

REDUCTION OF INORGANIC FERTILIZER AND APPLICATION OF ORGANIC FERTILIZER IN RICE PLANT

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ABSTRACT

The massive use of inorganic fertilizers without adequate organic fertilizers will cause land and plant productivity to decline. This study aims to obtain a combination of organic and inorganic fertilizers and their effect on rice production. The study used a Randomized Block Design with three replications and four treatments, namely a) full inorganic package (200 urea + 200 kg Phonska), b) organic fertilizer + 75% inorganic fertilizer, c) organic fertilizer + 50% inorganic fertilizer, d) organic + 25% inorganic fertilizers. Organic fertilizers are given as essential fertilizers, while half of the inorganic fertilizers are given when the plants are planted and the rest when the tillers are active. The results showed that: 1) Applying a combination of organic and inorganic fertilizers increased the percentage of productive tillers, weight of 1000 grains and weight of dry grain harvested per hectare. 2) Application of organic fertilizer + 75% NPK can increase grain weight by 4% compared to using only NPK fertilizer. The results of the study recommend that fertilizing rice with a combination of organic fertilizer + 50% NPK needs to be considered for increasing paddy grain production and improving the quality of rice fields.

Keywords: Reduction, Fertilizers, Organic, Inorganic, Rice.

INTRODUCTION

Increasing national rice production is achieved by intensification or extensification. The provision of nutrients is part of agricultural intensification, intending to increase production. However, the productivity level of paddy fields continues to decline. The use of inorganic fertilizers causes this condition to be massive without offsetting the use of organic adequate. Balanced nutrients are crucial to increasing crop yields (Mi et al., 2018; Gosal et al., 2018). The provision of nutrients disproportionately has led to mining nutrients from the soil, lowering plant productivity and the health of plants and soil (Veronica et al., 2019; Gosal et al., 2018). Fertilization with an unbalanced chemical NPK ratio has resulted in soil-related problems, such as acidic soil (Chen 2006), reduced organic matter, structural damage, and reduced biological activity and soil fertility (Zhong and Cai, 2007). As a result, crop yields have stagnated (Ladha et al., 2003). The system of managing integrated nutrients is an alternative and a marked reduction in the inputs of inorganic fertilizer and the combined use of inorganic fertilizers with organic material such as dung, crop

residues, green manures and compost (Negassa et al., 2007; Tomar et al., 2018; Gosal et al., 2018). Inorganic fertilizer NPK combined with fertilizer-based organic is a practical way in the sustainable agriculture system in the land paddy in low productivity (Mi et al., 2018). Organic fertilizers with a total N < 4% effectively increased growth and yields in the second year after being applied continuously (Moe et al., 2019). Rice productivity increased by 9.35 to 11.4% with the combination NPK with animal compost or combination NPK and compost plant residue (Tomar et al., 2018; Veronica et al., 2019). The system of planting rice-wheat with the management of nutrients unified can increase the production of two plants (Sharma et al., 2019). Besides increasing rice production, composting also increases pH, CEC, available P (Mi et al., 2018). It was also reported that the provision of fertilizer organic in rice crops optimises N beneficiaries in the soil and reduces the use of inorganic nitrogen fertilizer (Yan et al., 2020; Gosal et al., 2018). Thus the potential of organic fertilizer is expected to overcome the problem of farmers regarding the low levels of organic matter in paddy fields. The use of

organic fertilizers combined with inorganic fertilizers is expected to provide sufficient nutrients for rice plants. So it is necessary to study the effect of organic and inorganic fertilizer on paddy plants' production and protect the environment by replacing chemical fertilizers with organic fertilizers that have received increased attention in recent years (Geng et al., 2019; Tang et al., 2018). This study aimed to know a combination of organic and inorganic fertilizers and their effect on rice production.

RESEARCH METHOD

Research carried out in rice fields Subak Lepud, Village Baha of the month August - November 2020. Ciherang variety were planted of 14 days age after the nursery. The solid organic fertilizer used the compost produced from the local Simantri group with the composition (Table 1).

Table 1. Composition of cow dung compost

| Parameter | Results | Methods | Information |
|--------------------------|------------|------------------|-------------------|
| pH | 7.85 | H ₂ O | Slightly alkaline |
| C - Organic | 26.17% | Walkley&Black | Very high |
| N - Total | 1.43% | Kjeldahl | Very high |
| P- Available | 324,34 ppm | Bray | Very high |
| K- Available | 555.29 ppm | Bray | Very high |
| Air dry moisture content | 11.95 | Gravimetry | - |

Source: Laboratory of Land, Faculty of Agriculture Unud, 2020.

Research design used was Randomized Completely Block Design (RCBD) with four treatments and three replications. The treatment:

A : Full organic package : (200 urea + 200 kg Phonska)

B: Organic fertilizers + 75% inorganic fertilizer (150 kg + 150 kg Urea Phonska)

C: Organic fertilizer + 50% inorganic fertilizer (100 kg urea + 100 kg Phonska)

D: Organic fertilizer + 25% inorganic fertilizer (50 kg urea + 50 kg Phonska)

Organic fertilizer is given as basal fertilizer, while the inorganic fertilizer is given half the plant and rest when active tillering. Paddy plant observations included the number of tillers, percentage of productive tillers, panicle length (cm), 1000 grain (g) weight harvested dry grain (ton-ha). The data analysis by variance analysis, and if the treatment had a significant or very significant effect, continued with the 5% LSD test.

Results and Discussion

The research results showed that four fertilization treatments showed growth and different grain weights (Table 1 and 2). Percentage of tillers productive shows the differences between NPK fertilized alone with organic + NPK. The lowest percentage of productive tillers occurred in treatments that were only given NPK, while the highest percentage of tillers occurred in organic fertiliser treatment + 75% NPK (Table 1). Differences do not follow differences in productive tillers in panicle length. The average panicle length between NPK and organic fertilizer with NPK combinations ranges between 26 cm - 27 cm, with the lowest panicle length in the treatment of organic fertilizer + 25% NPK.

Table 2. Effect of inorganic and organic fertilizers on the number of rice tillers

| Treatment | Maximum number of tillers | Number of productive tillers | Percentage productive tillers (%) |
|-----------------------|---------------------------|------------------------------|-----------------------------------|
| A = NPK 100% | 15.33 a | 10.67 a | 69.58 a |
| B= Organic + NPK 75% | 14.00 b | 12.33 b | 92.76 c |
| C= Organic + 50% NPK | 16.33 d | 13.67 c | 83.58 b |
| D = Organic + 25% NPK | 12.00 a | 11.00 a | 83.26 b |
| LSD 5% | 0.943 | 1.116 | 2,288 |

Notes: Numbers followed by the same letter in each of the same columns indicate a non-significant difference in the 5% LSD

The application of inorganic and organic fertilizers increased the weight of 1000 grains. The application of organic fertilizer + NPK 75% increased the weight of 1000 grains by 3.43% compared to only fertilized with NPK (Table 2).

Table 3. Effect of inorganic and organic fertilizers on panicle length, the weight of 1000 and weight of harvested dry grain.

| Treatment | Panicle Length(cm) | Weight 1000 grains (g) | Weight of harvested grain ha ⁻¹ (tons) |
|-----------------------|--------------------|------------------------|---|
| A = NPK 100% | 26.00 a | 27.87 a | 6.53 b |
| B = Organic + NPK 75% | 26.67 a | 31.30 c | 6.93 c |
| C = Organic + 50% NPK | 27.00 a | 30.43 bc | 6.83 c |
| D = Organic + 25% NPK | 26.00 a | 29.93 b | 6.10 a |
| BNT 5% | ns | 1.348 | 0.223 |

Notes: Numbers followed by the same letter in each of the same columns indicate a non-significant difference in the 5% LSD

The highest yield of the dry grain harvest was obtained in the treatment of organic fertilizer + 75% NPK and able to increase grain weight by 4% compared to NPK fertilizer alone. This difference occurs because the grain yield is the final production of the rice plant, it is very dependent on environmental factors during the phases of rice plant growth. Grain filling is highly dependent on the assimilation produced after anthesis, while the storage capacity (sink) is highly dependent on the condition of the plant before anthesis (Evans, 1975).

Leaves are essential variables in predicting plant production because leaves can provide building materials through photosynthesis. The number of leaves is related to leaf area (Vegeta. 1990). The higher the number and area of leaves, the greater the rate of photosynthesis; by itself, the photosynthate produced is also high,

manifested in grain weight. In line with the results of research by Gusmiatun and Marlina (2018), the use of organic fertilizers can reduce the use of inorganic/chemical fertilizers. Rice productivity increased from 9.35-11.4% with a combination of NPK with livestock compost or a combination of NPK and crop residue compost (Tomar et al., 2018; Veronica et al., 2019)

CONCLUSION

The results of the study can conclude: 1).The combination of organic and inorganic fertilizers increased the percentage of productive tillers, the weight of 1000 grains and the weight of dry grain harvested per hectare. 2) The application of organic fertilizer + 75% NPK can increase grain weight by 4% compared to using only NPK fertilizer. 3) Fertilization of rice with a combination of organic fertilizer + 50% NPK needs to be considered for increasing grain production and improving soil quality.

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