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Urea And Kirinyuh Combination on Soil Fertility and Results of Land Kale

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ABSTRACT

Plants require nitrogen to grow, which can be obtained from urea fertilizer or Kirinyuh organic fertilizer. A study was conducted using a Randomized Block Design to determine the appropriate amount of fertilizer needed to improve soil fertility and increase land kale yields. The study had five treatments: UK1 which used 100% Urea (15 g m-²), UK2 which used 50% Urea (7.5 g m-²) and 50% POC Kirinyuh (2.375 L m-²), UK3 which used 25% Urea (3.75 g m-²) and 75% POC Kirinyuh (1.1875 L m-²), UK4 which used 100% POC Kirinyuh (4.75 L m-²), and each treatment was repeated four times. The results showed that UK4 was better than the other treatments for almost all variables of soil chemical properties, except for total N. On the other hand, the UK3 treatment had the best effect on the total soil N variable and had the same value as UK4 for the soil CEC variable. For soil fertility status, a combination of fertilizer treatment (UK2 and UK3) and 100% POC Kirinyuh (UK4) had the best effect with a moderate status. Regarding crop yield, UK1 had the best effect but was not significant with UK2 in Land Kale Fresh Weight tan-1 (g). A combination of Urea and organic Kirinyuh fertilizer is the best way to meet plants' nitrogen needs and enhance soil fertility.

Keywords: Fertilizer, Nitrogen, Land Kale

Introduction

Vegetables are in high demand and are therefore grown extensively by farmers. However, the cultivation of these vegetables relies heavily on inorganic fertilizers, such as land kale. According to reports from farmers in Lokoboko Village, land kale cultivation only uses urea fertilizer. This fertilizer was chosen due to its high nitrogen content. However, farmers frequently face challenges in its usage.

Farmers face challenges when trying to promptly obtain subsidized urea fertilizer from the government. This is because the process requires administrative arrangements for farmer groups. As a result, if farmers need to receive the fertilizer more quickly, they have to purchase non-subsidized fertilizer that is more expensive. Despite the higher cost, farmers have no choice but to buy it because they heavily rely on this fertilizer.

Farmers in Lokoboko Village use a very high amount of urea fertilizer, around 300-400 kg ha-1, for their kale plants. However, the recommended dose for using urea fertilizer for land kale is only 150 kg ha-1 (Balai Pengkajian Teknologi Pertanian Sulawesi Utara, 2016). Farmers use more urea fertilizer than the recommended dose, believing that higher doses will yield better results. This belief is supported by several research studies, such as Mahrus and Raksun (2020) and Pratama et al. (2014).

Soil degradation is a common problem caused by the use of inorganic fertilizers. Sukristiyonubowo et al. (2018) have suggested that land degradation can lead to structural damage, increased density,

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soil acidity, and environmental pollution. To minimize these adverse effects, it is recommended to use organic fertilizers.

Organic fertilizers have several advantages over inorganic fertilizers, as they minimize their negative impact on the environment. Besides providing more nutrients, organic fertilizers also improve soil quality. A study by Puspadewi et al. (2016) revealed that organic fertilizers can repair damaged soil aggregates. One excellent ingredient that can be used in organic fertilizers is Kirinyuh.

Kirinyuh is a plant used to make organic fertilizer due to its abundance (Pu'u & Charly, 2018). There have been several studies on the effectiveness of kirinyuh liquid organic fertilizer on both soil and plant yields (Marpaung, 2017; Renggi & Mutiara, 2020). This fertilizer contains not only nitrogen but also other macro elements that are beneficial for plant growth (Jeksen & Mutiara, 2017; Pu'u & Charly, 2018). According to Duaja (2012), kirinyuh organic fertilizer has a nutrient content of 0.14% nitrogen, 31% phosphorus, and 0.45% potassium. Based on this nutrient content, a farmer would need to apply 47,586 liters of kirinyuh fertilizer per hectare of land (4.75 liters per square meter), which may prove difficult. Therefore, it is recommended to combine both inorganic and organic fertilizers to achieve optimal results. This recommendation is supported by the findings of other studies (Marpaung et al., 2021; Napitupulu et al., 2018; Tumewu et al., 2018; Tumewu et al., 2019).

Material and Methods

The experiment was conducted at the experimental garden of the Faculty of Agriculture, University of Flores, in Lokoboko Village, Ndona District, Ende Regency. The research was conducted from June to August 2019. The research materials included land kale plant seeds, urea fertilizer, kirinyuh liquid organic fertilizer (POC), and soil and land kale vegetable seeds. The tools used included crowbars, hoes, spades, machetes, buckets, rakes, meters, scales, rulers, raffia ropes, plastic drums, sieves, plastic bags, and writing instruments.

Methods

The effectiveness of the treatment was evaluated using the Analysis of Variance (ANOVA) test. The experimental design used was Randomized Group, and the treatments applied were as follows:

UK0 : Tanpa perlakuan pupuk

UK1 : 100% Urea = 15 g m^{-2}

UK2 : 50% Urea = 7,5 g m^{-2} dan 50% POC Kirinyuh = 2,37 L m^{-2}

UK3 : 25% Urea = 3,75 g m^{-2} dan 75% POC kirinyuh = 3,56 L m^{-2}

UK4 : 100% POC Kirinyuh = 4,75 L m^{-2}

The experiment consisted of 20 experimental units with each treatment repeated 4 times. The land was cleared mechanically before planting. Then, the soil was cultivated to a depth of 20-25 cm, and raised beds were made with a length, width, and height of 1mx1mx40 cm. The treatment plots were spaced 30 cm apart, while the replications were spaced 30 cm apart as well. The Land Kale seeds were planted at a distance of 20 x 20 cm. One week before planting, 10 tons ha-1 (1 kg m^{-2}) of chicken manure was applied. Urea was applied when the plants were 2 weeks old, and POC kirinyuh was applied at 1 and 3 weeks, with doses according to the treatment.

Statistic

The following variables were observed and analyzed: N-Total Soil (Kjedhal method), Soil pH (measured using a pH meter), K2O (extracted with 25% HCl), P-Available Soil (extracted using Bray method), Cation Exchange Capacity (determined by saturating with ammonium acetate (NH4OAc)), Wet Saturation (extracted), and C-Organic Soil (extracted using Walkey and Black method). The chemical properties of the soil were evaluated based on standards from the Bogor Soil Research Center

(1995). To analyze the effect of fertilizers on Land Kale yields, a randomized block design was used for the analysis of variance with a 5% BNT follow-up test.

Results and Discussion

The analysis data for soil planted with land kale under various urea fertilizer treatments and Kirinyuh POC has been analyzed and is presented in Table 1.

Table 1. Results of analysis of soil chemical properties

Kode Sempel	C Organic	N Total	P Total	K Total	CEC	BS	pH
	…..(%)….		…(mg/100g)…		(Cmol (+)/kg)		
UK_0	0,39 VL	0,16 L	12,21 VL	10,10 L	23,43 M	23,72 M	4,3 S
UK_1	0,45 VL	0,21 M	12,21 VL	10,12 L	24,00 M	23,69 M	4,3 S
UK_2	0,48 VL	0,30 M	15,58 L	11,15 L	31,58 H	59,99 H	5.7 SS
UK_3	0,56 VL	0,31 M	18,55 L	14,28 L	32,00 H	65,19 H	5.9 SS
UK_4	0,61 L	0,22 M	18,65 L	14,58 L	32,00 H	67,19 H	6,0 SS

Note: VL = Very Low, L = Low, M = Medium, H = High, SS= Slightly Sour, S = Sour

Soil chemistry criteria

The UK4 treatment, which received 100% kirinyuh organic fertilizer, showed the highest soil organic C content, while the UK0 treatment had the lowest. The soil's C-Organic is classified as low to very low based on soil chemical criteria, and this can be affected by the organic fertilizer applied to the soil, as mentioned by Walida et al. (2020). However, the effect of the organic fertilizer application is not yet significant since it has not been continuously applied. According to Sukristiyonubowo et al. (2018), soil C-Organic increases with the continuous application of organic fertilizer, which is also supported by Farrasati et al. (2020).

The Nitrogen (N) content of the soil is categorized as low in UK0 treatments and moderate in UK1 to UK4 treatments. This indicates that the use of kirinyuh fertilizer treatment has increased the nitrogen content in the soil. Combining kirinyuh liquid organic fertilizer with urea resulted in the highest total soil nitrogen content. Studies by Sukristiyonubowo et al. (2018) have shown that organic agricultural land has a higher nitrogen content than semi-organic or conventional agriculture. On the other hand, research by Flatian et al. (2020) has found that the total nitrogen content of soil is affected by fertilizer efficiency.

The levels of two important nutrients, Phosphorus (P) and Potassium (K), were found to be low in all treatments. This is because the inorganic fertilizer used did not provide enough P and K. Additionally, the soil acidity level was below neutral, which caused the soil's P to be bound by Al and Fe, leading to low P and K content in the soil.

According to the analysis of Cation Exchange Capacity (CEC) and Base Saturation (BS), the criteria for both are in the medium to high range. Specifically, treatments UK0 and UK1 have medium criteria, while treatments UK2, UK3, and UK4 have high criteria. The high CEC and BS of the soil are attributed to the application of kirinyuh liquid organic fertilizer, either alone or in combination. A study conducted by Agustin and Suntari (2018) found that soil CEC can increase by using a combination of organic fertilizer and urea.

The results of soil pH measurements for treatments UK0-UK4 showed a range of 4.3 to 6.0, which falls under the acidic to slightly acidic criteria. Soil with acidic pH was observed in treatments UK0 (control) and UK1 (100% urea). On the other hand, soil treated with a combination of urea and Kirinyuh

POC (UK2 and UK3) and 100% Kirinyuh POC (UK4) exhibited a slightly acidic pH. As per the study conducted by Agustin and Suntari (2018), the use of organic fertilizers has a greater impact on increasing soil pH as compared to inorganic fertilizers like urea. Additionally, Napitupulu et al. (2018) have found that combining organic kirinyuh fertilizer with inorganic fertilizers can also improve soil pH.

Soil Fertility Criteria

The results of soil chemical analysis are compared to soil fertility criteria and presented in Table 2.

Table. 2. Soil fertility criteria

Kode Sempel	CEC	BS	P_2O_5, K_2O, C Organic	Fertility Status
UK_o	M	M	3 L	Low
UK_1	M	M	3 L	Low
UK_2	H	H	3 L	Medium
UK_3	H	H	3 L	Medium
UK_4	H	H	3 L	Medium

Note: L/M/H = Low/ Medium/ High

According to Table 2, the soil fertility status is low and medium. The soil fertility status is low in treatments without fertilizer (UK0) and 100% urea (UK1). On the other hand, the soil's fertility improves to medium status when treated with kirinyuh POC, either in combination (UK2 and UK3) or 100% (UK4). It has been found that using kirinyuh POC can significantly enhance soil fertility. This can be attributed to the high CEC (cation exchange capacity) and KB (base saturation) of the land. When organic material is added to the soil, it improves the soil's chemical properties, as stated by Hanafiah (2012). Furthermore, Supangat et al. (2013) have emphasized the importance of soil organic matter in supporting agricultural activities.

Land Kale result

The table presents data on kale plants' fresh weight per plant and hectare after treatment with urea fertilizer and Kirinyu POC. The results are shown in Table 3.

Table 3. The impact of nitrogen fertilization on the yield of land kale

Treatment	Land Kale Fresh Weight tan^{-1} (g)	Land Kale Fresh Weight ha^{-1} (ton)
UK0	30.25 d	7.56 e
UK1	77.01 a	19.25 a
UK2	68.08 a	17.02 b
UK3	48.53 b	12.13 c
UK4	43.25 c	10.81 d
BNT 5 %	3.31	0.83

Note: Numbers followed by the same letter in the same column indicate that they are not significantly different at the 5% BNT test level

The data in Table 3 show how fertilizer application impacted the yield of land kale plants. According to the data, the best results came from the UK1 treatment, which involved administering 100% Urea fertilizer. Urea is known for its high nitrogen content of 46%, which is much higher than the 0.145% POC Kirinyu (Duaja, 2012).

Although treatment UK1 (100% urea) gave the highest yield compared to other treatments, the statistical analysis showed that its yield was not significantly different from UK2 (50% Urea and 50% POC Kirinyu). According to the research results of Walida et al. (2020), a combination of organic fertilizer and urea is the best treatment that affects soil chemical properties and plant yields. This finding was also mentioned by Agustin and Suntari (2018), who reported that the combination of 50% urea and 50% compost had the best influence on the growth of corn plants.

Conclusion

The UK4 treatment, which uses 100% POC Kirinyuh, was found to have the best effect on almost all soil chemical property variables, except total N. The UK3 treatment, which uses a mix of 25% Urea and 75% Kirinyuh POC, had the best effect on the total soil N variable. Both the UK4 and UK3 treatments provided the best influence on the soil CEC variable. Regarding soil fertility status, the combined fertilizer treatment of UK2 and UK3 and 100% POC Kirinyuh of UK4 had the best effect with moderate status. In terms of crop yield, the best treatment effect was UK1 (100% Urea), but it was not significantly different from the UK2 treatment (50% Urea and 50% Kirinyuh POC). Based on these conclusions, it is evident that a combination of organic and inorganic fertilizers is the best choice for sustainable agriculture.

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