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Response of Batang Piaman variety of rice crops to fertilizers in suboptimal rice field

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Abstract. Suboptimal land is a problematic land for rice crop growth. This is because the nutrient content in the soil is very low but the content of iron or aluminium elements is so high, that causes toxicity to plants, and then inhibited plant growth. Therefore, it is necessary to add organic fertilizer to the soil, one of which is cow manure that is available at all times and easy to obtain. In addition to cow manure, kieserite is also important to be given into the soil because kieserite contains magnesium nutrients that are badly needed for plant growth. This research purposes to see the best response of rice plants of Batang Piaman variety to fertilizer given to increase growth and yield on suboptimal land. This study used Completely Randomized Design with 3 fertilizer treatments [100% inorganic fertilizer, cow manure 5 tons/ha+150kg/ha kieserite, and 10 tons/ha of cow manure without kieserite]. Each treatment is replicated 5 times. The data is analyzed with a variety of variance and if the results differ noticeably followed by Honestly Significant Difference [HSD] Post Hoc Test in level 5%. Observations had made on some quantitative parameters. From the results of the study obtained that the best response from rice plants of Batang Piaman variety is obtained in the treatment of cow manure 5ton/ha+150kg/ha kieserite that provides high growth of plants 90 cm and the total number tillers of rice as 34 stems and a yield of 6.52 tons/ha on suboptimal rice field.

Keywords: cow manure, kieserite, nutrient, suboptimal, variety

1. Introduction

System of rice intensification [SRI] is a rice cultivation method that can provide higher yields with fewer inputs than conventional methods including irrigation water. Rozen et al. [11] stated that the SRI method of rice cultivation can provide yields of dry grain harvested by 10 tons/ha, while rice production in West Sumatra has only reached 4.6 tons/ha. In this method, phyllochron is formed up to 12 times [15]. This method presents one seedling for one hole, planting the seedling in 7-14 days after seeding. A wider space planting [30 cm x 30cm], and intermittent rice irrigation without flooding in the rice field [13].

Rozen et al. [1] state that suboptimal land pH is very low [4.09], the nutrient content is low N [0.11%], P-available content is very low [0.45 ppm], K content is very low [0.42me], C-organic content is very low [0.94%], Ca content is very low [0.75 me], Fe content is high [8.95 ppm] and Al content is very high [4.168 me]. To increase the production of rice crops in suboptimal land needs the addition of organic materials. Organic fertilizer, containing all the nutrients of plants not only N, P, K but also Ca, Mg, S, Fe, Zn [9] 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 [14] by adding microelements can increase the nutrient absorption of rice crop, especially elements N, P, K Mn and Zn, so far farmers don't add microelements to the soil so the soil was degraded continuously [8].

Rozen et al [10] that response of both varieties [Batang Piaman and IR42]. Batang Piaman was considered a more responsive and adaptive rice variety compared to IR42. Rozen et al. [1] The response of three varieties of rice on suboptimal land shows that Batang Piaman varieties provide the



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best growth and results compared to ipb3s and IR42 varieties. Therefore, followed by testing the varieties of Piaman Stems by giving fertilizer. The application of cow manure 5 tons/ha plus kieserite 150 kg/ha and 10 tons of cow manure without kieserite provides the best growth and results on the suboptimal rice field [1].

2. Materials and methods

2.1. Location and time

This research has been carried out in the rice fields of the community, located in the Pasar Ambacang area of Kuranji District of Padang City, starting from June to October 2020. The land used is suboptimal land with very low nutrient content and low soil pH so that the soil is light.

2.2. Material and tools

Materials used in this research are the seed of Batang Piaman variety, cow manure, kieserite, label, envelope, and inorganic fertilizers. Tools used in this research are hand tractor, seedbed, sack, sickle, hoe, and thresher. The implementation of the research began by plowing rice fields twice and then muddy land and made a tile measuring 1 m x 5 m as much as 15 plots. A week before planting, cow fertilizer and kieserite are given to the land according to the treatment by spreading it in a map and then stirred evenly with the soil by hand so that fertilizer and soil are mixed evenly. Inorganic fertilizer is given a week after planting. Planting seedlings is carried out 12 days after seedlings by planting one seedling per planting hole, planting distance 25cm x 25cm with soil conditions in humid condition. Weed-controlling was conducted on the weed in the rice fields either in the experiment area or outside the area. Pest control did preventively, but there are still pests of rats and insects that attack rice plants.

2.3. Research design

The study used a Completely Randomized Design with 3 treatments and 5 replicated. The treatment is of 100% inorganic fertilizer, cow manure 5 tons/ha plus kieserite 150 kg/ha, and 10 tons/ha of cow manure without kieserite. The observation data is analyzed with a variety of fingerprints and when different is real followed by Real Different Designs Advanced Test in level 5%. Observed changes in the form of plant height, the total number of tillers, number productive of tillers, length of panicles, amount of grain per panicles, amount of pithy grain per panicles, grain weight per panicles, the weight of pithy grain per panicles, weight of 1000 grains, yield per clumps, as well as yield per plot and yield per hectare.

3. Result and Discussion

Table 1. Heigh plant of Batang Piaman variety age 56 days after planting.

Treatment	Heigh Plant [cm]
100% inorganic fertilizer	88.00
Cow manure 5 tons/ha + 150 kg/ha kieserite	90.15
Cow manure 10 tons/ha without kieserite	86.80
CV = 4.86%	

The numbers in the same column differ unreal according to the F test of the 5% rate.

From the table above it is seen that the applications of 5 tons/ha of cow manure + 150 kg/ha kieserite are higher than 100% inorganic fertilizer or 10 tons/ha of cow manure without kieserite. This application of cow manure 5 tons/ha + 150 kg/ha kieserite is more able to encourage the growth of rice plants on suboptimal land because the nutrients absorbed by plants are sufficient. But in the application of 10 tons/ha of cow manure without kieserite gives the height of the plant lower than

100% inorganic fertilizers. This is because the dose of 10 tons/ha of cow manure is longer decomposed so that it is slowly available to plants. When compared to the description of rice plants of Batang Piaman variety with a height of 105 – 117 cm [17], it turns out that the results obtained from this experiment are lower [86cm - 90cm]. This is because the height of rice plants is more influenced by the method used, whereby the SRI method of formation is more dominant than the high growth of rice plants. According to Rozen et al [1] that the provision of manure and kieserite can increase the height of rice plants [93 - 96 cm] compared to the application of inorganic fertilizers [79cm].

Table 2. Total number of tillers and number productive of the tiller of Batang Piaman Variety

Treatments	Total number of tiller and productive tiller	
	----- stem-----	
100% inorganic fertilizer	30.95	15.43
Cow manure 5 tons/ha+ kieserite 150 kg/ha	33.95	14.85
Cow manure 10 tons / ha without kieserite	30.60	13.35
CV	9.89%	14.24%

The numbers in the same column differ unreal according to the F test of the 5% rate.

From the above data, it is seen that the total number of tillers formed due to the application of cow manure 5ton/ha + 150kg/ha kieserite provides the highest number of tillers compared to 100% inorganic fertilizer. But the number of productive tillers formed even in the treatment of 100% more inorganic fertilizer. When compared to the description of the Batang Piaman variety it turns out that the number of rice tillers formed from the results of this test [30-34 stems] over the conventional way [20-25 stems]. Not all total rice tillers will be productive due to competition during plant growth and development. The number of productive rice of tiller formed is the same as the description of the rice plant variety of Batang Piaman [14 – 20 stems] [17]. The number of productive tillers earned is the same as the description. Productive tillers are more determining the yield of rice crops because it is included in the component of the results.

Table 3. Length of panicles, amount of grain and amount of grain pithy of Batang Piaman Variety

Treatments	length of panicles	amount of grain	amount pithy grain
	----cm-----	----- grain-----	
100% inorganic fertilizer	25.82	147.88	117.85
Cow manure 5tons/ha+kieserite 150kg/ha	26.22	147.57	129.86
Cow manure 10 tons/ha without kieserite	26.09	138.92	122.59
CV	2.73%	9.28%	7.6%

The numbers in the same column differ unreal according to the F test of the 5% rate.

Data in Table 3 shows that the treatment of cow manure 5 tons/ha + 150kg/ha kieserite provides a longer panicles length compared to 100% inorganic fertilizer, as well as against the amount of grain per panicles. This is because the rice plant of Batang Piaman variety is more responsive to the application of 5 to/ha of cow manure + 150 kg/ha kieserite. After all, it can increase the length of panicles as well as the amount of grain per panicles when compared to 100% inorganic fertilizer.

Table 4. Total grain weight and pithy grain weight of Batang Piaman Variety

Treatments	Total grain weight	pithy grain weight
	-----gram-----	
100% inorganic fertilizer	3.60	3.28
Cow manure 5 tons/ha + kieserite 150 kg/ha	4.00	3.83
Cow manure 10 tons/ha without kieserite	3.67	3.62
CV	9.78%	9.78%

The numbers in the same column differ unreal according to the F test of the 5% rate.

In Table 4 it is stated that the total grain weight and grain weight of pithy are higher in the treatment of cow manure 5 ton/ha + 150 kg/ha kieserite. This means that the rice plant of Batang Piaman variety is more in response to the treatment of 5 tons/ha of cow manure + 150 kg/ha kieserite. Varieties of Batang Piaman are more responsive to the provision of cow manure than just the provision of inorganic fertilizers only because cow manure contains macro and micronutrients while inorganic fertilizers contain only macronutrients [N, P, K].

Table 5. Weight of 1000 grains of rice plant of Batang Piaman Variety

Treatments	weight of 1000 grains [gram]
100% inorganic fertilizer	28.71
Cow manure 5 tons/ha + kieserite 150 kg/ha	29.16
Cow manure 10 tons/ha without kieserite	29.96
CV =	4.95%

The numbers in the same column differ unreal according to the F test of the 5% rate.

In Table 5 it is seen that the treatment of cow manure 10 tons/ha without kieserite and 5 tons/ha cow manure + 150 kg/ha kieserite is higher in weight 1000 grains of grain than 100% inorganic fertilizer. The weight of 1000 grains of grain produced [28.71 – 29.96 grams] gives the same result as the description of the rice crop of Batang Piaman variety [27 - 30 grams], but the application of cow manure increases the weight of 1000 grains of grain compared to just the application of inorganic fertilizer. Application of cow manure further increases the weight of 1000 grains compared to the provision of inorganic fertilizer and manure added kieserite. This is because cow manure is given enough nutrients available for plants. After all, cow manure contains macro and micronutrients.

Table 6. Yield per clumps, yield per plot, and yield per hectare of Batang Piaman Variety

Treatments	Yield per clumps	per plot	per hectares
	-----kg-----		-----tons-----
100% inorganic fertilizer	38.75	3.68	6.10
Cow manure 5 tons/ha+kieserite 150kg/ha	41.00	3.92	6.52
Cow manure 10 tons/ha without kieserite	35.50	3.38	5.62
CV	15.98%	16.12%	16.12%

The numbers in the same column differ unreal according to the F test of the 5% rate.

The result data of yield per clump, yield per plot, and yield per hectare in Table 6 show the treatment of 5 tons/ha cow manure + 150 kg/ha kieserite, which is the highest result than other treatments. This is because the treatment of cow manure is better able to provide sufficient nutrients

for the development of rice paddy plants in suboptimal land. The yield per hectare from treatment 5 tons/ha cow manure + kieserite 150 kg/ha [6.52 tons/ha] show the higher yield when compared to the description of the rice plant of Batang Piaman variety [6.27 tons/ha].

4. Conclusion

Based on the results of the research conducted can be concluded that the rice plant varieties of Batang Piaman more responsive to the treatment of cow manure application 5 tons/ha + kieserite 150 kg/ha, which can provide high growth of crops 90 cm and the number of tillers are 34 stems with a yield per hectare of 6.52 tons on suboptimal rice fields in Pasar Ambacang, Kuranji District of Padang City, West Sumatra province, this yield exceeds the description of the rice crop of Batang Piaman variety [6.27 tons/ha].

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