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The Effect of Solid Organic Fertilizer and Liquid Cow Dung Fertilizer on Rice Growth (*Oryza Sativa* L)

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Abstract
This research was conducted in Sei Beras Sekata Village, Sunggal District, Deli Serdang Regency, North Sumatra Province. With an altitude of ± 25 meters above sea level. This study aimed to determine the response of rice growth (Oryza sativa L) to the provision of cow manure and liquid fertilizer. The design used was a Randomized Block Design (RAK) Factorial with the main treatment being solid organic fertilizer (A) with three treatments, namely L1 = (660 gr / Plot) 3 tons / Ha, L2 = (1100 gr / Plot) 5 tons / Ha, L3 = (1650gr / Plot) 7.5 tons / Ha. Organic fertilizer 3 treatments, namely, K1 = 2.5cc / liter, K2 = 5cc / liter, K3 = 7cc / liter. The parameters observed in this study were plant height per clump (cm), number of tillers per clump (stem), and number of productive tillers per clump (stem). The study showed that solid organic fertilizer treatment had no significant effect on all parameters. In contrast, liquid organic fertilizer significantly affected the number of productive shoots but did not significantly affect plant height per clump (cm) and number of shoots per clump (stems).

Keywords— : Paddy fields, solid organic fertilizer, liquid fertilizer

Introduction

Rice (Oryza sativa L) is an important food crop that is the staple food of more than half of the world's population, especially in Indonesia. Because it contains the nutrients needed by the body, the carbohydrate content of milled rice is 78.9%, protein 6.8%, fat 0.7%, and others 0.6%. Indonesia, as a country with a large population, faces challenges in meeting these food needs.(Hayati & Zayadi, 2020).

Based on the KSA Survey (Area Sample Framework) results, 2021 the rice harvest area reached around 10.41 million hectares or decreased by 245.47 thousand hectares (2.30 per cent) compared to 2020. Meanwhile, rice production 2021 was 54.42 million tons of GKG (Dry Milled Grain). If converted into rice, rice production in 2021 reached around 31.36 million tons or decreased by 140.73 thousand tons (0.45 per cent) compared to rice production in 2020. In addition to producing an estimate of the harvest area, the KSA Survey also provides an overview of other rice amat phases, such as the area of early vegetative phase, late vegetative, generative, potential for crop failure, and the area of rice fields and fields that are not currently planted with rice. (BPS 2022)

An effective and efficient way to increase national rice production sustainably is to increase productivity by properly selecting technology components and considering biotic environmental conditions, abiotic environments, and optimal land management. The use of planting system technology in rice cultivation is expected to affect production results and ultimately affect food farmers' income. The right cultivation technology is concerned with the use of superior varieties and the selection of the proper planting method.(Darmaja et al., 2022; Fahri, 2017).

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Cow dung contains nutrients, including 0.33% nitrogen, 0.11% phosphorus, 0.13% potassium, and 0.26% calcium. Compost is the best and most natural soil conditioner compared to artificial/synthetic conditioners.(Indriyani et al., 2022; Suliartini et al., 2024)(Bengkulu BPTP). The selection of cow dung is not only because this animal is one of the livestock that is widely kept by residents but is also based on several studies in the world of agriculture which show that the use of 20 t ha-1 of cow dung fertilizer can provide a grain yield of 1.21 t ha-1 on rice plants and the addition of manure with a dose of 30 t ha-1 can provide a rice yield of 5.9 t ha(Hafizah & Mukarramah, 2017; Mertha, 2019)

Liquid organic fertilizer is a fertilizer in liquid form that has several nutrient contents in it. One of the ingredients of liquid organic fertilizer is cow dung. Cow dung is a solid and liquid waste that is very easy to find in Indonesia because the amount is enormous (Purnamasari et al., 2022). Cows weighing 400-500 kg can produce a waste of 27.5-30 kg/head/day. Cow dung contains macro and micro nutrients needed by plants.(Mading et al., 2021; Zainuddin et al., 2020). Based on the description above, this research was conducted with the title The Effect of Giving Cow Manure and Liquid Organic Fertilizer from Cow Manure on the Growth of Rice (Oryza Sativa L).

Literature Review

Rice has a fibrous root system. The primary root appears along with other roots called seminal roots during the germination process. Adventitious roots then replace the seminal roots, which grow from the lowest nodes of the stem. The rice stem consists of several segments. When the rice plant enters the reproductive phase, some of the segments of the stem elongate. In rice, delicate, short hairs cover the parallel, lanceolate veins of the leaves. The flag leaf is located at the bottom of the stem and is wider than the upper leaves.(Nirwana, 2019; Pranata, 2022).

The rice plant flower is called a panicle, and each flower unit is called a spikelet. Spikelets consist of primary and secondary grain branches and consist of stalks, ovaries, lemmas (small parts of rice grains), pistils, and stamens, as well as several smaller organs.(Nugraha, 2022; Putri, 2021).

Three critical phases shape the growth of rice plants: vegetative, reproductive, and ripening. According to(Nirwana, 2019), the vegetative phase consists of the beginning of growth until entering the primordia phase. At the beginning of the reproductive phase, primordia begins, followed by the elongation of the rice stem segments. The last phase is the ripening phase, which lasts from the grain filling to the ripening of the grain.

Organic fertilizer is a type of fertilizer made from natural ingredients with a specific amount of nutrients. Organic fertilizer is one of the most essential ingredients to increase soil fertility.(Lepongbulan et al., 2017). Cow dung fertilizer is an organic fertilizer with the above properties. According to(Ihsan, 2018), Organic fertilizers have many advantages. They are environmentally friendly, provide plants with macro and micro nutrients, split the soil, improve soil structure, and increase the size of soil pores, improving water holding capacity and soil aeration. In addition, organic fertilizers can provide nutrients and energy for soil microorganisms. Organic fertilizers have several disadvantages, such as taking a long time to make, causing nutrient imbalances if using the same ingredients, using immature compost can interfere with plant growth and production, and containing heavy metals above the threshold.

Another way to increase soil fertility is by using organic fertilizer. Cow manure has several benefits, including improving soil structure and helping microorganisms in the soil break down organic matter. According to(Hafizah & Mukarramah, 2017), Cow dung is one type of manure with a high fibre content, such as cellulose, as indicated by the measurement of the C/N ratio parameter, which is relatively high, exceeding 40. In addition, this fertilizer also contains

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macronutrients such as 0.5 N, 0.25 P2O5, and 0.5% K2O with a water content of 0.5%, as well as other essential micronutrients. One of the materials that can be used to make organic fertilizer is cow dung (Budiayanto, 2011). The amount of organic fertilizer needed will increase according to the demand for organic products. This is because organic products have a better taste, are healthier, and are better for the environment, according to(Hafizah & Mukarramah, 2017).

Research Method

This research was conducted in Sei Beras Sekata Village, Sunggal District, Deli Serdang Regency, North Sumatra Province. With an altitude of ± 25 meters above sea level. The design used was a Randomized Block Design (RAK) Factorial with the main treatment being solid organic fertilizer (A) with three treatments, namely L1 = (660 gr / Plot) 3 tons / Ha, L2 = (1100 gr / Plot) 5 tons / Ha, L3 = (1650gr / Plot) 7.5 tons / Ha. Organic fertilizer 3 treatments, namely, K1 = 2.5cc / liter, K2 = 5cc / liter, K3 = 7cc / liter. The parameters observed in this study were plant height per clump (cm), number of tillers per clump (stem), and number of productive tillers per clump (stem). An analysis of variance was used to test the effect of treatment. To test mean differences between treatments, honestly, significant difference tests, regression, and correlation were carried out at a test level of 5%.

Results and Discussion

Result

1. Plant Height (Stem)

Data on the height of rice plants at the ages of 2,3,4,5,6, and 7 Weeks After Planting (MST) due to the provision of solid organic fertilizer and liquid fertilizer. The analysis of variance shows that the treatment of providing solid organic fertilizer and liquid fertilizer, as well as the interaction between the two treatments, had no significant effect on the height of part 32 rice plants at all observation ages.

Table1.Average Plant Height (cm) of Inpari 32 Rice in the Treatment of Solid Organic Fertilizer and Liquid Fertilizer at Ages 2,3,4,5,6 and 7 MST

Treatment	Plant Height					
	2 MST	3 MST	4 MST	5 MST	6 MST	7 MST
L1	29.71	33.77	43.79	50.61	59.75	67.6
L2	29.05	32.71	41.88	49.31	58.54	66.91
L3	27.65	34.68	42.92	49.51	61.57	69.73
K1	28.83	35.69	42.87	49.78	58.97	67.02
K2	28.6	33.16	43.33	49.72	59.56	66.92
K3	28.97	32.31	42.39	49.93	61.32	70.3
L1K1	29.71	34.74	46.41	52.42	61.34	68.86
L1K2	28.93	33.57	42.47	49.09	58.90	66.37
L1K3	30.50	33.00	42.50	50.30	59.00	67.58
L2K1	28.87	31.80	40.35	48.44	57.74	66.51
L2K2	29.47	33.72	43.60	50.18	58.82	68.21
L2K3	28.81	32.62	41.69	49.31	59.05	68.02
L3K1	27.92	40.53	41.87	48.49	57.83	65.70
L3K2	27.40	32.20	43.91	49.88	60.97	68.17
L3K3	27.62	31.30	42.98	50.17	65.90	75.31

Table 1 shows that the highest solid organic fertilizer treatment for plants at 7 WAP was the L3 treatment, and the lowest was the L2 treatment. In the liquid fertilizer treatment, the highest plants were in the K3 treatment, and the lowest were in the K2 treatment.

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2. Number of tillers per clump (stem)

The number of tillers per clump is due to the provision of solid organic fertilizer and liquid cow dung fertilizer. The analysis of the variance list shows that the treatment of providing solid organic fertilizer and liquid fertilizer, as well as the interaction between the two treatments, has no significant effect on the number of rice tillers.

Table2. Average Number of Tillers Per Clump (Stem) of Inpari 32 Rice in the Treatment of Solid Organic Fertilizer and Liquid Fertilizer.

solid organic fertilizer	liquid fertilizer			Average
	K1	K2	K3	
L1	20.27	20.27	22.13	20.89
L2	18.73	19.53	23.63	20.63
L3	21.17	21.47	20.83	21.16
Average	20.06	20.42	22.20	20.89

Table 2 shows the treatment of solid organic fertilizer, the highest number of plant shoots in the L3 treatment and the lowest number of plant shoots in the L1 treatment, while in the liquid fertilizer treatment, the highest number of shoots in the K3 treatment, and the lowest number of shoots in the K1 treatment.

3. Number of productive shoots per clump (Stem)

Data on the number of productive tillers due to the provision of solid organic fertilizer and liquid fertilizer, which the analysis of the variance list shows, significantly affects the treatment of liquid fertilizer per clump of 32 rice plants in part. In contrast, the treatment of solid organic fertilizer and the interaction between the two have no significant effect on the number of productive tillers per clump. In part 32 rice due to the treatment of solid organic fertilizer and liquid fertilizer can be seen in Table 4.

Table3.Average Number of Productive Tillers Per Clump (Stem) of Inpari 32 Rice Due to Solid Organic Fertilizer and Liquid Fertilizer Treatment.

Solid organic fertilizer	Liquid fertilizer			Average
	K1	K2	K3	
L1	14.17	16.13	18.83	16.38
L2	16.07	14.07	18.87	16.34
L3	15.77	17.37	17.60	16.91
Average	15.34b	15.86b	18.43a	16.54

Description: Numbers followed by the same letter in the same column and treatment group mean they are not significantly different based on the Duncan test at the 5% level.

Table 4 shows that treatment (K3) has the highest number of tillers, followed by Treatment (K2) and Treatment (K1). Treatment (K3) is significantly different from K2 and K1, while treatment K2 is not significantly different from K1. The effect of solid organic fertilizer on the average number of the highest productive tillers per clump of rice plants in treatment (L3), followed by (L1) and L2), can also be seen. The interaction of the two treatments of the highest productive tillers per clump was obtained in L2K3 and the lowest L1K1.

Figure 3 shows the effect of the liquid organic fertilizer dose on the number of productive shoots. The higher the dose, the greater the number of shots.

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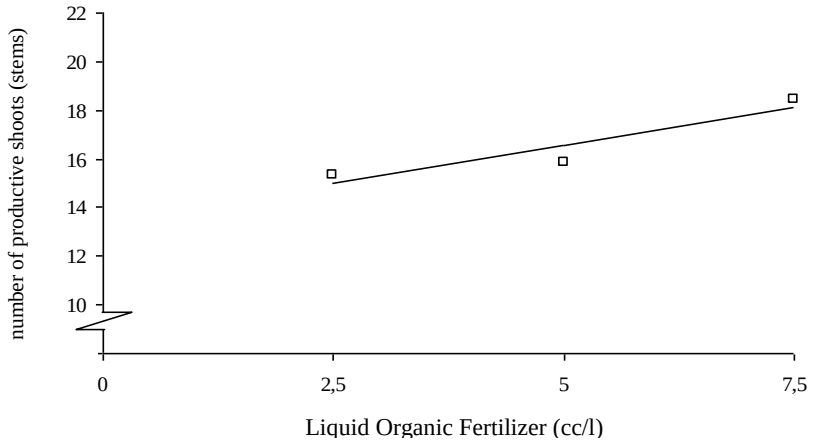

Figure 1. Effect of Liquid Fertilizer on the Number of Productive Tillers of Inpari 32 Rice Plants

Discussion

1. The effect of providing solid organic fertilizer on the growth of inpari 32 rice plants (Oryza sativa l).

The study results showed that the provision of solid organic fertilizer had no significant effect on plant height, number of tillers, or number of productive tillers. The advantages and benefits of solid organic fertilizer are increasing the diversity, population and activity of beneficial soil microorganisms, suppressing the development of pathogens (disease germs), containing macronutrients (P, N, K, Mg, Ca, and S) and micronutrients (Cu, Fe, B, Zn and others), increasing soil pH, increasing humus content in the soil, increasing soil looseness, efficiency of inorganic fertilizer use, increasing fertility and crop production(Wijaya et al., 2017).

Due to the dosage of fertilizer used, plant height, number of tillers, and number of productive tillers is not much. The effect of solid organic fertilizer on plants depends on the dosage of cow dung applied. Biologically, manure can increase the activity of beneficial microorganisms and other organic compounds in solid organic fertilizer. It can also increase the diversity and activity of microbes in the soil to increase nutrients and support plant growth.(Iswahyudi et al., 2020).

Plant growth is also influenced by soil factors and climate factors such as temperature, humidity, light intensity, soil texture, physical and chemical properties of the soil, CEC, and availability of nutrients. Good physical, biological and chemical properties of the soil are environmental conditions that positively affect plant growth and harvest yields.(Chen et al., 2018). Magnesium is a macro nutrient that is very much needed in the growth and production of rice, where Mg has a function in the process of photosynthate distribution, activator of the enzyme Ammonium Nitrate Reductase (ANR) and RuBP carboxylase so that it can increase photosynthesis activity and nitrogen assimilation (Marschner, 2012). In addition, Mg also plays a role in the physiological processes of plants(Chen et al., 2018)

2. The effect of giving liquid fertilizer on growth (oryza sativa L)

The analysis of the variance test showed that the liquid fertilizer treatment had a significant effect on the number of productive tillers but did not significantly affect plant height and number of tillers. Cow manure contains macro and micro nutrients needed by rice plants and also the process of improving the physical and biological properties of the soil so that plants grow well and produce a large number of productive tillers. Organic fertilizers have a good long-term effect on the soil. Namely, they can improve the structure of the organic content of the soil and produce

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agricultural products that are safe for health. Therefore, farmers are currently encouraging the use of organic fertilizers.

There are two types of organic fertilizers: solid organic fertilizers and liquid organic fertilizers. One of the essential ingredients for making liquid organic fertilizers is cow urine. The advantage of livestock urine as a liquid organic fertilizer is that livestock urine generally has a higher nutrient content than solid manure, so in its application, it is not as much as solid organic fertilizer and is much easier because it can be given by spraying or watering, and with the process the nutrient content can be increased (Nitrogen elements). Several mixtures are needed to make liquid organic fertilizer from livestock urine(Kurniawan et al., 2017).

Based on the initial soil analysis results, the nutrients have met the nutrient needs of rice plants. Hence, the content of N, P and K nutrients contained in liquid organic fertilizer is relatively low, where N (0.04%), P (0.06%) and K (3.64%) do not provide maximum results for the growth and production of rice plants but have met the needs in the formation of the number of tillers. Plants will not provide maximum results if the required nutrients are not available.(Effendi & Sahputra, 2021).

The table above shows the number of productive tillers per clump (stem) of paddy fields due to the liquid fertilizer treatment; the average number of productive tillers is the highest, followed by Level (K2) and Level (K1). The K3 treatment is significantly different from K2 and K1, while the average number of productive tillers per clump is the lowest in the K1 treatment. This occurs due to the fulfilment of nutrient needs in forming productive tillers, Taufiq et al. (2020).

3. Interaction Between Application of Solid Organic Fertilizer and Liquid Fertilizer on Rice Plant Growth (Oryza Sativa L.)

The study results showed that the provision of solid and liquid organic fertilizers had no significant effect on plant height, number of tillers per clump, number of productive tillers, number of unproductive tillers. Nutrient Content and Nutrient Availability: Organic fertilizers generally have lower nutrient content or slower release than inorganic fertilizers, so their effects on plant growth can take longer. Several studies have shown that plants need several growing seasons to respond to changes in nutrient availability from organic fertilizers. Then, if the dose or frequency of fertilizer application is not optimal, the effects may be less visible. Several studies have shown that adjusting the dose or combination of organic and inorganic fertilizers can provide better results. Soil properties, such as texture, pH, and microorganisms, affect how effectively plants can take up the nutrients in organic fertilizers. In certain soil conditions, nutrients in organic fertilizers may not be optimally available to plants(Asril et al., 2023).

Conclusion

The treatment of solid organic fertilizer had no significant effect on plant height, number of tillers, or productive tillers. The treatment of liquid fertilizer had a significant effect on the number of productive tillers at a level of 7.5 cc/l but was not significant on plant height or number of tillers. The interaction between solid organic fertilizer and liquid organic fertilizer had no significant effect on all parameters. Suggestion: Based on the study's results, further research can be conducted by increasing the treatment dose between solid organic fertilizer and liquid fertilizer concentration to achieve optimum production.

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