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Growth Response Of SRI Rice In Suboptimal Land To Application Of Cattle Manure And Kieseritey

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Abstract

Population growth rates cause an increase in food demand, but the planting area is decreasing due to land-use change. The land available to be utilized by farmers is mostly suboptimal land. The disadvantages of suboptimal land are low pH values (4.7) and a small number of nutrients (Nitrogen = 0.11%, Phosphorus = 0.45 ppm, very low Carbon, very high Aluminum, and medium Cation exchange capacity) and for increasing the value of suboptimal land can be given organic fertilizer such as cattle manure and kieserite. This study aims to determine the effect of cattle manure and kieserite on rice growth with the SRI planting system in suboptimal land. The study was carried out in farmers' paddy fields at Ambacang Market, Kuranji District, Padang from June to October 2019. This experiment uses a completely randomized design (CRD). Data were analyzed by the F test at a 5% significance level. If it is significantly different, it is continued with the Duncan New Multiple Range Test at the 5% significance level. The results showed that the application of cattle manure increases plant height and number of tillers. Giving 10 tons/ha of cattle manure without kieserite shows the optimal growth of rice plants. It is recommended to provide cattle manure before planting rice seedlings to increase the growth of rice plants in suboptimal land.

Keywords: number tillers, marginal land, high Al, high Fe, and increase plant height

1. Introduction

Rice is an important component in the national food security system. According to IPB (2000) Rice accounts for 60-65% of total energy consumption. In Bangladesh and the Philippines, rice accounts for 40-55% of total iron adequacy in low-income communities (Bouis et al. 2000). The majority of Indonesian people like fluffier-textured rice (high in amylose content), which causes a small amount of rice breeding to produce superior high-yielding rice with non-fluffier / pera-textured rice. In contrast to the Minangkabau people of West Sumatra who prefer non-fluffier / pera textured rice. This condition is quite favorable because the community still cultivates and maintains the non-fluffy / pera textured rice germplasm of rice that has been handed down for generations. Conversely, germplasm will not provide benefits if it is not used optimally for the welfare of the community (Ministry of Agriculture's Research and Development Agency, 2002). Increasing the benefits of rice causes the need for improvisation of production through various ways, including an intensification of the many available suboptimal lands, because fertile land used to grow rice has become land-use change.

Problems that occur in increasing rice production are lowland rice fields used that have low pH, high levels of Fe and Al, high nutrient levels, thus inhibiting plant growth. One effort to improve suboptimal land to become fertile is by adding organic material. Sources of organic material can be obtained from livestock manure such as cow dung, chickens, goats, birds, and horses. In addition, compost can also be made from plant remains, as well as from plants used as green fertilizer. Cow dung is not difficult to obtain, is available all the time, and is cheap. Cow dung contains macro and micronutrients which are good to use as organic fertilizer. Organic fertilizer needs to be given on suboptimal land especially if added with kieserite. Kieserite is not widely used by rice farmers, because it is expensive and little information is known by farmers about it. Kieserite contains Mg which is needed by plants in the formation of chlorophyll as well as an enzyme activator in the process of plant metabolism. In addition, Mg can also increase the pH and exchange capacity of soil cations, improve soil structure, and neutralize toxins in the soil due to high Al and Fe content in the soil.

Land-use change cannot be reduced because the population is growing very rapidly. The strategy to increase rice production is the Legowo row system method because this method can increase yields to 6 tons/ha. In addition to the Legowo row system method, an SRI method can also be used which can double the yield of 12 tons/ha (Rozen, et al, 2008). In this research, a combination of the two methods will be carried out by the addition of organic fertilizer (cattle manure) and kieserite.

2. Materials and Methods

A. Plant Material and Time of Research

The study was conducted on technical irrigated land. Batang Pasaman varieties were treated on suboptimal land by giving organic fertilizer and kieserite from Pasar Ambacang, Kuranji District, Padang City. The study was conducted from June to October 2019.

B. Experimental Details

Rice cultivation is carried out with the 4:1 type legowo row system by combining it with the SRI method on paddy fields. The experiment was carried out using cattle manure plus kieserite to improve soil structure which would result in more fertile and environmentally friendly plants. Each experimental unit was planted with 12-day-old seedlings with one seedling per planting hole. Random planting with a spacing of 25cm x 25cm. The treatment is the variety of Batang Pasaman was Cattle manure is obtained from local residents at doses of 5 and 10 tons/ha. Before the land is cultivated, N, P, K, C, Ca, Mg, Al, Fe, nutrients, and soil pH are analyzed in the Soil Science laboratory. The untreated soil is analyzed for nutrients in the laboratory.

Application of cow and kiserit manure is given a week before planting. Application of inorganic fertilizer with urea was given 3 times during the vegetative phase, whereas TSP and KCl were given together with one-third of urea and given only once, after planting seeds.

C. Observations

The observation in this research was plant height and the total number of tillers was determined. Observation of 10 sample plants on rice in the plot.

D. Statistical Analysis

The experiment used a completely randomized design (CRD) with 4 treatments and 5 replications, with 20 experimental units. This treatment used inorganic fertilizer 100%, cattle manure 5t/ha w/o kieserite, cattle manure 5t/ha + 150 kg/ha kieserite, cattle manure 10t/ha w/o kieserite and cattle manure 10 t/ha +150 kg/ha kieserite. Data from observations were analyzed with variance and if there were differences a DNMRT test was performed at a significant level of 5%. Data will be processed with Stat8 software.

3. Results and Discussion

A. Nutrient Levels

Analysis of soil nutrient levels before being treated on suboptimal land characteristics.

Table 1. Soil nutrient levels in suboptimal land in Kuranji District, Padang City

Component	Value	Criteria
Calcium	0,75 me	Very low
Magneisum	1,30 me	Middle
Natrium	0,71 me	Middle
Potassium	0,42 me	Very low
Nitrogen	0,11 %	Low
Cation exchange capacity	19,59	Middle
pH (H2O) (1:2)	4,70	Very low
pH KCl (1:2)	4,09	Very low
Carbon	0,94%	Very low
Phosphorus	0,45 ppm	Very low
Aluminum	4,168 me	Very high
Fe	8,95 ppm	Very high

The paddy soil is classified as acidic (Table 1). Nutrient levels in the soil are also low (N is low, Ca is very low, K is very low, P is very low, C-organic is very low, and Al and Fe are very high). This is a suboptimal soil characteristic. Rice plant growth will be problematic on suboptimal land. High levels of Al will bind the P element in the soil causing low P levels and are not available to plants. The problem of suboptimal land in the field can be overcome by adding cattle manure. Cattle manure is cheap and easy to obtain because it is available at any time around paddy fields.

The application of SRI in the field requires organic matter so that the soil becomes loose and fertile. SRI is the management of soil and water to save water up to 30% by moisturizing the soil during the vegetative phase. For this reason, it is necessary to add organic matter to the soil so that the water holding capacity increases. Organic matter can improve the biological, chemical, and physical properties of soils. Rozen et al., (2011) concluded that the application of organic SRI in Sicincin, Padang Pariaman Regency was 10 tons/ha. Observation of rice plant height was carried out during the vegetative phase. Analysis of variance showed that cattle and kieserite fertilizer treatments had a significant influence on the height of rice plants aged 60 days after planting.

Table 2. Height of rice plants 60 days after planting with treatment cattle manure and kieserite

Treatment	Plant height (cm)
Inorganic fertilizer 100%	79,400 ^{c}
Cattle manure 5t/ha w/o kieserite	93,367^{ab}
Cattle manure 5t/ha + 150 kg/ha kieserite	91,933^{ab}
Cattle manure 10t/ha w/o kieserite	96,467 ^{a}
Cattle manure 10t/ha + 150 kg/ha kieserite	86,067 ^{bc}
KK	**3,32%**

Figures with the same lowercase letters in the same column are not significantly different according to DNMRT level of 5%

Table 3. Total number of tillers 60 days after planting (dap)

Treatment	Number of tillers (sticks)
Inorganic fertilizer 100%	32,267
Cattle manure 5t/ha w/o kieserite	37,000
Cattle manure 5t/ha + 150 kg/ha kieserite	44,400
Cattle manure 10t/ha w/o kieserite	42,333
Cattle manure 10t/ha + 150 kg/ha kieserite	39,000
KK	**14,5%**

The numbers in the same column are not significantly different according to the F test, the significance level is 5%

The cattle manure and kieserite are higher than 100% inorganic fertilizers (Table 2), it is because the addition of organic fertilizer can increase the nutrients available to plants. Giving 5 tons/ha of manure without kieserite is not significantly from 5 tons/ha of cattle fertilizer + 150 kg/ha of kieserite and not significantly from 10 tons/ha of cattle fertilizer without kieserite. Plant height decreased at 10 tons / ha manure + 150 kg / ha kieserite. Cattle manure can be given as much as 10 tons/ha without kieserite highly.

Cow manure application is better than inorganic fertilizer application. This is because organic fertilizer can increase nutrients into the soil in the form of both macro and micro and also improve the physical, chemical, and biological properties of the soil. Organic fertilizers contain more nutrients than inorganic fertilizers, so plants can absorb nutrients well. Meanwhile, inorganic fertilizers only contain macronutrients (N, P, and K) without micronutrients, so that nutrients absorbed by plants are not sufficient for plant growth.

The total number of tillers was done in the vegetative phase. Analysis of variance showed that the treatment of cattle manure and kieserite significantly affected the total number of tillers. The number of tillers in the SRI method is higher than Legowo jajar (Table 3). The number of tillers by giving cattle manure and kieserite fertilizer was not significant, but the addition of cattle manure and kieserite increased the number of tillers (about 40 stems), normally around 20 stems. According to Rozen et al., (2009) the SRI method can increase yields up to twice that is 12 tons/ha. This is due to the formation of 12 times the phyllochron tillers in the SRI method so that exponential tillers are formed, this is not observed in the conventional methods.

4. Conclusions

The application of cattle and kieserite fertilizer increases plant height and number of tillers. Giving 10 tons/ha of cattle manure without kieserite shows optimal growth of rice plants. It is recommended to provide 10 tons/ha cattle manure before planting rice seedlings to increase the growth of rice plants in suboptimal land.

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