ISSN 2303-4521
Periodicals of Engineering and Natural Sciences *Original Research*
Vol. 9, No. 4, September 2021, pp.180-190

Fertilizer bio urine effectiveness test and the combination with chemical fertilizer on nutrient uptake and rice production

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ABSTRACT

The goal of the study was to determine the impact of applying bio urine fertilizers on soil chemical properties and rice yield in order to improve soil fertility. Randomized complete block design with 10 kinds of treatment had adopted in this study for three times. As part of the treatment, bio urine fertilizer and NPK fertilizer are used at various levels. As a result of these findings, the use of bio urine in conjunction with NPK fertilizer had a significant impact on pH as well as total N as well as available P and K as well as absorption of N, P and K, strawweight, dry grain weight and 1000 grain weight. As a result, rice plants can absorb more nutrients such as organic C, total nitrogen, existing P, K, N, P and K when combined with NPK fertilizer. 5.65 t ha-1 of rice was harvested using 30 ml of bio urine and 75 percent NPK fertilizer, while 4.01 t ha-1 of rice was harvested using the farmer's (control) method of treatment. It's 165.66 percent. When used at this dosage, the fertilizer is more in effect than standard fertilizers, and its economic test magnitude is about 1.42, making it a good choice for rice farming.

Keywords: Rice, the combination of fertilizer, bio urine, chemical fertilizers, nutrient uptake

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1. Introduction

The main commodity of people in Indonesia to agree with the food requirements of the population is rice crops. Rice (Oryza sativa L) stands for the foremost food crop in Asia [1] and is one of the most important staple foods for more than half of its population [2]. To ensure food security in the world's rice-consuming countries, large quantities of good quality rice are produced to meet society's needs in the future [3]. As the human population increases, it is imperative to raise rice yields on the residual agricultural land to meet present and upcoming food demands [4-8]. One of the obstacles to increasing rice production in Indonesia is the deterioration of soil quality. The decline in soil quality in Indonesia indicated that most rice fields in Indonesia are in a condition of soil sickness (soil sickness) with an indicator of soil organic C content of less than 2% due to the unbalanced use of organic and inorganic fertilizers. Extreme or unfitting use of inorganic fertilizers is a significant cause of nutrient imbalance in the soil, causing high losses, especially N from fertilizers, low N recovery (30%) [9], and low N use efficiency (around 35 %) [10] on rice. Unbalanced use of chemical fertilizers decreased soil fertility and reduced 38% of rice grain yield [11].

Organic fertilizers like chicken manure mostly have nitrogen compounds that are quickly mineralized to ammonia and nitrates [12, 13]. At the same time, cow dung is essential to the source of nutrients for plant production, rich in N content, and known as a substitute for inorganic fertilizers [14]. Organic fertilizer has excellent rice cultivation potential, which can function as soil fertilizer to supply nutrients for absorption by plants [15]. Besides, organic fertilizers are also an approach to enhance soil structure, increase nutrient content and produce sustainable crop yields that have high economic benefits [16-18]. N in organic fertilizers combined with N in chemical fertilizers has raised N use efficiency significantly, and it is easy to apply in rice fields [16, 19]. Organic fertilizers can partially replace chemical fertilizers, although organic fertilizers, either as a whole or partial substitution for inorganic N, do not significantly have impact on rice yields [20]. Several reported papers that organic fertilizers, combined with complete chemical fertilizers, significantly increased yield [21, 22]. Animal manure can be used as a substitute mineral N, which can be used as fertilizer to increase rice yields [23-25] Which can increase carbon (C) in the soil [25], can maintain soil structure and fertility[26, 27], and decrease mineral fertilizer input and ecological influences [28]. Manure is rich in nutrients for plants, easy to obtain, and can decrease mineral fertilizers' dependence. However, about 78% N of livestock manure is lost to the environment [29]; therefore, an alternative to substituting mineral fertilizers with manure is needed.

Among the various sources of organic matter, cow urine stands for a source of nitrogen. Analysing cow urine has shown that cow urine contains nitrogen, sodium, phosphate, sulfur, manganese, carbolic acid, iron, silicon, chlorine, salt, vitamins, A, B, C, D, and E, the mineral lactose, and hormone enzymes. Total N in cow urine ranges from 6.8-21.1 g N liters - 1 of which averages 69% urea, 7.3% allantoin, 5.8% hippuric acid, 3.7% creatinine, 2, 5% creatine, 1.3% uric acid, and 0.5% xanthine plus hypoxanthine, 1.3% nitrogen-free amino acids and 2.8% as ammonia [11]. The nutrient content in cow urine (bio urine), especially nitrogen, is much higher than other locally available fertilizers. Therefore, using livestock urine alone or combined with chemical fertilizers can increase soil and plant productivity. Urine enables farmers to reduce dependence and costs on fertilizers [14]. Based on the description, rice fertilization research was carried out using liquid organic fertilizers (Bio urine) and inorganic fertilizers (NPK). This study aimed to conclude the consequence of bio urine fertilizers and NPK on soil chemical features, rice yield and nutrient uptake.

2. Materials and methods

2.1. Site of research

The research was implemented in Bone Regency, South Sulawesi Province, Indonesia, from April to August 2017. The located at the position of 4 ° 13 '- 5 ° 6' South Latitude and 119 ° 42'-120 ° 30 'East Longitude. The average annual rainfall ranges from 1500-2000, starting from November to July with a temperate climate. Air humidity ranges from 95% -99% with a temperature of 26 ° C - 34 ° C. Ultisol soil type with a dusty clay texture, soil pH 5.01, total N 0.16%, 2.08% C-organic, P 17 ppm, K 135 me/100 gr.

2.2. Treatment details

Field experiments were arranged in a randomized complete block design (RCBD) with 10 treatment categories and 3 replications. A tested treatment was a combination of some bio urines and inorganic fertilizers (chemical fertilizers). (Table 1).

Table 1. The arrangement of treatment of bio urine fertilizers and chemical fertilizers on rice

Treatment	Urea	SP-36	KCl	Bio urine
		kg ha^{-1}		.ml liter water^{-1}
A = Without fertilizer (control)	0	0	0	0
B = Standar fertilizer(NPK 100%)	300	100	50	0
C = NPK 75%	225	75	37,5	0
D = Bio urine + NPK 75 %	225	75	37,5	10
E = Bio urine + NPK 75 %	225	75	37,5	20
F = Bio urine + NPK 75%	225	75	37,5	30
G = Bio urine +NPK 100%	300	100	50	10
H = Bio urine +NPK 100%	300	100	50	20
I = Bio urine +NPK 100%	300	100	50	30
J = Bio urine +NPK 50%	150	50	25	30

2.3. Crop management

The soil is thoroughly cultivated with a hand rotary plow (hand tractor), then a 5 m x 6 m plot is made, with a plot dividing 20-30 cm wide and 30 cm high. The rice variety used was the Inpari-42 variety, which was planted when the seeds were 17 days old with a spacing of 25x25 cm (tile system). The bio urine fertilizer application was carried out by spraying it on each experimental plot according to the concentration tested. Spraying is carried out in the morning around 09.00 - 10.00 and in the afternoon above 16.00. Spraying is carried out in the first week after the seeds are transferred to the field until the end of the study (before harvest) with an application time interval of once every seven days, spraying fertilizer evenly over the surface of the stems and leaves until wet.

Urea gave three times, first when the plants are ten days after planting, the second fertilization when the plants are 25 days after planting, and the third fertilization when the plants are 45 days after planting. SP-36 and KCl fertilization were given at the time of the first fertilization. Irrigation was carried out intermittently and ten days before harvesting water intake into the fields stopped. The first wedding was done manually at the age of 21 DAS, and then the plants were cultivated to be weed-free. Pests and plant diseases are controlled before and when there are symptoms of attack by spraying the plants with pesticides or insecticides. Plants are harvested by tuber when the plants have reached maturity; that is when the grain has been ripe yellow, at least 90% using a sickle, then knocked out in plastic bags, and the grain weighed for each experimental plot.

2.4. Soil sampling and analysis

At four different depths of 30 cm for each treatment, core samplers were used to accumulate soil samples. Soil samples can be analyzed to determine pH, C-organic, and minerals N, P, and K. Soil samples were extracted with 1 M KCl, followed by extraction steam distillation to determine mineral N [30]. Extracting 0.5 M sodium bicarbonate (NaHCO3; pH = 8.5; 1:20: soil / extractant) was used to determine the amount of P in soil samples [31]. The concentration of P in the extract can be measured colorimetrically [32].The existing K in the soil samples had extracted with 1 N ammonium acetate (NH4OAc, pH = 7.0) [30].

2.5. Plant sample collection and analysis

Grains and straw samples were dried in an oven at 50 °C to determine nitrogen concentration in the straw samples using the micro-Kjeldahl method after rice harvest. For example, the molybedo-phosphoric acid method requires that plant samples be digested in acid (HNO3/HClO4; 4:1), followed by estimation on a spectrophotometer after developing a yellow color. Potassium concentration had determined employing a flame photometer of the identical used extract for determining P. N, P, and K uptake by rice and straw computed by multiplying the plant's total dry matter yield by the relevant nutrient concentrations [33].

2.6. Observation of crop yields

Grain yield per plot (kg plot^{-1}), obtained from the yield of 2,5 m x 2.5 m, the yield of grain converted to tons ha^{-1} with K.A. 14% = (100-KA GKP / 86 x yield of plots)

2.7. Effectiveness of bio urine fertilizers

The effectiveness of bio urine is known by using the calculation of Relative Agronomic Effectiveness (RAE) as used by [34] as follows:

$$RAE = \frac{\text{The yield on tested fertilizers - yield on control}}{\text{The yield on standard fertilizers - yield on control}} \times 100\%$$

2.8. Test the economic effectiveness of bio urine fertilizer

The economic effectiveness test of fertilizers is used to determine whether the fertilizers used have good economic value. If the value produced is more than one, the tested fertilizer has an excellent economic value [34].

$$\text{The economic effectiveness of fertilizers} = \frac{P \times Q}{C}$$

P = price of grain Rp. kg $^{-1}$

Q = dry grain yield tons ha^{-1}

C = expenses, including the purchase of fertilizer Rp. ha^{-1}

2.9. Statistical analysis

The data on diverse parameters had tested by means of one-way analysis of variance (ANOVA), according to the Complete Randomized Block Design (CRBD) using SPSS. Then other treatments had carried out with further tests using Duncan's multiple distance test (DMRT). The treatments that were significantly different at $p < 0.05$ had been significant statistically. A statistical significance for coefficient of determination (R2) was tested using the F test. R2 was significant at $p < 0.05$ and $p < 0.01$, signified as * and **, respectively.

3. Consequences

3.1. Availability of nutrients in the soil

The research results indicate that there has been an increase in nutrient availability in the known soil by comparing the initial soil data (before the study) with the data from the soil analysis after the study in Table 2.

Table 2. Effect of bio urine fertilizer with chemical fertilizer on soil nutrient availability

Parameter	Before Study	Treatment A	B	C	D	E	F	G	H	I	J
pH	5,01	5,01 ^{a}	6,23 ^{ab}	6,21 ^{b}	6,23 ^{ab}	6,20 ^{b}	6,79 ^{d}	6,65 ^{cd}	6,25 ^{bc}	6,56 ^{cd}	6,41 ^{c}
C-org(%)	2,08	2,08	3,31	3,42	3,43	3,51	3,48	3,47	3,39	3,32	3,00
N tot(%)	0,16	0,16 ^{a}	0,20 ^{bc}	0,18 ^{ab}	0,17 ^{b}	0,21 ^{c}	0,21 ^{c}	0,20 ^{bc}	0,19 ^{b}	0,18 ^{ab}	0,16 ^{a}
P_2O_5 available(ppm)	17,0	17,0 ^{a}	20,0 ^{ab}	23,0 ^{b}	24,7 ^{b}	24,6 ^{b}	25,0 ^{bc}	18,2 ^{a}	20,2 ^{a}	25,0 ^{bc}	21,5 ^{ab}
K_2O available(ppm)	60,0	60,0 ^{a}	107,9 ^{c}	97,8 ^{b}	83,3 ^{a}	100,0 ^{b}	109,2 ^{c}	93,0 ^{b}	75,0 ^{a}	102,0 ^{b}	61,0 ^{a}

Note: The value on the same line followed by the similar letter has no significant difference based on the DMRT test at the 5% level

A = without fertilizer (control)
B = standar fertilizer (NPK 100%)
C = NPK 75%
D = bio urine 10 ml +NPK 75%
E = bio urine 20 ml +NPK 75%
F = bio urine 30 ml +NPK 75%
G = bio urine 10 ml +NPK 100%
H = bio urine 20 ml +NPK 100%
I = bio urine 30 ml +NPK 100%
J = bio urine 30 ml + NPK 50%

3.2. Crop Yield

Dry straw weights ranged from 3.25 to 5.83 tons ha^{-1}, where the weight of dry straw with 75% NPK + 10 ml and 20 ml bio urine was not significantly different from standard fertilizer treatment (NPK 100%). Increasing the dose of bio urine up to 30 ml combined with 75% NPK fertilizer gave the highest strawweight (5.85 tons ha^{-1}) and was significantly different from standard fertilizer (100% NPK). There was an increase in dry strawweight of 38.7% compared to standard fertilizers. Dry grain weights ranged from 4.01-6.65 tons ha^{-1}, and the highest yield was gotten in a treatment of 75% NPK fertilizer + 30 ml bio urine and was significantly different from standard fertilizer (NPK 100%), where there was an increase in dry grain weight. 41% compared to controls in Table 3.

Table 3. Effect of bio urine fertilizer with chemical fertilizer on strawweight and dry grain weight

Treatment	Straw dry weight (t ha^{-1})	Dry grain weight (t ha^{-1})	Grain weight 1000 grains (g)
A = Without fertilizer (control)	3,25 ^{c}	4,01 ^{cd}	27,12 ^{d}
B = Standar fertilizer (NPK 100%)	4,20 ^{b}	5,00 ^{ab}	28,14 ^{cd}
C = NPK 75%	3,85 ^{bc}	4,50 ^{cd}	27,52 ^{cd}

D = Bio urine 10 ml +NPK 75%	4,10 [b]	4,62 [c]	28,23 [abc]
E = Bio urine 20 ml +NPK 75%	4,00 [b]	4,85 [bc]	28,31 [abc]
F = Bio urine 30 ml +NPK 75%	5,83 [a]	6,65 [a]	29,33 [a]
G = Bio urine 10 ml +NPK 100%	5,12 [a]	5,15 [ab]	28,68 [ab]
H = Bio urine 20 ml +NPK 100%	4,83 [ab]	4,75 [bc]	28,23 [abc]
I = Bio urine 30 ml +NPK 100%	4,98 [ab]	5,07 [ab]	28,38 [abc]
J = Bio urine 30 ml +NPK 50%	3,50 [bc]	4,55 [c]	27,08 [d]

Note: The exact line's value, followed by the same letter, shows no significant difference based on the DMRT test at the 5% level.

3.3. N, P, and K uptake

The maximum N uptake was obtained in treatment F, namely applying 30 ml bio urine 75%+ NPK fertilizer and the first treatment, using 30 ml bio urine +100% NPK fertilizer. Treatment A without giving fertilizer or control and treatment C or giving NPK fertilizer, 75% showed the lowest N uptake. The highest P uptake was also obtained in treatment F and I, while the highest K absorption was obtained to treat bio urine 30 ml+NPK 100%. To determine the effectiveness of bio urine application to the nutrient content of N, P, and K in rice plants, in Figures 1–3.

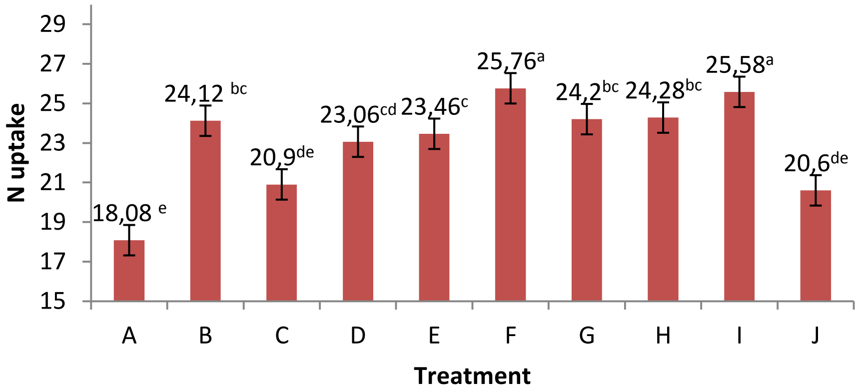

Figure 1. Effect of bio urine with NPK fertilizer on N uptake; the bar line shows a standard error of a mean. A mean value of N uptake followed by dissimilar letters was significantly different ($p < 0.05$) with Duncan's multiple range test (DMRT)

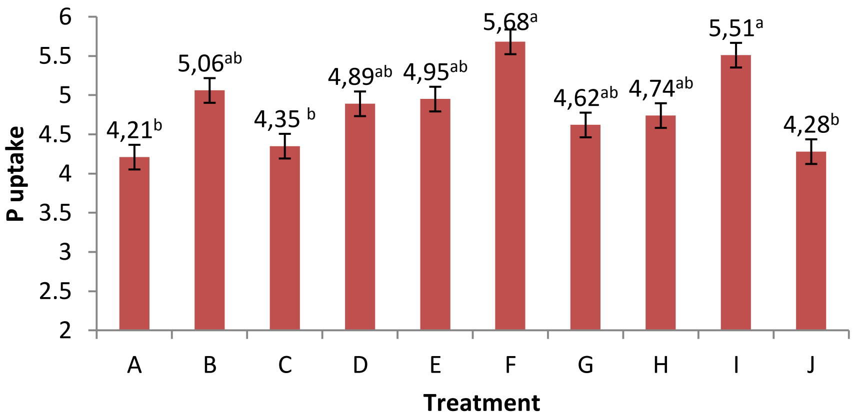

Figure 2. Effect of bio urine with NPK fertilizer on P uptake; the bar line shows a standard error of the mean. The mean value of P absorption followed by dissimilar letters was significantly different ($p < 0.05$) with Duncan's multiple range test (DMRT)

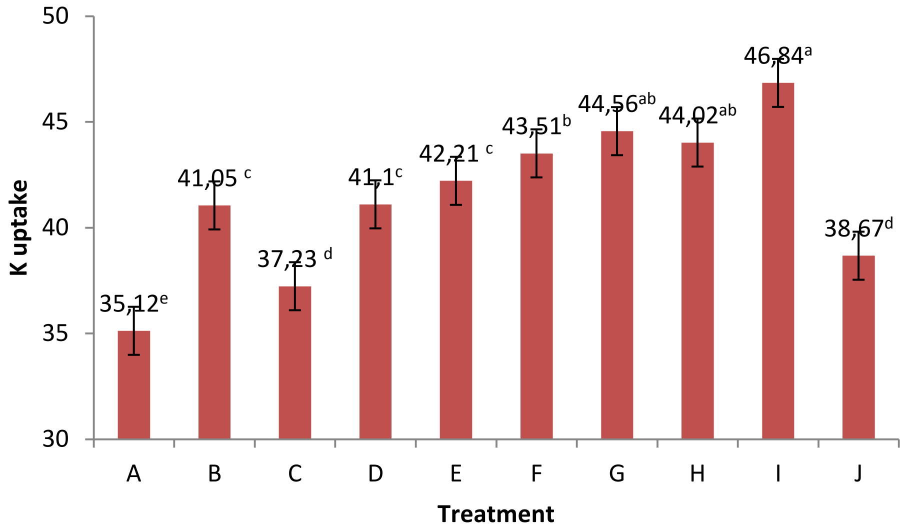

Figure 3. Effect of bio urine with NPK fertilizer on K uptake; the bar line shows the standard error of the mean. The mean value of K absorption followed by different letters was significantly different ($p < 0.05$) with Duncan's multiple range test (DMRT)

3.4. The Relative of Agronomic Effectiveness of Agronomy (RAE) and the economic effectiveness test of fertilizers

The 30 ml bio urine fertilizer +75% NPK fertilizer treatment gave the highest RAE value of 165.66. The treatment effectively increased the dry grain weight and had the highest economic effectiveness value of 1.42 compared to other treatments. NPK fertilizer with bio urine fertilizer on the relative value of agronomic effectiveness and the economic test value of fertilizers in Table 4.

Table 4. Effect of bio urine fertilizer with NPK fertilizer on the relative value of agronomic effectiveness (RAE) and the economic effectiveness test of fertilizers

Perlakuan	REA (%)	The Economic Effectiveness of Fertilizer
A = Without fertilizer (control)	-	1,07
B = Standar fertilizer (NPK 100%)	100	1,26
C = NPK 75%	49,50	1,15
D = Bio urine 10 ml +NPK 75%	61,62	1,18
E = Bio urine 20 ml +NPK 75%	84,65	1,23
F = Bio urine 30 ml +NPK 75%	165,66	1,42
G = Bio urine 10 ml +NPK 100%	115,15	1,29
H = Bio urine 20 ml +NPK 100%	74,75	1,19
I = Bio urine 30 ml +NPK 100%	107,1	1,26
J = Bio urine 30 ml +NPK 50%	54,55	1,16

4. Discussion

4.1. Availability of nutrients in the soil

Soil pH and soil organic C. In general, there had been an increasing in soil pH from 5.01 (initial soil conditions) in all treatments and was significantly different from the treatment without fertilization (control) ($P < 0.05$). Soil pH increases for the better, that is, approaching the pH towards the neutral. At neutral pH, microorganisms' activity will increase the soil's decomposition process, which can free cations that can be exchanged or adsorbed. The highest increase in pH was obtained in the treatment of using 75% inorganic fertilizers combined with 30 ml of bio urine (Table 2). The three factors that determine changes in soil pH according to [35] are: (1) the percentage of saturation of bases and aluminum and bases can exchange from the colloidal complex, (2) types of micelles, and (3) types of ion adsorbed. The four parameters observation of soil organic C content and urine bio fertilizer provision increased the soil organic C content. The addition of bio urine fertilizer can provide a high C contribution to soil and plants. The increase in soil C content was due to the contribution of nutrients from the soil organic fertilizer decomposition process [35, 36] stated that giving organic fertilizers added organic carbon to the soil and returned soil nitrogen [35] asserted that the primary source of C in the soil comes from the decomposition of organic fertilizers in the form of dead plant and animal remains. Total soil N content Table 2 shows an increase in the soil's total N (initial soil conditions) from 0.16% - 0.21%. The indicates an increase in total N levels by 30% from the initial conditions or in the treatment without fertilization (control). Fertilizer sprayed on plants can also be absorbed in the soil so that the residual fertilizer enters the soil and is food for soil organisms [35] stated that fungi could remodel plant tissues, release C and N nutrients, utilize some of these nutrients and release some together with carbon dioxide and ammonium. The highest total soil N content was obtained using 30 ml urine bio fertilizer +75% NPK fertilizer and had a significant effect ($P < 0.05$). Administration at this dose is thought to increase the total N in the soil. Bio urine fertilizer has an N content of 0.350% so that it breaks down quickly and provides additional N into the soil.

The element P is indispensable in the generative phase of plants. The element P plays an essential role in seed filling. The combined application of bio urine and inorganic fertilizers for specific doses can increase P levels in the soil. The P content increases the residual bio-urine fertilizer sprayed on the plant that enters the soil. The soil can absorb it, thereby automatically increasing the absorption of nutrients by external mycelium by expanding the surface of root absorption or through the results of chemical compounds that cause nutrient bonds released in the soil [37]. Likewise, the K element is also essential during the plant generative phase. The residual urine biofertilizer sprayed on plants can be absorbed in the soil, thereby increasing the soil's K content. The increase in soil P and K levels from soil conditions before being given the highest treatment obtained in each treatment combination of 30 ml bio urine fertilizer +75% NPK fertilizer and 30 ml bio urine fertilizer +100% NPK fertilizer and had a significant effect on the treatment without fertilization (control).

4.2. Uptake of N, P, and K of Rice Plants

The maximum N nutrient uptake was shown by treating 30 ml bio urine+75% NPK fertilizer. Because the soil's nutrient supply is insufficient, but the additional N, P, and K nutrients are available from organic fertilizers (bio urine). The addition of bio urine fertilizer was able to increase plant N uptake by 63.5%. The highest N uptake achieved in treating 30 ml of bio urine fertilizer+75% NPK fertilizer. The corresponds to the soil's total N content, where the higher the total N soil, the N uptake will also increase. Meanwhile, the application of fertilizer at this dose can raise the total N soil by 30%. Increasing the organic matter content in the soil will increase the uptake of plant N. N uptake in rice plants augmented by providing organic fertilizers compared to organic fertilizer [38]. Besides that, its high concentration causes this fertilizer to make it more quickly available to plants. High inorganic fertilizers' application reduced N uptake and rice yields compared to combining organic and inorganic fertilizers. Organic fertilizer treatment significantly raised soil organic matter and nutrient content compared to chemical treatment [20, 39]. The enhanced soil microbial biomass and activity by urine bio-fertilizers are favorable for N immobilization in the pre-growth stage and consequent re-mineralization [40], and thus raise the uptake of N by plants. P elements in the soil and their absorption by plants are strongly influenced by soil conditions, climatic conditions, and plants' ability to absorb nutrients from the soil. The element P is one of the elements that must be provided from the early stages of growth to ensure profitable growth until the generative phase. The high P uptake in the treatment was caused by soil inorganic P's contribution from SP-36 and direct absorption through stomata due to bio urine spraying. Besides, the micro-climatic conditions during plant growth are sufficiently following the conditions for growing rice plants to allow rice plants to carry out their physiological processes well and the nutrient absorption process to take place properly. Potassium is a nutrient classified as a luxury consumption [41] because whatever is available in the soil solution will be absorbed by plants without causing poisoning.

4.3. Rice yields

The combination of bio urine fertilizers with inorganic fertilizers has higher rice yields than the control (farmer's method). Following the research of [42], which combines inorganic fertilizers and organic fertilizers, it can reduce the use of chemical fertilizers without reducing hybrid rice yields and can increase the growth, yield, and components of rice yields. In [43], they suggest that organic fertilizers can help restore soil health. Still, it is not sufficient for plant nutritional needs, so that organic fertilizers need to be combined with inorganic fertilizers to get optimal results. Likewise, the results of [11] researched that the combined application of NPK + manure resulted in a significant increase in rice and wheat yield of 58 and 141%, respectively, compared to the control (without manure). In [44], also reported that organic fertilizers combined with adequate nutrients could increase yields. The process of cell division cannot be separated from the plant body's physiological activities, which are influenced by the presence of IAA (Indol Acetic Acid). IAA is an auxin type of ZPT that provides cells' development for plant growth so that rice plants grow well. Inorganic fertilizers can provide nutrients in the available form to plants to quickly get the nutrients they need. The process of cell division cannot be separated from the plant body's physiological activities, which are influenced by the presence of IAA (Indol Acetic Acid). IAA is an auxin type of ZPT that provides cells' development for plant growth so that rice plants grow well. The highest yield is in the combination of bio urine fertilizer with inorganic fertilizers, where at this dose, suspected that the plant nutrient needs had been met [37]. According to [37], one factor supporting plant growth and production is nutrients. Nutrients must be available in sufficient quantities so that growth and production will be optimal. Inorganic fertilizers can provide nutrients in the available form to plants to quickly get the nutrients they need. Treatment with 30 ml bio urine+75% NPK fertilizer got the best results, presumably because the N element in bio urine with inorganic fertilizers is different. At this rate, it can meet plant needs. Bio urine contains N in a form that is not available to plants, requires a mineralization process to be absorbed by plants. In contrast, the N element in urea is functional in large quantities to be directly absorbed by plants [45]. Based on some of the research results obtained, it shows that inorganic fertilizers need to be combined with liquid organic fertilizers to increase rice yields. In [16], they reported that cow urine combined with chemical fertilizers increased rice productivity by 21% compared to chemical fertilizers alone [46] showed an increase in soybean yields with organic fertilization compared to conventional processing. The generally recognized organic fertilizers (bio urine) can improve soil physical and chemical properties, increase soil nutrient conservation and promote plant growth [47-49]. The availability of nutrients that are not limited to organic fertilizers such as N, P, and K can also increase rice productivity [49]. Thus, compared to chemical N, organic fertilizers combined with chemical N have a positive effect on soil productivity and result in sustainable yield growth. Organic fertilizers rich in nutrients are an adequate substitute for reducing chemical fertilizers' costs [50]. However, excessive use of bio-organic fertilizers should be avoided, especially in soil, to reduce the risk of toxic effects from reduced metabolic intermediates [51]. The use of chemical and organic fertilizers in an integrated manner increases plant growth and increases rice yield and quality [50].

4.4. Value of Relative Agronomic Effectiveness (RAE) and Fertilizer Effectiveness Test

The RAE value shows how effective the fertilizer is to standard fertilizers, where the RAE value of standard fertilizers is 100%. The F, G, and I treatments are 30 ml bio urine+ 75% NPK, 10 ml bio urine +100% NPK fertilizer, and 30 ml bio urine +100% NPK fertilizer can be said to be more effective than the use of standard fertilizers on rice plants. The combination of NPK and bio urine fertilizers at these doses is used as an alternative to inorganic fertilizers. Specifically, F treatment can make the use of inorganic fertilizers more efficient in rice cultivation. The fertilizers' economic test is intended to determine whether the tested fertilizers are suitable and profitable as a business-oriented business. The economic test had done by calculating the ratio of revenue to income and expense, including fertilizer. Based on the economic difficulty results, the treatment of 30 ml bio urine +75% NPK fertilizer gives the highest effectiveness test value even though other treatments are also feasible in rice farming because all treatments have a fertilizer effectiveness test value> 1 the same results obtained from the research [52-54] aim to determine the optimum and economical dose for producing rice in saline and char lands ecosystem; the results show that the treatment combination is economically feasible to develop with indicators of marginal cost changes more significant than 2. MBCR of all plots compared to controls ranging from 2.43 - 3.40, which is higher than the permit capability limit (2.00).

5. Conclusion

The results showed that NPK fertilizer joint with bio urine fertilizer could raise soil pH and some organic C, full N, existing P, K, N, P, besides K uptake in rice plants. A maximum yield for rice had gotten in a treatment of 30 ml bio urine 7+5% NPK fertilizer, namely 6.65 t ha^{-1}, while the lowermost yield had been gotten in a farmer (control) method for treatment 4.01 t ha^{-1}, so that there had been an increasing of 41%. The

Relative Agronomic Effectiveness (RAE) magnitude is 165.66%. Using fertilizer at this dosage has higher effectiveness as compared with standard fertilizers. The value for economic test for fertilizers is about 1.42, consequently it is appropriate for rice farming.

Acknowledgments

Thanks for P.T. Mandiri Massadidu. They collaborated and financed this research and the extension workers assigned to the research location, and the implementing farmer groups to complete this research.

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