

The Nutrient Status of Paddy Fields Is Based on The Results of The Analysis Of the Rice Soil Test Device (RSTD) in Jerukagung Village, Klirong District, Kebumen Regency.

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ABSTRACT

This study aims to determine the nutrient status of the soil and obtain fertilization recommendations based on the results of the analysis of the Rice Soil Test Device (RSTD) in Jerukagung Village, Klirong District, Kebumen Regency. Data collection was carried out by data analysis with RSTD, direct interviews and distribution of questionnaires to farmers who own rice fields. Sample selection is carried out by random sample method (*probability sampling*). The number of samples taken by 30 farmers from 4 farmer groups who have paddy fields in Jerukagung Village, Klirong District, Kebumen Regency. Based on the test results using RSTD, with a low N content (86.67%) so it needs to be fertilized 250 kg of Urea / ha. The P content is high (86.67%) so it needs to be fertilized 50 kg SP-36/ha. The K content is medium (73.33%) so it needs to be fertilized 50 kg KCl / ha or by using straw as much as 5 tons / ha. The degree of acidity or pH in general is neutral (60%), which is in the range of pH 6-7 so that the recommendation for N fertilization is in the form of Urea with a conventional drainage system.

Keywords: soil analysis, nutrient status, rice fields, RSTD

INTRODUCTION

Indonesia is an agricultural country where most of the population works as farmers. The large number of Indonesians who depend on the agricultural sector shows the great role of the agricultural sector in supporting the economy and has an important role in the economic development of the community in the future, [1]; [2].

Farmers in Indonesia are currently the most dominant rice farmers. Speaking of rice farmers in the Central Java area, there is currently an area with

a large enough area of rice agricultural land, namely Kebumen Regency. Kebumen Regency is one of the rice producing centers in Central Java. The majority of the population has a livelihood as farmers in rice fields. Along with the increase in population with production conditions that are still considered unable to meet the food needs of the population.

In Kebumen Regency, there is Jerukagung Village which is a village located in Klirong

District. The total number of people is 2317 people consisting of 1110 men and 1207 women with a total population of productive age (aged 15 – 64 years) of 1487 people. It has an area of 210 Ha with rice paddy commodities of 118 Ha. The average rice production in Jerukagung Village is 6.9 tons/ha, [3] This is said to be still low from the government's target of rice production of 8-9 tons / Ha.

Rice is the main commodity cultivated by farmers. One of the factors that support optimal rice plant productivity is the availability of nutrients in sufficient quantities in the soil. If the soil cannot provide enough nutrients for plants, then fertilizer application needs to be done to meet the deficiency.

Fertilizer is one of the main factors of production besides land, labor and capital. Fertilization plays an important role in efforts to increase agricultural output. The recommended dose of fertilization for rice crops is 250 kg Urea / ha, 100 kg SP-36 / ha and 100 kg KCl / ha, [4]. Farmers usually apply fertilizer to rice plants based on the estimated dose of fertilization that is usually done without knowing the status of soil fertility and plant needs. This causes the dose of fertilizer applied by farmers tends to be unbalanced.

Excessive use of fertilizers can reduce fertilization efficiency and environmental quality. The dose of fertilizer used to fertilize one type of

plant will be different for each type of soil, this can be understood because each type of soil has characteristics and different soil chemical properties. Excess provision of certain nutrients and lack of other nutrients due to unbalanced fertilization can decrease soil organic matter levels, The degradation not only threatens the quantity (productivity) of rice yields, but also its quality, [5].

Site-specific balanced fertilization is one solution to improve and increase agricultural productivity. Site-specific balanced fertilization is the application of fertilizer into the soil based on location in order to achieve a balance between the availability of nutrients present in the soil and the need for plant growth. Balanced fertilization does not have to be a complete fertilization but only adds nutrients that are less available in the soil so that it can meet the nutrient needs of plants.

To address the gap in the application of this site-specific balanced fertilization technology, the Soil Research Institute has created a set of tools to determine the nutrient content (status) of soil that can be worked on in the field along with fertilizer recommendations. This tool is called the Rice Field Soil Test Device (RSTD). The use of RSTD is able to help farmers increase the accuracy of dosing N, P, and K fertilizers for rice fields.

MATERIALS AND METHODS

This research was conducted in Klirong District, Kebume Regency, where the majority of the area started lowland located at an altitude of 13-24 meters above sea level with a distance from Kebumen city $\pm$ 7 km to the north. The research was conducted in April - May 2021.

Data collection was carried out by data analysis with RSTD, direct interviews and distribution of questionnaires to farmers who own paddy fields. Sample selection is carried out by random sample method (*probability sampling*). The number of samples taken by 30 farmers from 4 farmer groups who have paddy fields in Jerukagung Village, Klirong District, Kebumen Regency.

The tools used in this study include: Rice Soil Test Device (RSTD) as a tool for testing

nutrient status N, P, K; Rice field soil pH; Drill the ground; Test tubes; Spoon; Camera; Plastic bags; Rubber band; Labels and stationery Laboratory equipment for soil analysis.

The materials used in this study were research site maps (Figure 1) and land use maps (Figure 2) on a scale of 1:50,000, soil samples taken from the research site and RSTD chemical components consisting of: Pereksi N – 1 as much as 120 ml, Pereksi N – 2 as much as 120 ml, Pereksi N – 3 as much as 20 ml, Pereksi N – 4 as much as 1.0 gr, Pereksi P – 1 as much as 250 ml, Pereksi P – 2 as much as 2.0 gr, Pereksi K – 1 as much as 120 ml, Pereksi K – 2 as much as 15 ml, Pereksi K – 3 as much as 15 ml, Pereksi pH – 1 as much as 250 ml, Pereksi pH -2 as much as 25 ml and Distillate Water (*Aquadest*) as much as 250 ml



Figure 1. Map of the Research Location

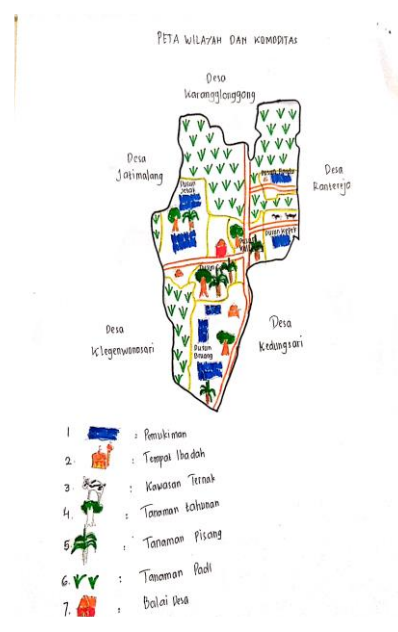


Figure 2. Land use map

RESULTS AND DISCUSSION

Research on qualitative tests of rice soil nutrient status based on the results of rice field soil test device analysis (RSTD) includes: Nitrogen nutrient status (N), Phosphorus nutrient status (P),

Potassium nutrient status (K) and soil pH. The results of Rice Field Soil Testing in Jerukagung Village, Klirong District can be seen in Table 1.

Table 1. Rice Field Soil Testing Results in Jerukagung Village, Klirong District

No	Name	Analysis Results			
		N	P	K	pH
1	Purwono	Low	High	Medium	Neutral
2	K Mashud	Low	Medium	Medium	Neutral
3	Muhrisun	Low	High	High	Slightly sour
4	Sugiyono	Low	High	Medium	Neutral
5	Doni Eko A	Low	High	Medium	Neutral
6	Ngadimun	Low	High	Medium	Neutral
7	Jamingan	Low	High	Medium	Slightly sour
8	Tohadi	Low	High	High	Slightly sour
9	Iman Santosa	Low	Medium	Medium	Neutral
10	Dutadi	Low	High	Medium	Neutral
11	Syamsudin	Medium	High	High	Slightly sour
12	Supriyono	Low	High	Medium	Neutral
13	Sipon Haryono	Low	High	Medium	Slightly sour
14	Wagiyono	Low	High	Medium	Slightly sour
15	Dwi Jayanti	Low	High	High	Neutral
16	Manisah	Low	Medium	Medium	Slightly sour
17	Siti Laeliah	Medium	High	Medium	Neutral
18	Lasmi	Low	High	High	Slightly sour
19	Mujiono	Low	High	Medium	Slightly sour

20	Suwaedi	Low	High	Medium	Neutral
21	Sri Ningsihati	Medium	High	Medium	Neutral
22	Agus Suharjo	Low	High	High	Neutral
23	Eko Hadi P	Medium	Medium	Medium	Neutral
24	Sarjianto	Low	High	Medium	Neutral
25	Suparno	Low	High	Medium	Neutral
26	Masturodin	Low	High	High	Slightly sour
27	Sholihin	Low	High	High	Neutral
28	Sunhaji	Low	High	Medium	Slightly sour
29	Moh Ngalif	Low	High	Medium	Netral
30	Mujahidin	Low	High	Medium	Slightly sour

Based on the results of RSTD analysis conducted on 30 farmers' rice fields in Jerukagung Village (Table 10), where N nutrients are generally dominated by low 86.67% (26 samples), P nutrient status in general is dominated by high

86.67% (26 samples), K nutrient status is generally dominated by medium 73.33% (22 samples), while overall pH is neutral 60% (18 samples).

Nitrogen (N) Nutrient Status

N nutrients for plants play a role in the formation of plant cells, tissues and organs. Nitrogen is absorbed by plants in the form of NO₃⁻ or NH₄⁺ ions. The need for N nutrients in plants is needed in large quantities, especially during vegetative growth, because N elements function as material for the synthesis of chlorophyll, proteins and amino acids. Along with elemental phosphorus (P), nitrogen is used to regulate plant growth as a whole, [6].

The status of Hara N in Jerukagung Village based on the results of rice field soil analysis using RSTD conducted on 30 samples of land owned by farmers, showed that the average N nutrient status was low (86.67%), while the rest was in medium status (13.33%). There were no soil samples that were in high N nutrient status. So that fertilization recommendations are obtained based on the results of the analysis using RSTD on low N status soils on 20-40% clay soils with 250 kg of Urea / ha, while on medium N status on clay soils 20-40% of Urea application only 200 kg/ha. While the low N

status soil on <40% clay soil is with 300 kg Urea / ha, while in medium N status on <40% clay soil the application of Urea is only 250 kg / ha (Table 2).

The low status of N elements in rice fields in Jerukagung Village is due to the lack of intensity of N fertilization carried out by farmers, so that rice plants grow stunted, yellow leaves, fall easily, late flowering, and limited root growth so that production is low, [7]. Symptoms of N deficiency in young plants show symptoms of yellowing of the whole plant, while symptoms in old plants show yellowish-green to yellow lower leaves. In addition, saplings produced by plants that lack N are reduced and late flowering, but the grain ripening process is fast so that the grain is less pithy and the grain from the panicles produced is also reduced. While fertilization carried out without paying attention to the nutrient status of the soil and plant needs will cause excess nutrients. For optimal growth during the vegetative phase, N fertilization must be balanced with fertilization of other elements.

Table 2. N nutrient status and N fertilization recommendations in Jerukagung Village, Klirong District

Hara status N	Sample		Recommended Urea for soil (kg/ha)	
	Numbers	%	Clay (20-40%)	Clay (<40%)
Low	26	86,67	250	300
Medium	4	13,33	200	250
High	0	0	-	-
Total	30	100,00		

The addition of element N to the soil can be done by using Urea, ZA, DAP, compound fertilizer or by using compost. Fertilization efficiency through timely fertilization that is, fertilization tailored to the needs of plants can be carried out. In addition to efficient fertilization, the use of

Phosphorus (P) Nutrient Status

Phosphorus (P), is one of the important elements for plants that play a role in compiling enzymes, proteins, ATP, RNA and DNA. ATP is important for the energy transfer process, while RNA and DNA determine the genetic properties of plants. In addition, element P also has a role for the growth of seeds, roots, flowers and fruits. Along with potassium, element P is used by plants to stimulate flowering. So that the need for P will increase high when the plant will flower until fruiting [9].

Berdasarkan hasil analisis status tanah sawah in Jerukagung Village, the general P nutrient status is high (86.67%), while the rest is medium

superior varieties that are responsive to N feeding and improving cultivation techniques, which consist of regulating plant populations, proper irrigation, and giving the right N both in dose and method and time of administration, [8].

(13.33%). The dominance of high and medium P element status in rice fields in Jerukagung Village due to intensive fertilization. Intensive fertilization on technical irrigated rice fields with planting intensity two or three times a year will cause the dominance of high P status, this is because not all P fertilizers given can be completely absorbed by plants, [10].

Fertilization recommendations based on the results of analysis using RSTD in Jerukagung Village on soils for high P nutrient status are 50 kg SP-36/ha and P nutrient status while fertilization recommendations are 75 kg SP-36/ha (Table 3).

Table 3. P nutrient status and fertilization recommendations in Jerukagung Village, Klirong District

Hara status	Numbers	Persentase (%)	Fertilization Recommendations
Low	-	-	-
Medium	4	13,33	75 kg SP-36/ha
High	26	86,67	50 kg SP-36/ha
Total	30	100,00	

In general, P has been identified as a nutrient that is important for plant root health and increases plant resistance to iron poisoning. In addition, lack of P nutrients in rice plants will cause slow plant root growth, stunted plants, dark green and erect leaves, over time purplish leaves. In addition, the number of saplings sedikit, late flowering time so

that it is uneven, the life of the plant or harvest is longer and the grain formed is reduced, [11]. In addition to affecting plants, excess P elements will cause the absorption of other elements, especially microelements such as iron (Fe), copper (Cu), and zinc (Zn) disrupted. But the symptoms are not physically visible in plants, [12].

Nutrient Status of Potassium (K)

Element K for plants has a role as a regulator of plant physiological processes such as photosynthesis, accumulation, translocation, carbohydrate transport, opening and closing stomata, or regulating the distribution of water in tissues. Lack of element K will cause leaves to burn and eventually fall, then affect the strength of the plant so that it can cause many pest and disease attacks, [13]. In addition, lack of element K causes

carbohydrate levels to decrease and causes weak plant stems so that plants collapse easily.

The average nutrient status of K in Jerukagung Village is medium with a percentage of 73.33%, while the remaining 26.67% is in high status. K status which is in medium and high conditions, one of which is because K fertilization is not always done by farmers and even if there is given in small amounts and is not balanced with the

amount of N and P. In addition, the return of straw in each harvest season ends is generally burned (to speed up the tillage process) and not returned to the field which automatically results in K elements carried by plants not returning to the ground. Rice straw contains SiO₂ between 1.7 to 9.3% while the K content in rice straw varies between 1 to 3%.

Fertilization recommendations on medium and high K nutrient status, adding K through KCl fertilizer is as much as 50 kg / ha or by addition using 5 tons of straw / ha. The status of element K in rice fields in Jerukagung Village is between medium and high.

Table 4. K nutrient status and fertilization recommendations in Jerukagung Village, Klirong District

Hara Status	Numbers	Persentase (%)	Fertilization Recommendations
Low	-	-	-
Medium	22	73,33	a. 50 kg KCL/ha or
High	8	26,67	b. 5 ton of straw/ha
Total	30	100,00	

Status pH

Based on the test results using RSTD, the pH status of rice fields in Jerukagung Village is generally neutral (60%). Based on the color chart of the test results with RSTD against pH, the neutral soil status is in the range of 6-7. Fertilization recommendations based on pH status are conventional drainage systems and N fertilizers in the form of Urea (Table 5). At a soil pH of less than 6, the availability of P, K, S, Ca, Mg and Mo elements decreases rapidly and the activity of microorganisms to decompose organic N becomes inhibited. Then soil pH also affects plant growth, which determines whether or not nutrient ions are easily absorbed by plants, [14]. But in general, nutrients will be easily absorbed by plants at pH 6-7, because at that pH most of the nutrients will

easily dissolve in water and the pH degree in the soil also indicates the presence of elements that are toxic to plants. In acidic soil conditions, there will be many aluminum (Al) elements which in addition to poisoning plants also bind phosphor so that they cannot be absorbed by plants, besides that in acidic soils there are also too many microelements that can poison plants. While in alkaline soils many elements Na (Sodium) and Mo (Molybdenum) are found, and soil pH conditions also determine the development of microorganisms in the soil. At pH 5.5 – 7 fungi and bacteria that decompose organic matter will grow well. Likewise, microorganisms that are beneficial to plant roots will also develop properly.

Table 5. pH status and fertilization recommendations based on soil pH

Status pH	Numbers	Persentase (%)	Fertilization Recommendations
Very sour pH < 4	-	-	-
Sour pH 4-5	-	-	-
Quite sour pH 5-6	12	40	a. Conventional drainage system b. Fertilizer N in the form of Urea
Neutral pH 6-7	18	60	
Slightly alkaline pH 7-8	-	-	-
Alkaline pH > 8	-	-	-
Total	30	100	

CONCLUSION

The results of the RSTD analysis conducted on 30 farmers' rice fields in Jerukagung Village, Klirong District, Kebumen Regency found that the average N nutrient status was low (86.67%), while the rest were in medium status (13.33%). Then the average P nutrient status is high (86.67%), while the rest is medium (13.33%). The average K nutrient status is medium (73.33%), while the remaining 26.67% is in high status. The pH status

in general is neutral (60%), while the rest is slightly acidic (40%). Then Recommendations for fertilization of rice field nutrient needs in Jerukagung Village, Klirong District, Kebumen Regency 250 kg Urea / ha, 75 kg SP-36 / ha, KCl fertilizer as much as 50 kg / ha or with additions using 5 tons of straw / ha

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