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Effectiveness of Nitrogen Foliar Fertilizer on Rice Productivity on Swampland in Majapahit Village, Lubuk Linggau City

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ABSTRACT

Rice is a very important and strategic commodity because it is the main source of carbohydrates for the community. Therefore, an increase in rice production is urgently needed. Swampland is considered a potential option to support food self-sufficiency, given the various advantages it has. One of the main advantages is the availability of abundant water, which is crucial in supporting plant growth, especially in uncertain climatic conditions. Fertilizer is one of the key factors in rice farming. Nitrogen (N) is one of the most important nutrients and should be available to plants. Foliar nutrition can generally increase grain yield while reducing the amount of fertilizer administered through soil application. The purpose of this study is to obtain the concentration and intensity of foliar urea application that is most effective in supporting the growth and yield of rice cultivated in swampland. The experiment was carried out using a complete group random design (RAKL) with a factorial design involving 2 factors and 3 replicates. The first factor is the concentration of urea solution, which consists of 4 levels, namely 3%, 6%, 9%, and 12%. The second factor is the intensity of the application which consists of 3 levels, namely 2 mst, 2 mst, and 4 mst, as well as 2 mst, 4 mst, and 6 mst.

Keyword *:* Intensity, Concentration, Rice, Urea.

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INTRODUCTION

Rice is a very important and strategic commodity because it is the main source of carbohydrates for the community. Therefore, an increase in rice production is urgently needed. The government through the Nawacita program has set several goals in the development of food crops, including: (1) increasing the production of food crops to achieve national food security; (2) creating more jobs and business opportunities; and (3) increasing the income and welfare of farmers and agribusiness actors, especially in rural areas. Thus, rice (Oriza sativa L.) has a very vital role in the lives of the Indonesian people, so that rice production is the main focus of attention (Tumewu *et al.,* 2019)

Swampland is considered a potential option to support food self-sufficiency, given the various advantages it has. One of the main advantages is the availability of abundant water, which is crucial in supporting plant growth, especially in uncertain climatic conditions. In addition, the relatively flat topography of the land makes it easier to manage and utilize it for various types of farming businesses.

The existence of swamp land not far from the river also provides ease of irrigation, while the close distance to the water source allows for more efficient irrigation management. The swamp land also allows for the selection of large areas of land for agricultural activities, which can support farming mechanically, with a capacity of about 2.0 hectares per head of family, thereby increasing the productivity and sustainability of the agricultural sector in the region (Umar *et al.,* 2017).

Hasyem (2018) explained that fertilizer is one of the key factors in rice farming, and the dosage is also adjusted to the rice variety used. Nitrogen (N) is one of the most important nutrients and should be available to plants. Plants' need for N nutrients is greater than other nutrients, and plants absorb N in the form of ammonium and nitrate (Anhar *et al.,* 2016). Foliar nutrition can generally increase grain yield while reducing the amount of fertilizer administered through soil application. Spraying fertilizer through leaves can increase plant metabolic activity. The application of fertilizer through leaves is an economical and effective method in increasing nutrient absorption. Plants respond to fertilizer applied through the soil within five to six days, while plant responses to foliar fertilizer application occur more quickly, i.e. within 48 hours.

In the study of Saha *et al.,* (2018) stated that the concentration of 3% urea fertilizer with a spraying frequency of 8 times produced the highest grain and the concentration of 3% urea fertilizer with a spraying frequency of 10 times produced the highest straw. The application of foliar urea fertilizer to rice plants in swampland is still rarely applied in Indonesia, so the optimal dosage and frequency of application are not yet known. Therefore, research on the concentration and intensity of foliar urea application is still needed as an alternative fertilization method for rice plants in swampy land. The purpose of this study is to obtain the concentration and intensity of foliar urea application that is most effective in supporting the growth and yield of rice cultivated in swampland.

RESEARCH METHODS

This experiment was carried out at the Agricultural Socio-Economic Experiment Garden, PGRI Silampari University, Lubuklinggau City, South Sumatra Province. With an altitude of ± 129 meters above sea level (masl). Starting on September 25, 2024. The tools used in this study are hoes, buckets, rakes, measuring cups and sprayers. The materials used in this study are rice seeds, herbicides, insecticides, urea fertilizers, SP36, and KCL.

The research method in this experiment uses a Complete Group Random Design (RAKL) 3 times. The first factor is the concentration of urea solution which consists of 4 factors, namely 3% (K1), 6% (K2), 9% (K3), and 12% (K4). The second factor is the spraying intensity which consists of 3 levels, namely 1 time (I_1) (2 mst), 2 times (I_2) (2 and 4 mst), and 3 times (I_3) (2, 4, and 6 mst). As a control treatment, the application of urea fertilizer 200 kg of urea/ha. Here's how it is treated:

K1I1 = Urea Fertilizer 3%, Intensity 1 time

K2I1 = Urea Fertilizer 6%, Intensity 1 time

K3I1 = Urea Fertilizer 9%, Intensity 1 time

K4I1 = Urea Fertilizer 12%, Intensity 1 time

K1I2 = Urea Fertilizer 3%, Intensity 2 times

K2I2 = Urea Fertilizer 6%, Intensity 2 times

K3I2 = Urea Fertilizer 9%, Intensity 2 times

K4I2 = Urea Fertilizer 12%, Intensity 2 times

K1I3 = Urea Fertilizer 3%, Intensity 3 times

K2I3 = Urea Fertilizer 6%, Intensity 3 times

K3I3 = Urea Fertilizer 9%, Intensity 3 times

K4I3 = Urea Fertilizer 12%, Intensity 3 times

K0 = Urea Fertilizer 200 kg/ha

Each concentration of urea fertilizer is made in the following way. Concentration of 3% = 3 g of urea + 97 ml of water, concentration of 6% = 6 g of urea + 94 ml of water, concentration of 9% = 9 g of urea + 91 ml of water, and concentration of 12% = 12 g of urea + 88 ml of water. Then it is dissolved until it is completely dissolved and then sprayed on the rice plant. Every 100 ml of urea fertilizer solution is applied to approximately 20 plants. Spraying application is carried out in the morning after dry dew. The first application of urea fertilizer through leaves is given when the plant is 2 m old, the 2nd application when the plant is 4 ms old and the 3rd application when the plant is 6 m old. Control treatment is given by spreading when the plants are 7 hst, 21 hst, and 56 hst.

RESULTS AND DISCUSSION

Table 1. Effect of concentration of urea solution on grain weight per clump (BGPR), panicle length (PM), weight of 1000 grains (B.1000), and harvest index (IP).

Concentration (%)	BGPR (g)	PM (cm)	B. 1000 (g)	IP
3	14.31 b	23.53 b	29,17	0.59 b
6	17.15 b	23.73 b	30,07	0.67 ab
9	16.76 b	23.76 b	29,91	0.70 ab
12	21,25 A	24.67 A	31,20	0.77 A
Control	12,80	23,80	28,60	0,54

Ket: Numbers in the same column followed by the same letter are no different at DMRT 5%

The application of urea solution with a concentration of 12% resulted in the heaviest grain weight per clump of 21.25 g and the longest panicle length of 24.67 cm which differed significantly with concentrations of 3%, 6% and 9%. Furthermore, the concentration of urea solution of 12% also produced the best harvest index, which was 0.77, which was not significantly different from the concentration of 6% and 9%, but was significantly different from the concentration of 3%. Meanwhile, the application of urea solution with a concentration of 3% resulted in the lightest grain weight per clump, the shortest panicle length, and the lowest harvest index (Table 1).

Leafwise application of fluoride at all tested doses resulted in dry grain weights per panicle, and a better harvest index, although the panicle length was shorter than that of soil-by-soil urea application (Table 1). This is because the application of urea solution through leaves absorbs more N elements, especially at a concentration of 12% compared to the application through the soil so that rice yields are better. Nitrogen nuaffects the vegetative growth of rice plants in producing abundant saplings and leaf

development (Rahmatika, 2010). Vegetative growth will indirectly affect the yield of rice plants. The results of previous studies also reported that rice yields increased along with the increase in the concentration of urea fertilizer applied through leaves (Manik *et al.,* 2016).

Table 2. Effect of frequency of urea solution application on flowering age (UB), harvest age (UP), percentage of rice (PGB), number of productive seedlings (JAP) and number of rice per panicle (JGPM)

Urea Solution Application Frequency	UB (hst)	UP (hst)	PGB (%)	JAP	JGPM
1	75,83	105,00	83,67	7.87 b	66.75 c
2	76,25	105,00	79,05	8.65 b	77.39 b
3	75,83	105,00	84,94	10.61 A	96.58 A
Control	78,33	105,00	65,11	7,50	52,22

Ket: Numbers in the same column followed by the same letter are no different in DMRT 5%

Increased N uptake and growth of rice plants led to an increase in crop yield. This is evident from the results of the study which showed that in addition to producing the highest N uptake and the best growth, the application of urea solution 3 times also produced the largest number of productive saplings (10.61 seedlings), and the highest number of grains per panicle (96.58 grains) which differed significantly with the frequency of 1 time and 2 times (Table 2) and the heaviest grain weight per clump (Table 3). In line with the results of previous studies that reported that the best rice yield was obtained from the application of urea fertilizer through leaves 3 times (Rahman *et al.,* 2017; Parvin *et al.,* 2013).

Table 3. Effect of frequency of urea solution application on grain weight per clump (BGPR), panicle length (PM), weight of 1000 grains (B.1000), and harvest index (IP).

Urea Solution Application Frequency	BGPR (g)	PM (cm)	B. 1000 (g)	IP
1	15.00 b	23,77	30,47	0,66
2	15.88 b	24,07	30,05	0,67
3	21,23 A	23,93	29,74	0,73
Control	12,80	23,80	28,60	0,54

Ket: Numbers in the same column followed by the same letter are not different at DMRT 5%

The application of urea through the leaves either only 1 time, 2 times, or 3 times produces the number of productive saplings, the number of grainy grains per panicle and the weight of grain per clump is higher compared to the application of urea through the soil. This is closely related to the absorption of N in urea fertilizer by plants. Urea fertilizer is a fertilizer that quickly provides N for plants. Nevertheless, urea has a disadvantage because it dissolves easily. Therefore, the application of urea fertilizer through the soil is suspected to be strong because the N nutrients contained are lost due to the evaporation and washing process by water so that the amount absorbed by plants is reduced. On the other hand, the application of urea through leaves is strongly suspected that the element N contained is directly absorbed by the plant so that the potential for loss becomes small. The fulfillment of the need for element N for plants will increase plant growth so that the yield will also increase.

CONCLUSION

Based on the results of the study , it was shown that the application of 12% urea solution through the leaves gave the best results on grain weight, panicle length, and harvest index. The application of foliar urea increases the absorption of nitrogen (N) which has an effect on rice growth and yield, compared to the application through the soil which tends to lose a lot of nitrogen. The frequency of triple application resulted in the highest number of productive saplings and grain per panicle, as well as the heaviest grain weight per clump.

BIBLIOGRAPHY

Anhar, R., Hayati, E., & Efendi, E. (2016). Effect of urea fertilizer dosage on growth and production local rice germplasm from Aceh.*Kawista Agrotechnology Journal*,*1*(1), 30-36.

Hashem, I. M. (2019). Studies on the effect of foliar fertilizer application in combination with conventional fertilizers on rice production.*Journal of plant Production*,*10*(6), 447-452.

Manik, I. A., M.A. Abedin, M.R. Rahman, T Chakrobarty, S.B. Jaman, M.A. Noor and R Sultana. (2016). Reducing urea demand for rice crop through foliar application of urea in Boro Season. *Res. Agric. Livest. Fish*, 3 (1) : 79-85.

Parvin, S., S. Uddin, S. Khanum and M.S.U. Bhuiya. (2013). Effect of weeding and foliar urea spray on the yield and yield components of boro rice. Am- Euras. *J. Agric. & Environ. Sci* 13(6): 866-871.

Rahman, M.H., M.A.H Khan, and I.A. Mahzabin. (2017). Efficacy and economics of urea spray technology for a locally discovered rice cultivar Haridhan in Bangladesh. *American Journal of Plant Biology.* 2(4) : 136-141.

Rahmatika, W. (2010). Rice Growth (*Oryza sativa*. L) Consequences of Influence Percentage N (Azolla and Urea). *Primordia,6*(2) : 84-88.

Tumewu, P., Nangoi, R., Walingkas, S. A., Porong, V. J., Tulungen, A. G., & Sumayku, B. R. (2019). Influence Kirinyu Organic Fertilizer for Efficiency of Urea Fertilizer Use in Rice Plant Growth (Oryza sativa L.).*Eugenia*,*25*(3).

Umar, S., Hidayat, A. R., & Pangaribuan, S. (2017). Testing of rice planting machines in the legowo row system (jarwo transplanter) in the swamp land of the ebb and flow.*Journal of Agricultural Engineering Lampung (Journal of Agricultural Engineering)*,*6*(1).