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Utilization of Chicken Manure and Indigenous Microbes for Enhancing Growth and Yield of Paddy in Rainfed Rice Field

Jumar[1] Riza Adrianoor Saputra[1,*] Muhammad Imam Nugraha[1] Ahmad Maulidin[1]

[1] *Department of Agroecotechnology, Faculty of Agriculture, Lambung Mangkurat University, South Kalimantan, Indonesia.*

[*]*Corresponding author. Email: ras@ulm.ac.id*

ABSTRACT

Rice production in South Kalimantan experienced diminishment in recent years. One of the problems that created this issue was the decline of soil fertility. Application of synthetic fertilizers in a long term would decline the soil fertility and subsequently diminished the productivity of rice field. Alternative application of organic fertilizers was one of the contemporary arrangements to maintain the stability of soil fertility and finally impacted the improvement of rice productivity. This study aims to determine the effect of the interaction between the dose of chicken manure combined with indigenous microbes (IMO) on the growth and yield of rice plants. This research was conducted from August to November 2020 at the Greenhouse of the Department of Agroecotechnology, Faculty of Agriculture, Lambung Mangkurat University (3° 26' 35.5488" S 114° 50' 19.986" E). The experimental design was Completely Randomized Factorial Design (CRD). The first treatment was chicken manure (k) which consists of 5 dosages, 0 t ha^{-1} (k_0), 10 t ha^{-1} (k_1), 20 t ha^{-1} (k_2), 30 t ha^{-1} (k_3), and 40 t ha^{-1} (k_4), and the second treatments was the IMO (m) in 3 different types, namely control without IMO (m_0), treatment IMO originated from waste cabbage (m_1) and pineapple peel (m_2). The boundary parameters in this study were the plant height, the number of tillers, the number of productive tillers, the weight of dry grain, and the weight of 100 grains of rice. The outcomes showed that there was no interaction impact between chicken manure and IMO treatments, yet it significantly affected on each treatment factor. Chicken manure had significant effects on all parameters, while IMO just impacted the number of productive tillers. The best treatment of chicken manure in rice plant growth was k_1 (10 t ha^{-1}) was able to improve plant height by 13.3% and the number of tillers was 17.8%; the k_4 (40 t ha^{-1}) increased the number of productive of tillers; while the best treatment of rice yields was k_2 (20 t ha^{-1}) which increased the dry grain weight by 44.9% and the weight of 100 grains by 8.7% and all these results significantly contrasted to the control treatment k_0 (0 t ha^{-1}). The IMO from waste of pineapple peel and cabbage gave the similiar significant results in increasing the number of productive tillers by 9.23% compared to the control treatment which was only 0.12%.

Keywords: *chicken manures, indigenous microbes, rainfed rice field, soil fertility, suboptimal.*

1. INTRODUCTION

Rice is a necessary food crop commodity in Indonesia and the natives made it as a staple food. In South Kalimantan, rice productivity decreased by 0.43%, from 4.21 t ha^{-1} in 2014 down to 4.19 t ha^{-1} in 2015 [1]. The decline caused by several problems, one of the problems was due to the low level of soil fertility on the land [2]. Another problem that hindered the increasing rice production was the preference for continuous usage of inorganic fertilizers, which has a negative impact on the fertility of the land. The usage of organic fertilizers as an alternative is objected for maintaining balance and increasing land productivity and reducing the negative impact on the soil environment. Fertilizer had crucial role as a buffer for physical, chemical and organic soil properties so that it can increase fertilizer efficiency and land productivity [3].

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Chicken manure is a waste produced originated from laying hens or broilers that has great potential to be used as organic fertilizer. The usage of chicken manure is necessary so that plants can grow well [4]. Farmers in general also prefered chicken manure as the fertilizer because the content of N, P, K, and Ca is higher than other livestock manures [5]. According to Santoso (45), chicken manure contained of 1.95% N, 4.88% P_2O_5, and 2.19% K_2O. In addition to the use of chicken manure, one of the efforts to increase nutrients in the soil is by applying indigenous microbes (IMO). IMO are organic liquids made from organic materials that are easily obtained from the surrounding environment and are used as a starter to establish the solid and liquid organic fertilizers [7].

Pineapple (*Ananas comosus* L.) is one type of fruit that is evenly distributed and easily available in Indonesia. Waste of fruit or pineapple peel after consumption can also be used as liquid organic fertilizer. Pineapple peel contained of 81.72% water, 17.53% carbohydrates, 4.41% protein, 20.87% crude fiber and 13.65% sugar. The nutrients that contained in the liquid organic fertilizers of wasted pineapple peel are 23.63 ppm P, 8.25 ppm K, 1.27% N, 27.55 ppm Ca, 137.25 ppm Mg, 79.52 ppm Na, 1.27 ppm Fe, 28.75 ppm Mn, 0.17 ppm Cu, 0.53 ppm Zn, and 3.10% organic C [8].

In addition to pineapple, cabbage also contained of water, protein, fat, carbohydrates, fiber, P, Fe, Na, K, Ca, vitamins (A, C, E, thiamine, riboflavin, nicotinamide), beta carotene and contains anthocyanins. The active substances in cabbage are sulforaphane and histidine [9]. Cabbage plants can also be used as organic fertilizer. Cabbage plants that are not marketable or are not qualified for consumption can be used as liquid organic fertilizer or IMO. The IMO of cabbage contains the highest organic P, Ca, Mn, and C compared to the IMO of papaya and the IMO of cow urine [10].

Based on the prior description, the application of chicken manure combined with IMO was expected to improve soil properties and increase direct nutrient cycles at the roots of rice plants, thereby promoting plant growth and yield. In order to promote it thoroughly, we need the proper combination of doses of chicken manure and IMO in increasing growth and yield of rice plants, so this study aims to determine the effect of interaction between doses of chicken manure combined with different types of IMO on growth and yield of rice plants.

2. MATERIAL AND METHODS

2.1. Material

The materials used in this study were rice plant seeds (Ciherang variety), chicken manure, IMO of leftover cabbage and pineapple fruit, and soil of rice field. The tools used are buckets, hoes, ovens, digital scales, rulers, analytical balances, cameras, and stationery.

2.2. Methods

This research was located at the Greenhouse of the Agroecotechnology Department, Faculty of Agriculture, Lambung Mangkurat University, Banjarbaru (3° 26' 35.5488" S 114° 50' 19.986" E) and was actualized from August to November 2020. The experimental design used was a Completely Randomized Factorial Design (CRD). The first factor was the dose of chicken manure (k) which consisted of 5 treatment levels, k_0 (0 t ha^{-1}), k_1 (10 t ha^{-1}), k_2 (20 t ha^{-1}), k_3 (30 t ha^{-1}), and k_4 (40 t ha^{-1}), and the second factor was the type of IMO (m) with 3 treatment levels, namely m_0 (control), m_1 (IMO of leftover cabbage), and m_2 (IMO of pineapple peel). Consisting of 15 treatment combinations and 2 repetition, so there were 30 treatment units.

The implementation of the research started from the establishment of the IMO. The leftover of cabbage and pineapple peels were fermented for 15 days in a confined space. After that, the Ciherang seeds went through method of good rice seeds selection using salt water. The seeds then were cleaned from salt water and the seeds were soaked again to help imbibition using water for 24 hours. Furthermore, the seeds are ripened using a wet cloth for 48 hours. During the ripening process, examination the growth of sprouts on the seeds was carried out, afterward the seeds were sow in the field for 20 days.

The planting medium was subtracted from rainfed rice fields in the Village of Timbaan, District of South Tapin, Regency of Tapin, Province of South Kalimantan. Soil was taken to a depth of 30 cm from the soil surface, then the soil was cleaned of plant debris and then stirred and mixed evenly. Furthermore, the soil was weighed 10 kg and then put it into experimental buckets. The results of the preliminary analysis data of soil as planting medium were presented in Table 1. The categories of characteristics of soil physical and chemical on rainfed rice field based on Eviati and Sulaiman [11].

The application of chicken manure and IMO was carried out after the preparation of the growing media. Each soil bucket was added with chicken manure at a dose according to the treatment specified. Then the soil bucket was added with water as high as 3 cm from the soil surface, and incubated for 2 weeks. During the incubation period the water level is maintained to analogize the soil conditions as in the field. Application of IMO of pineapple peel and cabbage residue was given 3 times, at the beginning of planting, 2 weeks after planting (WAP) and 5 WAP according to treatment specified with a dose of 30 mL L^{-1}. Planting rice seedlings, rice seedlings (Ciherang variety) were transferred to experimental buckets after 20 days in the

sowing nursery and two plants were planted for each experimental bucket.

Table 1. Characteristic of soil physical and chemical on rainfed rice field

Soil Properties	Amount	Categories*
Physical		
Texture (%)		Clay
- Sand	19.97	
- Slit	27.86	
- Clay	52.17	
Chemical*		
pH (H_2O)	5.12	Acidic
Organic C (%)	0.26	Very low
Total N (%)	0,08	Very low
Available P (mg kg^{-1})	7.95	Very high
Total P (mg 100 g^{-1})	453.13	Very High
Total K (mg 100 g^{-1})	35.31	High
Exchangeable Na (cmol(+) kg^{-1})	0.09	Very low
Exchangeable K (cmol(+) kg^{-1})	0.31	Moderate
Exchangeable Ca (cmol(+) kg^{-1})	1.53	Very low
Exchangeable Mg (cmol(+) kg^{-1})	0.46	Low
CEC (cmol(+) kg^{-1})	8.33	Low

Accumulation of harvest crop was carried out when the rice plant reached 125 days after planting (DAP) or had shown the following indicators: (a) all parts of the plant are yellow; (b) stems begin to dry out; (c) the grain was already difficult to break with nails [12].

Observation parameters consisted of: (1) the increment of plant height which was measured at 14 DAP and the first panicle appeared at least 3 buckets of plants or reached 60 DAP, (2) the number of tillers were counted at every clump per bucket when the plant reached 60 DAP, (3) the number of productive tillers were calculated from the number of tillers or stems which manifested panicles per clump before harvesting (13 DAP), (4) the weight of dry grain was measured at the time of harvest. The whole grain of each bucket was put into the oven and set the temperature of 65°C for 48 hours then weighed after roasting time finished, and (5) the weight of 100 grains of rice were measured at harvest time by weighing the selected 100 grains of rice.

3. DATA ANALYSIS

The experiments in this study were arranged using Completely Randomized Factorial Design (CRD). Observational data were analyzed by analysis of variance using Genstat 12th edition. The signification difference in variance between treatments was determined by the Duncan Multiple Range Test (DMRT) with a test level of 5%.

4. DISCUSSION

The results of the data analysis showed that there was no interaction between chicken manure (k) and IMO (m) on all observed variables. The effect that occurred significantly was only on each single factor. The chicken manure factor had significant effect on all observation variables and the IMO factor which only affected significantly the number of productive tillers.

4.1. Plant Height Growth of Rice

The results of the data analysis of variance showed that there was no interaction between application of chicken manure (k) and IMO (m) toward growth of plant height, but it had a very significant effect on each single factor of giving chicken manure dose and had no effect on the IMO treatment. The average increase in plant height can be seen in Figure 1.

The application of chicken manure had significant effect on the vegetative growth of rice plant height. The increase in height of rice plants in treatments k_1, k_2, k_3, and k_4 was significantly different from control (without treatment) and showed the growth of rice on plant height that applied with treatment had higher values. Plants could grow in the vegetative phase, presumably due to the influence of nutrients in the soil. The nutrients which

supplied through chicken manure such as substances of nitrogen (N), phosphorus (P), and potassium (K) were

The results showed that the application of different doses of chicken manure also differed productively in

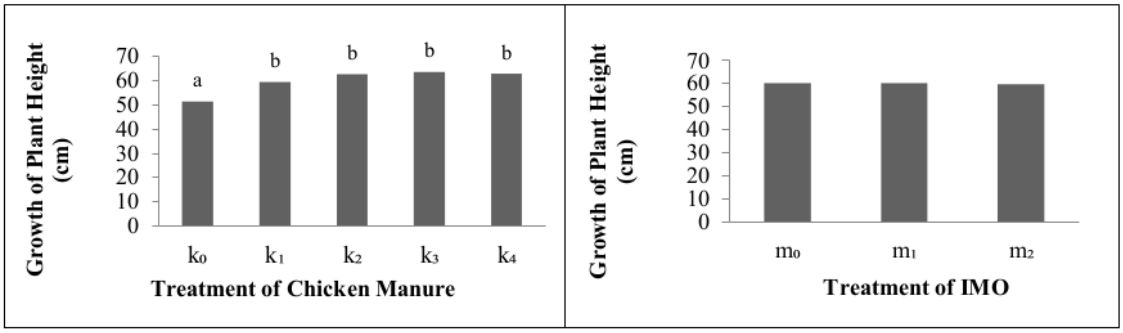

Figure 1 The mean values of growth on plant height from the dose of chicken manure and IMO.
Note: The values that shared the same letter over the bar showed that the treatment had no different effect based on the DMRT test at the level of 5%. Dosage of chicken manure: k_0 = 0 t ha^{-1}, k_1 = 10 t ha^{-1}, k_2 = 20 t ha^{-1}, k_3 = 30 t ha^{-1}, k_4 = 40 t ha^{-1}. IMO application: m_0 = without IMO, m_1 = IMO of cabbage, m_2 = IMO of pineapple peel.

able to support growth of plant height. Nitrogen was necessary for growth of stem and root. This was because chicken manure had a higher N content value of 1.82% compared to other animal manure fertilizers. Nitrogen in sufficient quantities played a role in accelerating vegetative growth of the stems and leaves of plants [13]. Jumar (565) also stated that organic matter was capable to provide essential nutrients in various stages of rice plants in acid sulfate soils. This statement was supported by Neni (142) which stated that nitrogen was very closely correlated with the development of meristem tissue, so it strongly supported plant growth such as plant height and number of tillers. Jumar (25) reported that IMO of fish amino acid (FAA) was able to increase plant height and number of tillers of rice from variety of Situ Patenggang, because the dose given was appropriate and suitable for the growth needs of rice plants.

4.2. Tiller numbers of Rice

The results of the analysis of variance showed that there was no interaction between chicken manure (k) and IMO (m) applied to the number of tillers, but it had a significant effect on the single factor of dose of chicken manure and had no significant effect on the IMO treatment. The results of number of tillers can be seen in Figure 2.

Tillers are shoots of rice that grow from the roots in the vegetative phase which determine the productivity of rice plants. Tillers of rice are a sign of healthiness of rice plant growth. The type of rice genetic variety and nitrogen function determined the number of tillers [17].

The tillers of rice in this research that planted in the planting medium were 2 tillers. Marlina (34) stated that the fewer rice tillers planted in planting medium, the less intraspecific competition, the more intensity of light received, the more chances for growing shoots and save production costs.

relation to number of tillers of rice plants. This is because in the process of forming tillers, rice plants require more P elements. Nutrients of P played a role in the process of respiration and plant metabolism, while N and K nutrients affected the increase in the number of tillers [19]. Yulianto (2167) described that nutrient of P on chicken manure was used to stimulate flowering, fruiting, root growth and seed formation. The nutrient of N was needed for vegetative growth of plants, stimulated overall growth, especially stems, branches and leaves, while the nutrient of K was needed for stronger stem growth, activator of enzymes in metabolism and transport of phosphorus. The nutrient of P played a role in the growth phase of plants and served to stimulate root growth and increase the number of tillers [21].

The test of DMRT showed that the k_1, k_2, k_3 and k_4 applications were not significantly different, so the selected treatment to recommended in increasing the number of tillers of rice plants was treatment k1 (10 t ha^{-1}) with an average of 14.00 tillers or 17.8% of increasing the number compared to control (0 t ha^{-1}). Chicken manure had a high P and K nutrient contents [22]. According to Zubaidah (2), the availability of P nutrients and the increase in P uptake by rice plants resulted in an increase in the number of tillers. Supported by the research of Saputra (3), that chicken manure had a significant effect in increasing the pH of peat soil. The increase in soil pH is positively correlated with the availability of nutrients for plants.

4.3. Productive Tiller Numbers of Rice

The results of the analysis of variance showed that there was no interaction between application of chicken manure (k) and IMO (m) and the number of productive tillers, but it had a very significant effect on each single factor of dose of chicken manure and on the IMO

treatment. The average number of productive tillers can be seen in Figure 3.

13.10 tillers or increment of 9.23% compared to no treatment (control) which only increased by 0.12%.

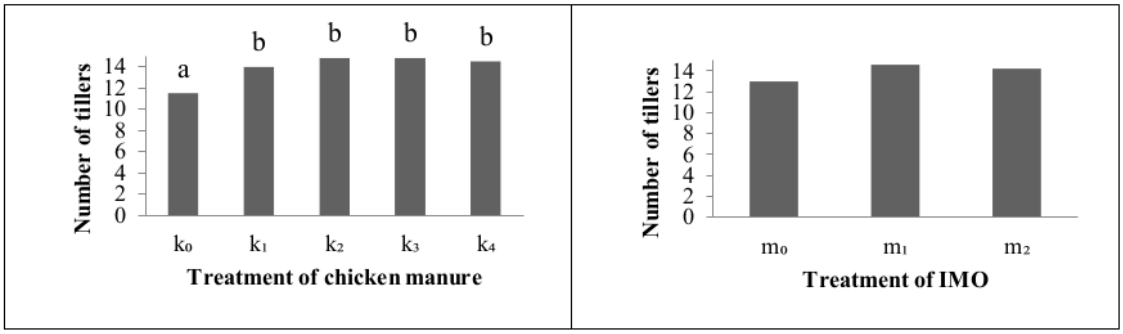

Figure 2 The mean values of tiller numbers on rice from the dose of chicken manure and IMO.
Note: The values that shared the same letter over the bar show that the treatment had no different effect based on the DMRT test at the level of 5%. Dosage of chicken manure: k_0 = 0 t ha^{-1}, k_1 = 10 t ha^{-1}, k_2 = 20 t ha^{-1}, k_3 = 30 t ha^{-1}, k_4 = 40 t ha^{-1}. IMO application: m_0 = without IMO, m_1 = IMO of cabbage, m_2 = IMO of pineapple peel.

Productive tillers were tillers that produce panicles and established after the plant enters the generative phase. Several certain tillers would experience emergence of panicles depending on the available nutrients. The number of productive tillers in each treatment was directly proportional to growth on number of tillers. The more the number of tillers that grow, the more the number of productive tillers produced and would affect crop yields. The results showed that 99% of the total tillers became productive tiller which mean that the treatment of chicken manure given to plants was sufficient for the nutrient needs of plant tillers to emerge panicles. These results are in line with the statement of Riyani (8) the formation of the number of productive tillers is related to the maximum number of tillers. The higher the maximum number of tillers, the more productive tillers produced. This is because the maximum tillers are able to produce panicles due to the small number of tillers so it minimized the competition for nutrients.

Observations on the number of productive tillers were carried out once the plants had issued panicles evenly before harvest or around 13 WAP. Based on the results of the analysis of variance, although there was no interaction between chicken manure and IMO, each single factor of giving chicken manure and IMO had a significant effect on the variable of productive tillers. This significant effect indicated that plants get sufficient nutrients in the growth process.

The DMRT test results showed that the dose of manure k_4 was significantly different to other dose treatments. The results showed that the best treatment in increasing the number of productive tillers of rice was k_4 treatment (40 t ha^{-1}) with an average productive tiller of 14.00 tillers or increment of 21.42%, while the IMO of pineapple peel (m_1) was not significantly different against treatment of MOL cabbage (m_2) and possessed the same average number of productive tillers, namely

Rice demanded sufficient nutrients during the vegetative phase to support optimal growth, thus influencing the number of productive tillers of rice plants produced. However, the number of productive tillers which were observed from this study were still relatively low, specifically 12-14 tillers when compared to those listed in the description about 14-17 tillers. This was presumably due to the age of the transfer of rice tillers to the observation planting medium at the age of 20 DAP, while the success of rice management was influenced by the nutrient availability and ability of plants to utilize environmental resources, one of which can be achieved through the use of appropriate seedling ages. According to Porong (37), the best recommended seedling age was 15 days after sowing (DAS) for transplanting, because production is significantly higher and the number of tillers is more than the age of 20 DAS, 25 DAS, 30 DAS, and 35 DAS. The faster the seedlings transplanted to the field, the more adequate they would be to adapt to the new environmental condition, so that they will be more adequate in the development of tillers and roots [27]. Napisah and Ningsih [28] also reported that the 15 DAS was the age for transplanting which was more adaptable to the environment.

4.4. Dry Grain Weight of Rice

The results of the analysis of variance showed that there was no interaction between application of chicken manure (k) and IMO (m) to the dry grain weight but it had a very significant effect single factor of dose of chicken manure dose and had no effect on the IMO treatment. The average dry grain weight can be seen in Figure 4.

Based on the results of the analysis of variance, it showed that the treatment of chicken manure had a significant effect on the dry grain weight. Dry grain weight is the total grain weight in one clump of rice

plants. The weight of dry grain per clump was influenced by the number of tillers, the number of productive tillers, the number of grains per panicle, pithy grains, and weight of 100 dry grains. Therefore, the number of tillers will affect the number of productive tillers. An important factor for obtaining high grain yields is the number of tillers and the number of panicles formed [29]. The more tillers that produce panicles, the more grain will be produced.

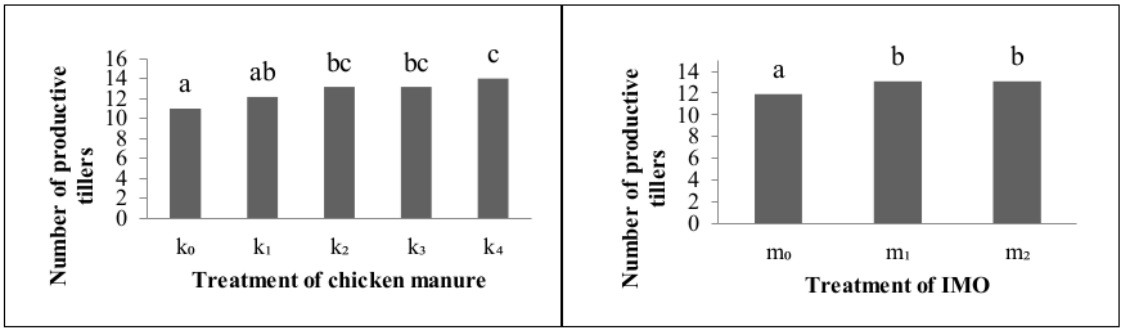

Figure 3 The mean values of productive tillers on rice from the dose of chicken manure and IMO.
Note: The values that shared the same letter over the bar show that the treatment had no different effect based on the DMRT test at the level of 5%. Dosage of chicken manure: k_0 = 0 t ha^{-1}, k_1 = 10 t ha^{-1}, k_2 = 20 t ha^{-1}, k_3 = 30 t ha^{-1}, k_4 = 40 t ha^{-1}. IMO application: m_0 = without IMO, m_1 = IMO of cabbage, m_2 = IMO of pineapple peel.

The results of observations of dry grain weight showed that the application of chicken manure gave a significant effect. The results of the average dry weight of grain in this study were ranged 23.00 g to 29.16 g. This was thought to have occurred because of the balance of the treatment of chicken manure given, so that when the grain filling process ran optimally due to the adequate supply of plant nutrients, it had a significant effect on levels of dose of k_2, k_3 and k_4 treatment that contrasted to control. The addition of chicken manure carried out at (2 weeks before planting) the time of tillage stage was thought to have succeeded in meeting plant nutrient needs, rice yields in the form of dry grain weight could be affected by plant growth such as plant height and the number of productive tillers that could be supplied from nitrogen nutrients. Nitrogen is a nutrient that plays an important role in the photosynthesis process in the vegetative phase, so that the photosynthetic process runs well and more photosynthate is produced so that it can increase the percentage of pithy grain and dry grain weight. The higher the uptake of nitrogen nutrients, the higher the yield of plants. The photosynthate produced during the photosynthesis process would be utilized by plants in physiological and metabolic processes such as cellular respiration and the formation of various organic compounds, used for filling seeds which in turn increased the pithy grain [30]. In addition, the nutrients N, P, K can affect the yield of rice plants by triggering the formation of flowers and rice grains.

The amount of grain produced from a panicle contained in a clump does not fully describe the potential number of results that will be obtained. The results showed that the k_2 treatment with the heaviest yield was 29.16 g or was able to increase the yield of rice plants by 44.9% and the lowest yield was in the k_1 treatment which was 23.00 g or only 30.2%. It showed that the results of the study obtained quite a lot of pithy grain even though the results between the doses of treatment were not significantly different.

Supartha et al. [13] stated that the content of micro and macro nutrients contained in chicken manure can increase plant growth and grain yield per clump. Chicken manure had a high content of K elements which could increase rice yields. The element K was an activator of several enzymes in plant metabolism and for the formation of adenosine triphosphate (ATP) and plays a role in determining grain size [32]. If the need for K elements did not meet the needs of the plant, the weight of the grain will decrease.

In addition to nutrients, other factors that affect crop yields were pests that attack plants when the rice plant released panicles or were during the fruit filling process. At the observations time, rice plants were being attacked by pests of *walang sangit* on the fruit which caused the decreasing of plant weight because many grains were not fully filled or become empty, as Purnomo [33] stated that pests and diseases that attack generated low grain weight per clump and validated by the large number of empty grains with characteristics such as brown spots on the grain due to the suction of fluids from these pests.

4.5. Weight of 100 Grains of Rice

The results of the analysis of variance showed that there was no interaction between treatment of chicken manure (k) and IMO (m) given to the weight of 100 grains, but it had a significant effect on the single factor of applied chicken manure and had no effect on the IMO treatment. The average weight of 100 grains can be seen in Figure 5.

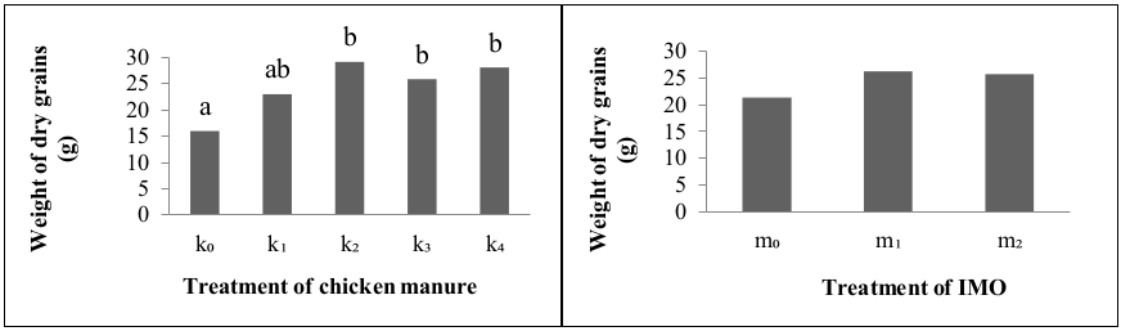

Figure 4 The mean values of dry grain weights on rice from the dose of chicken manure and IMO.
Note: The values that shared the same letter over the bar show that the treatment had no different effect based on the DMRT test at the level of 5%. Dosage of chicken manure: k_0 = 0 t ha^{-1}, k_1 = 10 t ha^{-1}, k_2 = 20 t ha^{-1}, k_3 = 30 t ha^{-1}, k_4 = 40 t ha^{-1}. IMO application: m_0 = without IMO, m_1 = IMO of cabbage, m_2 = IMO of pineapple peel.

The calculation of the potential yield of rice production can be done by weighing the weight of the rice grains. The weight of the rice grains is known by taking 100 rice grains that are pithy and then weighed using an analytical balance. The results of the weight of 100 grains of rice in this study obtained the average calculation results between 2.3 - 2.7 g, the application of k_2 treatment (20 t ha^{-1} of chicken manure) gave the best results in increasing the weight of 100 grains of rice which was 2.483 g or by 8.7% compared to without chicken manure treatment or control (k_0). If calculated in the weight of 1,000 grains, it's weight was only 24.3 g, which means it was still below the character from the description of Ciherang variety which stated that the weight of 1,000 grains of was 28 g [34]. The results of the analysis of variance in the DMRT 5% test showed that the application of chicken manure had a significant effect on the weight of 100 grains of rice, although there was no significant difference between the doses of the manure. This is presumably because the application of chicken manure had not been able to meet the nutritional needs of rice plants in the reproductive phase. This pattern could be seen in the results of the weight of grain content and the weight of 100 grains produced that was still low compared to the character description. The results were assumed that the rice plants were not given inorganic fertilizer (NPK) as additional fertilizer to meet the nutrient requirements to support the reproductive phase.

The insufficient yield of 100 grains was thought to be influenced by a shorter harvest time which was 113 DAS. The signs of maturity of rice plants to be harvested was started to appear but production was still not optimal. According to Jannah et al. [35], rice production was not optimal in this study, presumably because the harvest time was faster than it should be, in response to water shortages. Due to the reduced age of harvest, grain filling becomes less than optimal. If it is adjusted to the description of the Ciherang variety, rice plants should be harvested at the age of 116 to 125 DAS. Shorter harvesting time can affect the results of photosynthesis, and the results of photosynthesis can affect the level of grain maturity. The longer the time of photosynthesis, the more weight of grain formed at the time of seed filling.

In addition to the factor of filling seeds that are not optimal, environmental factors also affect the yield of 100 grains. Besides being affected by the age of harvest,

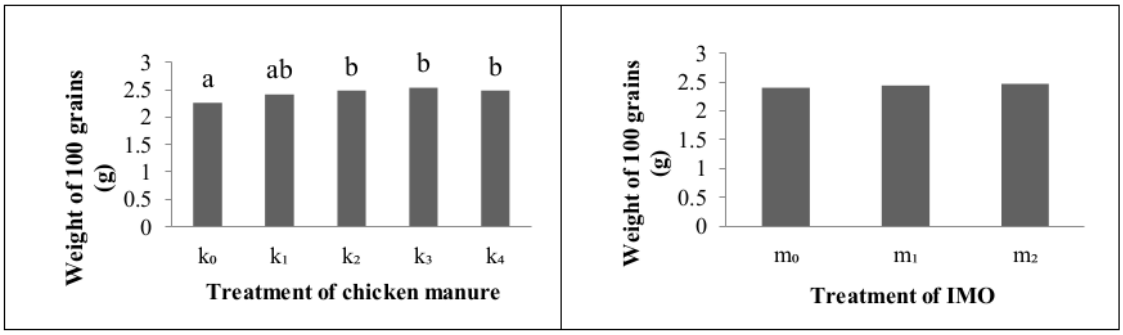

Figure 5 The mean values of weight 100 rice grains from the dose of chicken manure and IMO.
Note: The values that shared the same letter over the bar show that the treatment had no different effect based on the DMRT test at the level of 5%. Dosage of chicken manure: k_0 = 0 t ha^{-1}, k_1 = 10 t ha^{-1}, k_2 = 20 t ha^{-1}, k_3 = 30 t ha^{-1}, k_4 = 40 t ha^{-1}. IMO application: m_0 = without IMO, m_1 = IMO of cabbage, m_2 = IMO of pineapple peel.

the weight of 100 grains is also influenced by environmental factors in the seed maturation phase. The purity of the grain is largely determined by the guaranteed availability of nutrients and the assurance of plant physiological processes. The more grain that is formed, the higher the load on the plant to form grain that is full (piggy). This is in accordance with the research of Jannah et al. [35] that the characteristics of plants to produce pithy grain are not only influenced by genetic factors but also influenced by the availability of nutrients and the guarantee of plant physiological processes.

5. CONCLUSION

The best dose of chicken manure in increasing the growth of rice plants was the k_1 treatment (10 t ha^{-1}) which increased the plant height by 13.3% and the number of tillers by 17.8%. Treatment of k_4 (40 t ha^{-1}) could increase the number of productive tillers by 21.42%, while the yield of rice plants treatment k_2 (20 t ha^{-1}) which can increase the weight of dry grain by 44.9% and the weight of 100 grains of rice by 8.7% compared to the control treatment (k_0). The IMO of leftover cabbage and IMO of pineapple peel waste were able to increase the yield on the number of productive tillers by 9.23% respectively compared to no treatment (control).

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