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Table of Content

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Characterization and Similarity Analysis of 15 Tomato Genotypes in Lowlands Based on Morphological Characters

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Abstract

This study aimed to obtain information about the characteristics of 15 genotypes and to study a genetic similarity of each genotype that will be used for producing superior tomato varieties in lowlands. The research was conducted from March to August 2012 at the Experimental Field Leuwikopo Bogor Agricultural University, Darmaga Bogor. The experiment used The Randomized Complete Block Design (RCBD) using a single factor of genotype with three replications. Characterization and similarity analysis used the method of principal component analysis and cluster analysis. Based on principal component analysis and cluster analysis of tomato genotypes, it can be classified into three groups: group I (IPBT1, IPBT4, IPBT8, IPBT13, IPBT58, IPBT83 and IPBT84), Group II (IPBT3, IPBT23, IPBT30, IPBT33, IPBT34, IPBT53 and IPBT57) and group III (IPBT80). Characters with an influence on the genetic diversity of each component are the size of the cork layer between the scar stalk and the size of the center of the fruit in transverse slices. The genotypes with a high genetic similarity were IPBT1 and IPBT8, while IPBT30 with IPBT80 had a low genetic similarity.

Keywords: genotype, characterization, genetic similarity, morphology, tomato

A. Introduction

The low productivity of lowland tomatoes encourages breeders to improve tomato characters in lowlands. Efforts to improve these characters require several stages such as the expansion of genetic diversity. High genetic diversity greatly determines the success of breeding to get a superior variety and also provides a great opportunity to get the best combination of crossings with a combination of good characters. Thus, the collected genotypes were then characterized as well as analyzed for diversity and similarity to facilitate plant breeding activities.

Analysis of genetic similarity is conducted using the principal component analysis (PCA) and cluster analysis. The use of both methods is often performed to see the classification between genotypes. Genotypes belonging to a group or cluster indicate a close similarity or close genetic relationship, whereas intergroup genotypes indicate a distant similarity or distant genetic relationship. The analysis of the principal component and cluster is often used for various plants such as tomatoes (Albrecht *et al*., 2010, Aguire and Cabrera 2012) and chili (Yunianti *et al*., 2010).

The objective of the study was to obtain information about the characteristics of 15 genotypes as well as to obtain genetic similarity of each genotype to be used for the assembling of superior tomato varieties in lowlands.

B. Methodology

The research was conducted from March to August 2012 at the Experimental Field Leuwikopo Bogor Agricultural University, Dramaga, Bogor (230 m asl). Plant material used was 15 genotypes of tomato collection of Tomato Breeding Team of Genetics and Plant Breeding Division, Department of Agronomy and Horticulture Bogor Agricultural University namely; IPBT1, IPBT3, IPBT4, IPBT8, IPBT13, IPBT23, IPBT30, IPBT33, IPBT34, IPBT53, IPBT57,
IPBT58, IPBT80, IPBT83, and IPBT84. The genotypes were collected from landraces in several locations in Indonesia and IPB collections.

The research was conducted using The Randomized Complete Block Design (RCB) with a single-factor of 15 tomato genotypes with three replications so that there were 45 experimental units. Each experimental unit consisted of 20 plants and 10 of the plants used as plant samples.

Preparation of land and beds was performed at the same time during the seeding activities. Planting was carried out at 30 days after seedling. Plots of beds were made with the size of 5 m x 1 m for each experimental unit with a distance between beds of 50 cm. Furthermore, each bed was treated with 20 kg manure and 0.5 kg dolomite lime.

Maintenance activities included watering, fertilization, pesticide application and weeding. Fertilization was carried out once a week after the plants aged one week after planting (1 WAP) using NPK fertilizer (16:16:16) with a concentration of 10 g l^{-1} as much as 250 ml/plant. Pesticide application was carried out twice a week using a fungicide with an active compound of 80% mancozeb and 70% prophinep with a concentration of 2 g l^{-1}, insecticide with the active compound of profenofos 500 g l^{-1} with a concentration 2 ml l^{-1} and acaricides with active compound of dicofol with concentration 2 ml l^{-1}. Weed control was carried out manually. Harvesting was performed to the fruit with the criteria of yellow reddish, twice a week for six weeks.

Characterization was divided into qualitative and quantitative characteristics. Qualitative characters refer to The Individual Testing Guides in the form of novelty, uniqueness as well as tomato Uniformity and Stability (PPVT 2007) and UPOV (2011). Quantitative characters included plant height, length and width of the leaf (in a third of the middle plant), the age of flowering, harvest age, the number of fruits per plant, fruit weight per plant, fruit length, fruit diameter, fruit pulp, fruit hardness and moisture content. The value of the quantitative character was set based on Descriptor for Tomato (*Lycopersicon* spp.) for quantitative characters (IPGRI 1996).

The pattern of clustering and diversity between genotypes was obtained based on qualitative and quantitative character data analyzed using Principal Component Analysis and Cluster Analysis using the software of SPSS version 20.

C. Result and Discussion

1. Principal Component Analysis

The numerous number of character observation in the characterization can be reduced to a few principal components that were in smaller dimensions and independent. The number of principal components formed can be determined by the Eigenvalue. According to Santoso

(2004), the Eigenvalue indicates the relative importance of each factor in calculating the diversity of the variables analyzed. The calculation of the amount of the principal components formed based on the valid Eigenvalue which is more than one whereas the value less than one might be ignored (Simamora 2005; Yunianti *et al*., 2007; Maxisella *et al*., 2008; Bhartaya *et al*., 2011). Based on the principal component analysis with 32 characters of 100% diversity, it formed 14 components, however, the number of valid components based on Eigenvalue was only 8 components with the diversity percentage of 90.96% (Table 1). The component with the largest eigenvalue was obtained by component 1 of 10.080, while component 2 reached 5,339. Each genotype can be grouped according to each component. The number of Principal Components (PC) was used to describe the diversity of characters based on the cumulative proportions of total diversity (Yunianti *et al*., 2007 and Mattjik and Sumertajaya 2011, Undang *et al*., 2015). The grouping of each genotype based on the proportion of total diversity. The components with the largest proportion of diversity are component 1 and component 2 which reached 48.18%, thus, grouping was made based on components 1 and component 2 (Figure 1).

Tabel 1. The Eigenvalue of each component based on principal component analysis

Component	Eigenvalue			Quadratic Root Extraction		
	Total	% Diversity	% Cumulative	Total	% Diversity	% Cumulative
1	10.080	31.501	31.50	10.080	31.501	31.501
2	5.339	16.683	48.18	5.339	16.683	48.185
3	3.801	11.879	60.06	3.801	11.879	60.064
4	2.663	8.322	68.38	2.663	8.322	68.386
5	2.611	8.159	76.54	2.611	8.159	76.545
6	1.823	5.697	82.24	1.823	5.697	82.242
7	1.659	5.185	87.42	1.659	5.185	87.428
8	1.131	3.534	90.96	1.131	3.534	90.961

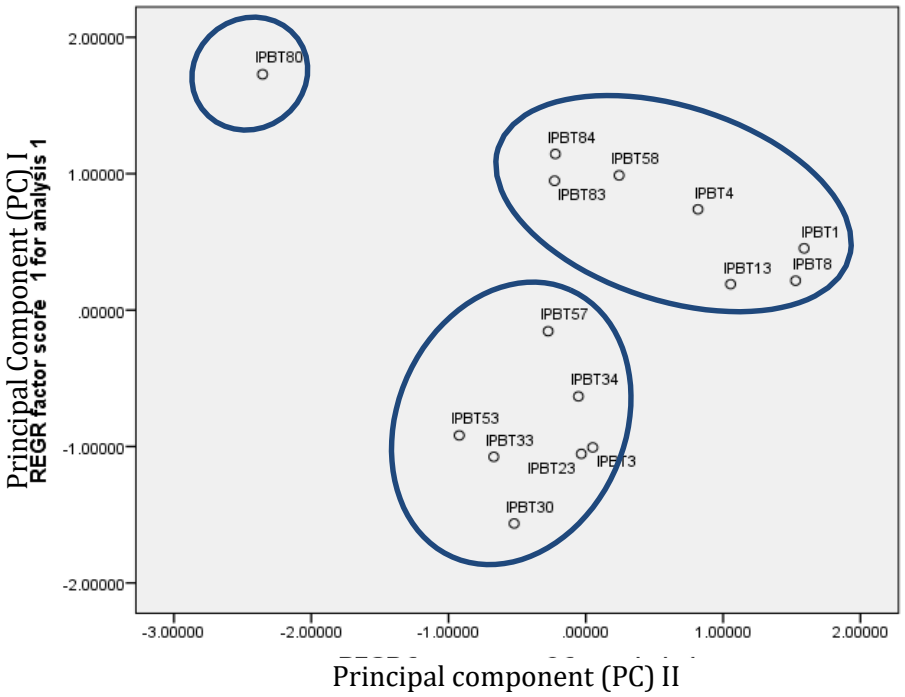

Figure1. Cluster of 15 tomato genotypes based on PC I and PC II

Characters that affect genetic diversity in the principal components are determined by the value of eigenvector. The characteristic vector value > 0.5 indicates that the character affected the diversity (Yunianti *et al*., 2007; Maxisella *et al*., 2008; Undang *et al*., 2015). The characters affecting principal component (PC) I consisted of 9 characters including fruit size, fruit depression at the end of the fruit stalk, the size of the cork layer between the fruit stalk, the size of the middle of the fruit in transverse slices, fruit length, fruit diameter, thickness of the pulp, the length and width of leaf . PC II consisted of 8 characters including the division of leaf blade, abscission layer, pedicel length, size of the cork layer between the fruit stalk, The size of the scar

at the end of pistil stalk, the size of the middle of the fruit in transverse slices, the number of fruit cavities and the color of ripe fruit (Table 2). Based on the eigenvector of two principal components, it indicated that there are two characters affecting the genetic diversity on each component that were the size of the cork layer between the scar stalk and the size of the centre of the fruit in transverse slices.

Table 2. Eigenvector of two principal components

Character	Component	
	I	II
Leaves position	0.463	-0.381
Division of leaf blade	-0.586	**0.628**
Intensity of green leaf color	0.272	-0.064
The position of leaflet on the main leaf bone	-0.288	0.494
Type of flower bunches	0.189	-0.321
Branch on flower bunches	-0.258	0.269
Abscission layer	-0.478	**0.651**
Pedicel length	-0.503	**0.540**
Size of fruit	**0.872**	0.160
The shape of the fruit in a longitudinal state	0.458	-0.050
Transverse slices	0.428	-0.695
Depression of fruit on the tip of the fruit stalk	**0.525**	0.434
The size of the cork layer between the fruit stalk	**0.682**	**0.577**
The size of the scar at the end of pistil stalk	-0.070	**0.606**
The shape of the fruit tip	-0.476	0.384
The size of the center of the fruit in transverse slices	**0.555**	**0.608**
The number of fruit cavities	-0.053	**0.601**
The shoulder of green fruit before fruit ripening	-0.761	-0.310
shoulder width of the green fruit	-0.761	-0.310
The intensity of green color on the shoulders of the fruit	-0.777	-0.310
The Intensity of green color of fruit	-0.233	-0.222
The color of ripe fruit	-0.530	**0.509**
The color of the pulp	-0.341	0.076
Number of fruits per plant	-0.814	-0.323
The weight of fruit per plant	0.346	0.401
Fruit length	**0.897**	0.292
Fruit diameter	**0.797**	0.317
Thickness of pulp	**0.812**	-0.256
flowering time	0.396	-0.211
Leaf length	**0.692**	-0.254
Leaf width	**0.680**	-0.218
Hardness of fruit	0.393	0.327

Note: bold numbers are the values of influential characters.

The tested genotypes was grouped into three groups based on PC I and PC II with a proportion of total diversity of 48.18% (Figure 12). Group I consisted of seven genotypes including IPBT1, IPBT4, IPBT8, IPBT13, IPBT58, IPBT83 and IPBT84. Group II consisted of seven genotypes including IPBT3, IPBT23, IPBT30, IPBT33, IPBT34, IPBT53 and IPBT57. Group III consisted of IPBT80. The genotypes clustered in one group had a high genetic similarity compared to the cluster that was not in one group.

2. Cluster Analysis

The similarity between genotypes can also be determined by Euclidean distance and able to form clusters which based on the dissimilarities level (Yunianti *et al*. 2007; Nisya 2010). The greater the value of the Euclidean distance between genotypes indicated the more low similarity of the genotype (Yunianti *et al*. 2007; Mattjik and Sumertajaya 2011). The cluster analysis of 15 genotypes obtained the Euclidean distance of 13.57-145.24 (Table 3). IPBT1 and IPBT8 had the smallest Euclidean distance of 13.57, while the largest Euclidean distance was obtained by IPBT30 and IPBT80 of 145.24. The Euclidean distance suggested that IPBT1 and IPBT8 had a low dissimilarity, whereas IPBT30 and IPBT80 had a high dissimilarity. The High and low of dissimilarity are reflected in the dendrogram presented in Figure 2. The value of

Euclidean distance of 13.57-145.24 scaled to 0-25 on the dendrogram. The cluster of genotypes which more closely to 0 indicated the genotype has a high genetic similarity or a low dissimilarity.

Table 3 Euclidean distance (Eigen Value) of each genotype based on cluster analysis

	Euclidean distance (Eigen value)														
Genotype	IPB T1	IPB T3	IPB T4	IPB T8	IPB T13	IPB T23	IPB T30	IPB T33	IPB T34	IPB T53	IPB T57	IPB T58	IPB T80	IPB T83	IPB T84
IPBT1	.00														
IPBT3	57.33	.00													
IPBT4	55.44	60.91	.00												
IPBT8	**13.57**	44.41	58.29	.00											
IPBT13	48.97	53.86	45.91	34.84	.00										
IPBT23	80.10	32.67	79.35	56.82	48.05	.00									
IPBT30	87.29	24.74	98.27	64.01	68.94	28.80	.00								
IPBT33	68.94	34.75	89.82	69.67	67.52	48.29	24.38	.00							
IPBT34	62.15	18.59	43.50	50.00	43.69	45.30	32.27	44.97	.00						
IPBT53	83.93	30.3	74.81	78.15	79.63	58.71	35.22	43.53	34.69	.00					
IPBT57	68.25	44.02	60.00	52.46	50.87	40.19	51.05	66.57	49.99	34.19	.00				
IPBT58	63.59	70.15	39.14	49.92	56.21	83.00	89.61	90.93	67.55	65.50	44.87	.00			
IPBT80	13.35	24.50	05.61	13.20	09.93	30.57	**45.24**	22.23	09.13	26.07	05.13	3.46	0		
IPBT83	2.32	9.05	7.61	5.67	2.98	7.09	6.52	7.78	0.98	8.53	1.83	0.84	3.76	00	
IPBT84	2.69	1.44	3.18	0.71	4.37	7.73	1.22	4.58	3.08	8.05	6.14	3.65	9.29	6.55	0

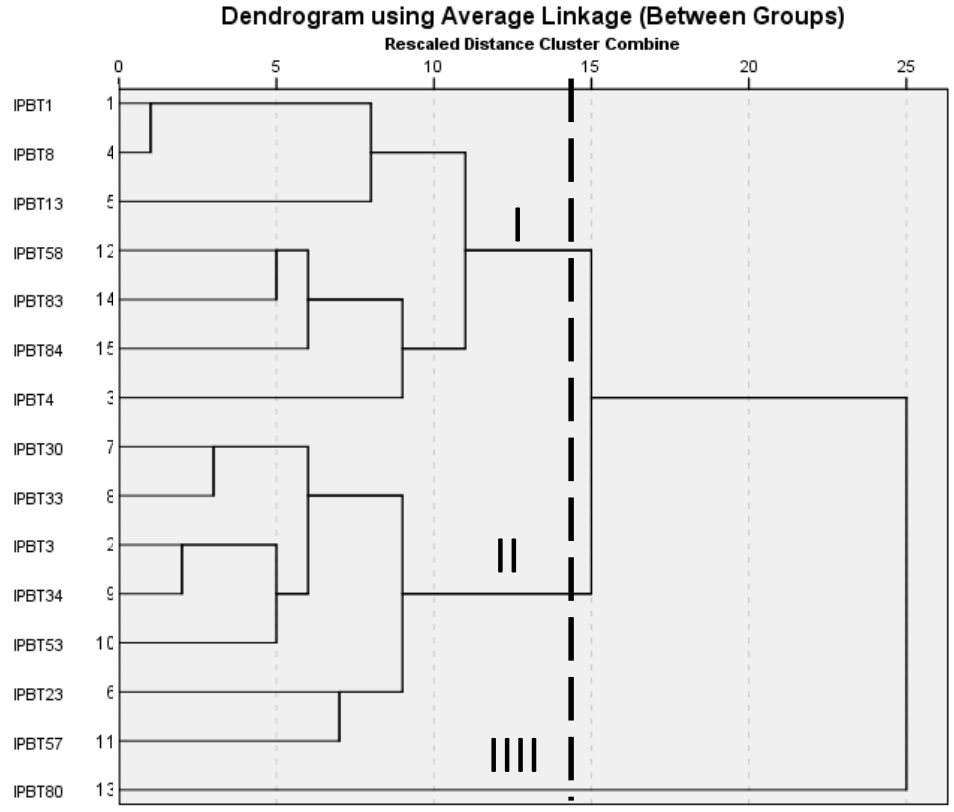

Figure2. Dendrogram analysis of 15 tomato genotypes

Cluster analysis on 15 tomato genotypes used 32 characters. Dissimilarity value (Euclidean distance) in dendrogram is the scaling of the original Euclidean distance (Appendix 3), for example, IPBT58 and IPBT83 had a Euclidean distance of 30.84 while IPBT3 and IPBT53 had a Euclidean distance of 30.36. Based on the original Euclidean distance, it was made resize with a maximum value of the Euclidean distance of 25 as presented in the dendrogram (Figure 2), thus the Euclidean distance between IPBT58 and IPBT83 as well as IPBT3 and IPBT53 were 5. On the dissimilarity value (Euclidean distance) 15, all tested genotypes could be grouped into three clusters. Cluster I consisted of seven genotypes including IPBT1, IPBT4, IPBT8, IPBT13, IPBT58, IPBT83 and IPBT84. Cluster II consisted of seven genotypes including IPBT3, IPBT23, IPBT30, IPBT33, IPBT34, IPBT53 and IPBT57. Cluster III was only one genotype of IPBT80. The grouping was the same as grouping produced by PC I and PC II.

D. Conclusion

The morphological characters of 15 genotypes are divided into three groups. Group 1 consists of IPBT1, IPBT4, IPBT8, IPBT13, IPBT58, IPBT83, and IPBT84, Group II consists of IPBT3, IPBT23, IPBT30, IPBT33, IPBT34, IPBT53, and IPBT57 as well as Group III consists of IPBT80. There are two characters that effect on the genetic diversity that exists on each component that are the size of the cork layer between the fruit stalk and the size of the middle of the fruit in a transverse slice. Genotypes with high genetic similarity are IPBT1 and IPBT8 while genotypes with low genetic similarity are IPBT30 and IPBT80.

E. Conclusion

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Fermentation of Whey Waste as Organic Liquid Fertilizer "PUCAFU"

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Abstract

Whey waste contains organic materials, particularly high complex proteins and amino acids in the form of suspended and dissolved solids, however the utilization of whey as a organic liquid fertilizer still has a less attention. Thus the Utilization of the whey waste through anaerobic process to be used as a organic liquid fertilizer is the purpose of the research. This research was conducted using factorial design with completely randomized design (CRD) which consists of two factors: the yeast concentration (without yeast; 0.25 and 0.50 g/500 ml of whey waste) and the fermentation time (0, 3, and 5 days). The variables measured were the content of organic C, C/N Ratio, and Total N, P_2O_5 and K_2O contents. The results showed that the fermented whey waste on the different fermentation time and yeast concentration had increased the organic C and C/N ratio, but decreased P_2O_5 and K_2O contents. The utilization of whey combined with solid or other liquid wastes gave a chance to produce a quality organic liquid fertilizer.

Keywords: fermentation, pucafu, tofu, yeast, waste.

A. Introduction

Industrial tofu waste consists of liquid and solid wastes. The tofu liquid waste is the biggest part of the tofu's waste and potentially contaminates the environment. Most of the liquid waste produced is derived from a viscous liquid separated from the tofu' solid at the stage of the coagulation and filtering process, called as whey (Husin, 2008).

Chemical compounds contained in whey waste are 40% - 60% of protein and amino acids in the form of suspended and dissolved solids, 25-50% of carbohydrate, 10% of fat (Said, 1999), 4.55% of iron, and 1.74% of phosphorus (Fatha 2007), as well as 0.24 mg/l Pb, 34.1 mg/l Ca, 0.12 mg L^{-1} Cu, and 0.59 mg L^{-1} Na (Lisnasari, 1995). The largest component of liquid waste of tofu is protein (Total N) of 226.06 to 434.78 mg L^{-1}. The presence of the organic compounds causes the liquid waste of tofu industry contains Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and TSS that are high (with the average of 3250, 6520, and 1500 mg L^{-1}, respectively) which is when these organic compounds are discharged into the waters without processing can cause pollution (Husin, 2008), due to the increase of total N in the waters.

The study of whey waste utilization has been carried out by Ahmia *et al* (2014) which found the utilization of whey as a raw material for biodiesel, Ridhuan (2016) and Subekti (2011) utilized that as raw material for biogas, and Sutiyani *et al*. (2013) used it as a raw material of Nata de Soya and soya, Rahayu *et al.* (2012) utilized the tofu liquid waste as a source of rural energy, and Handajani (2016) used it as a nutrient in the culture of *Microalgae Spirullina sp*. In addition, several methods were investigated to decrease the contamination level of whey waste, such as the methods of using the cow dung (Angraini *et al*., 2014), anaerobic digester (Indriyati and Susanto, 2012), fishing nets and bioball biofilters (Zahra *et al*., 2015), rotating biological contactor (Laili *et al*., 2014) to decrease BOD, COD and TSS levels of the whey waste.

Anaerobic respiration process (fermentation) is one of the biochemical processes that can be used to extract the organic compounds contained in waste with the help of microorganisms, which is also affected by several factors including: pH, time of operation, nutrient, temperature, and sugar content (Sari, 2009). Some researchers who have conducted the research of fermentation to know the mineral content of the material are Sapariantin *et al* (2010) which fermented the ethanol from cashew juice by *Z. mobilis* with the addition of urea, Santi (2008) studied the fermentation time, Siahan (2010) and Akib *et al* (2014) investigated the yeast concentration and fermentation time of *Leri* (rice water) waste.

Several information on the research results of whey waste utilizations have been reported, but the quantitative data about the quality of fermented whey waste for the organic liquid fertilizer (OLF) is remain unknown. Thus, the researchers have a big interest to conduct a research of whey waste with anaerobic processing for the organic liquid fertilizer "OLF PUCAFU".

B. Methodology

The research was conducted using factorial design with completely randomized design (CRD), which consisted of two factors: the concentration of yeast (0 g (control), 0.25 g and 0.50 g per 500 mL of whey waste) and fermentation time (0 day (control), 3 days and 5 days). The combination of these two factors resulted 9 treatment units.

The primary samples of fermented whey were taken in three points, that are in the bottom, middle and top of the fermentator container by using a pipette hose, 50 mL of the samples was taken then blended into a composite sample. The variables observed were: Organic C content, C/N ratio, Total N, P_2O_5 and K_2O contents. The results data of the laboratory test was shown in the figures.

C. Result and Discussion

Organic C (organic matter) is a part of solid or liquid medium which is a complex and dynamic system derived from the residues of the plant and animal contained in solid or liquid media that is constantly undergoing a shape change due to the impact of biological, Physics, and chemistry factors. Organic C is the percentage of fertility in solid and liquid media consisting of various C (carbon) bond (Irawan *et al*., 2016; Sipahutar *et al*., 2014; Nariratih *et al*., 2013).

The Organic C content of the fermented whey waste for 3 days with yeast concentration of 0.25 g per 500 ml of waste whey, showed an increase of Organic C content that was higher than other treatments. This might be caused by the better growth of microorganisms and there was no competition in the utilization of nutrition. Total population of microorganisms of whey waste was also very instrumental in the increase of Organic C of where microorganisms biomass was

also a part of the organic matter composed of carbohydrates, proteins and lipid (Purwitasari *et al*., 2004; Utomo and Shovitri, 2014).

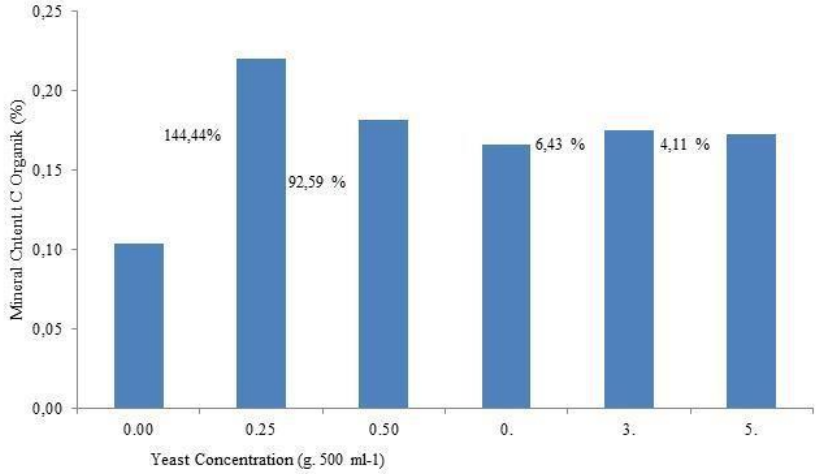

Figure 1. Organic C Content (%) of OLF PUCAFU on the treatment of the different fermentation time and yeast concentration (The data shown is the result of logarithmic interpolation).

The indicator of the quality and maturity level of fertilizer materials could be seen from the C/N ratio. Degradation processes occurred during the fermentation required an organic carbon (C) to meet the energy and growth, and nitrogen (N) to meet the protein as a cell metabolism-building substance (Ismayana *et al*., 2012).

A high increase of C/N ratio on the treatment of yeast concentration of 0.25 g per 500 ml of whey waste revealed that the decomposition process has not been finished. If the C/N ratio is too high (excess Carbon), the microbe will suffer N deficiency for protein synthesis so that decomposition slows down (Dewi and Treesnowati, 2012), however, the fertilizer material with a lower C/N ratio contained a lot of ammonia (NH_3) produced by ammonia oxidizing bacteria. These compounds could be further oxidized to be nitrite and nitrate which are readily taken by plants (Ismayana *et al.*, 2012).

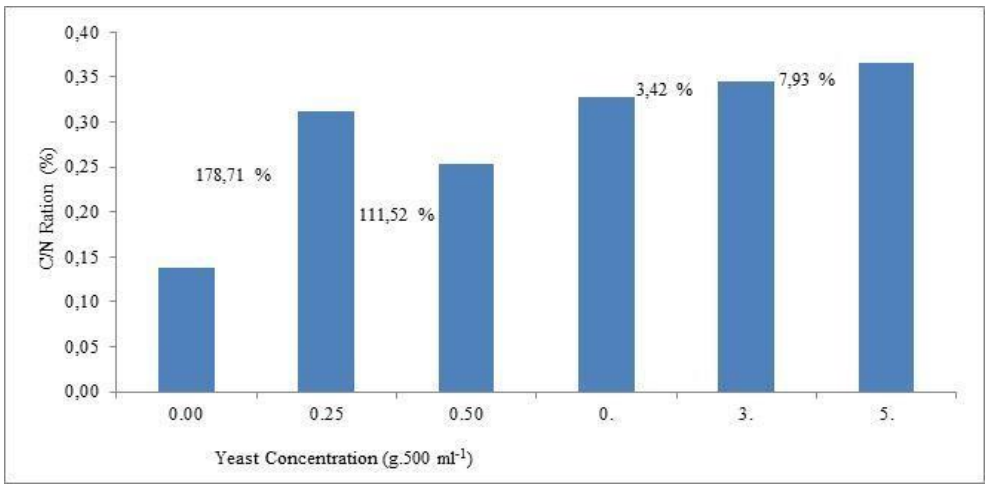

Figure 2. The C/N ratio of OLF PUCAFU on the treatment of the different fermentation time and yeast concentration (The data shown is the result of logarithmic interpolation).

N content in whey waste fermentation decreased after a few days in various yeast concentrations, the same result has also been reported by Makiyah (2013). The decrease indicated that the yeast as the microorganism required the nitrogen as the protein source for the process to reproduce itself.

Total N in a liquid fertilizer was influenced by the quality of the fermented substrate and the fermentation process. The addition of *Saccharomyces cerevisiae* in addition to help the degradation process of organic matter at the beginning of fermentation stage, also donated a number of single cell protein obtained in the extraction process of the solid substrate into a liquid substrate, which further used as the base material of the liquid fertilizer (Hidayati *et al*., 2011).

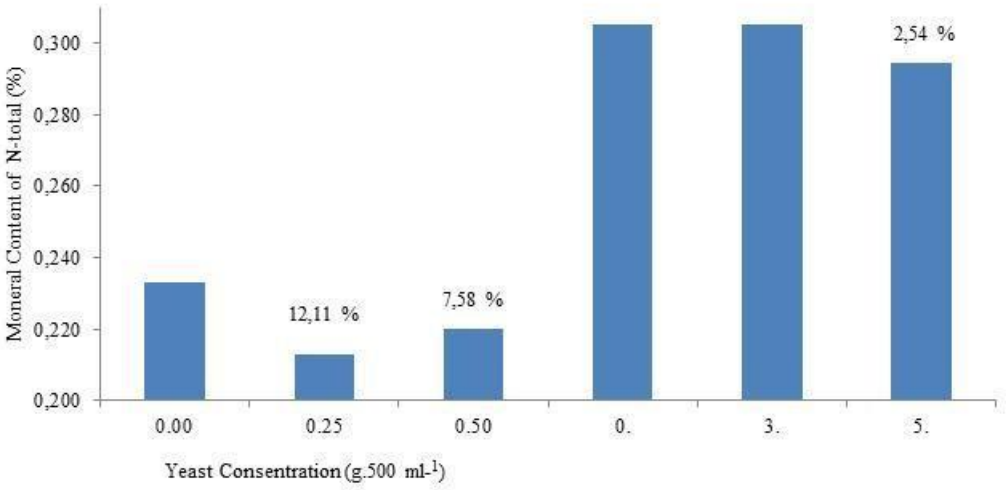

Figure 3. Total N Content (%) of OLF PUCAFU on the treatment of the different fermentation time and yeast concentration (The data shown is the result of logarithmic interpolation).

The breakdown of proteins into simpler compounds allows the compounds to be more degradable, either water-soluble or vaporized before use, particularly when the C/N ratio is too low will result in leading to the formation of ammonia gas, thus the nitrogen is easily lost into the atmosphere (Harada *et al*., 1993). According to Sintha (2008), the reaction of fermentation process to fix the nitrogen (N) is follows:

$$\text{Protein} \xrightarrow{\textit{Proteinase}} \text{TP} + \text{NADP} + \text{NH3} + \text{energy}$$

$$2NH_3 + 3O_2 \xrightarrow{\textit{Nitrosomonas}} 2HNO_2 + 2H_2O + \text{energy}$$

$$2HNO_2 + 2O_2 \xrightarrow{\textit{Nitrobacter}} 2HNO_3 + 2H_2O + \text{energy}$$

The decrease of P_2O_5 content occurred in all treatments (Figure 4). Stofella and Kahn (2001) suggested that the P2O5 content was related to the N content in substrate, the greater the nitrogen content will increase the multiplication of phosphorus solubilizing microorganisms, so that the phosphorus content in liquid fertilizer also increased. The content of phosphorus in the substrate will be used by most microorganisms to build its cells. The mineralization process of phosphorus was occurred due to the phosphatase produced by most microorganisms.

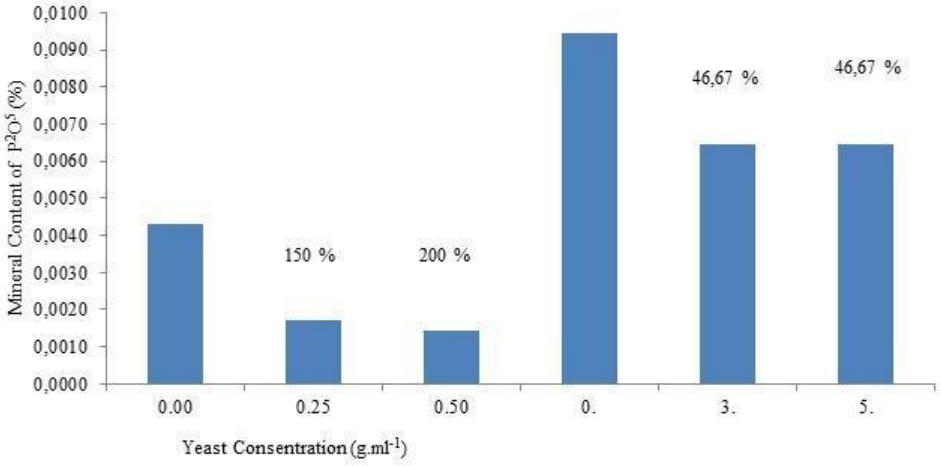

Figure 4 The content of P_2O_5 (%) of OLF PUCAFU on the treatment of the different fermentation time and yeast concentration (The data shown is the result of logarithmic interpolation).

One of the phosphorus bound in the form of P_2O_5 at the end of the decomposition process. Phosphorus is occurred in two forms namely inorganic and organic such as nucleic acids, phitin and lecithin. According to Yuli *et al.* (2011), the available sources of carbon and nitrogen

affected the fungus that could solubilize lecithin and nucleic acids as well as liberate phosphorus from insoluble phosphate complexes.

Similar results were also obtained by Lubis *t al.* (2014) who used palm oil mill effluent into the organic liquid fertilizer with the P_2O_5 content of 0.05%. According to Sitha (2008), the running metabolism to obtain the nutrient phosphorus is as follows:

ATP + glucose → ADP + glucose 6 phosphate

Glucose 6-phosphate + H_2O ↔ glucose + phosphate

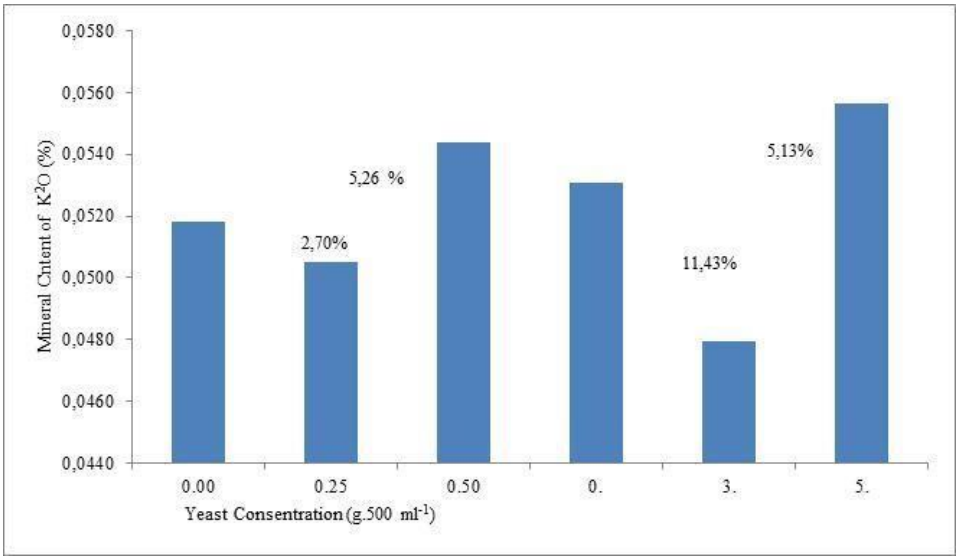

Figure 5. The average content of K_2O (%) of OLF PUCAFU on the treatment of the different fermentation time and yeast concentration (The data shown is the result of logarithmic interpolation).

Potassium (K_2O) is not contained in the protein. The element is not a direct element involved in the formation of organic matter where it only plays a role in helping the formation of protein and carbohydrates. Potassium is used by microorganisms in the substrate material as a catalyst. The presence of the fungus and its activity will greatly affect the increase of potassium content. Potassium is bonded and stored in the fungus cells. Therefore, when it is degraded then the potassium will become available again (Yuli *et al*., 2011).

D. Conclusion

Waste whey which is a residual waste of tofu production process has a chance to be used as organic liquid fertilizer. The results showed that the fermented whey waste on the different fermentation time and yeast concentration had increased the organic C and C/N ratio and decreased the content of Total N, P_2O_5, and K_2O.

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Potential Extracts of *Pangium edule* Reinw and *Derris elliptica* Wallich as Botanical Molluscicides for Management of Golden Apple Snail *Pomacea canaliculata* Lamarck

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Abstract

The research purposed was compared of two extracts as molluscicidal activities from root of *Derris elliptica* Wallich. and *Pangium edule* Reinw seed, that assessed to 3-month old snails *Pomacea canaliculata* L. The Golden apple snails is widely regarded as worst invasive pest species in the rice growing area. It normally destroys the young stems and leaves paddy and could consume 7 – 24 rice seedlings per day. The experiment research started with the mortality test of the golden apple snail, meanwhile hexane extract fraction and etanol extract fraction have completely jumble mode; using the lethal concentration (LC) have mean to describe short term potency of poisonous (toxicity) from materials and can gave little effect or impact for environment; processing phytochemical test from n-hexane extract and etanol extract of root *D.elliptica* and *P.edule* showed positive to contain tanin, saponin and fenol. The data of LC_{50} from n- hexane fraction measure with probit analyze (9,905 mg L^{-1}) by *D.elliptica* L. with high toxic category, and n-hexane fraction (11,574 mg L^{-1}) by *P.edule* Reinw. with toxic category are more effective for golden apple snail control. The golden apple snail mortality was highest using 5000 ppm n-hexane fraction showed 93,3% from *D.elliptica* and using 5000 ppm n-hexane fraction from *P.edule* showed 63,3%. In conclusion, both of extracts from *D.elliptica* roots and *P.edule* seeds was showed potency as botanical mollusicicides and it can be apply in the field.

Keywords: *Botanical molluscicides*, *Derris elliptica Pangium edule*, *Phytochemical screening*, *Pomacea canaliculata*

A. Introduction

The Golden Apple Snail (GAS) *Pomacea canaliculata* Lamarck (Gastropoda: Ampulariidae), GAS is one of the world's 100 worst invasive pest species and potential. The invasiveness is related to its inherent characteristic; a high reproductive rate, adaptability to harsh environmental conditions, ability to invade diverse habitats through multiple pathways (Arunlertaree *et al*, 2012).

Paddy is important food substance that have nutrient and energy for growth, also it has contents many substances can change as energy. The result of the people increased, can made many areas for farming more increase. The goverment with many programes all of the time trying for reserve rices production with wide areal farming, but one of inhibitor factor is destroyer organism can attack paddy.

P.canaliculata is a highly varaclous nocturnal herbivore, it can destroyer newly seedling rice as long as there is water in field. It cuts the base of young seedlings with its layered tooth (radula) and munches if the succulent tender sheath of rice.The Golden apple snails is widely regarded as worst invasive pest species in the rice growing area. It normally destroys the young stems and leaves paddy and could consume 7 – 24 rice seedlings per day (Joshi 2005; Manoppo 2003; Manoppo, 2015).

GAS is difficult to manage once it invades new areas because of its biological and morphological characteristics. A female GAS can lay 50-500 eggs at one time, and GAS has a gill (ctenidium) and a lung like organ enabling it to survive in and out water individual snails can live more than 4 year. The population of GAS approximately 8 GAS/m^2 can cause significant yield loss productions, the extent of damage to the rice crop depends on snails size and density and the growth stage of the rice plant, that assesed to 3 month old snails and that are 20-40 mm are the most destructive, regardless of rice establishment method. Gas also feeds on wide variety of live host plants, its other hosts and food include livestock feed, decaying matter, animal flesh and other crops (Musman, 2010; Manoppo, 2003; Manoppo, 2015).

Many ways that already used for controling the pest, in other hands to control the snails, we must know about the behaviour and live circles (Kertoseputro *et a.l*, 2007). The controling of GAS most of the time can using way mechanic, biology and chemistry. However controling with synthetic molluscicides can causes poisonous for farmer, animals especially yield of farming can containing residu from synthetic mollucicides (Soenaryo *et al.*, 1989)

The advances in the battle againsts the snails using natural molluscicides must be encourage in order to minimize the negative side effect to the environment. A number of tropical plants have been investigated for their molluscicides activity such as crown flower (*Calotropis gigantea*), sambong leaf (*Blumea balsamifera* L.), *Euphorbia tirucalli*, *Derris elliptica* Wallich, *Pangium edule* Reinw. (Suharto*.,* 2005; Wijayakusuma *et al.,* 1992; Manoppo, 2003; Manoppo, 2015). The compound groups from plants identified as having mollucicides activity are saponin, tanin, alkaloid and flavonoid also fenol.

The extracts from two botanicals, *D.elliptica* root and *P.edule* seed were evaluated against golden apple-snails inhibitor respiratory system and make a slow of desible of heart also inhibitor for catch oxygen. The research purposed was focused on potential extract of *D.elliptica* root and *P.edule* seed to manage the GAS as botanical molluscicides that friendly for environment. The research purposed was compared of two extracts as molluscicidal activities from root of *Derris elliptica* Wallich. and *Pangium edule* Reinw seed, that assessed to 3-month old snails *Pomacea canaliculata* L. The experiment research started with the mortality test of the golden apple snail, meanwhile hexane extract fraction and etanol extract fraction have completely jumble mode; using the lethal concentration (LC) have mean to describe short term potency of poisonous (toxicity) from materials and can gave little effect or impact for environment.

B. Methodology

1. Plant Material and Research Equipment

Specimen plants of *D.elliptica* Wallich roots and *P.edule* Reinw seeds were collected from Tonsealama village, in the North Tondano District, Northern Sulawesi. The *P.edule* Reinw. seeds were collected from trees at a height of about 3.5 m – 6.5 m, and placed in green house (28 ± 5^0C) to dry, after which they were then crushed into a crude material and stored in an airtight container until use.

The type of solvent that has been using was ethanol and n-hexane pro-Analyze (PA), a number of extraction kit rotavapor (Buchi R-250), blender, vacuum desicator, oven, digital ohauss, vacuum pump.

2. Snail collection

The identification and characteristic of *P.canaliculata* was performed based on data. *P.canaliculata* with 7-9 in^3 or 3 month old snails were collected from the rice field at Tonsealama village, North Tondano District and subsequently acclimated in glass aquarium.

3. Early procedure

Seed of*P.edule* Reinw have to separate from egg fruit, washing the seed *P.edule* can helping next step for taken flesh of seed after broken the seed, after then seed of *P.edule* must be dried, with temperature room without got sunlight directly (two weeks) or 14 days (Sakul *et al*, 2012). Meanwhile, roots of *D.elliptica* must be got the same point or same treatment, whereas we were used dry roots of *D.elliptica* (Manoppo, 2003).

4. Water content measure

After seed of *P.edule* and root of *D.elliptica* were dried, taken the sample both of plant approximately 3 gram with digital ohauss per sample and put in into electrict oven that have temperatures average 105^0C, for 5 hours, after then taken the sample and let it cooling into vacuum desicator. We still controlling for temperate in order to get maximum result. The water content measure was purpose to get less 10% of water content of seed *P.edule* and root *D.elliptica* and one each case for more better solvent etanol and n-hexane will working analyze.

5. Extraction process of *P.edule* seed and *D.elliptica* root with n-hexane fraction (solvent)

The water content measure with result 9,009 % for *P.edule* seed and 9,0 % for *D.elliptica* root, and we were used 512,3 gram seed of pangi and 500 gram *D.elliptica,* that shows both of plant ready to go in the next stage of extract.

First stage is maceration early with n-hexane 1000 ml, whereas root and seed have to separates kit or glasses, let the solvent 24 hours and we can got 2 layers as waste and result filtrat (maceration first made). The waste of first maceration mix with 800 ml n-heksan and let it solvent 24 hours after that if there is 2 layers of solvent took the waste result of second maceration (second filtrat).

Collected the result of maceration I and II, and refine with Whatmann Paper with vaccum pump for helping and got filtrat has been clearly yellow colour. In this case both of plant have the same treatment. After that put the filtrat into evaporator with temperate 40^0C as long as 1 hour, the patch of evaporator is 1000 ml.

The result of extract were put into minies bottle, dont forget for to take the measuring for bottle weight with empty condition of full substance,its mean for got substance measuring after all.

6. Extraction process of *P.edule* seed and *D.elliptica* root with using ethanol fraction (solvent).

The extraction with ethanol solvent has same point procedure with that process of *P.edule* seed extract usin n-hexane solvent. If result of macerate still though, its mean many the filtrat can collected. When both of extract already got, with the same point ethanol and n-hexane into the next step are LC_{50} test to aimed where is potential extract more an active for increase GAS mortality.

7. Statistical analysis

$LC_{50\text{-}48h}$ data values were determined following probit analysis and experimental data were subjected to one way ANOVA at 0.05 significance level using SPSS IBM-Software Ver.20. Means were then compared by Least Significance Different (LSD/BNT).

C. Result and Discussion

The phytochemical analysis of *P.edule* seed extract and *D.elliptica* root extract, have the purpose to prove, there is tanin, as we know tanin have natural polifenol and carboxil cluster with result “browning enzimatic” that cause colouring seed change from white to brown. This reaction is catalized by polifenolase enzyme. Tanin has a strong characteristic especially interaction with protein. Tanin consist of katekin, leukoantosianin and hidroxy acid (galat, kafeat and khlorogenat acid). In this case using 1 gram extract plant result and NaCl 10% also Fe_3Cl, if this solvent has tanin the result must have gradation blueblack colouring with settled at bottom.

Saponin analysis have to result constant of bubbles, whereas extract of *P.edule* and *D.elliptica* with etanol as positive and extract with n-hexane negatif result. In each case with fenol screening, there is different result. For fenol test, can usage 1% Fe_3Cl, and the solvent with n- hexane shows positif fenol with blue colour stabil and bubble will form.

The extraction of root *D.elliptica* and seed *P.edule* doing stuff with the maceration process, and after that continue with the evaporation technique with using n-hexane fraction and ethanol fraction. The result of treatment to measure the mortality of *P.canaliculata*, the table shows below :

Table 1. The test results of mortality *P.canaliculata* based on activity from *D.elliptica* plant root extract fraction of n-hexane after 48 hours

Treatment	50 ppm	1000 ppm	2000 ppm	3000 ppm	4000 ppm	5000 ppm
1	3	3	4	5	8	10
2	1	2	3	5	7	9
3	2	8	4	6	9	9
Total of mortality	6	8	11	16	24	28
Average	2	2,67	3,67	5,33	8	9,33
Percentage	20%	26,6%	36,7%	53,3%	80%	93,3%

Table 2. Test of Homogenity of Variances and Analysis Of Varians *From D.elliptica* plant root exctract fraction of n-hexane after 48 hours

Test of Homogeneity of Variances

VAR00001

Levene Statistic	df1	df2	Sig.
,031	2	15	,969

ANOVA

VAR00001

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,000	2	2,000	,223	,803
Within Groups	134,500	15	8,967		
Total	138,500	17			

According to result of dependent variable test with multiple comparison shows that treatment can gave effect that was real in 5%. For mortality of Golden Apple-Snails or number of GAS where as got the best result after test 48 hours. How ever that concentrate 500 ppm, 1000 ppm, 2000 ppm, 3000 ppm, 4000 ppm and 5000 ppm shows different result and the high result is 5000 ppm, whereas a number of snails was died in 48 hours for *D.elliptica* n-hexane fraction. The golden apple snail mortality was highest using 5000 ppm n-hexane fraction showed 93,3% from *D.elliptica* and using 5000 ppm n-hexane fraction from *P.edule* showed 63,3%.

Table 3. The test results of mortality *P.canaliculata* based on activity from *P.edule* plant seed extract fraction of n-hexane after 48 hours

Treatment	50 ppm	1000 ppm	2000 ppm	3000 ppm	4000 ppm	5000 ppm
1	2	2	4	5	4	8
2	1	3	2	4	4	6
3	2	1	3	4	7	5
Total of mortality	5	6	9	13	15	19
Average	1,67	2,00	3,00	4,33	5	6,33
Percentage	16,7%	20%	30%	43,3%	50%	63,3%

Table 4. Test of Homogenity of Variances and Analysis Of Varians *From P.edule* plant seed extract fraction of n-hexane after 48 hours

Test of Homogeneity of Variances

VAR00001

Levene Statistic	df1	df2	Sig.
,120	2	15	,888

ANOVA

VAR00001

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,111	2	1,056	,249	,782
Within Groups	63,500	15	4,233		
Total	65,611	17			

Table 5. The test results of mortality *P.canaliculata* based on activity from *D.elliptica* plant root extract fraction of etanol after 48 hours

Treatment	50 ppm	1000 ppm	2000 ppm	3000 ppm	4000 ppm	5000 ppm
1	1	1	4	4	4	6
2	1	2	3	3	5	8
3	2	2	3	4	6	7
Total of mortality	4	5	10	11	15	21
Average	1,33	1,67	3,33	3,67	5	7
Percentage	13,3%	16,6%	33,3%	36,7%	50%	70%

Table 6. Test of Homogenity of Variances and Analysis Of Varians *From D.elliptica* plant root extract fraction of etanol after 48 hours

Test of Homogeneity of Variances

VAR00001

Levene Statistic	df1	df2	Sig.
,129	2	15	,880

ANOVA

VAR00001

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,333	2	,667	,138	,873
Within Groups	72,667	15	4,844		
Total	74,000	17			

According to table 5 and 6, it mean that etanol fraction from species *D.elliptica* root extract have possibilities become a bioinsecticide, and the best concentration only 5000 ppm, because the total mortality of *P.canaliculata* can reach 21 species or 70% of lethal death.

Table 7. The test results of mortality *P.canaliculata* based on activity from *P.edule* plant seed extract fraction of etanol after 48 hours

Treatment	50 ppm	1000 ppm	2000 ppm	3000 ppm	4000 ppm	5000 ppm
1	2	2	4	5	4	7
2	1	3	2	3	4	5
3	2	1	3	2	6	5
Total of mortality	5	6	9	10	14	17
Average	1,67	2,00	3,00	3,33	4,67	5,67
Percentage	16,6%	20%	30%	33,3%	46,7%	56,7%

Based of data, according to table 7 and 8, it mean that etanol fraction from species *P.edule seed* extract have possibilities become a bioinsecticide too, but if we compare with the table 5 and 6, this differencies of total mortality from GAS (*P.*canaliculata) it very wide 56,7% < 70%, and the best concentration still in5000 ppm, because the total mortality of *P.canaliculata* can reach 17 species or 56,7% of lethal death.

Table 9. Toxicity classification LC_{50} and Toxicity Rating (ISO, 1982)

LC_{50} (mg/L)	Toxicity Rating
>10000	Non Toxic
1000 – 10000	Very low toxic
100 – 1000	Low toxic
10 – 100	Toxic
1 – 10	High Toxic
0,1 – 1	Very High Toxic
< 0,1	Extreme Toxic

Results showed that n-hexane fraction is the most effective againts Golden Apple-Snails mortality ($LC_{50\text{-}48h}$ = 9,905 mg/L) from *D.elliptica* root extract, ($LC_{50\text{-}48h}$ = 11,574 mg/L) from *P.edule* Reinw extract. According to the table 9, it's show the toxicity rating, *D.elliptica* root extract has a High Toxic category, it is same with *P.edule* Reinw extract, toxic too.

D. Conclusion

In this research, we determined that LC_{50} values of *D.elliptica* root extract and *P.edule* seed extract, with probit analyze shows that *D.elliptica* root extract had been highest effect (toxic) for Golden Apple-Snails mortality in 48 hours after treatment. In each case of *P.edule* seed extract shows effected for GAS mortality in 36 hours after treatment. It's assumed for screening phytochemistry that the observed biology effects of largely due to Tanin, Saponin, Fenol present in the root and seed extract. Thus, these results support that both of extracts from *D.elliptica* roots and *P.edule* seeds was showed potency as botanical molluscicides and an attractive compound for further studies leading to molluscicidal development.

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The Effect of Gamma Irradiation to the Phenotypic of Two Aglonema Varieties

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Abstract

Increased phenotypic diversity is needed to increase the economic value of Aglaonema. However, information on increasing phenotypic diversity of Aglaonema using gamma-ray irradiation has not been widely known. This study aimed to investigate the effect of gamma ray irradiation treatment to the performances of two varieties of Aglaonema. This research was arranged factorially using randomized group design (RKLT) of two factors consisting of 8 combinations of treatments that are 4 level of irradiation dose and 2 Aglaonema varieties. The results showed that the induction of gamma ray irradiation decreased the % viable of the plants, the number of leaves, leaf length, leaf width, and the % green color as well as increased the % blue on the leaves of *Aglaonema Butterfly* and *Aglaonema Siam Aurora*. The interaction between dose of irradiation and aglaonema varieties was obtained in the % red of leaf color. Both of Aglaonema varieties had a high radiosensitivity with LD^{50} values ranged of 16.70 - 17.14 Gy.

Keywords: Phenotypic, gamma-ray, aglaonema

A. Introduction

Aglaonema or known as *Sri Rejeki* has leaves that vary in the form of motifs, colors, shapes, and sizes. Aglaonema that adapted for growing indoors in one week without being issued is suitable to be used as indoor plants (Purwanto, 2006). In addition, the maintenance of Aglaonema is quite easy compared to the maintenance of other leaf ornamental plants. So it is not surprising if this ornamental plant to be one of the ornamental plants that are very potential to be developed and further become one of the ornamental plants sold by calculating the price per leaf (Purwanto, 2006)

Increased phenotypic diversity is needed to increase the economic value of Aglaonema. Increased phenotypic can be done by hybridization or artificial crosses and mutations. Otherways, Hybridization of Aglaonema is not easy to do as the different maturity time of male and female flowers. Therefore, one method that is considered effective for increasing diversity is a mutation, which causes changes in the color, strokes, and shape of Aglaonema leaves (Purwanto, 2006). Mutation in Aglaonema can be obtained naturally or by induction method (Wulan, 2007). However, the increase in phenotypic diversity using mutation induction is more popular in Aglaonema plants compared to natural mutations. This might be caused by the small chance of natural mutations occur in plants.

Induction of mutations in plants can be done physically and chemically. Gamma ray irradiation is one example of a physical mutation that can be done to increase the phenotypic diversity of Aglaonema. The success of increased phenotypic diversity in plants with gamma-ray irradiation is affected by several factors including appropriate dose, irradiation techniques used, plant species and plant parts used. However, Information on increased phenotypic diversity of Aglaonema with gamma-ray irradiation has not been widely known. Furthermore, Misniar (2008) stated that there is no LD^{50} at a dose of 10 - 50 Gy in Aglaonema plants. Thus, this study aimed to investigate the effect of gamma ray irradiation treatment to the performances of two varieties of Aglaonema.

B. Methodology

Gamma ray irradiation was carried out at the National Nuclear Energy Agency (BATAN), Pasar Jumat, Jakarta. The observation and maintenance of the plant were carried out at Citeureup Experimental Garden, Bogor District.

Plant materials used in this study consisted of two Aglaonema varieties that are "*Siam Aurora and Butterfly*". The irradiated material is Aglaonema seedling which has 3-4 leaves. The plant medium used in this study consisted of a mixture of cocopeat: fern: compost: husk charcoal with a ratio of 3: 3: 1: 1.

The research activity was started by preparing the root of *Aglaonema Butterfly* and *Aglaonema* Siam Aurora which has about 3-4 leaves. Before irradiation is done, the Aglaonema seedlings were cleaned first with water which was then inserted into a large brown envelope paper shaped. The Aglaonema seedlings were then irradiated with 4 doses levels of 0 Gy, 30 Gy, 60 Gy, and 90 Gy. Irradiated Aglaonema seedlings were then washed with water and then planted in pots of 15 cm in diameter media ratio of cocopeat: fern: compost: husk charcoal of 3: 3: 1: 1. Maintenance activities of the plant consisted of watering, fertilizing and controlling pests and diseases. Heavy watering was done twice a week while light watering was done once a day in the morning or afternoon by using hand sprayer. Fertilizer applied in the form of liquid and granules fertilizers. Liquid fertilizer is a leaf fertilizer with a concentration of 1-2 g l^{-1}, while the granular fertilizer is NPK Mutiara fertilizer with a concentration of 5-10 g of l^{-1} and 250 ml doses per pot. Pest control is done by sprinkling fungicides and bactericides with concentrations of 1- 2 g l^{-1} and a dose of 250 ml per pot. The application of Fertilization and pesticides was done once a week. The characters observed in this study consisted of plant height (cm), stem diameter (mm), % red, green and blue (RGB) of leaf, the number of leaves, leaf length (cm), and leaf width (cm). The observation of leaf observation was performed only on leaves that grew after irradiation, while the % RGB value of leaves were obtained by using image processing software.

This research was arranged factorially by using a randomized group design (RKLT) which consisted of 8 combinations of treatments, ie the radiation dose which consisting of 4 levels and two varieties. Each treatment was repeated 3 times which consisted of 5 plants. The general statistical equation for this design is:

$Yijk = \pi + \alpha i + \beta j + (\alpha\beta)ij + €ijk$
i = 0 Gy;30 Gy; 60 Gy; 90 Gy (radiation dose level)
j = Butterfly and Siam Aurora (variety level)
k = 1; 2; 3; (repetition)
π = general median
αi = Effect of dose factor on i-th radiation level
βj = Effect of variety on j-th level
(αβ)ij = Effect of the interaction of i-th dose irradiation factor and j-th variety factor
€ijk = Random error of radiation dose factor on i-th level and variety factor on j-th level

The LD^{50} analysis was done by using curvit analysis software while F test and multiple comparison tests were done by SAS software. Multiple comparison tests were performed when the F test was significantly different, by using Duncan Multiple Range test (DMRT).

C. Result and Discussion

Environmental conditions during the study were having a minimum temperature ranging 18.4° C -22.8° C, the maximum temperature of 32° C - 33.2° C, and relative humidity of 68-95%. It is less than ideal for aglaonema cultivation. Junaedhie (2006) stated that the appropriate temperature for Aglaonema was 25° C - 29° C during the day and 18° C - 21° C at night, while Djojokusumo (2006) stated that Air humidity corresponding to Aglaonema ranges Between 50 - 60%. This not ideal environmental condition caused some Aglaonema plants die due to its resistance to pests and diseases.

Recapitulation of Variance

The results of the variance analysis in Table 1 showed that the effect of gamma ray irradiation dose significantly affected the % blue color of leaf (% B) as well as significantly affected the %viable, leaf number, leaf length, leaf width, %green of leaf (% G) whereas the main effect of variety aglaonema only significantly affect on plant height character. The result of variance analysis also showed that there is an interaction effect between irradiation dose and aglaonema varieties on the character of the %red color of leaf (% R).

Table 1. Recapitulation of variance of Gamma Radiation Effect on Two Aglaonema Varieties

character	Source of variance		
	Varieties	Dose	Varieties x Dose
% viable of plant	tn	**	tn
Plant height	*	tn	tn
Stem diameter	tn	tn	tn
Number of leaves	tn	**	tn
Leaf length	tn	**	tn
Leaf width	tn	**	tn
% R	tn	tn	**
% G	tn	**	tn
% B	tn	*	tn

Note: tn = No significant effect, * = Significant effect at 5% level and ** = Significant effect at 1 % level

Main effect of the Varieties on Aglaonema

The result showed that most of the observed characters did not show significant differences between varieties of *Aglaonema Butterfly* and *Aglaonema Siam Aurora* (Table 2). It might be caused by the similarity of the elders of both varieties. Both varieties probably have genes derived from *Aglaonema rotundum* as the varieties have the red color derived from aglaonema rotundum. Purwanto (2006) stated that aglaonema rotundum species is the only species of aglaonema that has a red character.

Table 2. Main effect of the varieties on aglaonema phenotypic

Varieties	Character								
	% Viable	DBAT (cm)	TT (cm)	JD	PD (cm)	LD (cm)	% R	% G	% B
Butterflay	34.58	0.74	25.71 a	0.72	3.69	1.72	0.39	0.34	0.27
Siam Aurora	29.86	0.66	23.05 b	0.63	2.56	1.26	0.39	0.35	0.25

Note: The values in the same column followed by the same letter show no significant difference based on the DMRT test at the 5% level. DBD = Stem diameter, TT = Plant height, JD = Number of leaves, PD = Leaf length, LD = Leaf width,% R =% Red color of leaves,% G =% Green color on and% B =% Blue color on leaf

However, the significant difference was found in plant height between *Aglaonema Butterfly* and *Aglaonema Siam Aurora*, of which *Aglaonema Butterfly* has higher plant height than *aglaonema Siam Aurora*. The difference plant height might be due to genetic differences between the two varieties. The phenotype of a plant is influenced by several factors such as genetic, environmental, and interaction between genetic and environmental factors. The finding research by Qodriyah and Sutisna (2007) stated that *A. pseudobracteatum* has a higher regenerative power in root formation and shoot growth than *A. commutatum*, *A. crispum*, and *A. philippinensis var. Stenophyllum f. Longifolium***.** Budiarto (2007) also explained that the characteristics of faster or slower growth in plants are the original characteristic of the plant as the result of plant interaction with growing environments

Main Effect of Gamma ray Irradiation dose on Aglaonema

The results showed that the induction of gamma ray irradiation could decrease the % of viable plants, the number of leaves growing, leaf length, leaf width and% green color as well as increased the % blue on aglaonema leaf. Similarly, Misniar (2008) reported that induction of gamma ray irradiation lead to decrease the number of leaves, leaf length, and leaf width of Aglaonema. Meanwhile, Syukur (2000) reported that there was an increase in chlorophyll content in soybean plants with the treatment of a dose of 20 Krad and decreased at a dose of 35 Krad, moreover, while Fauza *et al.* (2005) also explained that the irradiation dose of 3 Krad gamma ray decreased the average number of chlorophyll of the first leaf of mangosteen plant.

Tabel 3. Main Effect of Gamma ray Irradiation dose on Aglaonema

Dose (Gy)	Karakter								
	% viable plant	DBAT (cm)	TT (cm)	JD	PD (cm)	LD (cm)	% R	% G	% B
0	100.00 a	0.67	26.40	1.53 a	10.44 a	4.09 a	0.39	0.39 a	0.23 b
20	9.72 b	0.70	23.63	0.50 b	0.61 b	0.43 b	0.39	0.34 b	0.26 a
40	11.67 b	0.73	24.31	0.33 b	0.73 b	0.53 b	0.40	0.32 b	0.28 a
60	7.50 b	0.70	23.18	0.33 b	0.73 b	0.91 b	0.40	0.34 b	0.27 a

Note: The values in the same column followed by the same letter show no significant difference based on the DMRT test at the 5% level. DBD = Stem diameter, TT = Plant height, JD = Number of leaves, PD = Leaf length, LD = Leaf width, % R =% Red color of leaves, % G = % Green color on and% B = % Blue color on leaf

The decreased % viable plants after gamma ray irradiation is due to the death of plant cells, while the decrease in the number, length, and width of the leaves is might be caused by the inhibition of aglaonema plant cell division. Broertjes and Van Harten (1988) suggested that, in general, the physiologic damage may occur in the form of inhibition of cell division, cell death, induction of mitotic activity, the effect of average growth, changes in reproductive capacity, and increased frequency of tissue formation after gamma ray irradiation. Soedjono (2003) also explained that the high-dose irradiation treatment would eliminate the mutated material or cause sterility, whereas at low irradiated dose it can generally preserve the viable plant or plant shoots.

Meanwhile, the decrease of % green and the increase of % blue color after gamma ray irradiation might be caused by the damage of cells in the chloroplast due to gamma ray irradiation. Aisyah et al (2009) stated that the occurrence of albino shoots due to gamma ray irradiation because of the disruption of chlorophyll synthesis which eventually lead to the deficiency of green leaf color.

Interaction of Gamma Rays Irradiated Dose and Aglaonema Varieties

The higher the irradiation dose in Aglaonema butterfly caused a higher % red color on leaves while the higher the dose of irradiation in the Aglaonema Siam Aurora caused the decrease of % red color on the leaves. This happens because the leaves of Aglaonema Butterfly are dominated by green color while the leaves of Aglaonema Siam Aurora are dominated by red color, so in Aglaonema, Siam Aurora damage not only to the cells of chlorophyll but also cells that contain red color in plants

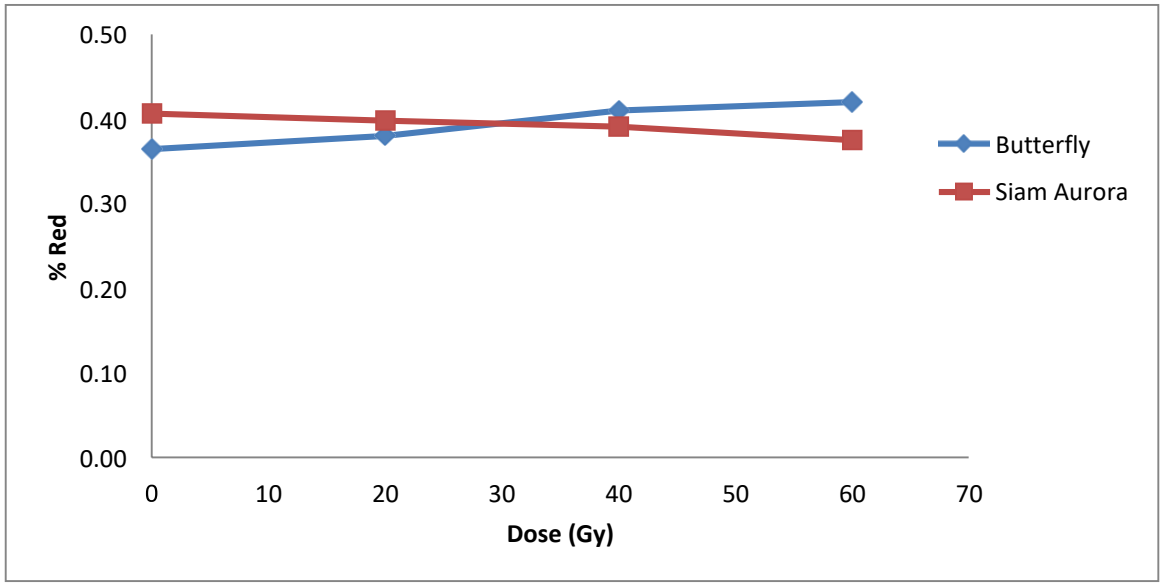

Figure 1. Graph of interaction gamma rays irradiation dose and Aglaonema varieties on the character of % Red

Based on the findings, to obtain a high red color in Aglaonema Butterfly, it should be used a high dose of gamma irradiation. Similarly, to maintain the highest red color in *Aglaonema Siam Aurora*, irradiation should be done in a low dose.

Radiosensitivy Level

Radiosensitivity Level is the ability level of plants in response to irradiation stimulation. One way that can be used to determine the level of radiosensitivity is to know the Lethal Dose (LD^{50}) of the plant (Herison, et al., 2008). The lower the LD^{50} of a plant the higher the radiosensitivity level, while the higher the LD^{50} value of a plant the lower the radiosensitivity level. Besides being used to determine radiosensitivity levels, LD^{50} is also used to increase plant diversity.

Table 4. LD^{50} value of 2 varietas of Aglaonema

Varieties	Type of equation	Equation	Value of LD^{50}
Butterfly	Linear fit	y = 69.3 – 1.2x	16.70 Gy
Siam Aurora	Linear fit	y = 77.3 – 1.6x	17.14 Gy

The value of LD^{50} could be obtained by correlating the irradiation dose with % viable plant. From the equation formed, then we can know the value of LD^{50} from Aglaonema. the Aglaonema variety of *Butterfly and Siam Aurora* equally produce linear equations and also have a high radiosensitivity. Both LD^{50} values of these varieties ranged from 16.70 - 17.14 Gy. A different finding reported by Misniar (2008) that there is no LD^{50} value at the irradiation dose of 0 - 50 Gy in Aglaonema. This might happen because radiosensitivity was also affected by the type of plant material used.

D. Conclusion

Induction of gamma ray irradiation can decrease % viable plants, the number of leaves, leaf length, leaf width, and % green color as well as increase % blue on aglaonema butterfly and Siam Aurora leaves. The interaction between irradiation dose and aglaonema varieties is found in % red leaf color. Both aglaonema varieties have high radiosensitivity with LD^{50} values of 16.70-17.14 Gy. Gamma-ray irradiation dose of 0-20 Gy on Aglaonema seedlings is worth to be used to increase the phenotypic diversity of Aglaonema

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Impact of Botanical Insecticides Derived from *Pangium edule* Reinw and *annona muricata* l. Seed Extracts on the "Gay Gantung" Diamondback Moth, *Plutella xylostella* l.

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Abstract

Insecticidal properties of fractioned extracts from *Pangium edule* Reinw seed and *Annona muricata* seed against *Plutella xylostella* larvae were investigated in the laboratory. The study was initiated to investigate the possibility of using botanical pesticides to control *P.xylostella,* a serious cosmopolitan pest of crucifer plants. The study aims to determine the most effective concentration and the most active extract; to evaluate the different extract concentrations on the treated larvae; and to characterize the phytochemical contents of the most effective extracts fraction. The study was an experiment initiated by test of phytochemical screening test in order to discover the presence of secondary metabolites in the extracts. It was followed by the test of mortality of the diamondback moth larvae. Furthermore, the extracts hexane fraction and etanol fraction, were conducted with completely randomized design; The LC_{50} values were determined following probit analysis, the data were treated in the software programme IBM Statistic SPSS 20. Results showed that n-hexane fraction is the most effective againts larvae ($LC_{50\text{-}48h}$ = 12,71 mg/L) from *P.edule* seed extract, ($LC_{50\text{-}48h}$ = 50,81 mg/L) from *A.muricata* seed extract. Larva mortality was highest using 1000 ppm n-hexane fraction (96,6%) derived from *P.edule* seed extract, (93,3%) derived from *A.muricata* seed extract. The ethanol fraction tested positive for alkaloid, saponins, flavonoids, terpenoids, phenol and tannins. N-hexane fraction of *P.edule* seed extract, and *A.muricata* seed extract are an effective botanical insecticides exhibiting larvicidal and antifeedant properties against *P.xylostella* thus it can be alternative to synthethic insecticides. Results indicate that these botanical insecticides have good possibilities for control of *P.*xylostella. Further work is necessary to evaluate and characterize the active components of the extract fractions and its efficacy in the field.

Keywords: *Botanical insecticides, Pangium edule, Annona muricata, "Gay Gantung" Plutella xylostella*.

A. Introduction

Botanical insecticides represent one alternative to synthetic insecticides due to the negative effects of the latter, i.e. pest resistance, secondary pest outbreaks and effects on the environment and non-target organisms. Intensive use of synthetic insecticides to control insect pests had lead to many problems such as pest resistance and surgence, effects on non-target organisms, human exposure and environmental impacts. The negative effects have provided the impetus dor the developmentof alternatives including botancial insecticides. Botanical insecticides developed from plant extracts are less persistent in the environment and are often safer than synthetic chemicals. Botanical insecticides is an agent and a part of biological control process (Abalos, 2013; Sakul,*et al*, 2012).

Biological control is the cornerstone of any sustainable pest management strategy and an essential component of integrated pest management. Biological control is defined as the "action of parasites, predators, pathogens, chemical compounds from plant, insecticidal secondary metabolites in maintaning another organism's (the pest) density at an average lower than would occur in their absence (Charleston *et al*, 2004; Leatemia, 2003).

Integrated pest management (IPM) attempts to integrate the available pest control methods to achieve a farmer's most effective, economical and sustainable combination for a particular local situation.Emphasis is placed on biological control, host plant resistance, cultural control and other non-polluting methods. Successful IPM programs produce many benefits, including :
1) lower production costs compared with conventional pest control strategies with a high input to synthetic pesticides, 2) reduced environtment pollution, particularly improvement of soil and water quality, 3) reduced farmer and consumer risks from pesticide poisoning and related hazards, and 4) ecological sustainability by conserving natural enemy species, biodiversity and genetic diversity (Lim *et al*. 1997; Charleston *et al*, 2004).

The plant kingdom is by far the most efficient 'factory' of chemical compounds, synthesising many products that are used in the defence against herbivores. The insecticidal secondary metabolites from one plant species can be applied to other plant species to provide protection for this second plant. Extract prepared from plant (botanical pesticides) have a variety of properties including insecticidal activity, repellence to pests, antifeedant effects, insect growth regulation, toxicity to nematodes, mites and other agricultural pests, also antifungal, antiviral and antibacterial properties against pathogens (Boeke *et al.*,2001 in Charleston *et al*, 2004).
The steps involved in the development of botanical insecticides from plant extracts begin with screening of candidates for deleterious effects on insects followed by standardization of promising extracts via bioassay (Leatemia, 2003).

The "Gay Gantung" Diamondback moth, *Plutella xylostella* Linnaeus (Lepidoptera: Plutellidae), is one of the most important insect pest of Brassicaceae in the world. This species also a cosmopolitan insect pest of cruciferous plants and can be especially destructive. Adult female moths lays their eggs on the underside of leaves. The larvae hatch and feed on the parenchyma, leaving the cuticle intact, but as the plant grows the cuticle tears resulting in a characteristics holey appearance on the surface of the leaf.

There are four larval instars before pupation occurs, and at 25^0C the life cycle from egg to adult emergence takes approximately 24 days. The first-instar larvae mine in the spongy mesophyl tissue, whereas older larvae feed from the lower leaf surface and usually consume all tissue except the wax layer on the upper surface, thus creating the a window in the leaf (Vanlaldiki,H.*et al*., 2013; Trindade,R.C.P. *et al*.,2011; Abbasipour,H. *et al*., 2010; Charleston,D.S. *et al.,*2004).

*Plutella xylostella*is the insect pests which is cosmopolitantly distributed in. Its attacks could damage vegetables resulting in loss of quantitative and qualitative. To overcome these problems need to develop a means of pest control, which are effective but enviromental friendly. North Sulawesi has a lot of plants, which is potentially developed as a source of botanical insecticides. Pangi plant (*Pangium* edule Reinw.) is a plant species which potentially developed and effective against several types of insect pest, but testing by using crude extract can give varies results depending on the type of extract used, the test insects and environment factors. Part of body from Pangi plant as such as leaves, bark of the stem, roots, and seed have a potentially as a botanical insecticides (Sakul, *et al.,* 2012; Salaki,*et al.,2012*).

The Annonaceae (custard-apple family) is a family of almost excluscively tropical trees and shrubs. Plant parts of some species of this family have been used traditionally as insecticides. Also soursop plant (*Annona muricata* Linn.) is a potentially plant, along with their importance as sources of food materials and of popular medicaments, many members of the Annonaceae are

also valued as insecticides.For example, the powdered seeds and leaf juices of *Annona* spp are used to kill head and body mosquitoes (Trindade, *et al,* 2011; Leatemia, 2003).

Insecticidal properties of fractioned extracts from *P.edule* Reinw. seed and *A. muricata* Linn. seed against *P. xylostella* larvae were investigated in the laboratory. The study was initiated to investigate the possibility of using botanical pesticides to control *P.xylostella,* a serious cosmopolitan pest of crucifer plants. The study aims to determine the most effective concentration and the most active extract; to evaluate the different extract concentrations on the treated larvae; and to characterize the phytochemical contents of the most effective extracts fraction.

The study was an experiment initiated by test of phytochemical screening test in order to discover the presence of secondary metabolites in the extracts. It was followed by the test of mortality of the diamondback moth larvae. Toxicity of the extracts was assesed using leaf dip (leaf disc) bioassay.

B. Methodology

Insect rearingand Seedlings of cabbage plants

P.xylostella population (larval stage), was collected from cauliflower crops of Tonsealama village at the North of Tondano, Minahasa, North Sulawesi, Indonesia. For egg laying, leaves of cauliflower, *Brassica juncea* L. (Brassicaceae) were used and eggs were transfered to leaves of mentioned plant to continue their development. Insect stock was maintaned in a controlled environment at 25 ± 2^0C and 65 ± 5% relative humidity (RH). For this research, larval stage from *P.xylostella* was used the third instar larvae (age of larva is 7-12 days). Seed of cabbage plants, *B. juncea* L. (Brassicaceae) were germinated in expanded polystyrene trays containing a mixture composition consist of soils, organic fertilizer, and coconut fibre, 2 : 1 : 1) and maintained for 35 days in the greenhouse. Seedlings of cabbage plants were transplanted into polibag and planted in black plastic bags in a green house (28 ± 5^0C). To protect the plants against insect damage they were placed within a tent-loke construction made from fine netting (mesh size <1 mm). The plants were fertilised when planted, and regularly watered.

Plant material

Specimen *P.edule* Reinw. seeds and *A.muricata* L. seeds were collected from a garden Tonsealama village at the North of Tondano, Minahasa, North Sulawesi, Indonesia. The seeds were harvested and collected from trees at a height of about 3.5 m – 6.5 m, and placed in green house (28 ± 5^0C) to dry; after which they were then crushed into a crude material and stored in an airtight container until use.

Preparation of plant extract with n-hexane fraction and ethanol fraction

A crude extract of the seed of *P.edule* Reinw. and the seed of *A.muricata* L. was prepared by steeping dried seed material in n-hexane liquid and ethanol liquid. In each extraction,especially the first maceration, used 500 grams of powdered seeds*P.edule* Reinwwere extracted by maceration in 1000 ml of n-hexane at room temperature for 1 days (1 x 24 h). Also 500 grams the powdered seeds *A.muricata* L. were extracted too by maceration in 1000 ml of n-hexane at room temperature for 1 days (1 x 24 h), and after that we collected the first filtrate.

After that sediment of *P.edule* and *A.muricata* seed collected in erlenmeyer flask, this sediment were extracted again by maceration process (stage 2) in 800 ml of n-hexane at room temperature for 1 days (1 x 24 h) and after that we collected the second filtrate. The next process is collected again the sediment of *P.edule* and *A.muricata* seed in erlenmeyer flask, were extracted again by maceration process (stage 3) in 500 ml of n-hexane at room temperature for 1 days (1 x 24 h) and after that we collected the third filtrate. The filtrate of n-hexane fraction and filtrate of ethanol fraction were filtered by using the Whatmann Filter Paper and Buchener Funnel, and after that the filtrates were concentrated to dryness by a rotary evaporator under low pressured and temperature of rotary evaporator in 40^0C. Seed extract was stored in labelled bottle atrefrigerator 4^0Cuntil required for bioassay. If water remained in the concentrated crude extract, the material was store in a vacuum dessicator over silica gel.

Bioassay

A leaf dipping bioassay method (Qin *et al.*2004) can be used to assess contact toxicity. A commond assay used to assess contact as well as stomach toxicity of a compound in older larva is a lead dip bioassay. In this assay, a leaf or leaf disc is dipped in a solution of the extract being tested or dipped in the solvent alone (=control). Test insects are fed these discs and mortality recorded. Cabbage leaves were washed with distilled water and dried for about 2 hour. Four concentrations 50 ppm, 100 ppm, 500 ppm and 1000 ppm of the seed n-hexane extract and four concentrations 50 ppm, 100 ppm, 500 ppm and 1000 ppm of the seed ethanol extract, both of

specimen (*P.edule* Reinw. and *A.muricata* L.) were prepared. Cabbage leaves disks (10cm diameter) were cut with a scalpel blade from fully expanded cabbage leave grown in a green house. The disks were dipped for 30 seconds in the test solutions extract and air dried. After air-drying at the room temperature, leaves disks were then placed in a plastic cup (15-20 cm in diameter, 5-7 cm in depth). Ten third instar larvae were starved for 2 hour and then released into the plastic cup for each treatment. Both of specimen *P.edule* Reinw. and *A.muricata* L. treatments (four concentrations 50 ppm, 100 ppm, 500 ppm and 1000 ppm) were replicated three times. The cups were placed in a growth chamber at 25 ± 2^0C and 65 ± 5% relative humidity (RH). Mortalities were recorded 48 hour after treatment. Larvae were considered dead if they did not move when prodded with fine brush. Live larvae were transferred to untreated fresh cabbage leaves to continue their growth and development. The cabbage leaves were replaced with fresh ones when needed.

Statistical analysis

$LC_{50\text{-}48h}$ data values were determined following probit analysis and experimental data were subjected to one way ANOVA at 0.05 significance level using SPSS IBM-Software Ver.20. Means were then compared by Least Significance Different (LSD/BNT).

C. Result and Discussion

Results showed that larva mortality was highest using 1000 ppm n-hexane fraction (96,6%) derived from *P.edule* seed extract, (93,3%) derived from *A.muricata* seed extract.

Table 1.
The test results of mortality *P.xylostella* based on activity from *P.edule* plant seed extract fraction of n-hexane after 48 hours

Treatment	50 ppm	100 ppm	500 ppm	1000 ppm
1	3	4	9	10
2	3	5	8	10
3	2	5	8	9
Total of mortality	8	14	25	29
Average	2,667	4,667	8,333	9,667
Percentage	26,6%	46,6%	83,3%	96,6%

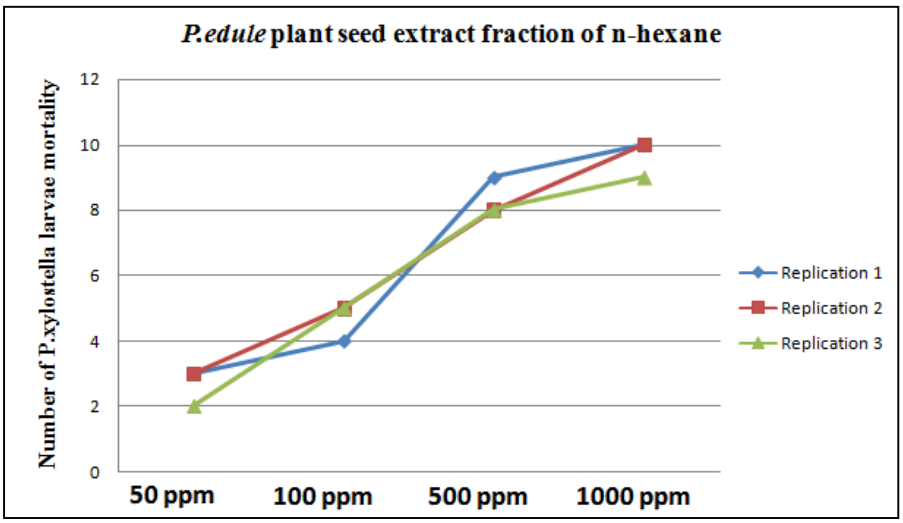

Figure.1. The test results of mortality *P.xylostella* based on activity from *P.edule* plant seed extract fraction of n-hexane after 48 hours

Table 2.
Test of Homogenity of Variances and Analysis Of Varians
From P.edule plant seed extract fraction of n-hexane after 48 hours

Test of Homogeneity of Variances

VAR00001

Levene Statistic	df1	df2	Sig.
1,055	2	9	,387

ANOVA

VAR00001

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7,200	2	3,600	,362	,706
Within Groups	89,467	9	9,941		
Total	96,667	11			

Table 3.
The test results of mortality *P.xylostella* based on activity from *A.muricata* plant seed exctract fraction of n-hexane after 48 hours

Treatment	50 ppm	100 ppm	500 ppm	1000 ppm
1	4	5	7	10
2	3	4	6	9
3	2	4	7	9
Total of mortality	9	13	20	28
Average	3,000	4,333	6,667	9,333
Percentage	30 %	43,3%	66,6%	93,3%

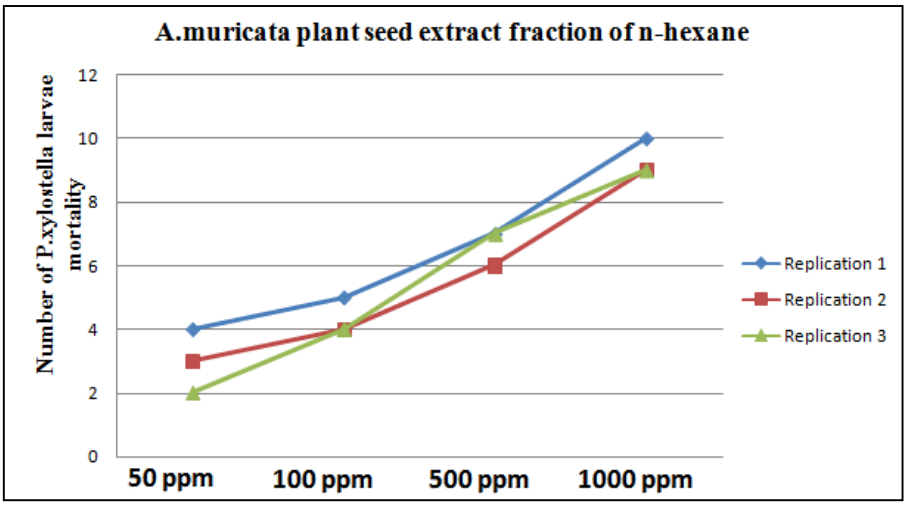

Figure.2. The test results of mortality *P.xylostella* based on activity from *A.muricata* plant seed extract fraction of n-hexane after 48 hours

Table 4.
Test of Homogenity of Variances and Analysis Of Varians
From A.muricata plant seed extract fraction of n-hexane after 48 hours

Test of Homogeneity of Variances

VAR00001

Levene Statistic	df1	df2	Sig.
,214	2	9	,811

ANOVA

VAR00001

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,667	2	1,333	,169	,847
Within Groups	71,000	9	7,889		
Total	73,667	11			

Table 5
The test results of mortality *P.xylostella* based on activity from *P.edule* plant seed exctract fraction of ethanol

Treatment	50 ppm	100 ppm	500 ppm	1000 ppm
1	2	2	4	5
2	1	3	5	6
3	1	4	5	5
Total of mortality	4	9	14	16
Average	1,333	3,000	4,667	5,333
Percentage	13,3 %	30,0 %	46,6 %	53,3 %

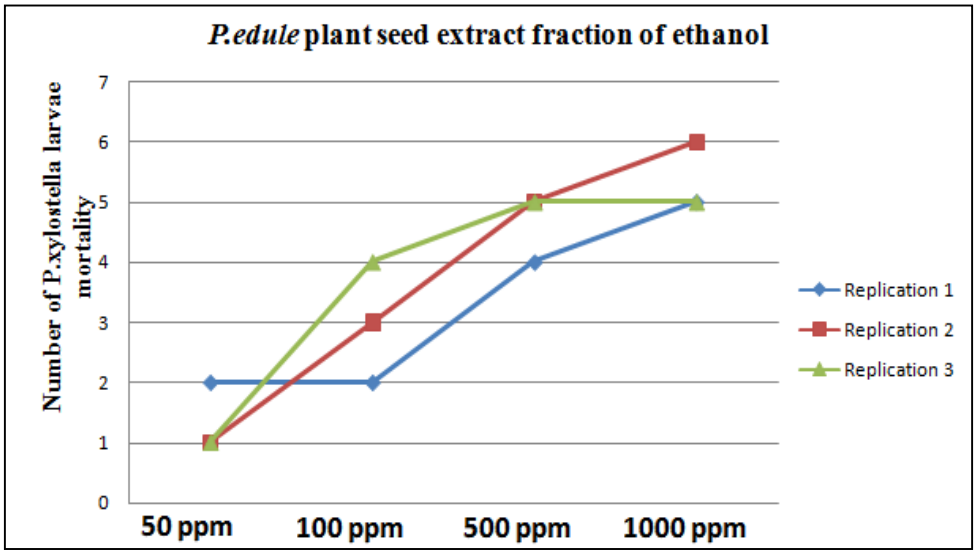

Figure.3. The test results of mortality *P.xylostella* based on activity from *P.edule*plant seed extract fraction of ethanol after 48 hours

Table 6.
Test of Homogenity of Variances and Analysis Of Varians
From *P.edule plant* seed extract fraction of n-hexane after 48 hours

Test of Homogeneity of Variances

VAR00001

Levene Statistic	df1	df2	Sig.
,394	2	9	,685

ANOVA

VAR00001

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,667	2	,333	,093	,912
Within Groups	32,250	9	3,583		
Total	32,917	11			

Table 7.
The test results of mortality *P.xylostella* based on activity from *A.muricata* plant seed exctract fraction of etanol

Treatment	50 ppm	100 ppm	500 ppm	1000 ppm
1	1	2	3	5
2	2	2	4	4
3	2	3	4	5
Total of mortality	5	7	11	14
Average	1,667	2,333	3,667	4,667
Percentage	16,6 %	23,3%	36,6%	46,6%

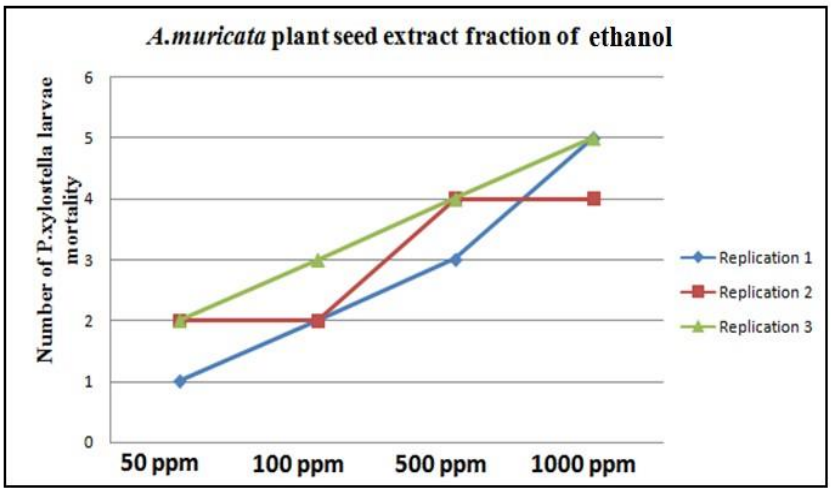

Figure.4. The test results of mortality *P.xylostella* based on activity from *A.muricata* plant seed extract fraction of ethanol after 48 hours

Table 8
Test of Homogenity of Variances and Analysis Of Varians
From *P.edule plant* seed extract fraction ethanol after 48hours

Test of Homogeneity of Variances

VAR00001

Levene Statistic	df1	df2	Sig.
,214	2	9	,811

ANOVA

VAR00001

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,167	2	,583	,296	,751
Within Groups	17,750	9	1,972		
Total	18,917	11			

Results showed that n-hexane fraction is the most effective againts larvae ($LC_{50\text{-}48h}$ = 12,71 mg/L) from *P.edule* seed extract, ($LC_{50\text{-}48h}$ = 50,81 mg/L) from *A.muricata* seed extract. According to table 5, it mean that n-hexane fraction from both of two species *P.edule* seed extract and *A.muricata* seed extract is toxic.

Table 5. Toxicity Classification LC_{50} and Toxicity Rating (ISO,1982)

LC_{50} (mg/L)	Toxicity Rating
>10000	Non Toxic
1000 – 10000	Very low toxic
100 – 1000	Low toxic
10 – 100	Toxic
1 – 10	High Toxic
0,1 – 1	Very High Toxic
< 0,1	Extreme Toxic

Test of phytochemical screening test in order to discover the presence of secondary metabolites in the extracts. And the result is the ethanol fraction tested positive for alkaloid, saponins, flavonoids, terpenoids, phenol and tannins.

D. Conclusion

n-hexane fraction of *P.edule* seed extract, and *A.muricata* seed extract are an effective botanical insecticides exhibiting larvicidal and antifeedant properties against *P.xylostella* thus it can be alternative to against the synthethic insecticides. Results indicate that these botanical insecticides have good possibilities for control of *P.*xylostella. Further work is necessary to evaluate and characterize the active components of the extract fractions and its efficacy in the field.

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Effect of Nitrogen Fertilizer on Growth and Yield of Maize Composite Variety Lamuru

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Abstract

This research was conducted at Seed Center Canru of Sabbangparu Subdistrict Wajo district, from August to November 2015. The research aimed to study the effect of nitrogen fertilizer on growth and yield of maize composite variety Lamuru. This research used the Randomized Block Design with the treatment of three doses of nitrogen ie 0 kg N/ha, 75 kg N/ha, and 150 kg N/ha. The results showed that the fertilization dose of 75 kg N / ha tended to serve the best effect to the length of cobcorn, moisture content, yield and productivity of maize crop. While that the highest maize plant and corncob position was produced by maize treated with the fertilization of 150 kg N/ha.

Keywords: nitrogen, maize, growth, yield

A. Introduction

Maize (corn) is the second main food crop after rice which is cultivated by most farmers in Indonesia. For the farmers who suffered the rice harvest failure due to pest attacks, maize cultivation is an alternative to gain profit or at least to cover the losses.

Based on the land resources and the availability of technology, Indonesia actually has an opportunity to be self-sufficient in corn consumption and even has the opportunity to become a supplier in the world market due to the increasing demand and the depletion of the maize stock in the international market. Furthermore, based on cultivation aspect, maize crops are also not difficult to cultivate as it grows almost in all soil types, however, it requires fertile, loose and rich humus soils for a good yield. Therefore, until now the production of Indonesian maize has not been able to properly meet the country needs.

According to the Ministry of the Agriculture Republic of Indonesia, the target of corn production in 2015 reaches 23-25 million tons. This target is higher than the Medium Term Development Plan which projecting the maize production in 2015 of 20.31 million tons. In 2014, the national maize production was 19.03 million or increased to 2.81% compared to that production in 2014. The planting area of 2014 reached 3.91 million ha with the harvested area amounted to 3.83 million hectares (ha) with the productivity of 4.9 ton per ha. Meanwhile, based on preliminary data for the balance of demand and availability of maize in 2014, the demand for maize reached 19.97 million tons. Thus, there was a deficit of about 941,399 tons (Anonymous, 2015)

Various efforts of the government in order to suppress the amount of imported maize which reaches 3.5 million tons are through the program of expansion of new planting areas, subsidized seeds, and assistance of agricultural machinery. On the other hand, maize (corn) production growth is not balanced with demand so that the deficit continues to grow. Currently, the growth of corn production is 5% per year, while feed industry demand is increased to 12% per year (Anonymous, 2015)

One of the causes of low maize productivity is the growth and development of maize, which strongly influenced by the availability of nutrients, especially nitrogen. Nitrogen is essential for plant growth, particularly in the vegetative phase, it is also useful during the formation process of leaf forage or chlorophyll that are very useful to help the photosynthesis process.

Nitrogen can be obtained through urea fertilization, a kind of artificial fertilizer. This fertilizer is preferred to be used due to its high nitrogen content compared to the other nitrogen fertilizers, moreover, its price is cheap and easy to access.

Application of nitrogen fertilizer to plants can improve the plant growth, such as the growth of root, stems, and leaves. The growth of roots leads plants to further expand into the soil and can easily to uptake water available in the underground layer. Plants with sufficient nutrients can complete their life cycle faster, while plants with insufficient nitrogen will be harvested more slowly, otherways, the excess nutrient can harm the plants thereby disrupting the growth process of the plant. To reduce the excess nutrients, proper fertilization needs to determine, where fertilization with the right dosage is one aspect to obtain fast and good plant growth.

B. Methodology

This research was conducted at Seed Center Canru of Sabbangparu Sub-district, Wajo District from August to November 2015. The research used randomized block design with Nitrogen fertilizer doses treatment of (N): n0: Dose 0 kg N / ha, n1: dose 75 Kg N / ha and n2: dose 150 kg N / ha.

C. Result and Discussion

Plant Height

The variance of the plant height showed that nitrogen dosage treatment had no significant effect on the height of maize.

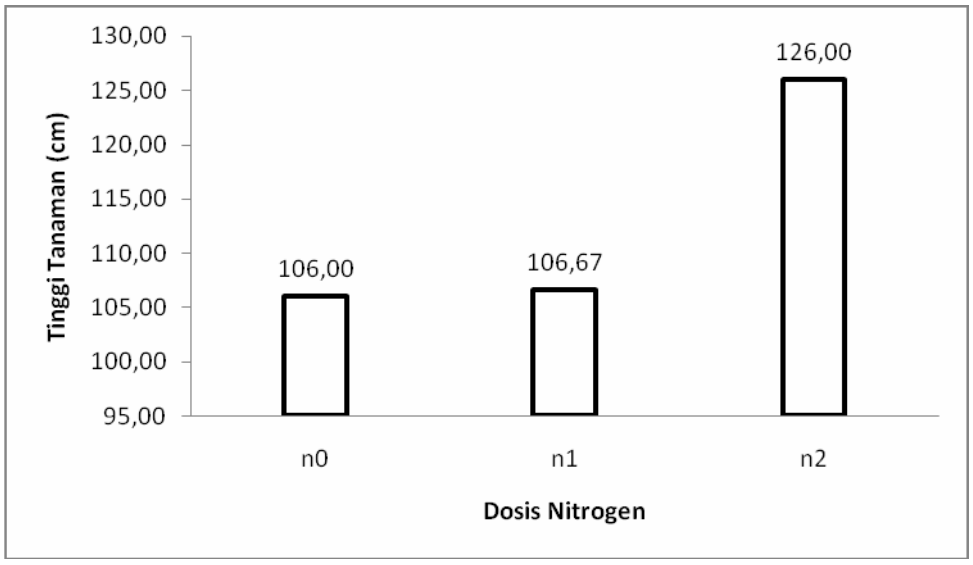


Figure 1. Chart of average Plant height of maize

Figure 1 shows that the highest maize yield was obtained by the treatment of nitrogen dose of 150 kg N / ha (n2).

Height of corncobs position

The variance of the height of corncobs position showed that nitrogen dosage treatment had no significant effect on the height of corncob position.

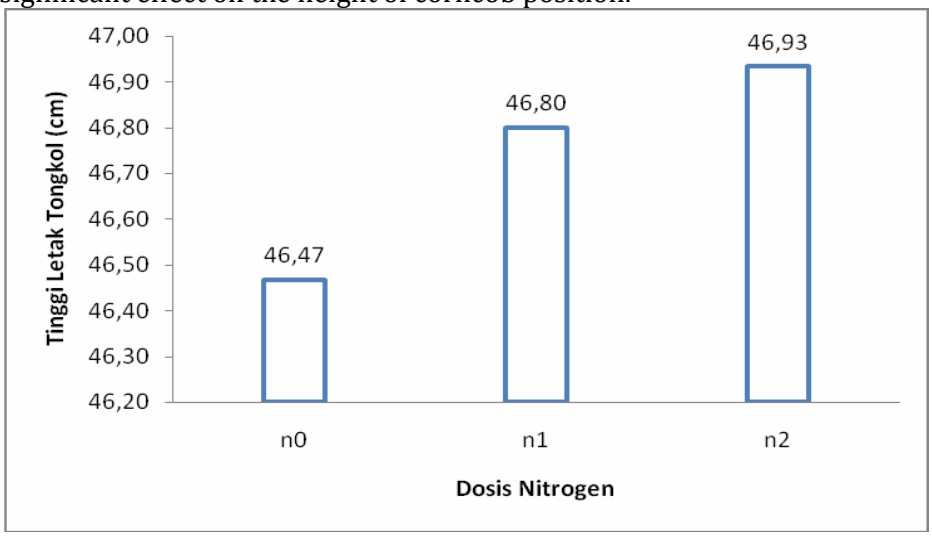


Figure 1. Chart of average height of corncob position

Figure 2 shows that the highest corncob position was produced in the treatment of nitrogen dose of 150 kg N / ha (n2).

Length of Corcob

The length of corncob showed that nitrogen dosage treatment had no significant effect on corncob length.

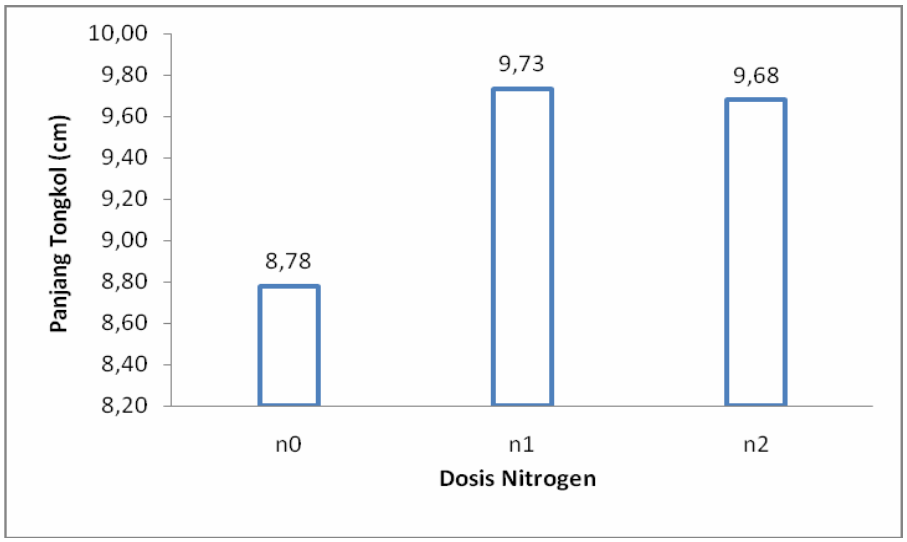


Figure 1. Chart of average lenght of cornchop

Figure 3 shows that the highest average of the length of corncob was obtained by the treatment of the nitrogen dose of 75 kg N / ha (n1).

Grain moisture content at harvesting time

The variance of the grain moisture content of maize showed that the nitrogen dosage treatment had a very significant effect on the grain moisture content of maize.

Table 1. Average grain moisture content of Maize

Nitrogen dose	Grain moistrure content of Maize (%)	CV LSD
n0	27,67b	
n1	27,10b	8,76
n2	31,17a	

Description: The numbers followed by the same letter mean not significantly different in LSD ά 0.05 test..

Table 1 shows that the treatment of nitrogen dose of 75 kg N / ha (n1) showed the highest grain moisture content and significantly different with the maize treated with nitrogen dose of 0 kg N/ha (n0) and 75 kg N/ha. Furthermore, grain moisture content between the treatment of nitrogen dose of 75 kg N / ha (n1) and 0 kg N / ha (n0) did not show any significant difference.

Seed yield at harvesting time

The variance of maize seed yield showed that the nitrogen dosage treatment had a significant effect on the yield of maize seeds.

Table 2 Average yield of maize seed

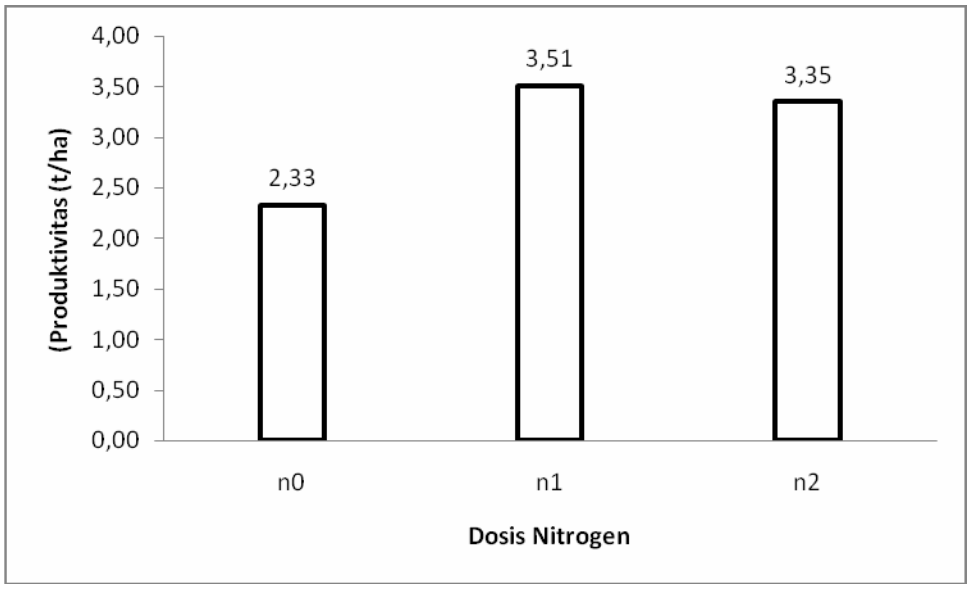
Nitrogen dose	Maize seed yield (%)	CV LSD
n0	0,63c	
n1	0,83a	0,15
n2	0,81b	

Description: The numbers followed by the same letter mean not significantly different in LSD ά 0.05 test..

Table 2 shows that the treatment of 75 kg N/ha nitrogen dose (n1) revealed the highest yield of maize seed and significantly different with the treatment of (n0) 0 kg N / ha and (n2) 150 kg N / ha nitrogen doses.

Maize Productivity

The variance of productivity of maize per hectare showed that nitrogen dosage treatment had no significant effect on maize productivity.



igure 4 Chart of Average maize Productivity

Figure 4 shows that the highest productivity of maize tended to be obtained by the treatment of the nitrogen dose of 75 kg N / ha (n1).

The result of statistic analysis showed that the nitrogen dosage treatment on maize cultivation had a highly significant effect on the grain moisture content as well as on seed yield of maize. While that on the observation of plant height, the height of the corncob position, and the length of corncob did not show any significant effect.

Application of Nitrogen dose of 75 kg N/ha in general showed a better effect on the length of corncob, grain moisture content, the yield of seeds and productivity of maize. The result of LSD test showed that the use of nitrogen fertilizer of 75 kg N/ha resulted in lower percentage of grain moisture content of maize and significantly different with the treatment of nitrogen dose of 150 kg N/ha, but did not show any significant difference with the treatment of 0 kg N/Ha. The result of LSD test on yield of rendement of seed also showed higher result on nitrogen dose treatment of 75 kg N/ha which was significantly different with the seed yield of maize in treatment of nitrogen dose of 150 kg N/ha and nitrogen dose of 0 kg N/ha. Similarly, in Figure 3 and 4, the results of the variance analysis showed an unstable effect on the length of corncob and productivity of maize, but the effect tended to be higher in treatment of nitrogen dose of 75 kg N/ha than for other treatments. This is might be caused by the nitrogen dose of 75 kg N/ha has a sufficient and balanced nutrients to support the growth and yield of the plant. This is in line with research finding by Setyamidjaja (1986) that nutrients needed by plants in sufficient and balanced quantities. Nitrogen needed by plants for formation process of leaf forage or chlorophyll to increase the protein content of plants. Phosphorus serves to spur the growth of roots and growth of plant tissue as well as potassium to facilitate the process of photosynthesis and improve the quality of crops.

Furthermore, in Figures 1 and 2 on the observation of plant height and the height of the cornncob position, the effect tends to be higher in the nitrogen dose of 150 kg N/ha, but the yield and productivity are lower than the treatment of nitrogen dose of 75 kg N/ha. This is might be caused by the higher dosage of nitrogen in the vegetative growth of plants, which is higher and more dense, and may also cause vegetative phase of the plant longer than the generative phase. According to Darmawan (2014), the vegetative phase is a growth phase that mostly uses carbohydrates formed by the process of photosynthesis. This phase mainly occurs in the development of roots, stems, branches, and leaves. While the generative or productive phase is a growth phase that hoard most of the carbohydrates formed during the photosynthesis process. Carbohydrates are used for the formation of flowers, fruits, and seeds, or enlargement/maturation of storage structures or food reserves such as tubers

Furthermore, in the treatment without nitrogen fertilizer, the growth and yield of maize tend to be lower than other treatments. This is due to the lack of nutrients in the soil which stimulate its growth of which nitrogen is naturally available only in the environment where maize is grown.

D. Conclusion

Based on the results of the research, it can be concluded that the fertilization dose of 75 kg N/ha tends to give the best effect on the length of corncob, moisture content, seed yield and productivity of maize. While the height of the plant and the best corncobs position is produced on the fertilization of 150 kg N/ha.

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The Effect of Waste Bagasse (*Saccharum sp*) Fetilizer toward Growth of Peanuts (*Arachis hypogaea L.*)

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Abstract

The process of sugar cane into sugar which is carried out in the sugar mill produces bagasse obtained from the milling process around 32% of the total cane processed. Sugarcane production in Indonesia in 2007 amounted to 21 million tons, the potential of bagasse produced about 6 million tons of bagasse per year. Up untill now almost every cane sugar mills uses bagasse as boiler fuel, animal feed mixes and the rest are burned or thrown away. One of alternative solid waste management is to turn solid waste into compost.The purpose of this research is to understand the effect of bagasse fertilizer on growth and progress of peanut plants (*Arachis hypogaea L.*). Bagasse fertilizer made using cow dung as bioactivator. Bagasse obtained from several places in Semarang mashed with finely enough size. Then, with a ratio of cow dung and bagasse 1: 3. Placed in a container then mix and sealed until there is no incoming air. Every 4 or 5 days in 4 weeks is being inverted. After 4 weeks it will get bagasse fertilizer with characteristic brown color, odorless and slightly moist. This research uses three treatments there are peanuts with mixed bagasse fertilizer on the soil medium, compost on the soil medium, and without fertilizer then measured the progress for 14 days. After 14 days, so it obtained an average of plants height and number of leaves. Respectively, are 2.10; 1.38;
2.24 while the number of leaves are 2.55; 2.66; 3.22.

Keywords: bagasse, peanut, fertilizer

A. Introduction

Peanuts are one source of food that is quite important in Indonesia, as the source of vegetative protein. Peanuts are also very important to be expanded because of in terms of productivity, peanuts that cultivated in Indonesia is still low, at only about 1 ton/ ha. The results achieved level of productivity is only a half of the potential yields when compared with the USA, China, and Argentina which has reached more than 2.0 tonnes / ha (Adisarwanto, 2000). Differences in the level of peanuts productivity does not particulary caused by differences in production technology that has been applied to farmers, but due to the influence of other factors: the nature or character of agroclimate, the intensity of pests and diseases types, varieties of planted, harvesting and farming operation . According to the results, the efforts towards the improvement of peanut plants need to be done, especially creating an appropriate environment for the growth of peanut plants. There are several ways in connection with these efforts, one of them is with the application of organic fertilizers and soil treatment system (Suwardjono, 2001).

Many soil nutrients are needed by plants and are often getting deficiency on the ground such as N, P, and K. unfulfillment of one nutrient, will decrease the quality and quantity of peanuts production. The nutrients N, P, and K in the soil are not enough available and will be reduced because they are taken for growth and carried away when harvest, washed, vaporized, and erosion. To suffice the nutrient deficiencies of N, P, and K, it must be done the fertilization. The suitable fertilizer that can suffice the nutrient requirements as well as is Phonskafertilizer (Phosphorus Nitrogen Sulphur Potassium). Its nutrient content of 15% N, 15% P, 15% K (Sitorus, 2004). Bagasse is a waste material that is usually dumped in open dumping without further management, so that will cause environmental disturbance and bad odor (Cahaya dan Dody, 2012).

The process of sugar cane into sugar which is carried out in the sugar mill produces bagasse obtained from the milling process around 32% of the total cane processed. In the sugarcane production in Indonesia in 2007 amounted to 21 million tons, the potential of bagasse produced about 6 million tons of bagasse per year. Up untill now almost every cane sugar mills use bagasse as boiler fuel, animal feed mixes and the rest are burned or thrown away. (Hamawi, 2005). According to Birowo (1992) bagasse that resulting from the squeezing process, only 50% had been utilized, for example as fuel in the production process, but the rest is still wasted and need more serious care to be reprocessed. One alternative solid waste management is to turn solid waste into compost or composting (Abilash and Singh, 2008). According to research have been done by Guntoro Dwi (2003) explain that dry bagasse content of water 15.86%, content of C 13.324%, content of N 0.422% , C / N 31.57, and pH is 7. The purpose of this research was to understand the influence of bagasse fertilizers to the growth of peanuts (*Arachis hypogaea L.).*

B. Methodology

The method that used is quantitative method by analyzing the length of the plants, and the number of leaves among the treated by bagasse fertilizer, compost and without fertilizer.

1. Method of Making Bagasse Fertilizer

Bagasse fertilizer made using cow dung as bioactivator. Bagasse obtained from several places in Semarang mashed with finely enough size. Then, with a ratio of cow dung and bagasse 1: 3. Placed in a container then mix and sealed until there is no incoming air. Every 4 or 5 days in 4 weeks is being inverted. After 4 weeks it will get bagasse fertilizer with characteristic brown color, odorless and slightly moist.

2. Data Collection Methode

Methods of data collection using experimental methods to analyze the length of plants, and number of leaves the untreated and treated with bagasse fertilizer and compost as a sample. This research was conducted by analyzing the effect of bagasse fertilizer in the growth of peanuts (*Arachis hypogaea L.*). The growth of peanuts without treatment, treatment with bagasse fertilizer and compost each day is measured by using a ruler for 14 days. The growth of peanuts seen from plants length, and number of leaves for 14 days. Fertilizer application on samples made by mixing bagasse fertilizer with red soil. Compared to bagasse fertilizer and soil is 1: 3, then stirred and placed 6 seeds of peanuts with the most excellent quality. Then observe the difference between peanut-treated bagasse fertilizer, compost, and without treatment.

C. Result and Discussion

The results of observations on growth and development of peanut plants (*Arachis hypogaea L.*) that given treatment by bagasse fertilizer with cow dung bio-activator, with a ratio of 4: 1 after analysis showed that the peanut-treated bagasse fertilizer influence on plants length, and leaves. The measurement results can be seen in the results table the average growth of plants and leaves of peanut plants for 14 days.

Based on the results, influence the using of compost and bagasse fertilizer to the growth of peanut plants (*Arachis hypogaea L.*) which the plants height data taken for 14 days:

Table 1. Average height

Peanut plants	Without treatment	Compost	Bagasse fertilizer
1	2,13	1,38	2,25
2	2,03	-	1,72
3	2,16	-	2,76
Average	2,10	1,38	2,24

At first, the research has been done by planting six peanut seeds. However, there are only 3 seeds in the ground that can grow in the soil that was not given the addition of fertilizer and soil with the addition of bagasse fertilizer. While on soil which the addition of compost only grow one seed peanuts. This research was conducted with watering every day for 14 days, also measuring the height of plants and the calculating the number of leaves.

In general, with the addition of fertilizer, the plants will be faster growing and more fertile than plants which not fertilized at all. Fertilizer application did not make peanut plants grow faster. However, the advantage in the fertilizer bagasse visible when the all media is not watered for two days. In pot 3 shows that the soil is still moist and wet, while the second pot still slightly moist, while pot 1 getting dryness of the soil so that plants are also drying up.

The using of planting medium influence on peanut plants height. Using of the planting medium which only the soil without adding fertilizers produce peanut plants 14 days old with an average height of 2.10 cm. In media supplemented with compost, obtained the average height 1.38 cm tall peanut plants. While for medium which add by fertilizer from bagasse obtained an average height of 2.24 cm.

Tabel 2. Average number of leaves

Peanut plants	Without treatment	Compost	Bagasse fertilizer
1	2,22	2,66	2,66
2	2,22	-	3
3	3,20	-	4
Average	2,55	2,66	3,22

The using of planting medium also affect the number of leaves produced peanuts plants aged 14 days. In the peanut plants that uses soil medium without fertilizer obtained peanuts plants aged 14 days with number of leaves 20 strands with an average of 2.55. For the planting medium which added by compost, have 16 strands leaves with average of 2.66. And on media supplemented with bagasse fertilizer obtained plants with 20 strands leaves with an average of 3.22. From tables 1 and 2, it can be seen that the plant height and number of leaves peanuts with bagasse fertilizer shows more rapid growth, because that bagasse fertilizer containing macro nutrients calcium. This is in accordance with the opinion of Suprayitno, 2016 that this element is most responsible in the growth of cells. Calcium strengthens component, and set the penetrating power, and treating the cell wall. Its role is crucial in the growing point of the root.

D. Conclusion

Based on the results of this research concluded that the addition of compost and bagasse fertilizer greatly affect the length growth of plants and the number of leaves on the peanut plants. The results obtained by the length growth of plants for planting medium without fertilizer obtained an average growth of 2.13 cm, the planting medium is added compost have an average of 1.38 cm, while the planting medium added by bagasse fertilizers have average plant growth of 2.25 cm per day. Besides on plant growth also affects the number of leaves produced. In the planting medium without the addition of fertilizer for 14 days obtained leaves number 20 strands. In the planting medium which added by compost for 14 days obtained as

much as 16 strands of number of leaves, whereas in the planting medium which added by bagasse fertilizer for 14 days obtained the number of leaves as much as 20 strands.

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IbM Empowerment of Cocoa Farmers (*theobroma cacao* l.) During Pre and Post-Harvest in Effort of Quality Improvement of Cocoa Commodity in Kolaka

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Abstract

Kolaka is known as the city that has a cocoa statue or also known as "Kolaka Cocoa City". Cocoa is the main commodity of Kolaka District. Based on data from Agricultural Department of Kolaka in 2013, the area of cocoa in Kolaka reaches 29,166.76 ha with dry bean production in 2013 of 8562.86 kg/ha which is mostly located in Latambaga and Samaturu Sub-districts. Partners in the IbM program are cocoa farmers of Induha Urban Village, Latambaga Sub-district and cocoa farmer in Samaturu Sub-district. Various cooperation programs have been conducted to improve the quality of cocoa commodities in Kolaka District. In its development, various classical problems remain faced by partner farmers both in terms of production and business management. In terms of production, pre-harvest problems faced by farmers are cocoa pests and diseases, which cause the farmers' dependence on pesticides and chemical fungicides as well as the age of plants, therefore, it is important to reduce the use of pesticides and chemical fungicides because in the long term it can have adverse impact on environmental sustainability and health. The problem of post-harvest for partner farmers is a low quality of cocoa production. Most cocoa farmers process cocoa fruits to be dried beans in a rough way so that ± 90% of the cocoa beans produced by farmers have a low quality with the main characteristic is not fermented. The problem faced by farmers in term of business management is the oligopsony tendency market structure, in which farmers are at the lowest position in the marketing chain so that farmers do not have a bargaining position. The objectives of IbM program were to 1) Reduce farmers' dependence on pesticides and chemical fungicides with the utilization of environmentally friendly pesticides 2) Design the fermentor to improve the quality of cocoa beans 3) Enhance the bargaining position of farmers through the active role of Farmer group (*Gapoktan*) in the marketing chain of cocoa.

Keywords: Cocoa, empowerment, quality improvement

A. Introduction

Sulawesi produces nearly 60% of Indonesia's cocoa production (Nielson, 2007). Most of the cocoa production is exported in the form of beans (raw materials) while the export of processed products only reaches 17-20% (Dirjen Bina Produksi Perkebunan, 2012). Kolaka is known as the city that has a cocoa statue and or also known as Kolaka Cocoa City. Based on data from Agricultural Department of Kolaka in 2013, the area of cocoa in Kolaka reaches 29,166,76 ha with dry bean production in 2013 of 8562.86 kg/ha which is mostly located in Lambandia, Ladongi, Latambaga and Samaturu Sub-districts. Partners in the IbM program are cocoa farmers of Induha Urban Village, Latambaga District and cocoa farmers in Puu Lawulo Village, Samaturu Sub-district.

Various activities have been undertaken to improve cocoa productivity in Kolaka District. The low productivity and quality of cocoa are inseparable from the unavailability of superior varieties where farmers commonly use planting material derived from seeds, the presence of pest and disease attack, the age of the older plants and the farmers do not perform post-harvest fermentation stage. Preliminary observations by AIAT Southeast Sulawesi at the end of May 2015 in the cocoa farming owned by farmers in Samaturu Sub-district showed a percentage of PBK attack (*Conopomorpha cramerella*) of 10% and fruit rot by 36% with average fruit per tree of 25 fruit. This condition causes the decrease of cocoa price from Rp. 2,000/ kg to Rp. 2,500/kg. This condition leads to high dependence of farmers on chemical pesticides and fungicides. According to the description of farmers in Induha Village, the use of pesticides in 2015 reached ≥ 30 L/Ha.

Management of cocoa beans during post-harvest is still not intensive. Post-harvest cocoa fermentation is carried out by farmers roughly, thus approximately 90% of cocoa beans produced by farmers are low quality because they are not fermented, less dry, very easily attacked by fungi and contain lots of contaminants. In addition to limited processing facilities and knowledge, farmers are not interested in following a good processing method because of the lack of price incentives between properly processed cocoa beans and roughly processed cocoa beans. The fermented cocoa beans are bought by the cooperatives built by the local agricultural department with the price of Rp. 30,000/kg, while nonfermented cocoa beans are bought by merchants for Rp. 25,000- Rp. 27,000/kg..

Related to the post-harvest processing of cocoa beans, quality dried cocoa beans will be achieved through the fermentation process. The fermentation of cocoa beans causes both physical and chemical changes in the inner and outer beans to form distinctive colors and flavor as well as the aroma of chocolate (Doume et al. 2013). In addition, fermentation can kill cocoa beans to prevent germination (Afoakwa et al., 2012).

Cocoa marketing pattern in Kolaka District is by farmers sell their cocoa to merchants at village or sub-district level, then the merchants sell the cocoa to exporters in Makassar, exporters will export abroad. In this case, the cocoa market structure that occurs tends to be oligopsony, in which farmers are in the lowest marketing chain so that farmers do not have a bargaining position. In addition, the quality of cocoa beans produced by farmers is relatively low. Based on research result by Jaya (2003), elasticity analysis of cocoa price transmission in Kolaka obtained the number <1, which means that the price at the merchant level will affect the price at the producer/farmer level, thus, it indicates that the cocoa marketing in Kolaka takes place in the imperfect competition market which means that the marketing system is inefficient.

B. Methodology

In order to solve the problems of pre and post-harvest of Cocoa that faced by partners, it is necessary to carry out empowerment effort using activity implementation method which is divided into 3 main group that is:

1. Manual Training of Bio pesticides:

Training on the manufacture of the Bio pesticide will be taught to both partners, started from how to obtain the material, the tools needed, the process of manufacturing, as well as how to apply to the plants, so that in the future the farmers will be able to make Bio pesticides to control of their cocoa pests and no longer depend on chemical pesticides or at least can reduce the cost of production because the materials needed in the manufacture of the Bio pesticides can be obtained easily and available in nature and some others can be purchased at a very low price.

2. Cocoa fermentor design and its application:

At this stage, it will be accompaniment the use of fermentor to partner farmers to produce cocoa beans produced fermented in a shorter time and produce cocoa beans with good quality so that in the future farmers have bargaining value on their cocoa products on the market. During the advisory phase, it is also provided the education to farmers on good and proper cocoa post-harvest processing techniques because, in order to obtain a high selling price, the harvested cocoa beans must be processed immediately. The proper post-harvest processing of cocoa beans is carried out by stages that are able to keep the cocoa bean quality optimally. The stages are as follow: the fruit sorting stage, to group the cocoa bean based on its physical appearance and bean size. Export quality cocoa beans (AA standards) are separated from medium quality beans (standard A and B) and low quality (C and S standards). These seeds are separated because each standard has different selling prices. During sorting, contaminants must be removed to prevent it from being stored in the storage. The contaminants include pieces of fruit skin, gravel, pieces of wood, metal, and various other foreign objects. Packaging and storage are also important series to obtain a good quality of cocoa.

3. Education on business management at gapoktan level

The third stage will be carried out in a team meeting forum with partners and other stakeholders.

C. Results and Discussion

Cocoa fruit borer attack (PBK) and *Phytoptora palmivora* infections cause a high degree of farmers' dependence on the use of chemical pesticides and fungicides. The older plants need to reduce the use of chemical pesticides because in the long term these chemical pesticides can have an adverse impact on the environment and health. Thus, plant-based pesticides are chosen in controlling cacao pests in this research. Bio pesticides are chosen as a long-term alternative to environmental sustainability. Some bio pesticides that can be used to control PBK are tobacco leaves (Handoko and Sundari 2004), betel leaf, Neem leaves (*Azadirachta indica*), *umbi ganyong* (canna), Sugar-apple seeds, jatropha seeds, suren leaves (*Toona sureni*) and Tithonia (*Tithonia diversifolia*). Bio pesticides as control agent of pests in the IbM program was made from the extract of betel leaves plus some other ingredients. Betel leaf is a type of bio pesticide that has the same effect as a synthetic pesticide (deltamethrin).

The pesticide of betel leaf extract was made with a composition of 500 g of smoothed betel leaf, 10 L water, 10 ml alcohol (fermentation) was stirred evenly, and then soaked for several hours. The result of the immersion of the material was filtered by filter cloth. The filtered solution was then added with 50 g detergent and stirred evenly. Betel leaf extract was ready for use as a pesticide.

The process of fermentation of cocoa using fermentor is as follows: the first day fermentation was performed in the first fermentor by laying the fresh cocoa beans that have been sorted. Wall or bottom of the fermentor was made a hole with a diameter of 1.5 cm at every distance of 10 cm. This hole serves as the outlet of oxygen, carbon dioxide, and water resulting from the fermentation process. The fermentation temperature was kept ≥ 40-50 ^{o}C, if the temperature is less than that the beans will be black and smelly. The pile of cocoa beans in the fermentor was covered with banana leaves. The cover not only suppresses the heat in the crate, but also prevents the dry beans from losing water content. On the second day, the pile of cocoa beans was stirred by being moved to the second fermentor with the purpose of heat generated from the fermentation process can be evenly distributed. On the next day, the cocoa beans were returned to the third fermentor. Entering the fourth day, cocoa beans can be issued for further drying. Cocoa fermentor was made with the size of 50x50x50 cm and capacity of 40 kg.

Partner education on marketing management was conducted in informal forums, on planning, analyzing, implementing and controlling cocoa farming activities. Providing an understanding that the purpose of framers group (*Gapoktan*) is to study the needs and desires of consumers, set prices to obtain a decent return on investment, manage distribution and check sales, create good marketing communications from framers group (*Gapoktan*) to merchants and exporters. So that the expected output of increasing the bargaining position of farmers through the role of active framers group (*Gapoktan*) in the marketing chain of cocoa can be achieved

D. Conclusion

1. There is an increase in understanding and skill of cocoa farmers of Kolaka District.
2. There is the existence of Bio pesticide and cocoa fermentor products produced during the science and technology program for the community (IbM) in Kolaka District.

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IbM of Integrated Farm by Making of "POC-FISH" as an Economical Alternative Efforts for Coastal Communities

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Abstract

Coastal communities play an important role in marine and fisheries development, as well as forming a culture in coastal areas. The socio-economic life of coastal communities in Kolakaasi Sub-District of Kolaka District is far from prosperous as the data obtained from BPS of Kolaka, in which the number of poor population in Kolaka in 2015 reached 27,210 with the percentage of 14.68%. Partners in this IbM activity are teenagers who drop out of school environments and groups of housewives living in coastal areas. The problem of partners in the activities of IbM is the number of teenagers dropping out of school in the partner environment due to the low level of welfare of coastal communities so that the average level of the highest education is junior high school where the young women have to help the family economy by working as laborers in traditional markets of Kolaka or only help parents at home while the men work at sea. Fishing is highly dependence to the nature, so that if the weather is bad then the fishermen cannot gain income. IbM-Integrated Farm by making "POC-FISH" is the manufacture of liquid organic fertilizer that combines agricultural activities with fisheries. POC-FISH is mad of small fish, commonly called lure fish (teri) by Kolaka community. This type of fish is abundant in Kolaka and sold cheaply (R.p 5,000/Kg). The purpose of this IbM activity was the empowerment of coastal communities through the transfer of science and technology by utilizing local potentials so that the partners involved can begin to be productive and economically independent by conducting business on a household scale. The method of making POC - FISH will be carried out simply so that technology transfer can be easily understood by partners. The process of transfer of science and technology was carried out with the pattern of 1) the education of the partner group on the importance of technology adoption by utilizing the potential and local wisdom that will be able to produce a product with higher economic/selling value 2) POC-FISH making training 3) mentoring partner group in marketing 4) monitoring and evaluation. The outgoing plan of this IbM activity is the publication of the ISSN national journal published in 2017 and POC-FISH Products.

Keywords: coastal community, fish, liquid organic fertilizer (LOF)

A. Introduction

The poverty level of coastal communities in Indonesia is still very worrying. In fact, Indonesia is a country with great natural and marine resources. However, the potential of marine has not been fully utilized. Villagers of Kolakaasi Sub-district, Kolaka District, Southeast Sulawesi Province who live on the coastal area depend their lives on the sea. Socio-economic life of coastal communities in Kolakaasi Sub-district is far from prosperous. As the data obtained from BPS of Kolaka, it was reported that the number of poor population of Kolaka in 2015 reached 27,210 with the percentage of 14.68%.

The great dependence on nature makes coastal communities generally have no other activities. If bad weather comes, coastal fishermen do not go to sea. To fill the leisure time people prefer to improve their net. Others prefer to repair their boats to fill their spare time as long as they do not go to sea. Although in certain seasons fishing income is very hig, however, income is very small in subsequent seasons fishing. Another characteristic of the coastal community of Kolakaasi Sub-district is the activity of women and children. There are many teenagers dropping out due to economic limitations so that generally coastal children only finish school up to high school level (SMP). Meanwhile, male teenagers have often been involved in fishing activities.

Development programs in coastal areas do not significantly contribute in improving the economic condition of coastal communities. The failure of the program is due to the fact that development projects within the context of coastal communities in Indonesia are not based on community empowerment and the utilization of local potentials. The introduction of various development programs is more laden with the content of a political bureaucratic approach than attempting to empower and utilize and local potential. Whereas, community empowerment and utilization of local potency can give big contribution particularly in encouraging social learning process so that integration of project mission or program with value of utilization of local resources, knowledge, ability, requirement of coastal community can be achieved (Masterson et al 2000).

Science and Technology Program for the Community "IbM-Integrated Farm by Making 'POC-FISH' as an Economical Alternative Efforts for Coastal Community" is a partnership program between the academics of Universitas Sembilan Belas November (USN) Kolaka with the community. The target partner of the IbM activity program is a group of drop out teenagers with age between 15-20 years and groups of housewives living in coastal area.

IbM-integrated farm by making POCH-FISH program is a community empowerment program for coastal communities to be able to have other business alternatives by utilizing the local potential of lure fish (teri) which has a cheap selling value into a product with a higher selling or economic value. The ultimate goal of this IbM program is to help improve the welfare of the people in coastal communities of Kolaka District.

B. Methodology

POC-FISH is chosen as a partner problem solution with some considerations: Fish used as main raw material of organic fertilizer is lure fish/teri which is a fish species that is very easy to be found in Sulawesi and sold at cheaper price than other fish species (Rp .5000/kg). Utilization of lure fish in the community is still limited to be processed into driedfish or used as live bait, so the availability of raw materials is no longer a consideration for increasing the amount of production at any time. A figure of lure fish can be seen in Figure 1.

Figure 1. Lure fish of Kolaka District

The approaches offered to solve partner problems in the IbM program are:

a. Determination of partners
   Partners of IbM-Integrated Farm by making "POC-FISH" as an Economical Alternative Efforts for Coastal Communities, in which group of drop out of school teenagers who do not complete their secondary education obligations over 15-20 years of age living in coastal areas. The second partner in this a program is a group of housewives who have no permanent job whose husband is a captive fisherman who fully depends on the family's economy from catching at sea. The consideration of choosing these two partners is that the two groups of partners are the groups that most need coaching, mentoring, and training the creative economy by utilizing the abundant natural potentials, so that the future can be economically independent.
b. Persuasive Approach
   The first step of the implementation of this IbM program is to conduct persuasive approach to the two groups of partners who do not open access to the input of external innovation on their custom, where coastal communities are known as a society that does not adaptive with other environment outside of their community. The persuasive approach is aimed to change the partner mind set that by applying science and technology plus the utilization of local wisdom/potency can produce a simple product with higher economic value rather than selling raw materials without any diversification or innovation process. In a persuasive approach, the partner education stage is done through meetings and socialization forum.
c. Active approach
   The active approach is carried out with the field practice of POC-FISH fertilizer, preparation of tools and materials, implementation of activities, and packaging.
d. Marketing
   POC-FISH product marketing is done by mapping the target market. The main target market is the local market. Another target market is the online market to reach the national market. At this stage, partners will be introduced to online marketing media. Training on making and using social media (Facebook, Whatsapp, BBM) as a marketing tools. Designing process of POC-FISH product package will be accompanied by the proposing Team. POC-FISH products will be packaged in ½ and or 1 L bottles.

C. Result and Discussion

Meetings and socialization between USN academics with both partners of IbM program. In this forum, the presentation of the purpose of the activity as well as the partner education stage about the existence of the economic value of a product with the innovation and diversification and is expected to be an economic alternative effort for the improvement of their welfare.

After the socialization stage, the activity continued with the stage of POC-FISH fertilizer preparation in the form of preparation of tools and materials, making POC-FISH, and packaging. The materials used in making POC-FISH are 10 kg of lure fish, 10 liters of water, 1 kg of tomatoes, 1 kg melted Javanese/aren sugar. Equipment required is a pot or 10 liter capacity pot, 5 liter drum capacity of 4 pieces and 1 pieceof pH meter. How to make: (1) 10 kg lure fish is washed, boiled until it half cooked, lifted and then cooled, then the fish is pressed, put the water together with the cooking water (2) After really cold and then filtered with a soft cloth and measured the pH. Neutralize the pH by inserting the filtered grated tomatoes until they become neutral in pH (pH 7). (3) Entering 1 kg of liquid sugar in the solution, stirring until the sugar is dissolved. Prepared drums that have been washed (4) Place the solution into the drum and close it tightly (5) Stored in a shady and cool place protected from sunlight/rain (6) Left for 12- 15 days. Check the drum, if there is a bubble, immediately open the lid cover so the gas can come out and close ittightlyagain. If the process runs then the solution will be the typical fresh natural scent, not fishy/foul (7) multi purpose Liquid Organic Fertilizer made from lure fish (POC-FISH) is ready for use (8) POC-FISH products are packed in bottles ½ and or 1 L . POC- FISH is presented in Figure 2.

Figure 3. POC-FISH Products

D. Conclusion

1. There are understanding and skill improvement of coastal community of Kolakaasi Village, Kolaka District
2. There are POC-FISH products produced by the coastal community of Kolakaasi Village, Kolaka District

E. Acknowledgments

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Effect of the Treatment of Rice Seed Infected with *Xanthomonas oryzae pv. oryzae* On Growth and Yield of Rice in the Field

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Abstract

This research aimed to study the effect of treatment of rice seed infected with *X. oryzae pv. Oryzae* naturally to control bacterial leaf blight and to increase growth and yield of rice in the field. The research used Slit plot design with the main plot of variety consisting of *IR64* and *Ciherang*, while the subplot is a seed treatment consisting of control, bactericide 0.2% (Agrept 20WP), 1% citronella oil, biological agent *Pseudomonas diminuta* (McFarland IV scale), matriconditioning + Agrept 0.2%, matriconditioning + 1% citronella oil, and matriconditioning + *P. diminuta*. Although seed treatment has not been able to control the bacterial leaf blight, it can increase the growth of seed and yield. Treatment of matriconditioning + Agrept 0.2% can increase the seed viability and dry weight of seedlings. Height of seedlings can be increased by the treatment of citronella oil, biological agents *P. diminuta*, matriconditioning + agrept 0.2%, and matriconditioning + 1% citronella oil. Treatment of citronella oil, matriconditioning + *P. diminuta*, biological agents *P. diminuta*, and matriconditioning + Agrept 0.2% can increase the estimated yield of *ubinan*/CCE harvest.

Keywords: biological agents, bactericide, bacterial leaf blight, matriconditioning, citronella oil, seed treatment

A. Introduction

Rice productivity tends to be patterned slope. This is due to many factors, one of which is the high attack of disease in rice. The extent attack of *kresek* disease/bacterial leaf blight (BLB) in 2007 reached 50,519 hectares and 12 hectares of them suffered *puso*/did not produce yield (Directorate of Crop Protection, 2009). BLB disease is caused by the bacteria *Xanthomonas oryzae pv. Oryzae,* in which affect the loss of rice yields in Japan with amount of 20-30%, in Indonesia the magnitude of yield loss is almost the same or may be larger than in Japan (Ou, 1985). *Xanthomonas oryzae pv. Oryzae* is a pathogen carried by seeds in rice (Sutakaria,1984).

BLB control can be one solution to increase rice productivity, in which the control can be done from the preparation of seeds by controlling the pathogen carried by seeds. This is done because the pathogen carried by seed *X. oryzae pv. Oryzae* correlates with the attack of BLB disease in the field (BBPPMBTPH, 2007).

Control of pathogen carried by seed can be done by seed treatment by using synthetic pesticides, bio pesticides, and biological agents. According to Ilyas *et al.* (2008b), the Agrept treatment on rice seeds with a concentration of 0.2% showed the higher seed viability and vigor indexes than other concentrations. Otherways, treatment of citronella oil with a concentration of 1% produces the higher seed viability, vigor index, and growth rate than other concentrations. On the other hand, the biological agent code A6 (*Pseudomonas sp*.) has the potential as an effective biological agent to control *X. oryzae pv oryzae* on rice seed.

Control of the pathogen carried by the seed should also be combined with the improved physiological quality of the seed. This is because in general, the seeds attacked by pathogens will experience a faster decline in quality. On the other hand, improvement of seed physiological quality can be performed by invigoration, an artificial technique to the enhanced the seed vigor through controlled metabolic processes that can repair the seeds damage.

One of the invigorating treatments is matriconditioning, which is in chili seeds can increase the appearance of seedlings planted in the soil with a quite low temperature (Ilyas, 1994). According to Ilyas et al. (2008a), matriconditioning plus *Bacillus subtilis* in rice seed yielded the good seedling growth and decreased the percentage of *X. oryzae pv oryzae* better than other treatments tested. Treatment of matriconditioning plus 1% citronella oil yielded the highest seed viability, increased vigor index, and decreased the infection rate of *X. oryzae pv oryzae*.

Control of *X. oryzae pv. Oryzae* starting from the stages of seed preparation is expected to improve the quality of seed health, while the invigoration treatment is expected to improve the physiological quality of the seed. Furthermore, the improvement of seed quality is expected to increase growth and yield of rice in the field.

This research aimed to study the effect of natural treatment of rice seed infected with X*. oryzae pv. Oryzae* to control bacterial leaf blight and to increase growth and yield in the field.

B. Methodology

1. Time and Place

This research was conducted from January to June 2009 at Seed Science and Technology Laboratory, Department of Agronomy and Horticulture, Bogor Agricultural University (IPB) and Rice Field Experiment Park, University Farm, Dramaga campus, IPB.

2. Method

Rice Seed

Rice seed variety *IR64* and *Ciherang* used are derived from *ICRR* Sukamandi with the quality grade of Breeder Seed. Prior to use, the seeds were stored in plastic packaging and placed in a room with a constant temperature of 16 ^{0}C at the Agricultural and Seed Saving Laboratory of Department of Agronomy and Horticulture of IPB for 2 months. Previously *IR64* and *Ciherang* seed varieties have also been retained for 3 months and 5 months at room temperature at the rice storage warehouse of ICRR Sukamandi. The health of rice seeds is tested for the presence of *X. oryzae pv. Oryzae* by the grinding method. The results showed that the rice seeds used were infected with *Xanthomonas oryzae pv. Oryzae* of 51 cfu on *IR64* and 40 cfu on *Ciherang*, naturally. Based on the physiological quality test, *IR64* rice seeds used had 92.5% seed viability and 89.5% vigor index, while *Ciherang* seeds had 91% seed viability and 90% vigor index.

3. Research Design

This study used the Slit plot design with the main plot of the varieties consisting of *IR64* and *Ciherang*, while the subplot is a seed treatment consisting of control (P0), bactericide 0.2% (Agrept 20WP) (P1), 1% citronella oil (P2), biological agent *Pseudomonas diminuta* (P3), matriconditioning + Agrept 0.2% (P4), matriconditioning + 1% citronella oil (P5), matriconditioning + *P. diminuta* (P6). Repetition is three times so that the total experimental

unit amounted to 42 units. If there is a significant effect of treatment on the analysis of variance (95% confidence level), further test with DMRT is done.

4. Seed Treatment

- Control: Without seed treatment.
- Bactericide: bactericide solution (Agrept 0.2%) 12.72 ml is used to moisten 10.6 grams of seed
- Citronella oil: 12.72 ml of citronella oil solution (1%) mixed with Tween 80 (4 drops ≈ 4 ml) was used to moisten 10.6 grams of seed.
- Biological agents: 10.6 grams of seeds moistened with 12.72 ml of biological agent solution (scale IV McFarland ≈ 4.5 x 108 cfu.L^{-1} (Kiraly Z. et al., 1994).
- Matriconditioning + Agrept 0.2% : 10.6 grams of seeds moistened with 12.72 ml bactericidal Agrept 0.2% then mixed with 8.48 grams of charcoal husk until evenly covered the seeds.
- Matriconditioning + citronella oil: 10.6 grams of seeds moistened with 12.72 ml of moisturizing solution (citronella oil 1% + Tween 80) then mixed with 8.48 grams of husk charcoal until evenly covered the seeds.
- Matriconditioning + *P. diminuta*: 10.6 grams of seeds moistened with 12.72 ml of *P. diminuta* solution then mixed with 8.48 grams of husk charcoal until evenly covered the seeds.
- All seed treatment is carried out in transparent bottles at 20 ° C, stirred every 12 hours to 30 hours of treatment duration. Each treatment in each tested varieties was repeated three times.

5. Land Preparation

This research was conducted in Babakan Darmaga garden on Latosol soil at 250 m asl. Land used is wet land last season which Irrigated with non-technical irrigation system.

The land preparation began by leveling the straw which is then immersed and left to rot for 2 weeks. Furthermore, the land was plowed to level the land. Then the soil was allowed to mud up to a week. After that, the land was divided into plots sized 3 m x 2.5 m.

6. Seedlings, Planting, and Plant Maintenance

Seedlings are carried out on a plastic bag by using mud. The time of seeding is 3 weeks. Planting was done at 3 weeks after seedling (WAS) with a spacing of 25 cm x 25 cm. The number of seedlings per planting hole is two seeds. Stitching was done no later than 2 weeks after planting (WAS). Weeding was carried out when weeds have affected plant growth.

Control of plant pest organism (OPT) chemically was not done. Control was only done on weeds with manual technical culture intensively.

Irrigation, at planting time - 3 weeks after planting (WAP): Tracemaking; 4-10 (WAP): watered as high as 2-5 cm; 11 WAP-primordia flowering: watered with 5 cm and allowed to dry by itself, then watered back (repeatedly); Flowering phase-10 days before harvest time (HSP): continuously watered as high as 5 cm; 10 HSP to harvest time: plot is dry. Application of manure with a dose of 5 tons/ha was done in the land preparation. Application of 200 kg/ha Urea is divided three times ie at 3 WAP, 6 WAP and primordia flowering time. Application of 200 kg/ha SP-18 and 200 kg/ha KCl was only done at 3 WAP.

7. Observation

Plant Growth

- Percentage of seedlings growth (viability) was done at 3 WAS.
- The dry weight of seedling was measured at 3 WAS. Seedlings sample was placed in oven at a temperature of 60 0C for 3 x 24 hours.
- Number of tillers: calculated on 6, 7, 8, 9, 10 WAS and harvest time.
- The dry weight of the stover was measured after harvest time by stirring at 60 ° C for 3 x 24 hours.
- Plant height measured from ground level at 1, 2, 3, 6, 7, 8, 9, 10 WAS. At harvest time, the plant height was measured from the ground to the tip of the longest panicle.

Bacterial Leaf Blight Attack

Bacterial leaf blight attacks were observed in intensity (%) at 11, 12, 13 WAS and at harvest time.

Production component and Yield

Observations were made at harvest of five sample plants per experimental unit.

- Productive tiller.
- *Ubinan* (crop cutting experiments =CCE) were done at the harvest time by harvesting an area of 3 x m2 from the rice plant without the plants on the edge.

- Number of panicles per clump.
- The number of pithy grain per panicle was calculated by taking one random panicle from each plant sample.
- The number of empty grain per panicle was calculated by taking one random panicle from each plant sample.
- The weight of pithy grain per panicle was measured by weighing the pithy grain taken from panicle which was used to the variable of number of pithy grain per panicle.
- The percentage of pithy grains per clump was calculated by knocking out all the panicles in a clump and calculating the percentage of the pithy grain.
- The percentage of empty grains per clump was calculated by threshing all the panicles in one clump and calculating the percentage of empty grain.

C. Result and Discussion

1. General Condition

The most common pests that attack the rice are the *Keong mas*/golden snail (*Pomacea canaliculata*), grasshoppers, Rice Ear Bug (*Leptocorisa oratorius)*, and birds. The golden snail attacked the rice (young rice) by scratching the plant tissue and eating it (Hasanuddin, 2003), while Grasshoppers attacked the rice by eating plant leaves, while Rice Ear Bug (*Leptocorisa oratorius)* attacked by sucking liquid in young grains of rice. Birds attack the almost ripe plants by eating the grains of ripe rice.

2. Plant Growth

Plant Height

The effect of seed treatment at week 1 and 2 indicated that the treatment of matriconditioning + Agrept 0.2% (P4) resulted in the highest plant height compared to other treatments. The control showed the lowest plant height at week 1 and 2 compared to other treatments. At week 3, the treatment of citronella oil, biological agents, matriconditioning + Agrept 0.2% , and matriconditioning + citronella oil resulted in higher plant height than other treatments (Table 1). Furthermore the control still show the lowest plant height compared to other treatments.

Different findings occurred at the 6 week until harvest, all the tested seed treatment showed no significant effect on plant height. The control resulted in the lowest plant height since the seedling time until harvest time, however, it indicated that the plant height is not significantly different with other treatments. This is might be due to the effect of growth stagnation or seed treatment that only affects in the seedling phase.

Table 1. Effect of seed treatments on plant height

Treatment	Plant height (cm) at week –*th*								
	1	**2**	**3**	**6**	**7**	**8**	**9**	**10**	**Harvest**
P0	6.7 e	17.7d	26.0 b	43.9	56.5	64.3	74.9	83.4	108.4
P1	12.4 b	21.6c	26.1 b	44.2	53.5	61.6	73.1	81.8	106.7
P2	9.4 d	22.0bc	**28.2 a**	43.9	55.7	65.5	75.7	84.0	109.0
P3	11.2 c	22.5bc	**28.0 a**	44.3	55.6	63.9	75.1	85.6	108.2
P4	**14.2 a**	**24.0a**	**27.9 a**	41.9	53.6	62.4	74.3	83.3	107.5
P5	9.9 d	22.8b	**27.4 a**	43.2	54.3	63.3	74.8	84.0	108.4
P6	13.2ab	22.6bc	26.9ab	43.1	55.1	64.4	76.1	84.3	110.7

Note: P0 = control, P1 = bactericide, P2 = citronella oil, P3 = biological agent, P4 = matriconditioning + Agrept 0.2%, P5 = matriconditioning + citronella oil, P6 = matriconditioning + *P. diminuta*. The average value followed by the same letter in the same column indicates no significant difference based on the DMRT test at α = 0.05.

Table 2. Effect of varieties on plant height

Varieties	Plant Height (cm) at week –*th*								
	1	**2**	**3**	**6**	**7**	**8**	**9**	**10**	**P**
Ciherang	**11.7a**	**22.4a**	27.4	42.7b	54.3	63.8	74.9	83.6	109.6
IR-64	10.3b	21.3b	27.1	**44.3a**	55.5	63.5	74.8	83.9	107.2

Note: The mean value followed by the same letter in the same column indicates no significant difference based on the DMRT test at α = 0.05.

The effect of varieties at week 1 and 2 showed that *Ciherang* has a higher plant height than *IR64*. At week 3, the plant height of both varieties were not significantly different. However, at week 6 the *IR64* varieties were higher than Ciherang. According to ICRR-*BB padi* (2007), *IR64* has higher plant height than *Ciherang*.

Table 3. Effect of interaction between seed treatment and varieties on plant height at week 6

Varieties	Seed Treatment						
	P0	P1	P2	P3	P4	P5	P6
IR64	42.9 ab	**45.6 a**	**45.7 a**	**43.9 a**	**45.3 a**	**44.3 a**	42.4 ab
Ciherang	**45.0 a**	42.8 ab	42.0 ab	**44.7 a**	38.5 b	42.0 ab	**43.9 a**

Note: the details are the same as in Table 1.

Table 4. Effect of interaction between seed treatment and varieties on plant height at week 10

Varieties	Seed Treatment						
	P0	P1	P2	P3	P4	P5	P6
IR64	85.9ab	83.4 abc	84.2 abc	85.6 abc	83.4 abc	84.9 abc	80.3 c
Ciherang	81.0bc	80.2 c	83.8 abc	85.6 abc	83.2 abc	83.1 abc	**88.3 a**

Note: the details are the same as in Table 1.

The interaction between varieties and seed treatment only found in a certain week indicated that the interaction had not a significant impact on overall plant development (Tables 3 & 5). The interaction at 6th week showed a trend that was not the same as the interaction at week 10. The matriconditioning treatment + *P. diminuta* (P6) in *Ciherang* was one of the interactions that increased plant height at week 6. However, at week 10, only the interaction of *Ciherang* + P6 treatment obtained the highest plant height. This suggested that the use of biological agents is quite good as they will continue to interact as long as the biological agents continue to live and grow.

Viability, Dry weight of Seeds, and Dry Weight of Stover

The variable of the seed viability indicated that the varieties treatment had no significant effect, seed treatment has a very significant effect, and the interaction between the treatments has no significant effect.

The best seed treatment to increase the seed viability was matriconditioning + Agrept 0.2% (Table 5). This is might be due to the effect of the good combination of solvents and matriconditioning media. Matriconditioning media should be able to form a rhizosphere around the seed that is capable of delivering the solvent into the seed (Khan et al., 1990). Treatment of matriconditioning + citronella oil and matriconditioning + *P. diminuta* which is also a treatment of matriconditioning showed not better result than matriconditioning + Agrept 0.2% . Chemical treatments (Vitavax, Thiram, and Mancozeb) on rice seeds were also reported to maintain the viability of seeds ≥ 80% despite have been stored for six months (Nghiep & Gaur, 2005).

Table 5. Effect of seed treatment on seed viability, dry weight of seedlings and dry weight of Stover

Treatment	Seed viability (%)	Dry weight of seed (mg)	Dry weight of Stover (g)
P0	77.5 c	31.833 d	65.345
P1	83.3 bc	39.500 cd	72.028
P2	75.0 c	44.500 bc	62.250
P3	80.8 bc	50.833 ab	71.117
P4	**94.1 a**	**57.167 a**	72.811
P5	80.8 bc	49.167 ab	75.511
P6	87.5 ab	51.000 ab	76.983

Note: the details are the same as in Table 1

The seed treatment with the lowest seedling viability was the treatment of citronella oil (P2) and control (P0). P2 had a low viability probably due to the low solubility of citronella oil so that is less absorbed by the seed. According to Untari (2003), there is a tendency that the higher concentrations of clove oil and the longer incubation time performed on pepper seeds will lead to an increase in T_{50}

The lack of solvent absorption (citronella oil) by the seed caused the effect of conditioning through immersion was less than maximum.

The effect of varieties is not significant on the dry weight of seed. However, the effect of treatment is very significant, whereas the interaction between the treatment had no significant effect. In this variables, the best seed treatment is matriconditioning + Agrept 0.2%. It is might be caused by the combination of matriconditioning with bactericide is the best treatment compared to other treatments so that seedling growth is faster. Moreover, the control showed the lightest weight of the seedlings.

Table 6. Effect of varieties on number of tiller

Treatment	Number of –*th* Tiller					
	6	7	8	9	10	Panen
Ciherang	12.886	20.324 b	23.829 b	26.124 b	25.143 b	19.2571 b
IR-64	15.267	**25.010 a**	**27.895 a**	**30.743 a**	**28.581 a**	**21.3810 a**

Note: The mean value followed by the same letter in the same column indicates no significant difference based on the DMRT test at α = 0.05.

Number of Tiller

Varieties have a very significant effect on 7-10 weeks and at harvest time. Seed treatment and interaction between varieties and seed treatment had no significant effect. The effect of varieties at 7-10 weeks and at harvest showed a similarity that IR64 has more numerous number of tillers than Ciherang (Table 6). This is might be caused by the genetic diversity of each variety. Genetically, IR64 has a greater number of tillers than Ciherang (BB padi, 2007)

Bacterial Leaf Blight

The coefficients of variation of BLB observation at week 11, 12, and 13 were high, that are 40.5, 30.4, and 30.8 respectively. This indicated that the incidence of BLB attacks in the field is still affected by uncontrolled environments. The factors and the tested interactions have not been effective to control BLB attacks in the field due to the difficult to control environment (especially the distribution of pathogens). At harvest time, the coefficient of variation decreased more that 11.5. This is might be caused by the growing phase of the plant had in mature phase so that the distribution of pathogens was low. The seed treatment that showed a tendency to decrease BLB attack at 11 WAS was matriconditioning + *P. diminuta*. However, at the harvest time, the treatment of matriconditioning + Agrept 0.2% tended to decrease BLB attacks (Table 7).

Table 7. Effect of seed treatment on bacterial leaf blight attack (%)

Treatment	11 WAP	12 WAP	13 WAP	Harvest
P0	3.700	4.233	4.300	12.200
P1	3.366	3.566	3.266	11.066
P2	2.433	3.000	2.866	11.333
P3	2.233	2.933	3.133	11.366
P4	2.366	3.066	3.233	**10.300**
P5	2.600	3.066	3.133	10.933
P6	**1.966**	3.100	2.933	11.066

Note: the details are the same as in Table 1.

Coefficient of variation (CV) at 11 WAP to harvest was: 40.5, 30.4, 30.8, dan 11.5 respectively. Ciherang varieties show a tendency to be more resistant to BLB attacks than IR64 (Table 8). This is might be affected by the genetic properties of Ciherang that are resistant to BLB strains III and IV, whereas IR64 was only slightly resistant to BLB strains IV (BB Padi, 2007).

Table 8. Effect of varieties on bacterial leaf blight attack (%)

Varieties	11 WAP	12 WAP	13 WAP	Harvest
IR 64	2.6286	3.3810	3.5143	11.1905
Ciherang	2.7048	3.1810	3.0190	11.1714

Note: The mean value followed by the same letter in the same column indicates no significant difference based on the DMRT test at α = 0.05.

3. Production Components and Yield

Productive tiller and the number of empty grain per panicle

Seed treatment had no significant effect on the number of productive tillers and the number of empty grains per panicle. Nevertheless, matriconditioning + *P. diminuta* treatment showed a tendency to produce more productive tillers than other treatments. Treatment of biological agents tended to result in the number of empty grains per panicle more than other treatments (Table 9).

Table 9. The effect of seed treatment on the number of productive tillers and the number of empty grains per panicle

Treatment	∑ productive tillers	∑ empty grains per panicle
P0	18.9	53.0
P1	20.0	55.2
P2	19.8	53.8
P3	20.7	**57.0**
P4	20.4	53.2
P5	20.7	51.6
P6	**21.5**	54.6

Note: the details are the same as in Table 1

Varieties had a significant effect on the number of productive tillers. IR64 had more productive tillers than Ciherang. This is probably caused by the genetic properties of IR64 that has more productive tillers than Ciherang (ICRR, 2007).

Tabel 10. The effect of Varieties on the number of productive tillers and the number of empty grains per panicle

Varieties	**∑ productive Tillers**	**∑Empty grains per panicle**
Ciherang	19.2 b	**63.3 a**
IR-64	**21.3 a**	44.8 b

Note: The mean value followed by the same letter in the same column indicates no significant difference based on the DMRT test at α = 0.05

Crop Cutting Experiment (CEC) Harvest/ ubinan harvest, percentage of pithy grain per clump, and Percentage of empty grain per clump

Seed treatment had a significant effect on CEC harvest. Treatment of citronella oil, matri conditioning + biological agents *P. diminuta*, , and matriconditioning + Agrept 0.2% yielded the highest CEC yield compared to other treatments (Table 11). citronella oil produced a high CEC yield probably due to the high percentage of pithy rice per clump (after matriconditioning + citronella oil), whereas the treatment of matriconditioning + *P. diminuta* had more productive tillers than other treatments. Treatment of biological agents increased the yield of CEC harvest reasonable caused by the number of productive tillers which close to that of matriconditioning + *P. diminuta* treatment. The low percentage of empty grain per clump and the lowest bacterial blight attack at harvest time were suspected to be the cause of the high yield of ± matriconditioning + Agrept 0.2% treatment.

Table 11. Effect of seed treatment on estimated yield of CEC harvest, percentage of pithy grain per clump, and percentage of empty grain per clump

Treatment	Yield of CEC/*ubinan* harvest (Kg)	% Pithy grain/ clump	% Empty grain/ clump
P0	1.2822 ab	82.273	17.727
P1	1.1302 b	82.119	17.881
P2	**1.4967 a**	86.635	13.365
P3	**1.3820 a**	84.865	15.135
P4	**1.3667 a**	85.884	14.116
P5	1.3007 ab	86.659	13.341
P6	**1.4585 a**	86.554	13.446

Note: the details are the same as in Table 1.

Seed treatment had no significant effect on the percentage of pithy grain per clump as well as the percentage of empty grain per clump. Nevertheless, the treatment of matriconditioning + citronella oil showed a tendency to produce a higher percentage of pithy grain per clump than other treatments. The control and bactericide treatment showed a tendency to produce a higher percentage of empty grain per clump than other treatments (Table 11).

IR64 produced a greater yield of CEC harvest than that of Ciherang. Based on descriptions of varieties, Ciherang produced a higher yield than IR64 (ICRR, 2007). This anomaly was caused by the percentage of empty grain per clump of the Ciherang variety was much greater than IR64 (Table 12) as well as a less percentage of pithy rice per clump than IR64. The high percentage of empty grains per hill this resulted in the loss of yield (ubinan harvest) in Ciherang. The high percentage of empty grain per clump in Ciherang is thought to be caused by a high attack of the pest.

Table 12. Effect of varieties on estimated yield of CEC harvest, percentage of pithy grain per clump, and percentage of empty grain per clump

Varieties	Yield of CEC/*ubinan* (Kg)	% Pithy grain/ clump	% Empty grain/ clump
Ciherang	1.28029 b	82.441 b	**17.559 a**
IR-64	**1.41024 a**	**87.556 a**	12.444 b

Note: The mean value followed by the same letter in the same column indicates no significant difference based on the DMRT test at $\alpha = 0.05$.

D. Conclusion

Matriconditioning + Agrept 0.2% is a seed treatment which is able to increase the percentage of viability, seedling height, and dry weight of seedlings. At the week 6 and 10, the treatment of matriconditioning + Agrept 0.2 % on seed rice variety *Ciherang* rice resulted in the highest plant height. Otherways, Treatment of citronella oil, matriconditioning + *P. diminuta*, biological agent *P. diminuta*, matriconditioning + Agrept 0.2% obtained the highest yield of ubinan harvest compared to other treatments. Varieties, seed treatment, and interaction between both treatments have no significant effect on bacterial leaf blight attack in the field.

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