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RICE (*ORYZA SATIVA* L.) CROP RESPONSE IN TERMS OF GROWTH AND PRODUCTIVITY TRAITS TO FIELD FERTIGATION SYSTEM

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SUMMARY

Increased rice (*Oryza sativa* L.) production is no longer sufficient due to climatic factors and soil fertility; overcoming these problems requires irrigation and fertilization technology. The following study investigated the effects of a fertigation system via water management technology along with organic and inorganic fertilization on the productivity of rice (*Oryza sativa* L.), conducted in 2023 in the South Sulawesi Province, Indonesia. A nested factorial experimental design with three factors, namely, two water management systems (light surface and intermittent), three different types of organic fertilizers (silica, trichocompost, and harmony compost), and three doses of NPK fertilizer (250:150:100, 200:100:50, and 150:50:50), successfully transpired. The results showed the macak-macak irrigation system with a combination of organic and inorganic fertilizers gave the best outcomes for various parameters. These were the number of tillers, panicle length, and the number of panicle branches, 1000-seed weight, the number of hollow grains per panicle, and dry grain weight per plot. The type of organic fertilizer and the dose of NPK increased the percentage of plant height. The best productivity was evident at a dose of NPK 150:50:50 in intermittent irrigation with a combination of trichocompost organic fertilizer with an average value of 13.57 kg plot^{-1}. A combination of light surface irrigation with trichocompost fertilizer gives the best results.

Keywords: Rice (*O. sativa* L.), irrigation, organic fertilizers, NPK, silica, trichocompost, yield traits

Key findings: A considerable increase occurred in the production of lowland rice (*O. sativa* L.) by using irrigation management and organic and NPK fertilizers. These different inputs used through the fertigation system showed a significant influence on the lowland rice crop.

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INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important and desirable food crops used by more than one-third of communities as a staple worldwide (Donggulo *et al*., 2017; Aulia *et al*., 2022). The Indonesian people also have a very high demand for rice, and almost 95% of its population consumes rice as a staple, with a total consumption reaching 154 kg per person per year (Putri, 2024). This resulted in unmet rice needs due to rice production that has not been optimal because of various factors, including drought and limited supply of costly nutrients.

According to data from the Central Statistics Agency (2022) based on the results of the KSA, the rice harvest area in Indonesia in 2022 was approximately 10.61 million hectares. It had an increase of 194,710 hectares, or 1.87 percent, compared with the area of rice harvest in 2021 of 10.41 million hectares. The approximate rice production in 2022 is 55.67 million tons of GKG (milled dry unhusked rice), an increase of 1.25 million tons of GKG, or 2.31 percent, compared with the rice production in 2021, which was around 54.42 million tons of GKG. The estimated rice production in 2022 for population food consumption was around 32.07 million tons, an increase of 718,030 tons, or 2.29 percent, compared with the rice production in 2021 of 31.36 million tons. The drought conditions that hit various regions in Indonesia have become a threat every year for the agricultural sector, especially rice commodities. With a relatively high population and national rice consumption needs reaching 2.3–2.4 million tons per month, the availability of rice reserves is crucial. Moreover, it caused ongoing polemics, where some parties state that rice reserves are sufficient, while others worry that rice reserves are insufficient.

In overcoming the rice field problems, it is necessary to use a fertigation system that includes the application of different irrigation methods to manage the irrigation (intermittent and macak-macak) integrated with fertilizer application to get the optimal growth and productivity (Utami *et al*., 2016). Irrigation water is also an important factor in crop cultivation to determine the level of crop production. Similarly, inefficient use of water is one of the primary issues responsible for low rice production. Irrigation water has a considerable effect on the growth of plant availability, nutrients, and weed retrieval, eventually affecting rice productivity (Wahid *et al*., 2022).

Fertilization is also a vital effort taken in maximizing the crop yield and uses important technological components to meet the nutrient needs of crop plants (Barokah and Susanto, 2020). Proper fertilizer application will considerably affect plant growth (Benauli *et al.*, 2023). The fertilization treatment can be in the form of organic and inorganic fertilizers; however, according to Murnita and Taher (2021), the continuous use of inorganic fertilizers without adding organic fertilizers causes nutrient imbalances and damages soil structure and soil microbiology, which consequently results in the inability to maximize the highest production.

Therefore, the need for integrated fertilization is essential by adding organic fertilizers that can provide better nutrients required by crop plants, and not only macronutrients but also micronutrients (Ezward *et al*., 2017). Improved soil structural and biochemical composition will be more friable, and the plant roots will grow well and can carry out their function in absorbing nutrients desired by plants more optimally. Based on this, one can conclude that water management technology and the use of inorganic and organic fertilizers positively affect rice productivity. Hence, the presented study aimed to determine the effect of the fertigation system in the form of water management technology and inorganic and organic fertilization on rice productivity.

MATERIALS AND METHODS

Experimental location and procedure

The latest research on rice (*O. sativa* L.) ran from June to October 2023 in the Alausalo Village, Gilireng District, Wajo Regency, South Sulawesi Province, Indonesia. The research location has an altitude of 36 masl, with a coordinate point of 3°56′27.0″ S and 120°10′51.1″ E. Using the nested factorial design with three factors, the first factor was the water management system—light surface (a1) and intermittent irrigation (a2). The second factor was organic fertilizers—silica (J1), trichocompost (J2), and harmony compost fertilizer (J3). The third factor comprised three NPK fertilizer doses (250:150:100 = d1, 200:100:50 = d2, and 150:50:50 = d3). Therefore, 18 combinations of treatments entailed repeating three times, and the total experimental units were 54. The size of the experimental plot was 3 m × 4 m, and the rice experimental field area was about 0.15 ha.

Treatments

The irrigation water management system received adjustments to the treatment of farmers with a 5–10 cm high inundation system (starting from planting until harvest), while other treatments were from planting to the primordia of the light surface irrigation system (subsurface). Organic fertilizers' application, i.e., trichocompost, nanosilica, and harmony compost, was once at the same dose of 2 t ha^{-1} before planting. The inorganic fertilizers used were d1 (NPK Phonska, urea, and SP36 at 667, 333, and 139 kg ha^{-1}, respectively), d2 (NPK Phonska, urea, and SP36 at 333, 333, and 139 kg ha^{-1}, respectively), and d3 (NPK Phonska and urea at 333 and 222 kg ha^{-1}, respectively). Plant maintenance included replanting, weeding, irrigation, fertilization, and pest control, carried out as per the recommended technology.

Crop husbandry

The crop husbandry proceeded before planting by combing and leveling, then spraying herbicides, with the rice plots equipped with water intake and discharge channels. The rice cultivar Ciherang's seed sowing continued 15–17 days after scattering. The rice seedlings at the age of 17 days with two leaves reached transfer to the field for transplanting with planting of two stems per hole at a specified plant distance of 50 cm × 25 cm × 12.5 cm. Before planting, each rice plot attained labels according to the predetermined treatments to facilitate subsequent planting procedures and field observations.

Fertilization

Fertilization took place according to the treatments by using organic fertilizers, viz., nanosilica, trichocompost, and harmony fertilizer, with the inorganic fertilizer (NPK) given to each rice plot as per specified doses.

Parameters recorded and analysis

In paddy rice, the data recorded comprised plant height (cm), the number of tillers, the number of panicle branches, and grains per panicle. Others included filled grains per panicle, hollow grains per panicle, 1000-grain weight (g), dry grain weight per plot (kg), and dry milled grain weight per plot (kg). All observed data for all parameters underwent assessment using the analysis of variance (ANOVA) (Table 1). On getting the mean differences, further testing proceeded with the least significant difference ($LSD_{0.05}$) test. All data analyses transpired using Microsoft Excel 2021 software.

RESULTS AND DISCUSSION

The results showed highly significant interaction effects among the irrigation systems, types of organic fertilizers, and NPK doses on the number of tillers, panicle branches, and empty grains per panicle, 1000-seed weight, and dry grain weight per plot in rice (*O. sativa* L.). Furthermore, a significant interaction on plant height existed.

The silica organic fertilizer comes from silica-rich materials, such as rice husk ash, which functions to strengthen plants and increase resistance to stress. Trichocompost is a compost enriched with *Trichoderma* spp. fungi to accelerate the decomposition of organic materials and suppress pathogens. The Harmony compost fertilizer comes from organic waste fermented with microorganisms,

Table 1. Analysis of variance for various traits of rice.

Parameters	A	U (A)	J	D	J:D	A:J	A:D	A:J:D	MSE
Plant height	0.19^{ns}	9.23**	16.14**	2.01^{ns}	14.85**	1.79^{ns}	1.64^{ns}	2.36^{ns}	20.62
Number of tillers	82.05**	0.18^{ns}	6.82**	5.12*	1.82^{ns}	1.76^{ns}	2.17^{ns}	7.22**	7.38
Number of panicle branches	25.08**	0.77^{ns}	18.00**	2.45^{ns}	0.98^{ns}	16.15**	0.65^{ns}	4.92**	0.57
Grains per panicle	4.97*	1.01^{ns}	2.41^{ns}	2.11^{ns}	2.33^{ns}	2.00^{ns}	2.85^{ns}	1.34^{ns}	656.45
Filled grains per panicle	5.00*	0.98^{ns}	1.25^{ns}	0.59^{ns}	1.29^{ns}	0.86^{ns}	1.80^{ns}	0.93^{ns}	813.11
Empty grains per panicle	1.82^{ns}	0.60^{ns}	0.32^{ns}	3.66*	0.63^{ns}	3.21^{ns}	2.33^{ns}	2.68*	14.67
1000-seed weight (g)	0.63^{ns}	0.42^{ns}	0.40^{ns}	3.52*	2.61^{ns}	0.00^{ns}	0.57^{ns}	3.01*	7.05
Dry grain weight plot^{-1} (kg)	3.54^{ns}	1.63^{ns}	3.10^{ns}	0.35^{ns}	0.87^{ns}	1.41^{ns}	1.50^{ns}	2.70*	1.47
Milled dry grain weight plot^{-1} (kg)	4.26*	1.34^{ns}	0.30^{ns}	1.27^{ns}	1.41^{ns}	0.55^{ns}	1.83^{ns}	1.65^{ns}	2.10

Remarks: A = Irrigation systems, J = Organic fertilizer type, D = NPK fertilizer type, MSE = Mean squared error, *, ** = Significant at $P < 0.05$ and $P < 0.01$, respectively, and NS = Nonsignificant.

Table 2. Effect of fertilization systems on plant height (cm) of rice.

Treatments	d1	d2	d3
j1	$_{x}$113.86$_{q}$	$_{xw}$118.07$_{p}$	$_{x}$122.60$_{p}$
j2	$_{w}$112.72$_{q}$	$_{x}$115.90$_{p}$	$_{x}$117.60$_{p}$
j3	$_{w}$134.40$_{p}$	$_{w}$118.31$_{p}$	$_{w}$118.81$_{p}$
NP (j) BNT 0.05 = 5.3399	NP (d) BNT 0.05 = 5.3399		

Remarks: Numbers followed by the same letter in the main plot column (a,b), subplot column (p,q,r), and subplot row (w,x) mean not significantly different at BNTα=0.05 test; j1= silica, j2= trichocompost, j3= harmony compost, d1= 250:150:100, d2= 200:100:50, and d3= 150:50:50.

producing balanced nutrients that are good for plant growth. The results of the study showed the interaction of organic fertilizer and NPK dose had a significant influence on the height of rice plants (Table 2). On average, the recorded taller plants (134.40 cm) emerged with the application of harmony compost (2 t ha^{-1}). Compost proved more influential on plant height because it contains various nutrients and organic matter that support overall plant growth, including plant height. The NPK fertilizer alone also has a notable effect on plant height. Shwe *et al*. (2021) mentioned the addition of compost to the soil can enhance the efficiency of chemical fertilizers, increase plant growth, and maintain environmental sustainability. The highest average plant height (120.33 cm) resulted from the treatment of NPK (250:150:100) in combination with harmony compost. These results were greatly analogous to the previous research using NPK fertilizer (300 kg ha^{-1}), which also increased plant height (Made *et al.,* 2022).

The results further exhibited that the irrigation system and organic and NPK fertilizers considerably impacted the number of tillers in rice (Table 3). The highest average tillers (48.57) appeared in the intermittent irrigation treatment. This is because intermittent irrigation can optimize water absorption by crop plants, helping to regulate water supply efficiently and ensuring plants get enough nutrients for optimal growth. Wahid *et al.* (2022) also reported the intermittent water treatment gave the most number of tillers (32.07) in rice. According to Fadhilah *et al*. (2021), the application of silica can increase the growth rate and number of tillering in rice plants. Amalya *et al*. (2020) stated the combination of NPK fertilizer doses (300 kg urea, 50 kg SP-36, and 50 kg KCl ha^{-1}) with silica fertilizer had the best influence on N uptake and plant growth in black rice plants.

The results of the study showed an interaction occurred between the irrigation system, organic fertilizers, and NPK doses on the number of panicle branches (Table 4). The

Table 3. Effect of fertilization systems on the number of rice tillers.

Treatments		d1	d2	d3
	j1	$_{w}40.81^{a}_{p}$	$_{w}38.57^{b}_{p}$	$_{w}40.24^{b}_{p}$
a1	j2	$_{x}34.19^{b}_{q}$	$_{w}39.71^{a}_{p}$	$_{w}40.38^{a}_{p}$
	j3	$_{x}36.33^{b}_{pq}$	$_{wx}39.67^{a}_{p}$	$_{w}40.95^{a}_{p}$
	j1	$_{y}38.81^{a}_{q}$	$_{wx}43.48^{a}_{p}$	$_{w}48.57^{a}_{p}$
a2	j2	$_{x}39.38^{a}_{q}$	$_{x}35.95^{a}_{q}$	$_{x}41.53^{a}_{q}$
	j3	$_{w}46.86^{a}_{p}$	$_{w}41.00^{a}_{p}$	$_{x}40.67^{a}_{q}$
NP (a) BNT 0.05 = 4.52	NP (j) BNT 0.05 = 4.52	NP (d) BNT 0.05 = 4.52		

Remarks: The numbers by the same letter in the main plot column (a,b), subplot column (p,q,r), and subplot row (w,x) were not significantly different at the $HSD_{0.05}$ test; a1= intermittent, a2= macak-macak, j1= silica, j2= trichocompost, j3= harmony compost, d1= 250:150:100, d2= 200:100:50, and d3= 150:50:50.

Table 4. Effect of fertilization systems on the number of panicle branches of rice.

Treatments		d1	d2	d3
a1	j1	$_{w}11.67^{b}_{pq}$	$_{w}11.62^{b}_{p}$	$_{w}11.57^{b}_{p}$
	j2	$_{w}12.05^{a}_{p}$	$_{w}11.67^{a}_{p}$	$_{w}12.00^{a}_{p}$
	j3	$_{x}10.52^{b}_{q}$	$_{w}12.00^{a}_{p}$	$_{wx}11.43^{a}_{p}$
a2	j1	$_{x}13.05^{a}_{p}$	$_{w}14.62^{a}_{p}$	$_{w}14.85^{a}_{p}$
	j2	$_{x}11.43^{a}_{q}$	$_{w}12.91^{a}_{q}$	$_{x}11.29^{a}_{q}$
	j3	$_{w}12.24^{a}_{pq}$	$_{wx}11.43^{a}_{r}$	$_{x}10.86^{a}_{q}$
NP (a) BNT 0.05 = 1.26	NP (j) BNT 0.05 =1.26	NP (d) BNT 0.05 = 1.26		

Remarks: The numbers by the same letter in the main plot column (a,b), subplot column (p,q,r), and subplot row (w,x) were not significantly different at the $HSD_{0.05}$ test; a1= intermittent, a2= macak-macak, j1= silica, j2= trichocompost, j3= harmony compost, d1= 250:150:100, d2= 200:100:50, and d3= 150:50:50.

highest average number of panicle branches (14.85) resulted in the macak-macak treatment with silica fertilizer, with an NPK dose of 150:50:50 in rice plants. This is because macak-macak irrigation can keep the land moist without puddles, allowing the rice roots to still get enough oxygen, thus increasing the efficiency of nutrient absorption. Additionally, the number of panicle branches formed increased, which directly affects the number of rice grains produced (Table 5). In a study on various applications of irrigation techniques, it was evident that macak-macak irrigation was able to significantly increase panicle length and the number of panicle branches compared with other irrigation methods. This technique ensures even and optimal water distribution, which supports panicle growth and the formation of more branches, thus contributing to increased rice yields (Herdiyanti *et al*., 2021). Nanthana *et al.* (2022) said applying silica fertilizer remarkably increased the number of planters and panicles per plant, increasing overall productivity in rice varieties.

The findings revealed the observation parameter of the number of grains per panicle (Table 6) displayed the highest average number of grains per panicle (303.14), obtained in the irrigation with macak-macak treatment. Irrigation water supplied from sources that reached a reduction in number due to the dry season can be optimal for use in rice cultivation by using a macak-macak irrigation system (Idrus and Darmaputra, 2021). Borojeni and Salehi (2013) reported the maximum grain yield (5656 kg/ha) emerged with intermittent irrigation with an interval of two days in rice plants. The highest average number of grains per panicle (260.36 grains) succeeded in its production with the NPK fertilizer treatment (150:50:50) combined with trichocompost organic fertilizer. Intermittent irrigation with optimal water utilization was

Table 5. Effect of fertilization systems on the grains per panicle in rice.

Treatments		d1	d2	d3
a1	j1	218.95	207.43	208.00
	j2	208.14	217.05	217.57
	j3	207.00	235.86	214.33
a2	j1	221.29	206.43	216.38
	j2	212.28	232.67	303.14
	j3	227.00	219.76	236.05
$LSD_{0.05}$	NS			

Table 6. Effect of fertilization systems on the filled grains per panicle in rice.

Treatments		d1	d2	d3
a1	j1	202.52	187.14	184.38
	j2	195.24	198.19	197.29
	j3	181.24	224.86	195.29
a2	j1	210.57	193.43	207.33
	j2	201.29	217.72	265.86
	j3	211.57	200.52	212.71
$LSD_{0.05}$	NS			

able to produce more grains per panicle than the flooded and intermittent irrigation in rice plants (Wahid *et al*., 2022).

The study outcomes showed the observation parameter of the number of filled grains per panicle in rice plants (Table 7) gave the topmost average number of filled grains per panicle (265.86), coming from the macak-macak irrigation treatment. Macak-macak irrigation reduces plant stress that inhibits the formation of filled grains, and as a result, rice plants tend to produce more and larger grains. By studying the irrigation and fertilization system to improve plant growth, similar findings were noteworthy (Syafruddin, 2013). The better number of filled grains resulted from the combination of random water application with the provision of NPK fertilizer. The system of water supply randomly creates aerobic conditions that can reduce symptoms of iron poisoning and increase the number of filled grains with a reduced number of empty grains.

The results of the study showed intermittent treatment with a combination of silica fertilizer at an NPK dose of 150:50:50 had a very influential effect on the number of empty grains per panicle (Table 7), with an average of 19.86. Pratama *et al*. (2017) disclosed that grain filling requires an adequate water supply; thus, if there is a lack of water, it will hamper the grain-filling process with more empty grains. Plants need more water supply for the photosynthesis process and grain-filling process (Hidayati and Nurhidayati, 2024).

The findings of the study demonstrated an interaction of macak-macak treatment with organic silica fertilizer at an NPK dose (150:50:50) on the 1000-grain weight, providing the highest average (35.00 g). This is because the use of NPK combined with silica can help increase the efficiency of N, P, and K use, which ultimately supports panicle formation and increases the 1000-grain weight. A study showed a 42.98% increase in the grain's 1000-grain weight when treated with 125 kg/ha of silicon fertilizer together with basal fertilizer, compared to control conditions (Monika and Malhotra, 2022). Wei *et al*. (2009) reported the provision of Si can increase yield components, such as the number of panicles/panicle branches and the percentage of filled grains. Increasing yields with silica fertilizer causes the leaf position to be upright so that photosynthesis can be optimal. According to the findings of Gusmiatu and Marlina (2018), the use of organic fertilizers can reduce dependence on inorganic fertilizers in rice cultivation. The combination of NPK with

Table 7. Effect of fertilization systems on the empty grains per panicle in rice.

Treatments		d1	d2	d3
	j1	${}_{x}10.43^{a}_{p}$	${}_{wx}14.29^{a}_{p}$	${}_{w}19.86^{a}_{p}$
a1	j2	${}_{x}11.67^{a}_{p}$	${}_{wx}12.62^{a}_{p}$	${}_{w}18.57^{a}_{pq}$
	j3	${}_{w}15.09^{a}_{p}$	${}_{w}9.76^{a}_{p}$	${}_{w}13.05^{a}_{q}$
	j1	${}_{w}10.71^{a}_{p}$	${}_{w}12.52^{a}_{p}$	${}_{w}9.05^{b}_{q}$
a2	j2	${}_{w}11.00^{a}_{p}$	${}_{w}14.95^{a}_{p}$	${}_{w}12.38^{a}_{pq}$
	j3	${}_{x}12.10^{a}_{p}$	${}_{wx}14.24^{a}_{p}$	${}_{w}18.57^{a}_{p}$
NP (a) BNT 0.05 =6.37	NP (j) BNT 0.05 =6.37	NP (d) BNT 0.05 =6.37		

Remarks: The numbers by the same letter in the main plot column (a,b), subplot column (p,q,r), and subplot row (w,x) were not significantly different at the $HSD_{0.05}$ test; a1= intermittent, a2= macak-macak, j1= silica, j2= trichocompost, j3= harmony compost, d1= 250:150:100, d2= 200:100:50, and d3= 150:50:50.

Table 8. Effect of fertilization systems on the 1000-seed weight of rice.

Treatments		d1	d2	d3
	j1	${}_{w}31.00^{a}_{p}$	${}_{w}30.67^{a}_{p}$	${}_{w}31.00^{a}_{p}$
a1	j2	${}_{w}30.67^{a}_{p}$	${}_{w}31.00^{a}_{p}$	${}_{w}33.33^{a}_{p}$
	j3	${}_{w}30.00^{a}_{p}$	${}_{w}31.67^{a}_{p}$	${}_{w}32.67^{a}_{p}$
	j1	${}_{w}31.00^{a}_{p}$	${}_{x}25.67^{b}_{q}$	${}_{w}35.00^{a}_{p}$
a2	j2	${}_{x}28.67^{a}_{p}$	${}_{wx}31.33^{a}_{p}$	${}_{w}34.00^{a}_{p}$
	j3	${}_{w}32.00^{a}_{p}$	${}_{w}32.00^{a}_{p}$	${}_{w}29.00^{a}_{q}$
NP (a) BNT 0.05 =4.4145	NP (j) BNT 0.05 =4.415	NP (d) BNT 0.05 =4.415		

Remarks: The numbers by the same letter in the main plot column (a,b), subplot column (p,q,r), and subplot row (w,x) were not significantly different at the $HSD_{0.05}$ test; a1= intermittent, a2= macak-macak, j1= silica, j2= trichocompost, j3= harmony compost, d1= 250:150:100, d2= 200:100:50, and d3= 150:50:50.

Table 9. Effect of fertilization systems on the dry grain weight per plot of rice.

Treatments		d1	d2	d3
	j1	${}_{w}11.57^{a}_{pq}$	${}_{w}11.27^{a}_{p}$	${}_{w}10.43^{a}_{q}$
a1	j2	${}_{w}13.33^{a}_{p}$	${}_{x}11.17^{b}_{p}$	${}_{w}13.57^{a}_{p}$
	j3	${}_{w}10.63^{b}_{q}$	${}_{w}11.37^{a}_{p}$	${}_{w}12.30^{a}_{pq}$
	j1	${}_{w}12.83^{a}_{p}$	${}_{w}12.47^{a}_{p}$	${}_{w}11.87^{a}_{p}$
a2	j2	${}_{w}11.97^{a}_{p}$	${}_{w}13.40^{a}_{p}$	${}_{w}12.77^{a}_{p}$
	j3	${}_{w}13.53^{a}_{p}$	${}_{w}12.17^{a}_{p}$	${}_{w}11.77^{a}_{p}$
NP (a) BNT 0.05 = 2.015	NP (j) BNT 0.05 = 2.015	NP (d) BNT 0.05 = 2.015		

Remarks: The numbers by the same letter in the main plot column (a,b), subplot column (p,q,r), and subplot row (w,x) were not significantly different at the $HSD_{0.05}$ test; a1= intermittent, a2= macak-macak, j1= silica, j2= trichocompost, j3= harmony compost, d1= 250:150:100, d2= 200:100:50, and d3= 150:50:50.

animal compost and crop residue compost can increase rice production by 9.35%–11.4% (Tomar *et al*., 2018; Veronica *et al*., 2019). The treatment of organic fertilizers to rice plants also has reports of optimizing the beneficiaries of nitrogen in the soil and reducing the use of inorganic nitrogen fertilizers (Gosal *et al*., 2018; Yan *et al*., 2020).

Research on rice cultivation has shown that a combination of irrigation methods and organic and inorganic fertilizers can improve plant growth and yield. In this study, the highest dry grain weight per plot was successful with an average of 13.57 kg. The application of trichocompost fertilizer proved to significantly increase the dry grain weight of rice through improved soil health and

Table 10. Effect of fertilization systems on the milled dry grain weight per plot (kg) of rice.

Treatments		d1	d2	d3
	j1	8.57	6.60	6.53
a1	j2	8.13	6.63	8.27
	j3	7.90	6.50	7.73
	j1	9.40	8.00	8.87
a2	j2	6.97	10.07	8.07
	j3	8.97	7.63	7.37
$LSD_{0.05}$	NS			

increased nutrient availability. Trichocompost made from rice straw enriches the soil with organic matter and provides essential nutrients that contribute to increased productivity. Novriani *et al*. (2020) reported the use of 30 tons of trichocompost per hectare combined with NPK fertilizer resulted in an increase in rice yield of 4.6 kg per plot compared with other treatments.

The study results indicated the irrigation system provided a significant effect on the milled dry grain weight per plot. The average and highest milled dry grain per plot (8.50 kg) appeared in the macak-macak irrigation treatment. According to Taufiq *et al*. (2014), proper water management is one of the keys to success in increasing the yield of milled dry grain in paddy. Yulianto *et al*. (2020) also stated the comparison of productivity in the two watering systems showed using more water was not necessarily able to provide greater yields, and even the use of less water can produce higher production in rice.

CONCLUSIONS

Based on this completed research, one can conclude the macak-macak irrigation system with a combination of organic and inorganic fertilizers gives the best results on the studied parameters. These were the number of tillers, panicle length, the number of panicle branches (11.74), 1000-seed weight, the number of empty grains per panicle, and dry grain weight per plot (12.53 kg) (Tables 8, 9 and 10). The best productivity was visible at a dose of NPK 150:50:50 on intermittent irrigation with a combination of trichocompost organic fertilizer with an average value of 13.57 kg $plot^{-1}$. The results of the combination of organic fertilizer types and NPK doses can increase plant height parameters. The combination of light surface irrigation with trichocompost fertilizer gives the best results.

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