Fertilization Recommendations Based on Nutrition Status of N and K on Rainfed Rice field in Mantoh District

Rekomendasi Pemupukan Berdasarkan Status Hara N, P dan K pada Lahan Sawah Tadah Hujan di Kecamatan Mantoh

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Abstract: This study aims to recommend fertilization based on the nutrient status of N and K in rainfed rice fields; therefore, it is necessary to conduct a soil analysis to formulate fertilizer recommendations based on the nutrient status of N and K. This research was carried out in Bombanon Village, Mantoh District in July 2021. The chemical properties of the soil analyzed were N (Kjeldahl) and K (HCl25%). The result of soil analysis then matched with the PPT criteria for soil chemical properties status and Balitbangtan guidelines of N and P fertilization for rice crops. The results showed that the N contents at T1 and T3 were low, whereas T2 had a moderate N content. K content at the entire sampling sites were considered moderate. This study recommended N and K fertilization of 275 kg/ha and 50 kg/ha of urea and KCl, respectively, without returning straw.

Keywords:, total N and K, ricefield, soil fertility.

Abstrak: Penelitian ini bertujuan untuk merekomendasikan pemupukan berdasarkan status hara N dan K pada lahan sawah tadah hujan, oleh karena itu perlu dilakukan analisis tanah untuk merumuskan rekomendasi pemupukan berdasarkan status hara N dan K. Penelitian ini dilaksanakan di Desa Bombanon Kecamatan K (K_2O HCl25%). Data yang dianalisis kemudian di cocokkan melalui kriteria sifat kimia tanah PPT dan panduan pemupukan Balitbangtan. Hasil analisis menunjukkan bahwa kandungan N pada T1 dan T3 tergolong rendah sedangkan pada T2 berstatus sedang. Kandungan unsur K pada keseluruhan lokasi pengambilan contoh tergolong sedang. Penelitian ini merekomendasikan pemupukan N dan K sebesar 275 dan 50 kg/ha, masing-masing menggunakan urea dan KCl, tanpa arahan pengembalian jerami.

Kata kunci: kesuburan tanah, N dan K total, padi sawah.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the staple food crops of almost half the world's population (Hadianto *et al*., 2020). Rice production must be increased significantly to meet the increasing needs of the world's population. Rice is also the main source of carbohydrates in Indonesia (Budijanto and Sitanggang, 2011). Therefore, food security policies are the main focus in the development and development of agriculture, especially rice plants (Anggraini *et al*., 2013). Rice paddy is also the largest consumer of fertilizer in Indonesia (Harahap *et al*., 2020). However, the efficiency of paddy fields fertilization in Indonesia is still low, ranging from 30 to 50% (Nurhayati *et al*., 2010).

Increasing soil productivity to produce high rice production is one of the challenges that will continue to be faced to achieve food security. So that to achieve increased production, sustainable land management technology is needed, including fertilization technology (Ndekano *et al*, 2021). Fertilizer efficiency plays a vital role in increasing farmers' income and is

also related to the sustainability of the production system, environmental sustainability, and energy resources (Nurmegawati *et al*., 2012).

The success of cultivating rice is largely determined by soil fertility. However, the irrational use of fertilizers to boost soil fertility will result in inefficiency, land degradation, and pollution (Nurhayati *et al*., 2010). Therefore, the fertilization application must concern (a) how and in which extent the soil in providing nutrients, as well as plants in absorbing them, (b) the desired yield target, and (c) the type of fertilizer used. These consideration is needed to achieve optimum and sustainable rice production. The purpose of this study was to recommend fertilization based on the nutrient status of N, P, and K at some rainfed in Mantoh District.

MATERIALS AND METHODS

This research was carried out in July 2021 in rainfed rice fields at Bombanon Village, Mantoh District, Banggai Regency, as depicted in Figure 1. Soil samples were collected from three locations, namely T1, T2, and T3. The collection of soil samples were conducted in triplicate, hence, resulting in nine samples in total. A Kjeldahl and HCl 25% methods were conducted at the laboratory to determine N and K, respectively. The laboratory results then were matched with the Soil Research Institute (PPT, 1995) guidelines for soil nutrient status. The recommendations concerned the Balitbangtan national guidelines (Balitbangtan, 2020).

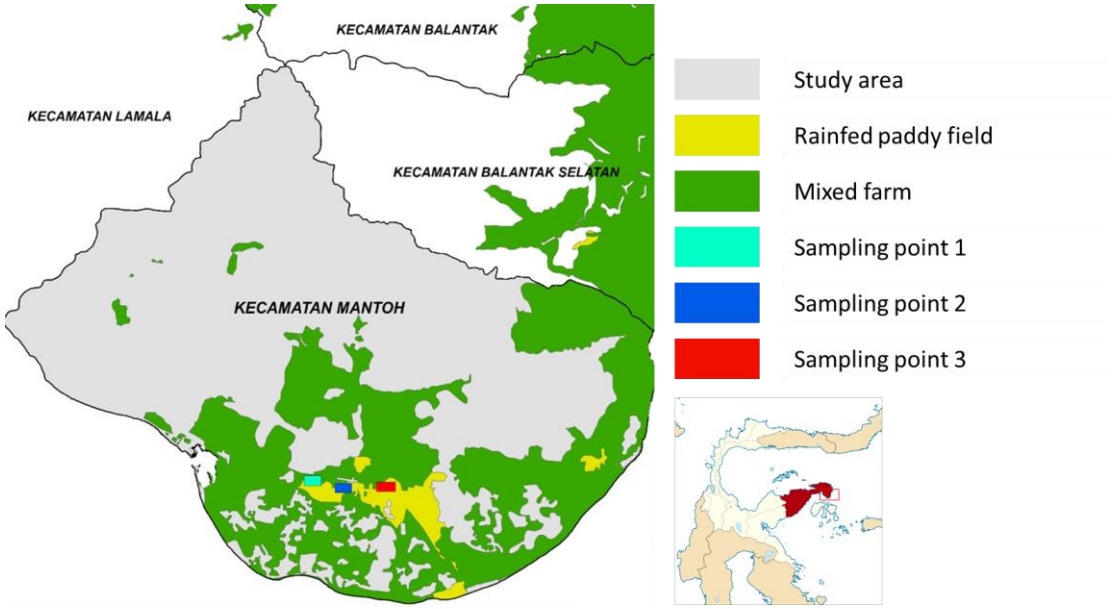

Figure 1. Location of the study site and soil sampling

RESULTS AND DISCUSSION

Status of soil N and K

The soil N nutrient status analysis results at points 1 and 3 were classified as low, ranging from 0.19 to 0.20%, whereas point 2 was moderate. Hidayanto (2019) revealed that one of the causes of low nitrogen nutrients is the lack of understanding of farmers in applying nitrogen fertilizers and the addition of organic matter. Rice plants are very responsive to

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nitrogen fertilizers and require more nitrogen in the growth process. Some nitrogen nutrients can also be lost during harvesting and leaching. The N element in the soil is generally relatively low, so for optimal plant growth, it is necessary to add N in the form of fertilizer or other sources at the beginning of each farming (Hidayanto, 2019).

Table. 2 The status of soil N and K based on PPT (1995)

Sampling point	N		k	
	Content (%)	Status	Content (mg/100g K_2O)	Status
1	0,19	R	24,56	S
2	0,22	S	21,74	S
3	0,20	R	25,65	S

Furthermore, the analysis results of soil K at the study site showed that the entire sampling points were classified as moderate, ranging from 21.74 to 25.65 mg/100g. The soil K in content was classified as moderate status is due to some of the rice straw being returned to the land or not being burned (Hidayanto. 2019). Potassium (K) could be provided by amending rice straws into the soil to fulfil rice K requirements. However, K ion was highly mobile in soil solution in its available form (Hartanto, 2013), which can be leached out from soil solum.

Recommendations for Fertilization of N and K

Based on the Balitbangtan (2020) national guidelines, the standard for calculating the dose of nitrogen (N) fertilization is based on rice production. The land with low productivity (<5 t/ha) requires 200 kg/ha of urea. A moderate production level (5-6, t/ha) would be achieved using 250-300 kg/ha of urea fertilization. Meanwhile, at high production levels (>6 t/ha), 300-400 kg/ha of urea is required. Meanwhile, the increase in rice productivity with about 2.5 t/ha of increment level requires approximately 275 kg/ha of urea. Around 325 and 375 kg/ha of urea is needed to achieve is 3.0 t/ha and 3.5 t/ha of rice production increments, respectively. Based on interviews with farmers at the research site, the productivity of lowland rice is low (around 4.5 t/ha). Therefore, in order to achieve an optimum rice production of 4.5 – 7 t/ha, an additional 2.5 t/ha increment level is needed, which requires a urea rate of 275 kg/ha. Low rice productivity at the study site occurred due to low to moderate soil N content, as shown in Table 2.

Table 3. Recommendations for fertilizing N and K in soil

Nutrients	Sample Point and Nutrient Status			Fertilization Recommendations	
	1	2	3	Kg/ha	Fertilizer
N	R	S	R	275	Urea
K	S	S	S	50	KCl

The potassium content at the entire rainfed rice field sites were classified as moderate (Table 3). About 80% of potassium in the soil is absorbed by rice plants and accumulated in the straw. Ariawan *et al*, (2016) stated that rice fields with a moderate and high status of potassium nutrient content do not need to provide additional K fertilizer due to the availability of soil K

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that comes from returning straw. Concerning Balitbangtan (2020) 's guidelines, rice fields at the research location had moderate potassium content, which requires about 50 kg/ha of KCl, without additional KCl fertilizer. However, returning the straw is recommended to save the farmer's cost in purchasing fertilizer, as well as replenish available K that is absorbed by plants or leached from soil solum.

CONCLUSIONS

Based on the results of research and discussion, it can be concluded that the chemical status of nitrogen nutrients in rainfed rice fields at the research site were relatively low. Moreover, the chemical element potassium (K) status of whole points was also classified as moderate. The recommendation for nitrogen (N) and potassium (K_2O) fertilization at the study site was 275 kg/ha urea and 50 kg/ha KCl, respectively. Further research is needed to clarify the straw retuning to slowly replenish the availability of N and K nutrients in the soil and decrease the chemical fertilizer input.

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