

SUBSTITUTION OF INORGANIC FERTILIZER WITH LIQUID ORGANIC FERTILIZER ON THE GROWTH OF RICE PLANTS SRI METHOD

¹Nalwida Rozen, Musliar Kasim, Indra Dwipa, Auzar Syarif, Sutoyo
Agrotechnology Study Program, Faculty of Agriculture, Andalas University

ABSTRACT

Increasing rice production has been carried out in various ways. One method that has been implemented is the SRI method which can increase yields up to two times or more, but this method has not been adopted optimally by farmers because of the difficulty in cultivating practices in the field. Apart from that, farmers still use inorganic fertilizers without balancing them with organic fertilizers. One alternative that can be applied is to use organic materials that are available in the rice field environment, namely using liquid organic fertilizer (LOF) from banana stems and coconut fiber which are very easy for farmers to obtain in the field. Apart from the difficulty of getting fertilizer, due to high prices, fertile land has changed its function so that the area for rice cultivation is starting to decrease, but the land that is still widely available is marginal (suboptimal) land with low soil nutrient content and low pH. The aim of this research is to obtain the interaction between the type of LOF and the recommended dose of inorganic fertilizer as a substitute. The research location was carried out in Pasar Ambacang Village, Kuranji District, Padang City from May to November 2023. The research was carried out using a 2-factor factorial design in a Completely Randomized Design (RAL), where the first factor was the type of LOF (banana stem and coconut fiber) and the second factor is the dose of inorganic fertilizer TSP and KCl (0, 25, 50, 75, 100) % recommendation. The results obtained are that providing LOF types with inorganic fertilizers with different recommendations showed an interaction with the leaf area index. The number of stomata is influenced by the type of LOF and inorganic fertilizer, where LOF coconut fiber with 100% inorganic fertilizer gives the best results.

Key words: banana stems, yield, fertilizer, coconut fiber, substitution

INTRODUCTION

Background

Rice plants still need attention in their cultivation, because this plant is still predominantly needed for the lives of Indonesian people. For this reason, serious efforts are needed to increase rice production. Many efforts have been made to increase production, but food security has not yet been achieved. For this reason, it is necessary to find a more appropriate solution, including improving soil fertility, both physically, chemically and biologically.

One way that can be done to increase rice production is the SRI method where rice crop yields can be increased up to twofold, namely 12 tons/ha (Rozen *et al.*, 2009). This is because the soil is added with organic fertilizer (cow manure). Apart from organic fertilizer in solid form, organic fertilizer is also available in liquid form. In this research, the SRI method of

rice cultivation was carried out by adding liquid organic fertilizer (LOF) from banana stems and coconut fiber as a substitute for inorganic fertilizer (TSP and KCl) on sub-optimum land.

Inorganic fertilizer is a problem for farmers because of its expensive price, where TSP fertilizer is rarely found on the market, as well as the price of KCl fertilizer which is increasing every year. Farmers only use government subsidized urea fertilizer with the addition of N, P, K ponsca to their rice fields. For this reason, the solution that can be taken is to add organic materials from banana stems and coconut fiber, which are abundant and available at all times. These materials are very easy for the public to obtain because they are available and very easy to obtain in their environment.

Applying coconut fiber to the soil can replace the K element from KCl fertilizer,

¹ Correspondence author: Nalwida Rozen. Email: nalwida_rozen@yahoo.co.id

because coconut fiber contains nutrients and microorganisms that plants need for plant growth, development and yield. Gunadi (2009) cit. Zaini *et al.*, (2018) stated that coconut fiber contains natural nutrients that plants need, namely potassium (K) around 10.25%. The soaked results from coconut fiber which contain the element Potassium (K) are very good as fertilizer and as a substitute for inorganic KCl for plants. The chemical composition of coconut fiber includes cellulose, lignin, tannin and potassium. Liquid Organic Fertilizer (LOF) from coconut fiber not only contains the nutrients that plants need, but also improves the physical and chemical properties of the soil, thereby enabling better plant growth and yields.

Faizi *et al.*, (2020) added that coconut fiber contains nutrients such as the element potassium (K). The K element in coconut fiber functions as an enzyme activator in the formation of proteins and carbohydrates for plants. Apart from that, according to research by Russiani *et al.*, (2018) that giving 250 ml LOF of coconut fiber and banana stems gave a response to the growth and yield of peanuts, namely plant height and number of leaves at 28 HST. Meanwhile, according to research by Rahma *et al.*, (2019), the treatment of coconut fiber liquid organic fertilizer at a concentration of 150 ml/pot given to corn plants had a significant effect on plant height, number of leaves, root dry weight and CEC. In line with this, the research results of Wijaya *et al.*, (2017) stated that the application of 300 ml/pot liquid organic fertilizer from coconut fiber had a significant effect on the dry weight of the corn plant canopy.

Giving banana stems that have been crushed and then made into an extract and poured onto the soil really helps add P elements to the soil. Banana stems contain the element P so that if the fruit has been removed from the banana stem and cut down, it can be used to add nutrients to rice fields. According to Anggrayni (2021), banana stems contain 92.5% water, 0.35% protein, 4.4% carbohydrates, 135mg per 100 grams of

phosphorus, 213 mg per 100 grams of potassium, and 122 mg per 100 grams of calcium. The cellulose content of banana stems is quite high and most banana stems contain water and fiber. The Agricultural Research and Development Agency (2019) added that the main content of banana stems is nitrogen which plays an important role in the formation of the vegetative parts of the plant. Banana stems are often wasted and become waste. This organic waste can be processed into liquid organic fertilizer so that plants can more easily absorb nutrients from the soil. Liquid fertilizer is an organic fertilizer that is easily absorbed because it contains decomposed elements. Apart from that, the benefits of liquid banana stem fertilizer are that it forms the vegetative parts of plants, accelerates the photosynthesis process, forms organic compounds, and stimulates the development of microorganisms in the soil.

Research purposes

The aim of this research is to obtain the interaction between the type of LOF and the dose of inorganic fertilizer for substitution of inorganic fertilizer.

RESEARCH METHODS

Place and time of research

The research was carried out in the Ambacang Market area, Kuranji District, Padang City on community land with technically irrigated land. Apart from that, observations of stomata and chlorophyll were carried out at the Physiology Laboratory of the Faculty of Agriculture and at the Central Laboratory of Andalas University, Limau Manis Campus, Padang.

Experimental design

The experimental design used was a 2-factor factorial in a Completely Randomized Design (CRD) with 3 replications, where the variety used was the Batang Piaman variety with the first factor being the type of LOF with two levels (coconut fiber LOF and banana stem LOF) and the second factor was recommendation. inorganic fertilizer with 5

levels (0%, 25%, 50%, 75% and 100% recommended TSP and KCl inorganic fertilizer). The LOF is given to rice plants by spraying the soil until it is wet according to the treatment with an interval of once a week starting in the second week after planting until entering the generative phase (week 10), the LOF is given at 4 liters per plot. Seedlings are planted according to the SRI method, namely 14 HSS transplanting age with a planting distance of 25cm x 25cm, one seedling is planted per planting hole and the land is in mixed conditions. Plant maintenance includes irrigation during the vegetative phase in humid conditions until the hairline cracks and entering the generative phase of the land in conditions of 2-5 cm of water. Weeding is done from 10 HST to 42 HST by pulling out weeds that grow by hand. Pest and disease control is carried out as early as possible by keeping the plants free

from weeds and the plants are planted according to the Legowo 4:1 type B row. This is to control pest attacks and diseases of the rice plants and maintain the microclimate around the plants. Harvesting is carried out when the harvest criteria have been achieved. The variables observed were rice plant growth (plant height, total number of tillers, LTR, ILD, LAB), and observations of chlorophyll and leaf stomata density.

RESULTS AND DISCUSSION

Data on the height of lowland rice plants of the Batang Piaman variety with banana stem LOF and coconut fiber LOF after processing with variety analysis shows that there is no interaction between the type of LOF and the recommended dose of inorganic fertilizer, as well as single factors. Observation data on rice plant height is presented in Figure 1.

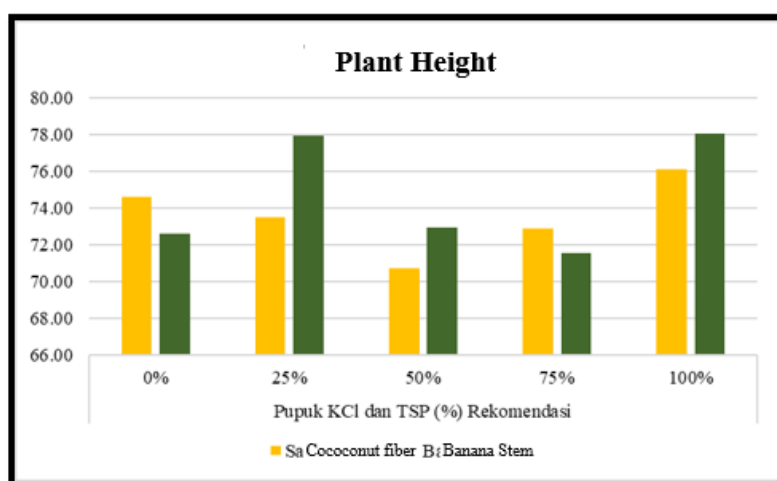


Figure 1. Rice plant height with LOF treatment and inorganic fertilizer aged 9 WAP

From Figure 1 above, it can be seen that there is no interaction between the type of LOF and the recommended TSP and KCl fertilizers given on rice plant height. This is because giving LOF during the vegetative phase has not affected the height of the rice plants. However, it can be seen that at 25%, 50%, and 100% the recommended dose of inorganic fertilizer for banana stem LOF is higher compared to coconut fiber LOF. Meanwhile, at 0 and 75% of the recommended

dose of inorganic fertilizer, coconut fiber LOF is higher compared to banana stem LOF.

Observation data on the total number of tillers of the Batang Piaman rice variety after being analyzed using variance showed that interactions were not significant, as was the case with single factors. Data on the total number of tillers for rice plants is presented in Figure 2.

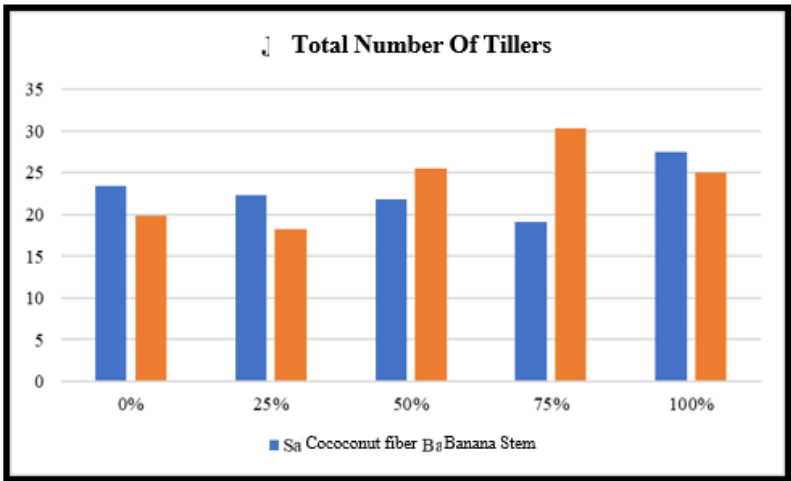


Figure 2. Total number of tillers in rice plants with LOF treatment and inorganic fertilizer aged 9 WAP

FromIn Figure 2, it can be seen that there is no interaction between the type of LOF and the TSP and KCl fertilizers given on the total number of tillers of rice plants, even though the number of tillers is more than the conventional method. This is because LOF has not affected the growth of the Batang Piaman rice variety. However, it can be seen that when applying 0, 25% and 100% of the recommended dose of inorganic fertilizer, coconut fiber LOF produces more shoots

compared to banana stem LOF. Meanwhile, at the recommended dose of 50% and 75%, LOF is given for banana stems with more shoots.

Observation data on the leaf area index of rice plants of the Batang Piaman variety at the ages of 7, 8 and 9 WAP with coconut fiber LOF and banana stem LOF treatment provided an interaction. The type of LOF has a significant influence on the leaf area index. Leaf area index observation data is presented in Figure 3.

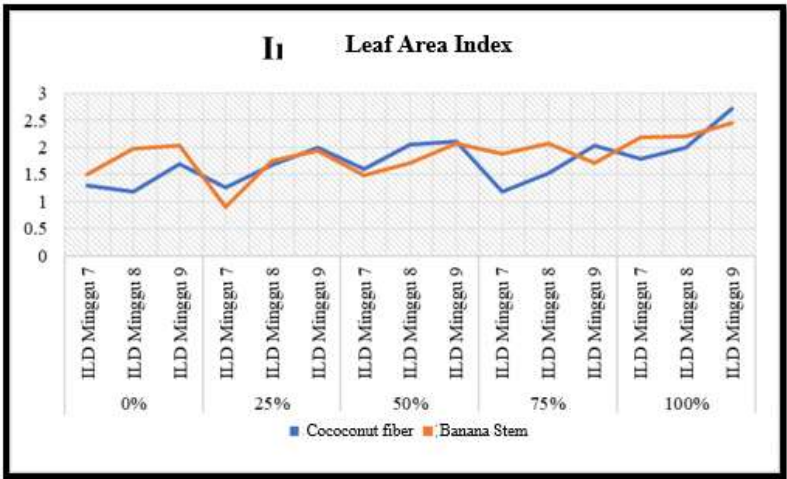


Figure 3. Leaf area index of rice plants treated with LOF and inorganic fertilizer

From Figure 3 it can be seen that there is an interaction between giving LOF and inorganic fertilizer, giving inorganic fertilizer has a real influence on the leaf area index, this is because the leaf area index is also influenced by giving TSP and KCl inorganic fertilizers, where giving 100% of the recommended fertilizer TSP and KCl were better than other treatments.

The leaf area index of the Batang Piaman rice variety is influenced by the type of LOF and the application of TSP and KCl fertilizers at different recommendations. This is because the type of LOF provided is able to increase the leaf area index, where the banana stem LOF type provides a higher leaf area index

compared to coconut fiber LOF. The higher the dose of TSP and KCl fertilizer given, the higher the leaf area index value. Banana stem LOF at 100% recommended TSP and KCl fertilizers gave the highest leaf area index, as did coconut fiber LOF. Below is presented Figure 3 regarding the leaf area index.

Observation data on the net assimilation rate of rice plants of the Batang Piaman variety by giving banana stem LOF and coconut fiber LOF at the age of 7-8 WAP showed that the interaction was not significant, as did the single factors. The observed data on the net assimilation rate is presented in Figure 4.

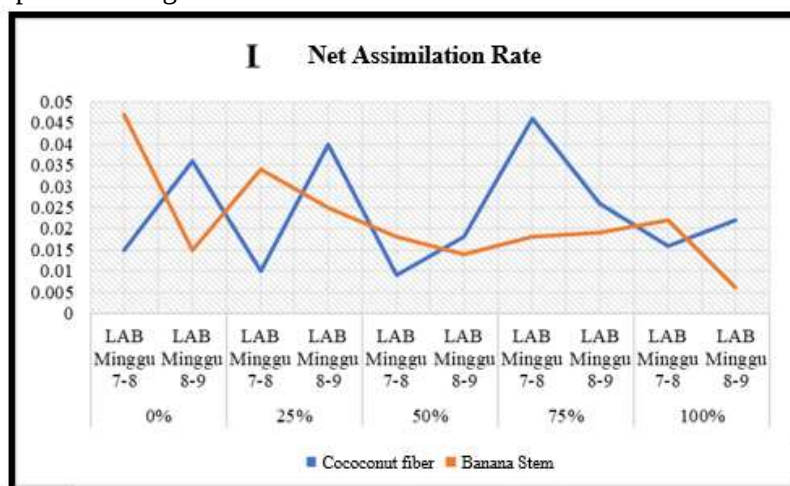


Figure 4. Net assimilation rate of rice plants with LOF and inorganic fertilizer treatment

Observation data on the net assimilation rate of rice plants of the Batang Piaman variety by giving banana stem LOF and coconut fiber LOF at the age of 8-9 WAP showed no significant interaction. Likewise with the single factor. From the results of observing the net assimilation rate, it can be seen that the administration of LOF types with TSP and KCl fertilizers with different recommendations does not interact, this is because the net assimilation rate has not been influenced by the type of LOF and inorganic fertilizer.

Observation data on the relative growth rate of rice plants of the Batang Piaman variety when treated with banana stem LOF and coconut

fiber LOF at the age of 7-9 WAP showed a significant interaction. The LOF type of coconut fiber when given 75% of the recommended inorganic fertilizer is better than other treatments. Meanwhile, giving the banana stem LOF type at 0% recommended inorganic fertilizer is better than other treatments. The relative growth rate of the Batang Piaman rice variety is presented in Figure 5.

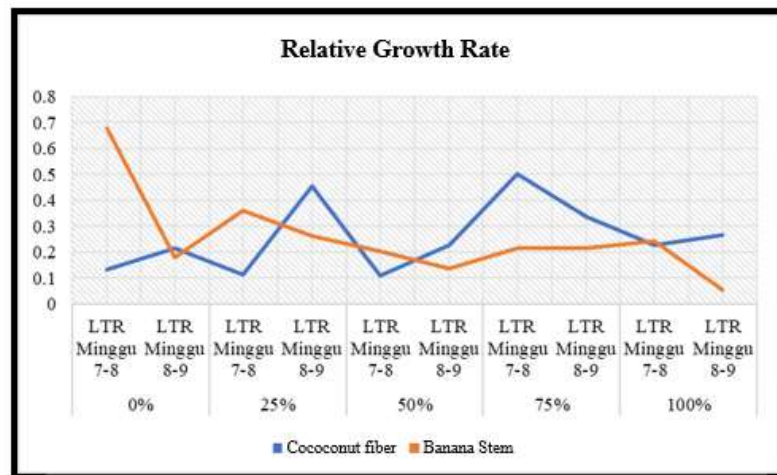


Figure 5. Relative growth rate of rice plants with LOF and inorganic fertilizer

Observations of the number of stomata are presented in Figure 6 below. The observation results show significantly different effects, both interactions between the two factors and single factors.

The results from Figure 6 show that LOF coconut fiber at a dose of 75% of the recommended inorganic fertilizer gave the highest number of stomata compared to other treatments. Meanwhile, banana stem LOF gave the highest number of stomata on the 100% inorganic fertilizer recommendation. At a dose of 25% recommended for inorganic fertilizer, there are a greater number of stomata on banana stem LOF compared to LOF for coconut fiber, as well

as at a dose of 100% recommended for inorganic fertilizer. Meanwhile, at the 50% recommended dose of inorganic fertilizer, coconut coir LOF has a higher number of stomata compared to banana stem LOF, as does the 75% recommended dose of inorganic fertilizer.

Observation data on the number of stomata of rice plants treated with LOF and inorganic fertilizer after being analyzed using variance analysis show that the interaction is not real, but the single factor of inorganic fertilizer recommendations has a real effect. Data on the number of stomata in the seed ripening phase is presented in Figure 6.

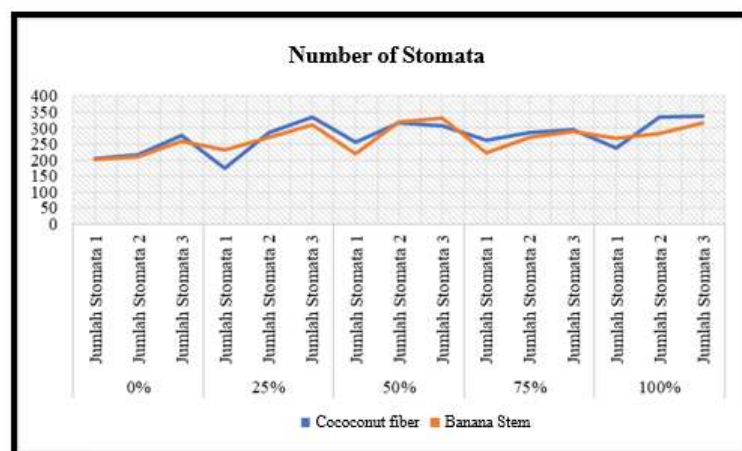


Figure 6. Number of stomata in rice plants with LOF and inorganic fertilizer

Based on the results of observationsThe number of stomata can be seen that the application of LOF and TSP and KCl inorganic fertilizers provides different numbers of stomata. The recommendation for TSP and KCl fertilizers is 100% higher in the number of stomata compared to other treatments. This is because it is related to the leaf area index, where the leaf area index shows a real influence, so the number of stomata obtained will also have an effect.

General Discussion

Based on observational data obtained from the research results, it turns out that the plant height and total number of tillers of the Batang Piaman rice variety show results that do not interact between the treatment of LOF banana stems and LOF coconut fiber with the application of TSP and KCl fertilizers which have different recommendations. It is suspected that the provision of LOF and KCl and TSP fertilizers provided has not been able to meet the nutrient needs of the Batang Piaman variety of lowland rice plants, so there has been no difference in plant height and total number of tillers. Judging from the description of the Batang Piaman rice variety, it turns out that the observed plant height is still below the description (105-117cm).

Lua index observations leaves show that the provision of LOF types and inorganic fertilizers with different recommendations interacts, but for observing the net assimilation rate and growth rate of practice, the provision of LOF and TSP and KCl fertilizers provides an interaction that is not significant. This is because by giving banana stem LOF and coconut fiber LOF plus giving urea fertilizer according to the recommended dose and TSP and KCl fertilizer according to the treatment, it has been able to provide a different leaf area index, the leaf area index will affect the rate of photosynthesis and the number of stomata.

Conclusions and recommendations

Conclusion

From the research results obtained, it can be concluded that the application of coconut fiber

LOF and banana stem LOF with the application of TSP and KCl fertilizers with different recommendations shows an interaction with the leaf area index. The number of stomata is influenced by the type of LOF and TSP and KCl fertilizers, where LOF coconut fiber with 100% inorganic fertilizer gives the best results.

Suggestion

It is recommended to add organic fertilizer to rice fields to increase soil fertility so that rice plants develop well.

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