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THE EFFECT OF ORGANIC LIQUID FERTILIZER TO 5 VARIETIES PADDY GOGO (*Oryza sativa* L.) IN THE SUB-OPTIMAL LAND OF WAMENA

Sumiyati Tuhuteru[1*)], Rio Ginting[2)], Anti Uni Mahanani[1)], Patras Pumoku[1)]
[1]Program Study of Agrotechnology, College of Agriculture Science Petra Baliem Wamena, Jl. Sanger, Potikelek, Wamena, Jayawijaya, Papua, Indonesia
[2]MAED Science Educations, College of Education, Adventist University of The Philippines, Puting Kahoy Silang, Cavite, Philippinesy
*Corresponding Author: sumiyati.tuhuteru@yahoo.com

ABSTRACT

Paddy gogo is one type of non-irrigated paddy that can grow on limited inputs of water. Paddy gogo can grow on various types of soil, including sub-optimal land in Wamena. It is said to be sub-optimal considering the soil's ability in the study area is a type of soil with lesser nutrient content. This study aims to determine the effect of the use of NASA organic liquid fertilizer on the growth and yield of 5 varieties of upland rice plants tested in the sub-optimal land of Wamena. This research was conducted in March-August 2019. The study was arranged in factorial research design, namely 5 varieties types such as the variety of Inpago Unsoed 1, Inpago Unsoed Parimas, Inpari 28, Inpago 9 and one type of Local varieties as Comparator and the concentration of NASA liquid organic fertilizer as a 150 ml/plot. The results showed that the best growth was shown by Wamena's Local variety (Moai) with the highest appearance of plant height and Inpago Unsoed 1 variety which showed producing many offspring. Then, the Inpago 9 variety showed the highest leaf area index value and grain weight per clump with the highest stomata density value indicated by the Wamena's Local variety (Moai), and the Inpago Unsoed Parimas variety, which showed the highest total chlorophyll value. However, the Inpari 28 variety showed that it produced the highest weight value of 1000 seeds compared to other varieties.

Keywords: NASA; Paddy gogo; Sub-optimal land, Wamena

INTRODUCTION

Paddy gogo is plants that are influenced by ecological aspects of the production process. Ecological aspects such as high temperatures and drought often limit the production of rice (Mawardi *et al*. 2016). Upland riet alce development is one of the answers in increasing rice production, but upland rice productivity in Indonesia is still very low. One of the reason is the low use of superior varieties. However, from the many superior varieties of paddy gogo, not all varieties are suitable to be developed in an area. To find out the suitable varieties to be developed in an area, it is necessary to study the introduction of varieties to obtain location-specific adaptive varieties (Sujitno *et al*. 2011). Paddy gogo is one type of non-irrigated rice that can grow on limited inputs, one of which is the water availability problem. These conditions make paddy gogo cangrow and develop on dryland (Dobermann and Fairhurst, 2000). Dryland used for paddy gogo is average marginal land that is not suitable for plants. The percentage of growing paddy gogo is smaller than that of lowland rice, so the seeds needed are more.

Paddy (*Oryza sativa* L.) is a commodity that plays an important role in producing rice as food for the Indonesian people. More than 90% of Indonesian people need rice as a staple food (Syahputra *et al*. 2016). Paddy gogo is a plant that can grow on various types of soil, including sub-optimal land in Wamena. It is said to be sub-optimal, considering the soil's ability in the study area is a type of soil with lesser nutrient content, which is influenced by local climate conditions (Mahanani *et al*. 2019). Sub-optimal land can be interpreted as the land that naturally has low productivity due to internal (intrinsic) factors such as materials, physical, chemical and biological soil characteristics, and external factors such as rainfall and extreme temperatures (Las *et al*. 2012; Mulyani and Sarwani, 2013). The optimum soil reaction (pH) ranges from 5.5-7.5. Permeability at the sub horizon is less than 0.5 km/hour. The depth of paddy gogo up to cm 50 cm (Sarwani, 2008). Paddy gogo must be planted in humid land, crumb structures and contain enough water and air, suitable land varies from smooth, dusty, fine to rough soil, and water availability is needed quite often (Rahayu dan Harjoso, 2011).

One alternative that can be done by utilizing sub-optimal land such as sub-tropical dry land in Wamena to increase production and food self-sufficiency and make the area as the food barn, continues to be pursued in various ways through the creation of innovation and the development of local wisdom. Chicken manure is an abundant natural resource in various regions, which can be developed and utilized as organic fertilizer (chicken manure fertilizer enriched by *Azospirillum* bacteria and phosphate solvent bacteria) (Marlina *et al*. 2016).

So far, most farmers use chicken manure (and a few farmers still do not use chicken manure) in large numbers, reaching tens of tons per hectare. However, in Wamena, the use of chicken manure is still relatively low compared to cow manure. The reason is that there are only a few chicken farmers compared to cattle farmers. Generally, farmers have not yet fully utilizie cow manure. The organic farming system understood by farmers and the local community is an agricultural system without any additional input other than the carried out planting process. For this reason, it is hoped that the creation of innovations in the provision of organic fertilizer will continue to be developed through the use of animal manure and surrounding plants which are enriched with many bacteria that are beneficial to the cultivated soil and plants, such as Azospirillum and phosphate solvent bacteria.

Biofertilizers are expected ferment organic material quicky and produce organic compounds such as proteins, sugars, and amino acids and can provide nutrients N, P, K, and sulfur, enlarge soil CEC and increase soil P solubility. In addition, the presence of microorganisms in the soil have the advantage in increasing soil fertility, producing important compounds such as nutrient solvents, phytohormones, and antimicrobials, tethering N2, dissolving P to become more available, changing organic matter, thereby increasing nutrient availability in the soil (Saraswati and Purwani, 2009).

So far, the technological innovation development that has been widely used by farmers is a type of liquid organic fertilizer. The type of organic fertilizer developed, marketed, and can help improve soil texture and increase crop productivity is NASA's liquid organic fertilizer. NASA's liquid organic fertilizer is 100% natural liquid organic fertilizer extracted from organic material of livestock and poultry waste, plant waste, natural waste, certain types of plants, and "herbs or other natural substances" which are processed based on environmentally friendly technology with the principle of Zero-Emission Concept (Sutisman, 2011). Liquid organic fertilizer contains macronutrients and micronutrients needed by plants. In addition to nutrients, liquid organic fertilizer contains microorganisms that are not present in the soil, such as Azotobacter sp, Azospinillum sp, Lactobacillus sp, Pseudomonas sp, phosphate solvent microbes, and cellulolytic microbes. Therefore, the use of organic growing media plus liquid organic fertilizer is expected to increase plant growth and production (Andalasari *et al.* 2017). This study aims to determine the effect of using NASA organic liquid fertilizer on 5 Paddy Gogo varieties' growth and yield tested in the sub-optimal land of Wamena.

MATERIALS AND METHODS

This research was conducted in March-August 2019, located in Sogokmo District, Wamena City, with an altitude of 2653 meters above sea level (masl) and daily temperatures of 11.4-25^{o}C with humidity of 65-75%, the condition of the soil texture is classified in the sandy clay loam class (UNSOED Laboratory, 2018). The study was arranged in factorial research design, namely 5 types of varieties as Inpago Unsoed 1 variety, Inpago Unsoed Parimas, Inpari 28, Inpago 9, and one type of Local varieties Rice as Comparator and the concentration of NASA liquid organic fertilizer as a 150 ml/plot.

Initially, observations of soil samples taken from the research location were carried out before the planting process was undertaken. Observations on this soil sample analysis were carried out at the Soil Science Laboratory, Faculty of Agriculture, Jenderal Soedirman University, Purwokerto. The initial soil analysis process is carried out to see the soil's ability before it is given treatment. Analyzing the soil's chemical chemical properties is carried out for ± 2 months until the results of the analysis are released. The analysis results of the soil's chemical properties can be seen in Table 1.

During the analysis process, the stages carried out were the process of planting 5 varieties of Paddy Gogo that were ready for planting. After the agricultural land was cleared and made beds measuring 2 x 3 m totaling 15 beds, the planting process was carried out, and had been given basic fertilizer (in the form of cow manure) plus the initial treatment of liquid NASA organic fertilizer 150 ml/plot. Afterwards, the land was left for 3 days then the researcher plant the prepared seeds. Planting is done with a spacing of 25 x 25 cm.

After the planting process is carried out, the next step is the second treatment of liquid NASA organic fertilizer 150 ml/plot when the plant is 5 WAP. The next stage (third), the research applies organic fertilizer when the plant is 12 WAP. While the treatment was taking place, the observation process was also carried out on several plant parameters, which were parameters of the productivity of the upland rice seeds tested. The parameters observed were the parameters of plant height (cm) and the number of productive tillers (tillers) observed when the plants were 5 weeks after planting (WAP), then the plants' physiological parameters in the form of:, parameters of leaf area index ($cm2g^{-1}$), stomata density (mm2) and total plant chlorophyll (mg.g-1). These physiological parameters were observed when the berry was 6 MST. Then the production parameters consisting of grain weight parameters per clump (gr) and the weight of 1000 seeds (gr) which were observed during the harvesting process or when the plant was 15 WAP.

Data observation were analyzed using ANOVA (F-test), if the study results showed a significant effect, then the analysis was continued with the DMRT (Duncan Multiple Range Test) tests at a 5% level.

RESULT AND DISCUSSION

The results obtained in this study consisted of the analysis of the study area's initial soil chemical properties of the study area and observational data for each predetermined parameter. The analysis results of the soil chemical properties of the 5 Paddy Gogo tested planting areas can be seen in table 1. The analysis result of the soil chemical properties show the soil conditions of the Paddy Gogo planting area sthat were tested. The analysis result showed a low degree of acidity (soil pH), macro and micronutrient content, and relatively low organic matter.

Based on research criteria according to CSR (1983) and the Soil Research Institute (2005), it shows that the soil used in this study is classified as very acidic (pH H_2O = 5.48), the C-organic content of 1,525% is classified as low, C/N ratio of 8.55 is classified as moderate, N-total content is classified as low (0.1895%), P_2O_5 is relatively high (26.18 ppm), exchanged bases such as Ca-dd 4.60725 $CmolKg^{-1}$ are classified as moderate, Mg-dd 0.6495 $CmolKg^{-1}$ is classified as low, K-dd 0.1965 $CmolKg^{-1}$ classified as moderate, Na-dd 0.3045 $CmolKg^{-1}$ is classified as moderate (Table 1)

Table 1. Results of Preliminary Soil Chemical Analysis before Planting

No.	Parameter	Result of Analist	Assessment
1	N Total (%)	0.1895	Low
2	Na-dd (Cmolkg-1)	0.3045	Medium
3	Mg-dd (Cmolkg-1)	0.6495	Low
4	K-dd (Cmolkg-1)	0.1965	Medium
5	pH (H_2O)	5.48	Acid
6	C Organik (%)	1.5245	Low
7	P_2O_5 tersedia	26.18	Hight
8	Ca-dd (CmolKg-1)	4.60725	Medium
9	C/N-Ratio	8.55	Medium

Source: Primary Data Processed, 2019

The analysis results of the soil chemical properties conducted before the study showed that the soil in the study had a low level of soil fertility with minimal nutrient content, which was indicated by a relatively acidic pH. Therefore, it is expected that by adding 150 ml NASA liquid organic fertilizer/plot can increase The soil's fertility so that it can be developed for the cultivation of other plants.

The results of the diversity analysis recapitulation showed that the treatment of liquid NASA organic fertilizer 150 ml/plot significantly affected each observed parameter (Table 2).

Table 2. Summary of Observation Results

Observations	Treatment of NASA 150 ml/plot	Coefisient Variant (%)
Plant Height 5 WAP (cm)	*	6.15
Number of productive tillers (tillers) 5 WAP	*	6.29
Leaf Area Index (cm^2g^{-1})	*	131.41
Density of stomata (mm^2)	**	17.06
Total of Chlorophyll ($mg.g^{-1}$)	*	32.56
Grain weight parameters per clump (gr)	*	11.20
Weight of 1000 Seeds (gr)	*	15.14

Paddy that were given 150 ml NASA liquid organic fertilizer/plot provided plant height growth and the number of tillers that continued to increase at 1,3 and 5 MST (Tables 3 and 4). The results showed a significant effect on plant height parameters as indicated by Wamena's local varieties. It shows that over time the addition of NASA liquid organic fertilizer has been able to contribute nutrients to the Wamena's local variety of the tested paddy gogo.

Table 3. Average Plant Height of 5 Gogo Rice Varieties at 1, 3, and 5 WAP (Week After Planting)

Varietas	1 WAP	3 WAP	5 WAP
Inpago Unsoed 1	8.95 b	28.79 b	50.90 c
Inpago Unsoed Parimas	9.53 ab	32.58 b	54.47 c
Inpari 28	8.69 b	27.61 b	48.10 c
Inpago 9	10.46 ab	32.79 b	67.43 b
Local of Wamena (Moai)	13.99 a	43.76 a	83.67 a
CV	22.26	9.62	6.15

Descriptions. : The value followed by the same letter in the same column is not significantly different from the DMRT test at α = 5%; tn = Not significantly different in the F test, α = 5%; ** = Very significant difference in the F test, α = 5%;

NASA's liquid organic fertilizer is 100% natural organic fertilizer from organic extracts of livestock and poultry waste, certain plant wastes, and other natural substances that are processed based on environmentally sound technologies. NASA's liquid organic fertilizer can accelerate plant growth, reduce the pest attack level, has no adverse side effects to plants and the environment, and is safe for humans (Natural Archipelago, 2004). Furthermore, the application of NASA liquid organic fertilizer can increase nutrient uptake, especially nutrient N, which is needed for plants' vegetative growth. Prihmantoro (1999) stated that N nutrients are needed for plants' vegetative growth such as leaves, stems, and roots. Damaetie and Abiy (2009) stated that N has a dominant influence on sugar cane and the quality of its solution. Gana (2008) states that N amount in the soil is the result of the equilibrium between climate and vegetation factors, topography, physical and chemical properties of the soil, human activities, and time. Previously it has also been stated by Noor (1996) that the availability of groundwater influences plant height growth because the plant height process begins with the process of cell division and enlargement that is affected by cell turgor and will occur if the cell experiences turgidity whose main element is water availability. Then, differences in genetic factors existed in plants resulting diversity in the appearance of plant height. According to Mildaerizanti (2008), differences in plant height are more determined by genetic factors rather than environmental factors. Additionally, it is suspected that each variety has a different mechanism in distributing water and tends to be influenced by genes (Idwar *et al*. 2017).

Wamena's local variety is known to be an adaptive variety growing on the sub-tropical land, with one of the vegetative features that are classified as high, but this growing resistance has not been confirmed to produce well. The characteristic is due to the influence of altitude and climate factors in which Wamena's temperature is decreased 8^{o}C in 2019, which is known to affect the growth and production of plants cultivated at that time (BMKG Papua, 2019).

Fertilization using liquid organic fertilizer is better because it has advantages, plants' root can easily absord it and can provide nutrients conforming to plant needs (Putri, 2011). In addition, sources of organic fertilizer raw materials are widely available in abundant quantities in the form of waste, both household waste, restaurants, livestock, and other types of organic waste (Nasaruddin and Rosmawati, 2011).

In addition to plant height growth, the study result also showed a different effect on observing parameters of the number of productive tillers. The results showed that observations of 1 MST showed no significant effect. While the observations of 3 and 5 MST were shown to have a significant effect as indicated by the Inpago Unsoed 1 variety with an average number of productive tillers of 20.44 tillers (3 MST) and increased to 30.66 tillers (5 MST) (Table 4). It is assumed by the genetic ability of The Inpago Unsoed 1 variety in producing the number of productive tillers compared to other varieties. It was also suspected that the addition of NASA's liquid organic fertilizer affected the ability of the soil to provide nutrients for plants. Elizabet, *et al*. (2013), states by fulfilling plant needs for growth elements stimulates increase in plant height and forming new leaves

Table 4. The Average Number of Tillers of 5 Varieties Paddy Gogo at 1, 3 and 5 WAP

Varieties	1 WAP	3 WAP	5 WAP
Inpago Unsoed 1	9.00. a	20.44 a	30.66 a
Inpago Unsoed Parimas	9.22 a	17.28 b	26.05 b
Inpari 28	8.44 a	12.05 d	21.22 c
Inpago 9	9.78 a	15.33 c	26.66 b
Local of Wamena (Moai)	8.29 a	12.11 d	24.22 bc
CV	9.68	5.32	6.29

Descriptions. : The value followed by the same letter in the same column is not significantly different from the DMRT test at α = 5%; tn = Not significantly different in the F test, α = 5%; ** = Very significant difference in the F test, α = 5%;

However, with the influence of climate, this can only become a possibility. Besides, plant genetic factors also determine the productivity of the plant in question. For this reason, what needs to be seen in this research is the plants physiological ability. The study results related to the leaf area index 5 of the rice varieties of Gogo tested showed that the Inpago 9 variety had the highest leaf area index value. The difference in leaf area index values in Table 5 for each variety is because the leaf area index values depend on the genetic ability of plants and the supply of nutrients. It is known that the Inpago 9 variety can absorb high nutrients. The leaf area index value, which reaches 4, shows that the Inpago 9 variety can capture light more than 90% (Mungara *et al*. 2013).

The research results related to the number of productive tillers are known to affect plant production (table 4). Then, the DMRT test result on physiological parameters and crop production seem to vary from each variety tested (Table 5). The results of the rice leaf area index showed a significant effect shown by the Inpago 9 variety (4,853 cm^2.g-1), then in the stomata density parameter, the study results were significantly affected by the Local Wamena variety (265.02 mm^2), then in the total plant chlorophyll parameter the results of the research were significantly affected by the Inpago Unsoed Parimas variety (0.0004 mg.g-1) (Picture 1), on the contrary, the research results on plant production parameters showed that the Inpago 9 variety displayed the highest grain weight (154,667 gr) while the weight parameter of 1000 seeds resulted in a significant effect which is shown by the Inpari 28 variety (23,667 gr) (Table 5)

(i) Stomata Density of Local Wamena Variety (Moai)

(ii) Stomata Density of Inpago Unsoed Parimas

Picture 1. Stomata Density

Table 5. Physiological Responses and Production of 5 Varieties Paddy Gogo Given Organic Liquid Fertilizer of NASA Treatment 150 ml/plot

Varieties	Leaf Area Index (cm^2g^{-1})	Density of Stomata/m^2	Total of Chlorophyll ($mg.g^{-1}$)	Graint Weigh per Clump (gr)	Weight of 1000 Seed (gr)
Inpago Unsoed 1	0.053 b	166.72 b	0.0002 b	61.667 c	17.333 b
Inpago Unsoed Parimas	0.390 b	226.49 ab	0.0004 a	74.000 c	19.667 ab
Inpari 28	0.060 b	207.22 ab	0.0002 ab	117.333 b	23.667 a
Inpago 9	4.853 a	187.95 b	0.0003 ab	154.667 a	23.333 a
Local of Wamena (Moai)	1.333 b	265.02 a	0.0003 ab	57.667 c	7.667 c
CV	131.41	17.06	32.56	11.20	15.14

Descriptions. : The value followed by the same letter in the same column is not significantly different from the DMRT test at α = 5%; tn = Not significantly different in the F test, α = 5%; ** = Very significant difference in the F test, α = 5%.

The research result on the leaf area index parameter of 5 Padi Gogo varieties tested showed that the Inpago 9 variety had the highest leaf area index value. In Table 5, the differences of each variety in lead area index value is due to the leaf area index value depending on the genetic ability of the plant and the provision of nutrients. It is known that the Inpago 9 variety can absorb high nutrients. The resulting photosynthate will be used for plant growth and development (Gardner *et al*. 1991). Yoshida (1981) states that a large leaf area index is needed to capture solar radiation. Leaf Area Index value required to capture 95% of the light comes in the canopy of paddy around 4-8 for the course of photosynthesis. Light is an essential factor for plant growth and development In addition, light also contributes significantly in the plants' physiology, especially photosynthesis, respiration, and transpiration. Plant photosynthesis is determined by incoming solar radiation, the rate of photosynthesis per unit leaf area, leaf area index, and leaf angle. However, it does not affect the level of stomata density nor total plant chlorophyll.

It is known that Wamena's Local variety has a very high level of stomata density compared to other varieties, while the Inpago Unsoed 1 variety shows the lowest stomata density value. It is known to be closely related to the rate of transpiration in plants. With the high value of plant stomata density, the transpiration rate in these plants is known to be very low. Opening the stomata wider means that the leaves becomes absorbing more nutrients and other materials when compared to plants without acoustic frequency treatment. It is known that opening the stomata causes oxygen O2 gas to diffuse out and CO_2 carbon dioxide gas into the cell as material to carry out photosynthesis process with the help of sunlight (Salisbury and Ross, 1995). From this photosynthesis process will directly affect the process of respiration because the main ingredient of the process of respiration is carbohydrates produced by the photosynthesis process. This respiration process will produce energy in the form of ATP (*Adenosine Tri*

Phosphate). This process will ultimately affect the amount of chlorophyll formed.

The results showed the Inpago Unsoed Parimas variety produced the highest total amount of chlorophyll than other varieties (0.0004 mg.g-1), especially the Inpago Unsoed 1 variety known as as to also have a very low-density value. This is thought to be influenced by the adaptive power of each Paddy Gogo variety. The high amount of total plant chlorophyll does not allow the effect on production achieved. As shown in Table 5, the parameters of grain weight per clump and weight of 1000 seeds, it can be seen that the grain weight parameters per family of Inpago 9 variety show the highest grain weight per family. The result is known to be influenced by its ability to capture light as indicated by the leaf area index value, although it is known that the total amount of chlorophyll formed is relatively low. It is ecause the level of stomata density is also relatively low. Besides, nutrients that the rice plants' root have absorbed are then used for filling seeds so that the amount of grain contains more. A large number of filled grains make an important contribution (Marlina *et al*. 2015).

However in this study, although the leaf index value is low, stomata density is low, chlorophyll content to low grain weight does not rule out the possibility of weighing 1000 seeds high. As seen in Table 5, the Inpari 28 variety shows the highest weight value of 1000 seeds. The changes is predicted to be supported by local climate patterns. Ismail *et al*. (2003) reported that the weight of 1000 seeds correlated with rainfall and soil moisture content. Enough water will affect the plants' photosynthesis process which impacts the amount of photosynthate produced. Rice plants need good rainfall to meet irrigation needs. The average rainfall requirement is around 200 mm / month or more with distribution for four months, while the annual rainfall is around 1500-2000 mm (Nurlia, 2016). As it is known, rainfall in Wamena ± 2000 - 2500 mm per year with humidity reaches 65-75%, and the daily temperature is 11.4-25^{o}C, and the region altitude is 2653 masl. Then the full sun only lasts half a day. The aspects were deduced to affect the growth and yield of 5 varieties of upland rice tested. And besides, the significant effect was supported by soil conditions that are known to have low nutrient content.

CONCLUSIONS

The results showed that the application of NASA organic fertilizer 150 ml/plot influenced the growth and yield of 5 varieties of Paddy Gogo tested. The results showed that the best growth was shown by Wamena's local varieties with the highest appearance of plant height and Inpago Unsoed 1 varieties, which showed a large number of productive offspring. The Inpago 9 m variety shows the highest leaf area index and grain weight per clump when viewed from physiological and production parameters. Furthermore, Wamena Local variety showed the highest value of stomata density, the Inpago Unsoed Parimas variety showed the highest total chlorophyll value, and the Inpari 28 variety produced the highest weight value of 1000 seeds.

REFERENCES

Andalasari T. D., Widagdo, S., Ramadiana, S., dan Purwati, S. 2018.

Effect of Planting Media and Liquid Organic Fertilizer on Growth and Production of Shallots (*Allium ascalonicum* L.). Essay. Faculty of Agriculture, University of Lampung.

Damaetie, A. and F. Abiy. 2009. Determination of optimum nitrogen rate for sugarcane at Wonji-Shoa sugarcane plantation. Proceeding Compilation. Ethiopian Sugar Development Agency Research Directorate. Page 105-115.

Dobermann, A. dan T. Fairhurst. 2000. Rice: Nutrient Disorders dan Nutrient Management. Potash & Potash Institute of Canada. Canada.

Elisabeth, DW, Santosa, M & Herlina, N 2013, 'The effect of giving various organic material compositions on the growth and yield of shallot plants (Allium ascalonicum L.)', Journal of Plant Production, vol. 1, no. 3, pp. 2338–3976.

Gana, A. K. 2008. Effects of organic and inorganic fertilizers on sugarane production. Afr. J. General Agric. 4 (1): 55-59.

Gardner, F.P, R.B. Pearce, dan R.L. Mitchell. 1991. Physiology of Crop Plant (Fisiologi Tanaman Budidaya, alih bahasa D.H. Goenadi). Gadjah Mada University Press, Yogyakarta.

Idwar, Armaini, and Manurung J. 2017. Effect of Groundwater Voltage on Several Rice Gogo (Oryza sativa L.) Plants Local Varieties in Ultisol Medium. Proceedings of the National Seminar on Western Region PTN BKS in Agriculture. Bangka Belitung University. Pages: 279-287.

Ismail, B.P., B. Suprihatno, H. Pane, and I. Las. 2003. Response Components of Variety Results Against Agronomic Treatment. Journal of Agricultural Food Research, 27 (3): 6-14.

Mahanani A. U., Sumiyati T., Totok A. D.H, dan M. Rif'an. 2020. Land Suitability Evaluation for Paddy Gogo in Three Agroecosystem Areas of Jayawijaya Regency. Journal of Land and Land Resources. 7 (1): 77-86.

Marlina, N, Gofar N, P.K.S. Halim, A., dan Rahim, A. M.. 2015. Utilization of Biofertilizer Combined with Inorganic Fertilizer to Improved Rice Varieties IPB 4s Production (Oryza sativa L.) in Tidal Land Flood Type C. Proceedings of the National Seminar and the Annual Meeting of the Dean (SEMIRATA) BKS -PTN West Region Agriculture. Bangka Belitung University. Page: 108-117.

Mawardi, Ichsan C. N., dan Syamsuddin. 2016. Growth and yield of some varieties of rice plant (*Oryza sativa* L.) at the level of drought conditions. Jurnal Ilmiah Mahasiswa Pertanian Unsyiah, 1 (1): 176-187

Mildaerizanti. 2008. Performance of several upland rice varieties in the Batanghari watershed.http: //katalog.pustaka-deptan.go.id/pdf.

Mungara E, Indradewa D., dan Rogomulyo R. 2013. Analysis of Growth and Yield of Rice (*Oryza sativa* L.) Conventional, Organic Transitional, and Organic Farming System. J. Vegatalika, 2 (3): 1-12

Nasaruddin and Rosmawati. 2011. Effect of liquid organic fertilizer (poc) fermented from gamal leaves, banana stems, and coconut fiber on the growth of cocoa seedlings. Journal of Britain. 7 (1): 29-37.

Natural Archipelago. 2004. NASA Liquid Organic Fertilizer Product Guide. Karya Anak Bangsa, Yogyakarta.

Noor M. 1996. Rice of Marginal Land. Jakarta: Self-help Spreaders.

Nurlia T. 2016. Comparison of the Stomata Anatomical Character of Several Family Poaceae Species. Essay. Faculty of Science and Technology, Alaudin State Islamic University Makassar.

Papua Meteorology, Climatology and Geophysics Agency. 2019. https://www.bmkg.go.id/cuaca/prak forecast-buaca.bmkg?Kota=Wamena&ArealID=501461&Prov=24 (Accessed, 23 March 2020)

Prihmantoro, H. 1999. Cultivating Vegetable Plants. Penebar Swadaya, Jakarta.

Putri, H. A. 2011. The influence of providing some concentration of fully liquid organic fertilizers (POCL) Bio Sugih on the growth and results of sweet corn crops (Zea Mays Saccharata). Thesis. Department of Agriculture, Faculty of Agriculture and University of Andalas. The field. 48 page.

Rahayu, A. Y. and Harjoso T. 2011. Applications of husk ash on Gogo Rice (Oriza sativa L.) on silicate and leaf proline content and amylose and seed protein. Biota: Journal of Life Sciences, 16 (1): 48-55.

Salisbury & Ross. 1995. Plant physiology. ITB Press. Bandung.

Saraswati, R and J. Purwani. 2009. Biological Fertilizer Application Techniques for Fertilizing Efficiency and Increased Productivity of Wetland Soils. Bogor: Institute for Soil Research.

Sarwani, M. 2008. Rice Cultivation Technology. Center for Food Crop Research and Development.

Soil Researche Institute. 2005. Technical Guidelines for Chemical Analysis of Soil, Plants, Water and Fertilizers. Soil Research Agency. Bogor. 13 p.

Sujitno E., Fahmi T., and Teddy S. 2011. Study Of Adaptation Of Several Vegetable Varieties Of Gogo Rice In Low Drying Lands In Garut District. Journal of Agricultural Technology Study and Development, 14 (1): 62-69.

Sutisman. 2011. Nasa Natural Nusantara Cirebon Organic Fertilizer Shop. http://pupuknasaonline.blogspot.co m / 2011/11 / poc-nasa.html. (Accessed December 24, 2019).

Syahputra, Idwar, and Gunawan Tabrani. 2016. Response of Several Rice Gogo Varieties (Oryza sativa L.) Planted in Ultisol Land to Amelioran. JOM Faperta: 3 (1).

Yoshida, S., 1981, fundamentals of rice crop science. International Rice Research Institute. Los Banos, Philippines.