Effect of liquid organic fertilizer on the rice varieties field production

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Abstract. Rice production for rice supply in Indonesia still needs to be increased in line with the growing population growth. One effort that can be done by planting high-yielding rice varieties and using liquid organic fertilizer. This study aims to obtain the rice variety which is the best in production among the varieties studied in this study and the appropriate concentration of liquid organic fertilizer is applied. The study was conducted in Sendang Rejo Village, North Sumatra Province, Indonesia. The study used a Randomized Block Design with two treatment factors, namely: Liquid Organic Treatment Factor consists of 4 levels of treatment: M₀=Without liquid organic fertilizer. M₁= 3 cc/l of water. M₂= 6 cc/l of water. M₃= 9 cc/l of water. Variety treatment factors consisted of 3 types of paddy rice varieties: V₁= Ciherang. V₂= Inpari 30. V₃= Inpari 32.

The results showed that the highest grain production is found in the treatment of liquid organic fertilizer 6 cc/l water with a production of 27.48 g per plant (4.40 tons/ha). There is a tendency of the highest production found in the variety of Inpari 32 with a production of 26.38 g per plant (4.22 tons/ha).

1. Introduction

Rice plants are cereal plants that have long been cultivated by farmers in Indonesia which are the main source of carbohydrates as a staple food for the Indonesian population. The need for rice to produce rice continues to increase in connection with the increase in the population of Indonesia with a growth rate of around 1.5% per year. At present the number of Indonesians who need rice as a daily staple food source is around 260 million people. The extent of rice cultivation in Indonesia to date is seen from the National Statistics data of around 14 million ha and the average dry milled grain production is around 4.0 tons/ha. In an effort to increase productivity per hectare of planting area, especially irrigated lowland rice fields, it is necessary to implement relevant production technologies. One of the relevant technology applications applied is the use of superior rice varieties that produce high and equipped with the use of liquid organic fertilizers whose quality in addition to the use of inorganic fertilizers still exists to better maximize plant growth and better production. It has been known that there are a number of superior varieties of lowland rice that are known to produce high varieties such as Ciherang, Inpari 30 and Inpari 32. From the description data the variety is known that Ciherang variety has the potential to produce 8.5 tons/ha, plant age 116-125 har, plant height 107-115 cm, suitable planted in irrigated rice fields at...
altitudes below 500 m above sea level. Inpari 30 varieties have a production potential of 9.6 tons/ha, a plant age of 111 days, a plant height of 101 cm, suitable for planting in irrigated fields at altitudes below 400 m above sea level. The Inpari 32 variety has a production potential of 8.4 tons/ha, a plant life of 120 days, a plant height of 97 cm, suitable for planting at altitudes below 600 m above sea level [1].

Liquid organic fertilizer has several advantages in general, namely a complete fertilizer containing macro nutrients such as N, P, K, Mg and micro nutrients such as Zn, Mn, Cu, Mo, B, Mo and Fe. Generally, it can also contain acidic compounds - amino acids, organic acids, vitamins, natural growth regulating substances such as Giberelin/GA3, Zeatin, as soil enhancers, improve chemical, physical and biological properties of the soil, increase the activity of soil microorganisms, control natural pests, [1-3]. All these components have been known to improve both the quality and quantity of growth, development and production of plants to be obtained.

Based on the description of the data and information as mentioned above, it is necessary to study several superior rice varieties of rice fields to the difference in production and how it affects the use of liquid organic fertilizer used in this study in the field.

This study aims to obtain the best variety of rice production among the varieties studied in this study as well as the appropriate dosage of liquid organic fertilizer applied, then the best interaction between varieties and the concentration of liquid organic fertilizer used on rice production that can be achieved.

2. Materials and Method

2.1. Place and time
The research was carried out in paddy fields, Sendang Rejo Village, Binjai District, Langkat Regency, North Sumatra Province, Indonesia. The research location is at an altitude of about 55 meters above sea level, from August to November 2016.

2.2. Materials and tools
The materials used in the study included rice seeds of variety Ciherang Inpari 30 and Inpari 32, TOP G2 liquid organic fertilizer which contains 14 essential macro and micro nutrients such as N, P, K, Mg, Zn, Mn, B, growth regulators Zeatin and Giberelin (GA3), amino acids and vitamins, Urea, TSP, KCl and insecticides and fungicides. The equipment used consisted of manual hoe, harrow, sickle, meter, analytic scales, hand sprayer, knapsack sprayer, and others.

2.3. Research methods
The study used a randomized block design with two treatment factors, namely:a. Liquid Organic Treatment Factor consists of 4 treatment levels: Mo = Without liquid organic fertilizer. M1 = 3 cc/liter of water. M2 = 6 cc/liter of water. M3 = 9 cc/l of water. Variety Treatment Factors consist of 3 types of rice paddy varieties: V1 = Ciherang. V2 = Inpari 30. V3 = Inpari 32. The study consisted of 3 replications (blocks) with a total number of treatment plots of 36 plots with the size of each treatment plot 150 cm x 150 cm. The number of paddy rice plants in each experimental plot was 25 clumps of plants with a sample of 5 plants per treatment plot. The spacing of rice in each experimental plot was 25 cm x 25 cm. The research data was processed using the Variance Analysis method (Fisher’s test) and the Duncan Multiple Ranga Test (DMRT) mean difference test at a 5% real test level [4].

2.4. Research implementation
The implementation of the study began with the clearing of the wetland of the experimental site from the growing weeds. Then the soil is processed until the soil conditions are muddy. After completion of the tillage, a number of 36 plots were divided into 3 blocks (replications). There are 12 experimental plots in each experiment block. The size of each experimental plot is 150 cm x 150 cm with a distance of 50 cm between plots and 50 cm distance between the experimental blocks.

In each experimental plot rice seed varieties were planted according to the treatment of the studied varieties namely Ciherang, Inpari 30 and Inpari 32. The seedlings were planted on each experimental
plot of 20 days with a spacing of 25 cm x 25 cm. In the experimental field uniform inorganic fertilization was also given on each plot with dosages per ha of 200 kg of Urea, 100 kg of SP-36 and 75 KCl. The application of liquid organic fertilizer to rice plants in each experimental plot was given at the beginning of transplanting and when the rice plants were 30 days after planting. Application of liquid organic fertilizer given according to the concentration treatment studied in this study.

Maintenance of rice plants in the experimental plots during the study consisted of providing irrigation water, weeding, controlling pests and plant diseases and harvesting the results. Giving irrigation water to rice plants in the experimental plots around 5 cm water level during rice plant growth and 10 days before harvested rice, the water in the experimental plot was dried. Weed weeding in the study area is done manually, when weeds are grown. Pest and disease control is carried out every 10 days in the study area using insecticides and fungicides. The insecticide used by Bestox 50 EC, Hamasid 25 EC, while the fungicide used was Seranto and Dennis 75 WP. Harvesting is done when the grain in the panicle of the rice plant has yellowed 95% done by manual.

3. Results and Discussion

3.1. Number of panicles

In Table 1 it can be seen that the treatment of the concentration of organic liquid fertilizer has a significant effect on the number of panicles per clump of plants. While the treatment of varieties and the interaction of varieties with organic liquid fertilizers does not have a significant effect on the number of panicles per plant clump.

Table 1. Number of panicles per plant clump in fertilizer treatment organic liquid and Varieties.

| Liquid Organic Fertilizer Concentration | Varieties | Average |
|----------------------------------------|-----------|---------|
|                                        | $V_1 =$ Ciherang | $V_2 =$ Inpari 30 | $V_3 =$ Inpari32 |
| $M_0 = 0$ cc/l of water                 | 13.73     | 15.40   | 12.73 | 13.96 b |
| $M_1 = 3$ cc/l of water                 | 16.60     | 16.73   | 14.87 | 16.07 a |
| $M_2 = 6$ cc/l of water                 | 15.87     | 15.27   | 16.93 | 16.02 a |
| $M_3 = 9$ cc/l of water                 | 16.93     | 14.33   | 17.20 | 16.16 a |
| Average                                 | 15.78     | 15.43   | 15.43 | 15.55   |

Description: The numbers followed by the same letter on the same line are not significantly different according to DMRT at the level of $a = 5\%$.

In the treatment of the concentration of organic liquid fertilizer, it was shown that the higher the concentration given the higher number of panicles obtained. The highest number of panicles was obtained in $M_3$ treatment with the number of panicles 16.16 per clump of plants. The highest number of panicle varieties were found in Ciherang variety with panicle number 15.78 panicles per plant clump. In the interaction treatment the highest panicle number varieties were found in $M_1V_3$ treatment with the number of panicles 17.20 panicles. The number of panicles is the main component that determines the production of rice grain that will be obtained in the cultivation of rice plants. Increasing the number of panicles obtained by increasing the concentration of liquid organic fertilizer that is applied is related mainly to the presence of N elements in liquid organic fertilizer. In the growth and development of rice plants, macro N elements mainly function, among others, to multiply tillers that will determine the number of panicles that will be obtained [5].
### 3.2. Percentage of grain contains

The percentage of grain containing per clump of rice plants based on data analysis in Table 2 is significantly affected by the treatment of organic liquid fertilizer. In the treatment of varieties and the interaction of varieties with concentrations of liquid organic fertilizer did not have a significant effect on the percentage of grain containing per clump of rice plants.

#### Table 2. Percentage of grain contains per plant clump (%) in fertilizer treatment organic liquid and varieties.

| Liquid Organic Fertilizer Concentration | Varieties | Average |
|----------------------------------------|-----------|---------|
|                                        | V\(_1\) = Ciherang | V\(_2\) = Inpari 30 | V\(_3\) = Inpari32 | |
| M\(_0\) = 0 cc/ liter of water          | 66.72     | 62.26   | 68.23     | 65.74 b |
| M\(_1\) = 3 cc/ liter of water          | 71.62     | 80.30   | 79.77     | 77.23 a |
| M\(_2\) = 6 cc/ liter of water          | 72.40     | 74.46   | 76.34     | 74.40 a |
| M\(_3\) = 9 cc/ liter of water          | 81.46     | 82.57   | 83.12     | 82.38 a |
| Average                                | 73.05     | 74.90   | 76.86     | 74.94   |

Description: The numbers followed by the same letter on the same line are not significantly different according to DMRT at the level of \(\alpha = 5\%\).

In the treatment of liquid organic fertilizer, it is generally seen that the higher the concentration given to rice varieties, the higher the percentage of grain produced will also be. The highest percentage of grain contained in M\(_1\) treatment was 82.38 \%. The highest percentage of grains contained in the treatment was found in Inpari 2 variety (76.86 \%). In the combination treatment of varieties and liquid organic fertilizer, the highest percentage of grains contained in M\(_1\) V\(_3\) treatment (83.12 \%). The percentage of filled grains is the main determinant component in grain production in rice cultivation. It is clear that the higher the concentration of liquid organic fertilizer applied, the higher the percentage of filled grain that will be produced. It is also related to nutrition N, P, K contained in liquid organic fertilizer used in this study which plays a role in filling chemical compounds in seeds, especially carbohydrates, in addition to proteins, fats, and other compounds such as vitamins [3, 5].

### 3.3. Weight of 1000 grains

Parameters 1000 weight of paddy grain from the results of data analysis in Table 3 are significantly affected by the treatment of liquid organic fertilizer and by the treatment of varieties. While the interaction of treatment of liquid organic fertilizer and varieties does not have a significantly different effect.

In the treatment of liquid organic fertilizer, the highest weight of 1000 grains of rice grain were obtained in the treatment of M\(_1\) (3 cc/l water) with a value of 27.90 g which was not significantly different from the treatment of M\(_2\) and M\(_3\) but was significantly different from the treatment of M\(_0\). In the treatment of 1000 weight grain the highest grain was found in the V\(_3\) variety treatment (Inpari 2) with a weight of 28.03 g which was not significantly different from the V\(_2\) treatment (Inpari 30) but significantly different from the V\(_1\) (Ciherang) treatment. In combination treatment, the highest weight of 1000 grains of rice grain were found in the combination treatment M\(_2\) V\(_3\) (28.80 g).

The weight of 1000 grains determine the level of grain production obtained from a certain rice variety, the higher the 1000 grain weight, the higher the total grain production achieved. This is determined in addition to the character of the variety also determined the level of nutrition given to plants during its growth, especially NPK. The variety is mainly determined by the difference in genetic
composition factors. At higher concentrations of liquid organic fertilizers, the NPK nutrients obtained by the plant will increase the grain weight [5-6].

Table 3. Weight of 1000 grains (g) in treatment of liquid organic fertilizers and varieties.

| Liquid Organic Fertilizer Concentration | Varieties | Average |
|----------------------------------------|-----------|---------|
|                                        | V₁ = Ciherang | V₂ = Inpari 30 | V₃ = Inpari 32 |
| M₀ = 0 cc/litre of water                | 25.77      | 26.00    | 26.57    | 26.12 b |
| M₁ = 3 cc/litre of water               | 26.63      | 28.42    | 28.65    | 27.90 a |
| M₂ = 6 cc/litre of water               | 26.94      | 27.57    | 28.80    | 27.77 a |
| M₃ = 9 cc/litre of water               | 27.29      | 27.84    | 28.09    | 27.74 a |
| Average                                | 26.66 b    | 27.46 a  | 28.03 a  | 27.38   |

Description: The numbers followed by the same letter on the same line are not significantly different according to DMRT at the level of α = 5%.

4. Productions
Grain production per clump of plants from the results of this study in Table 4 is significantly influenced by the treatment of the provision of liquid organic fertilizer which was studied in this experiment. In the variety treatment and the interaction of giving liquid organic fertilizer with varieties does not have a significant different effect on grain production per plant clump achieved.

Table 4. Production of grain per crop clump (g) in fertilizer treatment organic liquid and varieties

| Liquid Organic Fertilizer Concentration | Varieties | Average |
|----------------------------------------|-----------|---------|
|                                        | V₁ = Ciherang | V₂ = Inpari 30 | V₃ = Inpari 32 |
| M₀ = 0 cc/litre of water                | 22.32      | 22.39    | 23.79    | 22.84 b |
| M₁ = 3 cc/litre of water               | 26.86      | 27.43    | 26.15    | 26.81 a |
| M₂ = 6 cc/litre of water               | 26.96      | 27.08    | 28.40    | 27.48 a |
| M₃ = 9 cc/litre of water               | 25.98      | 26.54    | 27.18    | 26.57 a |
| Average                                | 25.53      | 25.86    | 26.38    | 25.92   |

Description: The numbers followed by the same letter on the same line are not significantly different according to DMRT at the level of α = 5%.

From the treatment of liquid organic fertilizer, rice grain production highest per clump of plants was found in M₂ treatment (6 cc/litre of water) with a production weight of 27.48 g (4.40 tons/ha) which was not significantly different from the treatment of M₁ and M₃ but was significantly different from the treatment M₀. In the treatment of varieties, rice grain production per highest clump plant was found in V₃ variety (Inpari 32) with grain production 26.38 g (4.22 tons/ha). Whereas between Ciherang and Inpari 30 varieties, the grain production per clump of plants is relatively the same. In combination treatment, rice grain production per highest clump of plants was found in M₂V₃ treatment with a production value of 28.40 g (4.54 tons/ha).
Grain production per clump of plants will determine grain production per unit area of planting in rice cultivation in general. This is certainly determined by the amount of plant population density in units of planting area. This condition is determined by the resources in the plant environment to meet the needs for growth and development. In this situation it looks different is the state of the provision of liquid organic fertilizer which is applied which is largely determined both macro nutrients such as N, P, K, Mg and micro elements such as Fe, Mn, Cu, Zn, B including the growth regulating substances they contain like GA3, Zeatin which all play a role in the growth, development and level of production that will be obtained in rice plants studied in this experiment [2, 7-9].

5. Conclusions
The research results showed that the highest grain production is found in the treatment of liquid organic fertilizer 6 cc/l water with a production of 27.48 g per plant (4.40 tons/ha). From the treatment of varieties, the highest grain production tends to be found in the variety of Inpari 32 with a production level of 26.38 g/plant (4.22 tons/ha).

6. Recommendation
Based on the results of this study, one of the production techniques in lowland rice cultivation that can be recommended using Inpari 32 varieties, especially in rice fields in Langkat Regency, North Sumatra Province, Indonesia and using liquid organic fertilizer TOP G2  6 cc/litre of water.

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