

EFFECT OF *RICE-STRAW COMPOST* FERTILIZER ON THE YIELD PERFORMANCE OF SULAWESI LOCAL AROMATIC RICE IN INDONESIA

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Abstract

A field experiment evaluated the effect of different doses of composted organic fertilizer made from rice straw on the yield of three local aromatic rice varieties of Luwu Regency in the safe growing season (rainy season). The local aromatic rice varieties were Ngappa, Sassa, and Latimojong varieties, and four doses of composted organic fertilizer from rice straw, namely 0, 4, 8, and 16 tons/ha, were used as treatment variables. The experiment was laid out in a Completely Randomized Block Design (CRBD) with two factors and three replications. At harvest, data were collected on various characters that contributed to the yield of aromatic rice. The results showed no characters were affected by the interaction of variety and compost dosage. Ngappa variety produced the highest dry grain yield per hectare with 3,834 kg/ha, while the highest average production of local Sulawesi aromatic rice was with the application of 16 tons per hectare of rice straw compost in this experiment which produced 4,241.78 kg of paddy per hectare.

Keywords—*Compost, Aromatic Rice, Local-variety, Yield*

Introduction

Soil fertility is currently declining and is one of the main problems, and efforts to add nutrients to the soil with uncontrolled use of inorganic fertilizers can reduce productivity and environmental quality (Kaya, 2018). Therefore, the addition of soil organic matter is very urgent to do, to restore soil fertility in the land. Adding organic matter can be done by utilizing rice straw compost organic fertilizer. Organic fertilizers such as Compost, in addition to providing nutrients for plants, can also improve soil's physical, chemical, and biological properties and maintain environmental balance. Rice straw is one of the materials that can and is easily used for making organic fertilizer because of the large amount of rice straw when the harvest season arrives. Usually, rice straw is only used as animal feed, and although some farmers put it directly into harvested agricultural land, the decomposition process is very slow in providing nutrients. According to Tekwa *et al.* (2010), the potential of rice straw is approximately 1.4 times the harvest. Farmers have not maximally processed a large amount of straw even though straw contains many nutrients needed by rice plants. One of them is straw processed into Compost. Rice straw produces 0.5 tons to 0.75 tons of Compost every 1 ton.

The use of rice straw compost, in addition to straw waste, is expected to improve the physical and sensory quality of the crop. Compost helps to increase the nutrient content in plants, which can affect aroma, flavor, and other qualities in aromatic rice varieties. In addition, the use of Compost can also increase the availability of micronutrients such as iron and zinc, which are essential for the synthesis of aroma compounds in aromatic rice.

Rice straw is high in organic matter, and its use in Compost will increase soil organic matter content. Organic matter is essential for improving soil fertility, increasing the soil's ability to store water, and providing essential nutrients for soil microbes and plants (Syawal *et al.*, 2017). The effect of Compost on the growth and production of local aromatic rice is also strongly influenced by genetic characteristics based on the inherent traits of the variety. Various local varieties of Sulawesi aromatic rice can be developed, such as Sassa, Ngappa, and Latimojong. A suitable combination of variety and rate of Compost dosage is necessary for better yield of Local Aromatic Sulawesi rice. Information on the varietal performance of aromatic rice and Organic Manure with Compost response are sporadic and scattered (Hossain *et al.*, 2008). Because the varietal response will be very different based on the type of variety (Jahan *et al.*, 2014), extensive research is necessary to determine the appropriate variety and optimum rate of Compost to obtain a satisfactory yield of these rice varieties. The present study was conducted to identify the suitable aromatic rice variety and determine the optimum Compost fertilizer rate for the Local aromatic rice cultivation in South Sulawesi, Indonesia.

Research Method

The research was conducted in Sampano village, Luwu Regency of South Sulawesi, from March to July 2022. The experiment was conducted in factorial design in a completely randomized Block design (CRBD) with three replication. The first factor is three local Aromatic rice varieties (Sassa, Ngappa, and Latimojong), and the second factor is Rice Straw Compost Application Dose with doses of 0, 4, 8, and 16 tons/ha, respectively. Thus there were 12 treatment combinations. Rice was planted in plots where samples were taken from each plot of as many as five plants. The treatment dose of Rice Straw Compost was given at planting time by mixing evenly on the plot after conversion. For grain yield parameters, an area of 1m² as an urban plot was harvested from the center of the plot, and the harvest data taken were seeds with 14% moisture content and expressed in tons/ha. Data collected on various parameters were tabulated and analyzed by analysis of variance (ANOVA) using STAR (Statistical Tools for Agricultural Research version 2.0.1) application. Influential parameters were tested for mean differences using Duncan's Multiple Range tests (DMRT) (Gomez and Gomez, 1990).

Results and Discussion

The results of the analysis of all parameters, none of the parameters were affected by the interaction between varieties and doses of rice straw compost, so the effect of treatment appears only on the single factor of varieties and doses of rice straw compost. Significant differences influenced by different varieties of local aromatic rice (Table 1) are the number of panicles per clump, the number of grains per panicle, the weight of 1000 seeds, the number of tillers, and the percentage of empty grains. Table 3 is the production/dry grain weight per hectare, which is also significantly different.

The highest number of panicles per clump was found in the Sassa variety (6.44 panicles), while the Ngappa and Latimojong varieties were statistically significantly different. Differences in their genetic makeup can cause variations in the number of panicles. Hossain *et al.* (2008) observed variations in vegetative and generative growth based on varietal differences. The results also showed a high number of grains per panicle in Ngappa and Latimojong varieties which were better than the Sassa varieties. Ezward *et al.* (2017) stated that varietal differences in the number of filled grains/panicles could be caused by differences in genetic constituents that also observe variations in grain weight. Significant differences were found in 1000-grain Weight among genotypes where Ngappa and Sassa's varieties were higher and significantly different from the Latimojong variety. Islam (2007). Grain yield significantly differed among this study's three local Sulawesi aromatic rice varieties (Table 3). The Ngappa variety produced the highest dry grain weight with 3,834 kg, significantly different from Latimojong (3,024.13 Kg), and the lowest was

the Sassa variety with 2,564 Kg. Hossain *et al.* (2008) reported that the yield of aromatic rice varied among rice varieties. The effect of variety on biological yield did show significant results.

Table 1. Differences in yield component characters of 3 local Sulawesi aromatic rice varieties

Varieties	Number of tillers	Number of panicles per clump	Number of Grain per Panicle	1000-Grain Weight	% Empty Grain
Ngappa	17.53 ^a	4.72 ^b	94.24 ^a	32.58 ^b	12.63 ^a
Sassa	16.32 ^a	6.44^a	83.31 ^b	33.50 ^b	12.50 ^a
Latimojong	18.68 ^a	4.48 ^b	95.57 ^a	34.75 ^a	13.38 ^a
Level of Significance	0.05	0.05	0.05	0.05	0.05

Similar letter (s) are not significantly different in a column, whereas dissimilar letters are significantly different as per DMRT.

Significant differences influenced by different doses of rice straw compost (Table 2) are the number of tillers, the number of panicles per clump, the number of grains per panicle, the Weight of 1000 grains, and the percentage of empty grains. In Table 3, dry grain production/Weight per hectare was also significantly different as influenced by the dose of Rice Straw Compost. The lowest number of tillers was in plants that were not treated with Compost (Control), while the highest number of panicles per clump, number of grains per panicle, and 1000-Grains Weight were those treated with 16 tons of Compost per hectare, as well as the lowest percentage of hollow grain, was in the application of 16 tons of Compost per hectare. Table 3 also shows that the highest dry grain production per hectare is in the application of 16 tons of rice straw compost per hectare.

Table 2. Effect of Application of Various Doses of Rice Straw Compost Fertilizer on Yield Components of Sulawesi Local Aromatic Rice

Rice-Straw Compost Dosage	Number of tillers	Number of panicles per clump	Number of Grain per Panicle	1000-Grain Weight	% Empty Grain
0 (Control)	13.81 ^b	12.92 ^d	131.17 ^d	32.67 ^c	19.91 ^a
4 ton/ha	17.23 ^a	15.11 ^c	148.18 ^c	35.33 ^b	14.46 ^b
8 ton/ha	19.82 ^a	17.07 ^b	158.48 ^b	35.78 ^b	10.74 ^{bc}
16 ton/ha	19.16 ^a	21.40 ^a	177.61 ^a	37.44 ^a	8.11 ^c
	0.05	0.05	0.05	0.05	0.05

Similar letter (s) are not significantly different in a column, whereas dissimilar letters are significantly different as per DMRT.

Table 3. Effect of Various Doses of Rice Straw Compost Fertilizer and Types of Varieties on the Yield of Sulawesi Local Aromatic Rice

Treatment	Dry Grain Weight/Ha (Kg)
Rice-Straw Compost Dosage	
0 (Control)	1,845.51 ^d
4 ton/ha	2,949.16 ^c
8 ton/ha	3,526.58 ^b
16 ton/ha	4,241.78^a
Varieties	
Sassa	2,564.13 ^c

Latimojong

3,024.13^b

Ngappa

3,834.00^a

Similar letter (s) are not significantly different in a column, whereas dissimilar letters are significantly different as per DMRT.

The addition of organic matter to paddy rice with different genetic variations of local Sulawesi aromatic rice varieties affects plant production organs such as the number of tillers, the number of panicles, the number of grains per panicle as well as the percentage of empty grains, and course dry grain per area (hectare). The effect of fertilization with organic fertilizer of 16 tons/hectare is the highest. Dry grain weight per hectare is the main parameter for production per unit of land area. The treatment of organic fertilizer doses aims to see the extent to which the production of some local Sulawesi aromatic rice varieties that are planted responds well. Higher doses of fertilizer were seen to have a significant effect on other treatment doses. Organic fertilizer improves soil texture and other soil physical characteristics. In general, after applying organic fertilizer treatment, the microbial content in the soil increases, so one of the advantages of organic fertilizer is to improve soil quality which ultimately affects plant growth and production (Adi & Puja., 2019; Li *et al.*, 2019).

The lowest yield was obtained by plants that were not applied Compost (Control). This means that the application of rice-straw Compost significantly affects the production of local Sulawesi aromatic rice varieties in this study. The treatment of 16 tons/ha of rice straw compost gave the highest yield, with 4,241.78 kilograms per hectare, in contrast to the control yield of only 1,845.51 kilograms. These results indicate that increasing the application rate of rice straw compost can significantly increase the biological yield of plants. The results of research by Kumar *et al.* (2003) and Bagas (2021) showed that the application of organic fertilizer doses improved rice plants' performance on plant dry weight variables and plant yield components. While Kaya (2018) found that applying straw compost together with NPK fertilizer can increase Nitrogen (N) uptake, independently straw compost can increase soil N and plant yield components. The dosing of 3 tons ha⁻¹ of straw compost and 150 kg ha⁻¹ of NPK fertilizer gave the highest nitrogen uptake of 3.51%. The provision of rice straw Compost is able to improve the performance of rice plants where some experiments also show significant results of rice straw compost on increasing rice production on land with suboptimal soil conditions such as (Masganti *et al.*, 2017) or ordo ultisol soil (Herman & Resigia, 2018)

Conclusion

There were no growth and production characteristics of local Sulawesi aromatic rice influenced by the interaction of varieties and doses of rice straw compost. However, on a single basis, varietal differences had a significant effect on the number of panicles per clump, the number of grains per panicle and the Weight of 1000 seeds, while the dose of rice straw compost had a significant effect on the number of tillers, the number of panicles per clump, the number of grains per panicle, the Weight of 1000 seeds and the percentage of empty grains. Ngappa variety produced the highest dry grain production per hectare with 3,834 kg/Ha, while the highest average production of local Sulawesi aromatic rice was with the application of 16 tons per hectare of rice straw compost which produced 4,241.78 kg of paddy per hectare in this study.

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