22 members and percentage as big as 52,38%. Members participate in the preparation of RDK and RDKK in a high category with 20 members and with percentage as big as 47,62%. Meaning that members participate in planning still not play an active role in planning activity. Members who doesn't follow the meeting, socialization, presence, decision making and preparation program of RDK and RDKK because other members having other business like such as take care of the garden, looking for animal feed and another kind of job to fulfill their needs so they don't have enough time to come in the meeting for preparation of RDK and RDKK.

Group participation in planning classified as low with percentage as big as 52,38%, because of most of the members still not confident enough to put forward their opinion, in the end, they just accept the agreement. Activity in planning basically is very fundamental in planning activity. The presence in planning is very important, because of that the members must participate in the activity so the planning will run smoothly.

The level of education is a very important factor for the members, in that matter showed the higher education level of someone then they would be more active in implementing group activity. Suka Maju farmers group members participated in preparation on RDK and RDKK in Sumber Sari Village Babulu District Panajam Paser Utara Regency in attending the meeting and socialization categorizes as low with the percentage of 52,38%. The most dominant education in farmers group is in the level of Junior High School between other members. Enough education doesn't change the presence of the members in the preparation program of RDK and RDKK. This matter caused the members less active in attending the group meeting or planning

activity, while members participation in decision making in determining the program, while members participation for decision making in determining the program, group members also less active in executing group decision.

Participation in Planning

Group members participation in program implementation is the continuity of the agreement plan before, whether related to the planning, implementation or goal/target Cohen and Uphoff in Irene, (2011). High participation of members on activity implementation with the obtained average score from 42 farmers group member is 12,5 seen from members participation in attending the meeting, members activeness, the involvement of extension and material donation.

Based on those five participation indicators on the level of attending the meeting, members activeness, the involvement of extension and material thought, in preparation of RDK and RDKK there is two categories in its implantation those are middle and high. Members participate in the implementation of the program with 7 respondents of 42 with percentage as big as 16,67% in the middle category. High participation level in implementation showed by 35 respondents who stated following the activity with 83,33% percentage.

Group members in the implementation of activity are high category because the members are obligated to attending the meeting. Whether its related to the meeting, members activeness, involvements of extension and material thought. Caused in implementation the members must arrange the real data and handed to extension workers so the preparation of the program run smoothly without any obstacle to fulfilling the group needs, whether its fertilizer, seed, pesticide, and everything that arranged in RDK and RDKK match with the plan. Members activeness also supported by material from extension worker whether its money or food to the group if one of the members cannot attend the meeting in that will be arranged for the group.

Members participation level also showed that participation in every group activity, members active role in implementing the program that part of plan continuity activity agreed before. Whether its planning, implementation, and goal. The level of members participation based on meeting presence in implementation of the meeting can be seen from the members who always attend the meeting, those who active was because of their own desire, the members feel that that meeting is important in the development of implementation preparation program of RDK and RDKK as well the meeting can be beneficial for

the members because there is a lot of information in those meeting.

Participation in Result Utilization

Members participation on utilization result can be seen from time and field situation or on Suka Maju farmers group and that farmers group has enjoyed the result from preparation of RDK and RDKK as desired or not. Those things generated from Suka Maju Farmers Group in preparation program carried out. Same interesting that in every working plan there has been existing preparation program carried out for RDK and RDKK that planned by the government trough Sumber Sari Village officer and Babulu District Central Agriculture Extension, so there will be time to see the result of that preparation program implementation. The level of members participating in utilizing the result with an average score from 42 members was 5,52 in high category seen from every help and the wanted result and given by the government to Suka Maju Farmers Group in supporting preparation program of RDK and RDKK in Sumber Sari Village Babulu District Panajam Paser Utara Regency.

Farmers group members participated in utilizing the result in two categories which is middle and high. Utilization result activity that stated 4 people less satisfied with 9,52% percentage of 42 group members in the middle category. Members participation that stated satisfied with the help they received from the government was 38 people of 42 members in 90,48% percentage and including in high category in participation utilization result.

Based on that two participation, participation in form of satisfaction from the help get from farmers and government has been accepted by farmers group and utilized in form of rice milling, rice field hijackers, rice threshing machine, subsidy fertilizer, rice seed, and corn seed. All of that from planning activity, activity implementation that arranged trough RDK and RDKK. Meaning whether participation that related to helping or subsidy from the government and result from that preparation group members feel satisfied. The involvement of government can fill the needs and hope of farmers in fulfilling the needs like seeds, fertilizer, pesticide, and everything matter trough preparation of RDK RDKK.

Participation in Evaluation

Members participation in evaluation activity seen from assessment planning, implementation down to utilization result stated has been suitable or not suitable. Assessment implementation also part of feedback for members performance in the implementation that

has been before the assessment used to increase productivity in the next performance. Suka Maju Farmers Group member participation in the preparation program of RDK and RDKK with an averagescore from 42 group members was 8,67 in middle category seen from the planned program. Implemented, utilized and evaluation from every activity. Evaluation participation related to the planned program, activeness, thoughts and activity evaluation.

Farmers Group members participation in evaluation activity has three indicators those are low, middle and high. There are 3 people with low participation with 7,14% percentage, members in the middle category in a total number of 28 people with 66,67% percentage. Participation in a high level of evaluation activity with a total number of 11 people with 26,19% percentage.

Evaluation activity on preparation program of RDK and RDKK that stated did not follow the activity in low category caused they think that the achieved activity done by the group did not need to evaluated anymore. As much as 66,67% middle category that stated sometimes they followed the evaluation activity held by the group. They stated that every evaluation is important because to assessed is it a goal of the group has been achieved yet. The evaluation also becomes the parameter for the group to run the program and will happen. Based on the evaluation related to the program that has been arranged and has been utilized which mean on evaluation activity there still members whose less active in the activity for preparation of RDK and RDKK.

The indicator of participation level in Suka Maju Farmers Group members evaluation in planning, implementation, utilization and program evaluation preparation of RDK and RDKK caused less active members. The related activity with the assessment observing the activity privately and less involved in assessed the result of activity that has been done by the group members. Evaluation or assessment is done to correct the flaws in Suka Maju Farmers Group.

The Problem Faced by Farmers Group Members in Preparation of RDK and RDKK

Farmers group members right now are not just demand rights equality but also stated the function has meaning for social development. Farmers group as an organization and work together between members is very important for the life of the peasant community because every activity and problem in a farming activity carried out together by the group. seeing those potential, then farmers group need to advancing the empowering to develop optimally.

Just like any other group Suka Maju Farmers Group has some problem in the preparation of RDK and RDKK from planning activity, implementation, result utilization, and evaluation. This is according to Hanifie, 2010 where a farmers group not without problem, of course, will have a problem, whether internal and external matter. Some of the internalexample that happens between farmers group was in less clear organization structure and farming union management. Meanwhile, the matter outside organization can be a problem on each member like fertilizer scarcity, illegal fees, funding and etc. the following problem faced by farmers group based on indicators as follow :

Problem in Planning

Members participation in planning is one of the factors what is activeness. Suka Maju Farmers group members less socialized on every occasion. There are some member in the meeting who not attend the planning considered to less benefit for them, Most of the members still hasn't realized how important a panning in implementing the activity. This matter proofed with the planning activity with an indicator in the middle category from 22 people with 52,38% percentage members who stated himself a less active role in planning the program preparation activity of RDK and RDKK. From that indicator, we can see how much the role of a member in the group. the members in all those activities sometimes not everyone in the meeting can come because each member hasa business of their own. the bustle of those of members is like gardening and take care of their livestock, sometimes in every occasion, they give less idea, suggestion and critic.

Participation indicator in planning including in middle category because Farmers Group members attendance level and extension workers less active in the meeting discussing program planning preparation of RDK and RDKK and discuss the activity or another program. Most of the member still not realize how important planning in planning before implementing the program they will arrange. The basic problem on farmers group members in planning was a less active role in following the meeting caused the planned activity lessto maximize the planning activity. Another problem that makes planning become less maximize wasfewer members participated in a group meeting, socialization, attending, decision making and arrangement.

Farmers Group Members Participation Problem in Implementation

Participation in implementation has indicators about material thoughts, the assessment obtained from Suka Maju Farmers Group members, and cash or donation to the members. The members often agree the decision makers in the meeting just like that without knowing the implementation later on. Participation in implementation has indicator about material thoughts, they lack in giving the idea or suggestion for the group and that's why it's very important to have good group management for scheduling members time. Most of farmers group play an active role in activity implementation including giving material thoughts, assessment to farmers group and members donation.

In implementation activity run without a problem that matter proofed in the high score of participation from 42 members with 35 of them play an active role with 83,33% percentage in implementation. This thing is fundamental from Suka Maju Farmers group because knowledge and technology utilization is in high score. Even if they have long experience in farming but tech usage only when its needed the most. Reinforcement in Group organization whether training, meetings, extension and guided still needed. The point is only to work and help but still lacked giving an idea and speak out their opinions about the running program.

Farmers Group Members Participation Problem in Result Utilization

Participation in result utilization has an indicator about help and the result from the preparation of RDK and RDKK. Based on the interview, farmers group members don't have any problem with the given subsidy. Group members enjoying and utilized the help showed in the high category from 42 members there is 38 people who stated satisfied with 90,48% percentage.

Some results from program palling that has been enjoyed by the farmers like subsidy fertilizer, pesticide, seed, highjackers tool, and milling machine. The achievement from farmers group almost all of them enjoyed the result from the preparation of RDK and RDKK is very helpful for them. The help is given for farmers group from planning and implementation program preparation of RDK and RDKK very helpful for the group. So the next activity that will occur can be carried out as the group wants.

Members Participation Problem in Evaluation

Evaluation can define as an assessment given for certain quality. Other than that, the evaluation also is seen as the planning process, earning and providing information needed for

alternative decisions. Because of that evaluation in needed to measure the level of success.

Members participation in evaluation is one of the indicators was activeness, material thoughts, assessment, and members donation and help from the result of RDK and RDKK preparation. Sometimes not every member followed the evaluation activity because they have their own business outside the meeting and often they considered that not very important to discuss. This thing can be seen from the members who participate in evaluation with middle indicator from 42 members with only 28 of them stated less participate in evaluating the activity with 66,67% percentage. There are members with a low category with a total number of three respondents with 7,14% percentage. Meaning the problem in evaluation is a lot. 26 members also stated sometimes they did attend the group meeting, the problem was the lack of guidance from extension workers to help farmers group members.

Suka Maju Farmers group evaluating the activity trough meeting attended by the farmer's group and extension worker. The evaluated activity lays from the preparation that arranged and the next program. The achieved goal like subsidy fertilizer for farmers. If that's not enough then will be recommended to department of agriculture so the fertilizer can be distributed in time.

Material thoughts or Suka Maju Farmers group members opinion still not maximize yet for responding for the evaluation activity. Basically, opinion, critic, and suggestion from group members against evaluation activity are one of the most important things.

The problem on farmers group members in participation is only agreeing on the decision made in the meeting, without knowing the implementation later on. There are very little suggestion and idea given from Suka Maju Farmers group members in every program especially in the preparation of RDK and RDKK, for that management is needed to make the group even better for the members for giving their opinion and idea.

CONCLUSION

The level of participation from Suka Maju Farmers Group members in preparation of Definitive plan needs and definitive plan group needs in Sumber Sari Village Babulu District Panajam Paser Utara showed that indicator results in implementation, planning, result utilization, evaluation in middle category with a total score of 1.601 and average score 38,12.

The problem faced by Suka Maju farmers group in planning and evaluation was the low attending of members in every meeting for Preparation of RDK and RDKK activity

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AREA CHARACTERISTICS AND MANAGEMENT OF OIL PALM PLANTATION OF COMMUNITY IN KECAMATAN MUARA BADAK

Akhmad Sopian^{a*}, Zainudin^a, and Yusriansyah^b

^a*Department of Agroecotechnology, Widya Gama Mahakam University, Indonesia*

^b*Palm Oil Research Center, Widya Gama Mahakam University, Indonesia*

*Corresponding author : sopian063@gmail.com

ABSTRACT

The study aims to find out the characteristics of the area and the quality also potential and obstacles in the management of palm oil plantation which belongs to the community. Research using descriptive methods includes special data in the form of maps of soil types, slopes, and area use. While the potential of BJR was done by picking test. The results showed the characteristics of the area in the potential research for the development of palm oil plantation because it was dominated by tropudults with slopes <26%, namely 79%. BJR was classified as potential because it was in S3 area class at the age of 9 and 10 years, while 4 years old were classified as S1 area class. The low production of palm oil on the community area because it did not use seeds and was on the area with steep topography. Potential rainfall characteristics for oil palm cultivation. Community plantations that used genetic material from plants not from superior seeds should be replanted and replaced with superior seeds. Area conservation efforts need to be done by planting cover crops to prevent erosion and landslides. Increased production can be castrated on TBM, intensive fertilization, and breeding of elaeidobius beetles.

Keywords: characteristics, oil palm, the area of community

INTRODUCTION

Oil Palm (*Elaeis guineensis* Jacq) can grow well and provide optimal production potential in climatic conditions, soil types and growing conditions such as the right place. However, oil palm plants have a fairly high tolerance and can grow at the level of soil species diversity, especially the type of ultisol (A.D. Kudadiri at., Al, 1999). Muara Badak Subdistrict is very potential to be developed with a production of 2.47 tons/ha and is the most cultivated commodity (BPS Muara Badak, 2016).

The people's plantation area continues to increase but in the management does not pay attention to the characteristics of the land such as slope, soil type, and technical culture. Area characteristics are factors that can be measured in terms of the type of soil, slope, and rainfall. Soil texture can affect land quality at ease of processing, sensitivity to erosion, and water availability. Yasin S and Yulnafatmawita's research results (2018) state that the lower part has better physicochemical properties than sloping soil, the middle slope has the poorest physicochemical properties after 26 years of conversion of forests to oil palm plantations. Kasno and Subardja (2010) Research results show that spodic horizons in oil palm plantations vary between 30 and 70 cm. In addition to the spodic horizon, the Albic horizon, the horizon that

cannot be penetrated by plant roots, is also found. The texture is sandy with sand content around 69-98%. To produce well and sustainably, it is necessary to pay attention to the type of land use and land limiting factors. Paramanathan (2003) states that for oil palm cultivation on land with a slope of 23-38% including class S3 (marginal) and land with slope > 38% including grade S4 (unsuitable).

The results of land mapping by the Soil Research Center and Agroclimate, that the potential land area is either based on the land suitability class of S1, S2, and S3, while the potential medium is land with less than S3 suitability. The land area has the potential to be good for oil palm development, most of the S3 class land which in normal economic conditions is still feasible if cultivation and technical culture are carried out properly according to the standards (Z.Poeloengan at., Al, 2000). According to Risza (2015) and Pahan 2010, the factors affecting palm oil productivity are environmental, genetic and cultivation techniques. In the study area, it was viewed from the condition of the soil type that ultisol soil was suitable for oil palm plants so that large expansion of large plantations was developed (Puslittanak Bogor, 2000).

Cultivation techniques include fertilization, soil and water conservation, pest and disease control, and pollination by elaeidobius

beetles. According to Pujianto et al (2013) strategies to increase fertilization efficiency can be done by improving plant genetic efficiency in the use of nutrients. According to Harahap et al, (2013) the factors that caused the decline in fruit sets were related to the natural pollination process, namely a decrease in the number of male flower bunches and pollinating insect populations *Elaeidibius kameranicus*. The study aims to determine the characteristics and quality of the area and the technical culture of the management of community palm oil plantations.

MATERIALS AND METHODS

This research was conducted in Muara Badak sub-district, Kutai Kartanegara, East Kalimantan. Area characteristics were assessed

using special data in the form of maps of soil types, slopes, and area use then overlaid. Then, the research area consisted of three types of soil namely mineral, sand and peat soil with the planting years of 2007, 2008, and 2013. Production potential The average weight of bunches (BJR) was carried out by picking test namely weighing of Fresh Fruit Bunches (FFB) at harvest time compared with the standard of productivity potential of PPKS (2014) as in Table 1. The superior material of the plant was tested by looking at the thickness of the shell, type of dura; shell 2-8 mm, psifera; the shell is very thin, tenera is a cross between the dura and psifera, has a fairly thin shell (0.5-4 mm), high mesocarp content.

Table 1. Standards for potential productivity of palm oil according to age and class of land suitability

| Age | Year Planting | Average Bunch Weight (kg/bunch) | | |
|-----|------------------|---------------------------------|------|------|
| | | S1 | S2 | S3 |
| 3 | 2014 | 4,2 | 4,0 | 3,8 |
| 4 | 2013 | 6,7 | 6,3 | 6,0 |
| 5 | 2012 | 7,8 | 7,5 | 7,1 |
| 6 | 2011 | 10,2 | 9,9 | 9,3 |
| 7 | 2010 | 13,2 | 12,8 | 11,5 |
| 8 | 2009 | 15,8 | 14,3 | 13,8 |
| 9 | 2008 | 18,2 | 17,5 | 16,5 |
| 10 | 2007 | 20,4 | 18,8 | 17,4 |

RESULT AND DISCUSSION

Place dan Times

In the study area, the dominant soil type used for palm oil plants was tropudults which was 92.6% while the type of tropaquepts soil was 7.42%. Tropudults included ultisol soil type, splattered clay texture, P classified as medium and K classified as high, CEC was classified as low and had saturation based 26.18%, CEC 14.69% (Sopian, 2018). Ultisol soil conditions had undergone intensive washing, including poor NPK nutrients, very acidic pH, poor organic matter, an aluminum-rich bottom layer, and sensitive to erosion, and in hills and mountains (Puslittanak Bogor, 2000).

The slope characteristics of plantation land were quite diverse from sloping to very steep, in the villages of Sallo Cella, Salo Palai, and Tanah Datar there were oil palm plantations with steep to very steep conditions covering an area of 1,708.53 ha (21%) of the plantation area. While land with sloping conditions was slightly sloping (<26%) with potential for plantation land covering 6,413.83 ha (79%). Topographical conditions with a slope of > 25% would affect the

production of bunches, in addition to the difficulty in land management such as maintenance, fertilization, and harvesting which have an impact on costs.

Palm Oil plantation land in the 16-25% slope research area could still be cultivated for the development of oil palm plantations. The results of Sopian's research (2018) stated that land in slopes <30% in the Muara Badak area was classified as IV capability class, where on this land it was recommended for agricultural land but it needs soil conservation efforts. Arsyad (2010) on land with a slope of 15-25%, the threat of considerable damage was needed by conservation measures by making a bench terrace.

Average Production Potential of Bunch Weight

Ultisol soil productivity was an illustration of the potential of palm oil production on ultisol soil. Potential production of BJR palm oil from three types of soil, namely mineral, peat, and sand soil types, aged 10 years had reached > 84% of S3 land class. Whereas at the age of 4 years on mineral soil type is 97% in S3 land class and was

resistant to peat and sand soil reaches 100% in S1 land class. Potential of BJR in the Three Types of

Land in the Community Estates of Muara Badak were seen in Table 3.

Table 2. Characteristics of Soil Types and Topography in Palm Oil Plantation Area in Muara Badak

| Type of soil | Slope | | | | | Grand total |
|--------------------|---------------|--------------------------|----------------|-----------------|---------------------|-----------------|
| | Flat (<2%) | Slightly Tilted (16-25%) | Steep (26-40%) | Sloping (2-8%) | Very Steep (41-60%) | |
| Tropaquept | 602.99 | | | | | 602.99 |
| Salo cella | 565.94 | | | | | 565.94 |
| Tanjung limau | 37.06 | | | | | 37.06 |
| Tropudults | | 4,464.96 | 491.42 | 1,345.88 | 1,217.11 | 7,519.37 |
| Muara badak ulu | | 290.02 | | 278.65 | | 568.67 |
| Salo cella | | 631.58 | 477.46 | | 196.79 | 1,305.83 |
| Salo palai | | 1,853.31 | | 606.16 | 437.80 | 2,897.27 |
| Seliki | | 930.11 | | 439.88 | | 1,369.99 |
| Tanah datar | | 288.45 | | | 582.52 | 870.96 |
| Tanjung limau | | 471.51 | 13.96 | 21.19 | | 506.66 |
| Grand total | 602.99 | 4,464.96 | 491.42 | 1,345.88 | 1,217.11 | 8,122.36 |

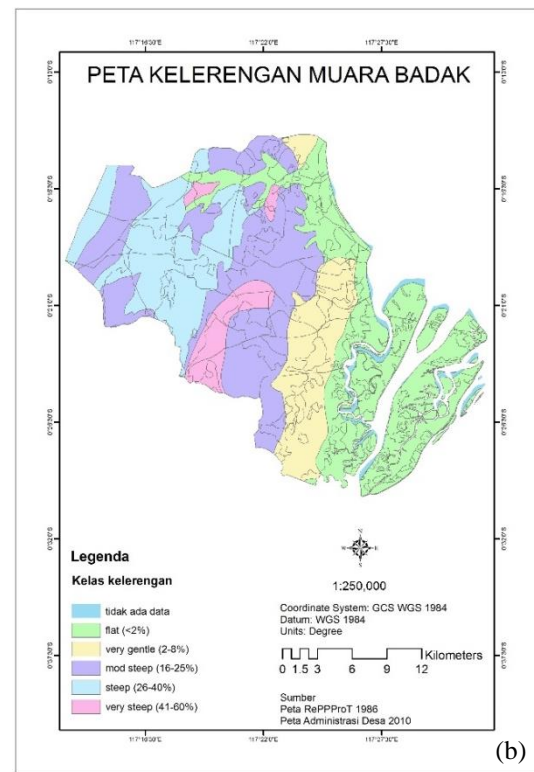
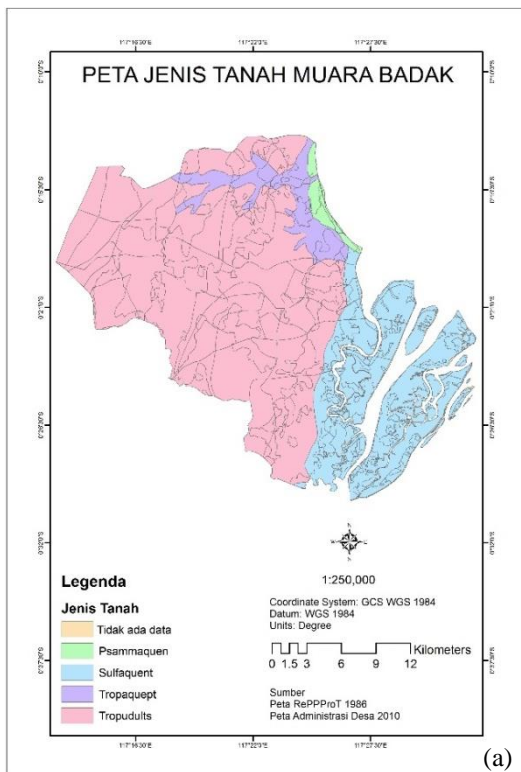


Figure 1. Area Characteristics in Muara Badak (a) map of soil types (b) slope map. On Muara Badak plantation area

Table 3. The Potential of BJR in Three Types of Land in the Community Plantation of Muara Badak District

| No | Type of Soil | Planting Year | Age | BJR | Standard BJR | Achievements |
|----|--------------|---------------|-----|-----------------|--------------|--------------|
| | | | | Production (Kg) | PPKS | Land Class |
| 1 | Mineral | 2007 | 10 | 13.55 | 16.00 | 85% (S3) |
| 2 | Gambut | 2007 | 10 | 13.67 | 16.00 | 85% (S3) |
| 3 | Pasir | 2008 | 9 | 13.19 | 15.70 | 84% (S3) |
| 4 | Mineral | 2013 | 4 | 5.13 | 5.30 | 97% (S3) |
| 5 | Gambut | 2013 | 4 | 7.17 | 6.00 | 100% (S1) |
| 6 | Pasir | 2013 | 4 | 6.63 | 6.00 | 100% (S1) |

BJR on mineral, peat, and sand soils aged 9 and 10 years was relatively the same, while BJR aged 4 years on peat soil was higher than sand and mineral soils. RBT on peat soil 7.17 kg and sand soil 6.63 kg was classified as land class S1 and BJR of mineral soil 5.13 kg belonging to S3 land class. The results of the study by Kudadiri et al., Al (1999) in West Kalimantan and East Kalimantan mean the productivity of palm oil plants at the age of 3 to 13 years was lower than the S3 land class standard which was only 61.8% and 62.5%. The

low production at the age of 9 and 10 years was assumed to be less intensive technical culture, especially lack of fertilization. According to Ginting and Sutarta (2013), that fertilization had a very important role in efforts to increase crop productivity in oil palm plantations. Giving fertilizer in less amount would cause the planted to not be able to produce optimally, while if excessive could threaten environmental sustainability.



Figure 2. Field identification results on two petanine fields (a) oil palm fruit farmers using dura and psifera varieties (b) oil palm fruit tenera varieties farmers use superior seeds

The results of the identification of plant materials used by farmers on different land that the gardens were on flat land with an area of 3.5 ha in 2014, classified as high productivity and tenera seeds, namely seeds from Medan PPKS. While farmers on hilly land - steep with an area of 10 ha in 2006, where many male flowers appear and FFB production was very low, as long as the seeds were classified as dura and psifera (Figure 2).

From Figure 2a, where the flesh was thick but there was no shell, the fruit was classified as psifera. if the thin fruit flesh and thick shell were classified as dura. The psifera parent tree is relatively small in number and did not even bear fruit throughout the year. While the fruiting dura was quite a lot, the yield of the oil was very low because the flesh was thin. In Figure 2b. classified

as tenera where the flesh was thick but the shell was thin. The low production of FFB due to the use of seeds derived from fake seeds and topographic factors. Gardens on steep terrain caused loss of soil fertility due to erosion. According to Arsyad (2010), erosion causes loss of fertile soil layers and is good for plant growth and reduced ability of the soil to absorb and retain water. In the form of deterioration of soil chemical and physical properties.

In his research Sopian (2018) stated that the rainfall in the Muara Badak area was 1,724 mm / year with evenly distributed rain throughout the year, which averaged 144 mm / month. This was in accordance with the characteristics of palm oil plants that require evenly distributed rain throughout the year with the potential water needs of the plant, which was 120 mm/month.

CONCLUSION

The Potential characteristics of the land for the development of oil palm plantations are because they are dominated by tropudults with slopes <26%. BJR is classified as S3 field class at the age of 9 and 10 years, and 4 years old is classified as S1 land class. Low production due to plant genetic material using fake seeds. Community gardens that use fake plant material need to be replanted. Efforts to increase production with intensive fertilization, castration, and breeding of elaeidobius beetles.

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GENETIC QUALITY STANDARDS APPROPRIATE WITH THE DEVELOPMENT OF SCIENCE AND TECHNOLOGICAL IN THE PERSPECTIVE OF ENVIRONMENTAL LAW

Siti Kotijah^a, Suradiyanto^a, and Fitryah^{a*}

^aFaculty of Law, Mulawarman University, Indonesia

*Corresponding author : fitryahtya@gmail.com

ABSTRACT

A good and healthy environment is a basic right of every Indonesian citizen mandated in Article 28 H paragraph (1) of 1945 Constitution of the Republic of Indonesia. It is to guarantee the environmental quality against environmental pollution, environmental quality standards, as one of the preventive instruments of pollution and environmental damage, including genetic quality standards. Genetic quality standards, the types that are appropriate with the development of science and technology, where everyone is permitted to throw waste into the environmental media by fulfilling the requirements. The regulation of genetic quality standards is regulated in Article 20 paragraph (2) G of Law No. 32 of 2009 concerning Protection and other Environmental Management, Law No. 5 of 1990, Act 4 of 2006, and Law No. 11 of 2013 concerning Nagoya Protocol and PP No. 21 of 2005.

Genetic management benefits humans if it is used appropriately. On the other hand, the developing science and technology produce hazardous and toxic waste (B3), which is at risk for the life environmental, health, and various pest threats, a disease that interfere the sustainability of natural resources. The result is on the increase of climate changing and global warming which can threaten the genetic resources needed that has been used until this time to fulfill food needed in Indonesia. For this reason, the frequency of resources for people who are not possible is not used by those who are not responsible for the right application. Therefore, the protection of genetic resource by the government is important to be done in order to prevent extinction and to prevent abuse by people who are not responsible with the firm sanction.

Keywords: environmental law, quality standard, genetic

INTRODUCTION

Genetics is the study of genes, namely the factors that determine the nature of an organism. In the biological process of life, there is a metabolism that takes place in the cell. Determination of the nature of organisms is carried out by genes by controlling the chemical reactions that make up a metabolic trajectory. In genetics is studied the structure, the process of formation and inheritance of genes and also the mechanism of expression in controlling the nature of organisms¹. There are several types of genetics, namely plant genetics, animal genetic resources, and genetic engineering.

Genetic management benefits humans appropriate with the development of science and technology, among others, enhancing the quality of life and changing the human lifestyle. The use of chemical-based products has increased the production of hazardous and toxic waste materials. This requires the development of a safe disposal system with little risk for the environment, health, and the survival of humans and other living things.

On the other hand, developing science and technology produce hazardous and toxic waste (B3), at risk for the environment, health, and various pest threats, diseases that disrupt the sustainability of genetic resources. This caused the increasing of climate change and global warming which can threaten the availability of the genetic resource which has been used to fulfill the food needed in Indonesia.

In the perspective of environmental law, there is an environmental prevention instrument; one of it is environmental quality standards. In that quality standard, one of the genetic quality standard which is included in other types of quality standards appropriate with the development of science and technology. Basically, everyone is legally permitted to dispose of waste into the environmental media by fulfilling the requirements, but there is a parameter so that there is no pollution happened.

The regulation of genetic quality standards is regulated in Article 20 paragraph (2) G of Act No. 32 of 2009 concerning Protection and other Environmental Management, and spreading in several Acts namely: Act No. 5 of 1990, Act 4 of

2006, and Act No. 11 of 2013 concerning Nagoya Protocol and PP No. 21 of 2015.

The existing genetic quality standard dispositions still do not give a deterrent effect on the perpetrators. In fact, the development of science and technology related to genetics continues to grow and produces hazardous and toxic (B3) material, which is at risk for the environment, health, and various threats of pests, and diseases. This makes the quality of the environment declining; threatening the survival of human life and other creatures, for that the environmental protection and management is important and consistent for all stakeholders.

MATERIAL AND METHODS

The research conducted was normative, with a legislative approach, a concept approach, and a case approach, with legislation primary legal materials, and field data as secondary data that supported legal arguments in this study.

RESULT AND DISCUSSION

Legal Construction of genetic quality standards

Genetics derived from the Greek language, which means "giving birth" is an important branch of biology at this time¹. This science studies various aspects concerning the inheritance of traits and nature's variations in organisms and sub-organisms (such as viruses and prions). Some also briefly say, genetics is the science of genes. The name "genetics" was introduced by William Bateson in a personal letter to Adam Chadwick and he used it at the 3rd International Conference on Genetics in 1906².

The history of genetic development began in the 17th century, people believed that life emerged spontaneously. This opinion, known as generation spontanea, was refuted by Francesco Redi (1621-1697), Lazzaro Spallanzani (1729-1799), and Louis Pasteur (1822-1895), who considered that living organisms originated from organisms that lived earlier. Another opinion, called ovisma, assumed that an ovum had a female organism having an important role as a carrier of hereditary factors that would be passed on to the next generation. In this case, male organisms produce liquids whose function is to activate the development of ovum.

Genetics evolved after the invention of the microscope and the rediscovery of Mendel's work became a standard in the use of scientific methods in science or science. There are several stages of genetic development:

1. 1859 Charles Darwin published *The Origin of Species*, as the basis for genetic variation.
2. 1865 Gregor Mendel submitted a *Trial text on Plant Crosses*;
3. 1878 E. Strassburger gave an explanation of multiple conceptions;
4. 1900 The rediscovery of Mendel's work separately by Hugo de Vries (Belgium), Carl Correns (Germany), and Erich von Tschermak (Austro-Hungary) was the beginning of classical genetics;
5. Chromosomes are known to be units of genetic inheritance;
6. 1905 British biologist William Bateson introduced the term 'genetics';
7. 1908 and 1909 Laying the basis of population genetic theory by Weinberg (doctor from Germany) and separately by James W. Hardy (British mathematician) was the beginning of population genetics;
8. 1910 Thomas Hunt Morgan showed that genes were on chromosomes, using fruit flies (*Drosophila melanogaster*) was the beginning of cytogenetic;
9. 1913 Alfred Sturtevant made the first genetic map of a chromosome;
10. 1918 Ronald Fisher (British biostatistics) published on the correlation between relatives on the supposition of Mendelian inheritance (freely meaning "Relation between relatives based on Mendelian inheritance"), which ended the feud between biometric theory (Pearson et al.) and Mendel's theory as well as initiating the synthesis of both of these were the beginning of quantitative genetics;
11. 1927 Physical changing in genes was called mutations;
12. 1928 Frederick Griffith discovered a carrier molecule that could be transferred between bacteria (conjugation);
13. 1931 Crossing caused recombination;
14. 1941 Edward Lawrie Tatum and George Wells Beadle showed that genes encoded proteins, which were the beginning of the main dogma of genetics;
15. 1944 Oswald Theodore Avery, Colin McLeod and Maclyn McCarty isolated DNA as material genetic (they call it the principle of transformation);
16. 1950 Erwin Chargaff showed the general rules that apply to four nucleotides in nucleic acids, for example adenine tended to be as much as thymine;
17. 1950 Barbara McClintock discovered transposons in corn;
18. 1952 Hershey and Chase proved that the genetic information of bacteriophages (and all other organisms) was DNA;

19. 1953 The puzzle of the DNA structure was answered by James D. Watson and Francis Crick in the form of double helix, based on X-ray diffraction images of DNA from Rosalind Franklin being the beginning of molecular genetics; and
20. 1956 Jo Hin Tjio and Albert Levan ensured that the human chromosome was 46.

From this division, genetics develops both as pure science and applied science. These branches of knowledge are formed primarily as a result of the deepening of a particular aspect of the object of study.

Genetic Quality Standard Disposition

Convention on Biological Diversity (Act No. 5 of 1990 concerning Biodiversity and Ecosystems)

The Convention on Biological Diversity (CBD) is a legally binding International Agreement adopted at Rio De Janeiro in June 1992 which was inspired by the growing commitment of the world community to sustainable development. In Article 8 J the biodiversity convention requires member states of the Convention on Biological Diversity to comply with national legislation by respecting, protecting and maintaining knowledge, innovations, and practices of indigenous and local communities that reflect traditional lifestyle, appropriate with the conservation and sustainable use of biodiversity and extending its determination more broadly with the approval and involvement of knowledge owners of innovations, and such practices are encouraging equitable sharing of benefits resulting from the utilization of knowledge, innovations, and that kind of practices. It means that the development of science and technology in the field of biodiversity is developed appropriately with the usefulness or benefits of a country.

Access and Distribution of Profits on Utilization of Genetic Resources Regulated in the Bonn Guidelines

The Bonn Guidelines are guidelines for determining the steps in the process of access and distribution of profits on the basis of the use of genetic resources, with an emphasis on the obligation for users to obtain approval on the basis of initial information from the provider country (Prior Informed Consent)⁵. In addition, it regulates the requirements of Mutual Agreed Terms and determines the roles and responsibilities of both users and providers of genetic resources and the importance of stakeholder involvement. The Guidelines also regulate the determination of incentives, accountability, verification, and dispute

resolution. This guide is in developing strategies regarding access and benefit-sharing for the use of genetic resources, determining the steps in the process to gain access to genetic resources and sharing benefits from their use.

Act Number 4 of 2006 concerning Agreement About Plant Genetic Resources for Food and Agriculture (Treaty on Plant Genetic Resources for Food and Agriculture)

An international agreement on plant genetic resources for food and agriculture (SDGTPP) was addressed by the Food and Agriculture Organization (FAO) on 3 November 2001 at the 31st session of the United Nations Food and Agriculture Organization (UN-FAO) in Rome⁶. In general, PGRFA is a multilateral system of access and benefit sharing on the use of genetic resources (Multilateral System on Access and Benefit Sharing) that supports breeders and farmers.

The SDGTPP agreement gives acknowledgment on the rights of farmers, regulated in Article 9 which is a continuation of the Nairobi Conference adopted from the biodiversity convention and FAO Conference in 1993, Article 9 acknowledges the contribution to indigenous/traditional communities and farmers for conservation and sustainable development on the genetic resources of plants, especially food and agricultural products and provide responsibility for realizing the rights of farmers in national law.

Indonesia as a country that is very rich in biodiversity, needs to be conserved and utilized to carry out sustainable development in order to improve the welfare of all people, for that reason to ratify and enact in Act Number 4 of 2006 concerning Agreement about Plant Genetic Resources for Food and Agriculture (Treaty on Plant Genetic Resources for Food and Agricultural). The point is the plant genetic resources continues to experience declining due to the low attention and utilization, and also changes in traditional agricultural practices.

On the other hand, in the changing environment and the dynamics of consumer demand, there needs to be a reserve of plant genetic resources for the recovery of plants in providing community welfare. Furthermore, it is encouraged to provide plant genetic resources in an effort to preserve and utilize sustainable genetic resources.

UU no. 11 of 2013 concerning Nagoya Protocol

The Nagoya Protocol is prepared based on the principles of international law, namely countries that have sovereignty and sovereign rights to exploit natural resources appropriate

with environmental policies and development, and also have the responsibility to ensure that activities in their jurisdiction or control do not cause harm to the environment of other countries or regions outside the jurisdiction of the country concerned.

Indonesia, which has abundant genetic resources and traditional knowledge and has economic value, needs to be preserved, to developed and utilized for the prosperity of the people. Act No.11 of 2013, as access to genetic resources and traditional knowledge related to genetic resources, must be given based on the approval and provider of genetic resources from conventional knowledge of the country.

The use of genetic resources provides fair and balanced benefits to providers of genetic resources and conventional knowledge for Indonesia by entering Nagoya Protocol on Access the Genetic Resources and the Fair and Equitable Sharing of Benefits From Their Utilization to the Convention on Biological Diversity (Protocol Nagoya on Access to Fair and Balanced Genetic Resources and Profit Sharing from Utilization of the Convention on Biological Diversity)⁶, which regulates the process of access and fair and balanced distribution of benefits to genetic resource providers.

Government Regulation of the Republic of Indonesia Number 21 of 2005 concerning Biosafety of Genetically Engineered Products

Biosafety genetically engineered products are environmental safety, food safety and/or safety of genetically engineered feed products. Utilization of biodiversity through modern biotechnology with the results of Genetic Engineering Products (PRG) provides an opportunity to support agricultural production, food endurance and improve the quality of human life.

This regulation aims to improve the used result and the used energy of Genetic Engineering (PRG) products for the welfare of biological resources, consumer protection, legal certainty and certainty in doing business.

The Government Regulation of Indonesia Number 48 of 2011 Concerning Animal Genetic Resources and Animal Breeding

Genetic Resources (SDG) Animals are managed through utilization and conservation activities. Utilization of Animal SDGs is carried out through cultivation and breeding, while Animal SDG preservation is carried out through conservation in their habitat and/or outside their habitat and other efforts such as land conservation.

Utilization of SDG Animals is used as one of genetic material for the formation of germs. The government establishes livestock breeding policies to encourage the availability of certified livestock germs and supervise the procurement and distribution in the context of sustainable livestock development.

Minister of Agriculture Regulation Number: 67 / Permentan / Ot.140 / 12/2006 concerning Preservation and The Use of Plant Genetic Resources

Plant Genetic Resources is the priceless asset of state, its existence is spread in various places, and it is an important basic material to be used in breeding activities to obtain new superior plant varieties for the purposes of Preservation and Utilization of Plant Genetic Resources, to maintain the existence of diversity and the potential of it needs to be done by doing the activities of searching, collecting, breeding and development, to fulfil the breeding needs which is required and also the Genetic Resources of Plants originating from the outside of Indonesia with exchange way.

Preventive Instruments in Genetic Quality Standards in The Perspective of Environmental Law.

Protection of genetic resources is mandated in legislation, both Article 33 paragraph (3), Article 28 H paragraph (i) of the 1945 Constitution of Indonesia, Article 20 paragraph (2) G of Act No. 32 of 2009 concerning Protection and other Environmental Management and legislation referred to above. It becomes the basis of instrument prevention for environmental and pollution. Genetic quality standards and other types of quality standards appropriate with the development of science and technology, where everyone is permitted to dispose of waste into the environmental media by fulfilling the requirements.

In the determination of existing genetic quality standards, how many B3 waste standards that have been disposed into the environmental media will be known, and still will be the carrying capacity and capacity of the environment. Basically, by maintaining the standard of environmental quality, it will protect the pollution and environmental damage, it means fulfilling human rights to a good and healthy environment.

The problem of decreasing environmental quality due to quality standards that exceeds more than the availability environmental media is the responsibility of all parties, including the government, stakeholders, entrepreneurs, and the public. The environmental media has a standard of environmental damage and pollution.

Prevention and / pollution of the environment must be done with coordination, systematic, and law enforcement for the perpetrators.

Instrument to Prevent Standard Criteria for Seagrass Beds Damage in the Environmental Law

A good and healthy environment is a basic right of every citizen guaranteed by the State Article 28 H paragraph (1) of the constitution in the Unitary State of Indonesia. To guarantee this right, instruments for preventing pollution and environmental damage are carried out, including the media environment used, related to genetic quality standards that produce B3 exceeding the limit.

To ensure environmental quality against environmental pollution, there are environmental quality standards, as one instrument to prevent pollution and environmental damage, including genetic quality standards. Genetic quality standards, each person is permitted to dispose of waste into the environmental media by fulfilling the requirements. The regulation of genetic quality standards is regulated in Article 20 paragraph (2) G of Act No. 32 of 2009 concerning Environmental Protection and Management.

Prevention and environmental damage instruments in the Act of Environmental Protection and Management, one of them is in the environmental quality standard. Determination of the occurrence of environmental pollution is measured through genetic quality standards, for genetic resources. Everyone is allowed to dispose of waste into the environmental media with the requirement of fulfilling the environmental quality standards and get permission from the Minister, Governor, Mayor or Regent appropriate with their authority.

Regarding B3 waste generated in the utilization of genetic resources, in Article 88 concerning the Act of Environmental Protection and Management states that every person whose actions, business and/or activities use B3, produces and/or manages B3 waste, and/or which poses a serious threat to the environment is liable to the absolute responsibility for losses that occur without the need to prove the elements of error. The point is, if there is someone throwing B3 into the environmental media beyond the carrying capacity of the environment, there is no need to prove a mistake because the evidence is clear. Regarding to B3 waste, in the criminal provisions of the Environmental Protection and Management Act, Article 103 is regulated, "every person who produces B3 waste and does not carry out the management as in Article 59 paragraph (4), is punishable with the shortest prison of 1 (one)

year and the longest is 3 (three) years and a fine of at least Rp. 1,000,000,000.00 (one billion rupiahs) and a maximum of Rp. 3,000,000,000.00 (three billion rupiah). The article of criminal refers to Article 59 paragraph (4), related to B3 waste management must obtain permission from the Minister, Governor, or Mayor appropriate with their authority. The criminal provisions above are in order to provide a deterrent effect on B3 production related to the use of genetic resources.

CONCLUSIONS

The regulation of genetic quality standards is regulated in Article 20 paragraph (2) G of Act No. 32 of 2009 concerning Environmental Protection and Management, in the category appropriate with the development of science and technology. Environmental quality standards are permitted to be disposed of in environmental media, suitable with the prescribed standards. The use of genetic resources provides benefits for humans, but on the other hand, produces B3 waste that can interfere with the environment. Management of B3 without permission can be subject to criminal provisions in Article 102 of Act No. 32 of 2009 concerning Environmental Protection and Management.

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SENSORY PROFILE OF DURIAN (*Durio zibethinus* Murr) YOGHURT AS A SYNBIOTIC YOGHURT WITH SUGAR AND MILK FORMULATION

Aswita Emmawati^{a*}, Rini Rahmawati^a, Taufikkilah Romadhon^a, Marwati^a, Yuliani^a, Bernatal Saragih^a

^a*Agricultural Product Technology, Agricultural Faculty, Mulawarman University*

*Corresponding author: aswita_emmawati@faperta.unmul.ac.id

ABSTRACT

Yogurt is a fermented food that has benefit to human health. It could be developed based on local fruits as its material. The combination of yogurt containing probiotic bacteria and local fruit with its potential as a source of prebiotics would produce a synbiotic food. This study aimed to determine the sensory profile of durian yogurt with the addition of milk and sugar. Sensory profile analysis is very important to improve product formulation.

The study was conducted using two treatments, namely the addition 0, 5 and 10% sugar and the addition 0, 5 and 10% skim milk. Panelists were selected and trained based on their preference and sensitivity to yogurt sensory attributes. The parameters observed were sensory profile of durian yogurt by focus group discussion (FGD) and quantitative sensory profile assessment.

From the results of the FGD, the sensory attributes of durian yogurt were sour, sweet and distinctive taste of durian, sour aroma and durian's distinctive aroma, thickness and smooth texture. As the increasing of sugar and milk, the sour taste and aroma decreased, the sweet taste and taste and aroma of durian increased, the smooth texture and thickness also increased.

Keywords: fruit yogurt, probiotic, prebiotic, sensory profile

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Samarinda**

Email : ictaff2018@gmail.com

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