



Response Land (*Ipomoea reptans* Poir) as a Result of Fertilizing NPK and Manure of Various Doses Under the Shade of Citrus Plants

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Abstract. Organic fertilizers can improve soil fertility, but the availability of nutrients is generally low due to low nutrient content. So that the response of plants to organic fertilizers will be slower, because organic fertilizers are slow release. Therefore, it is necessary to add fast-release inorganic fertilizers such as Pearl NPK fertilizer to increase plant growth. This study aims to determine: (1) Get the right dose of NPK Mutiara 16-16-16 in increasing the growth and yield of land water spinach, (2) Get the right dose of cow manure to increase the growth and yield of land water spinach, (3) Obtain the interaction between the dose of NPK Mutiara 16-16-16 and the right cow manure in increasing the growth and yield of ground land water spinach plants. The results showed that: The application of NPK Mutiara at various doses showed that the increasing dose of NPK Mutiara fertilizer increased yields, this was clearly seen in the plant height and plant yield per plot with the application of NPK Mutiara at a dose of 300 kg/ha (m3). However, the dose of 20 tons/ha (p2) gave higher yields compared to the dose of 10 tons/ha (p1) in the variables fresh plant weight, fresh canopy weight, yield per plot, and marketable yield. There was no interaction between giving NPK Mutiara 16-16-16 and cow manure fertilizer.

Keywords: Water Spinach; NPK Fertilizer; Cow Manure Fertilizer

INTRODUCTION

The use of yard land in urban areas is one of the government's programs to realize food security (Aditiameri et al., 2021). Land planted with oranges can be intercropped with vegetable crops such as kangkong. Kangkung (*Ipomoea reptans* Poir.) is a vegetable plant from the Convolvulaceae family that is popular and favored by the people of Indonesia. According to Putri et al (2019), kale consists of 3 types, namely water kale (*Ipomoea aquatica*), land kale (*Ipomoea reptans*), and forest kale (*Ipomoea crassiculatus*), kale contains vitamin A, vitamin B, vitamin C, minerals, amino acids, calcium, phosphorus, carotene, and iron. Based on the topographic characteristics of Lampung Metro City, it is a relatively flat area with a slope of less than 6 °C, has a dusty clay and clay soil texture, granular structure and podzolic soil types of red yellow and slightly sandy. In soil conditions like this it is very possible to plant kale in the Lampung Metro City area, but there are problems with the physical

properties of the soil and classified as soil that is poor in organic matter and nutrients (Muktiono, 2010).

Soil as a plant growing medium, if planted continuously can cause poor nutrients in the soil so it is necessary to take an action to return and add nutrients through fertilization. One type of fertilization that can improve soil structure is organic fertilizer. Organic fertilizers can improve soil fertility, but the availability of nutrients is generally small due to low nutrient content. So the response of plants to organic fertilizer will be slower, because organic fertilizer is slow release. Therefore, it is very necessary to add fast release inorganic fertilizers such as NPK Mutiara fertilizer to increase plant growth. In kale cultivation, fertilization is needed to increase and maintain soil fertility so that it can provide the nutrients needed by plants in spurring plant growth and increasing production, and can improve the quality of production (Putri et al., 2021).

In this study, the type of organic fertilizer applied to the cultivation of land kale is cow manure. The characteristic of cow manure is that it has a complete and relatively balanced nutrient content compared to other manure. Cow manure is a fertilizer derived from cow dung waste and has a high fiber content, because it contains cellulose. The type of cow manure used is ready-to-use manure, with characteristics including odorless fertilizer, darker fertilizer color, fertilizer easily destroyed in nature in dry conditions and fertilizer feels cold if held. Among types of manure, cow dung that has a high fiber content with a fairly high C/N ratio of > 40 (Setiawan, 2010), contains macronutrients such as Nitrogen of 0.4%, Phosphorus 0.2%, and Potassium 0.1% with a water content of 0.5%, and also contains other essential microelements (Prasetyo, 2014). The treatment of NPK Mutiara fertilizer and manure of various doses in land kale cultivation is expected to find a combination of doses that can be applied to increase the yield of kale plants.

METHODS

The research method used in this study is an experimental method that is arranged factorially using Complete Group Random Design (RAKL). The first factor is the dose of NPK Mutiara 16-16-16 (M) which consists of three levels, namely: dose 100 kg / ha (m_1), dose 200 kg / ha (m_2), and dose 300 kg / ha (m_3). The second factor is cow manure (P) which consists of three levels, namely: without cow manure (p 0), a dose of 10 tons / ha (p 1), and a dose of 20 tons / ha (p 2), so that there are nine combinations of treatments, namely: $m_1 p_0$,

m₁ p₁, m₁ p₂, m₂ p₀, m₂ p₁, m₂ p₂, m₃ p₀, m₃ p₁, and m₃ p₂. Each treatment was repeated three times, resulting in 27 trial plots.

This research was conducted at the STIPER Dharma Wacana Metro Experimental Garden, located on Jln. Wana Bakti III, RT 22 / RW 06, Margorejo Village, South Metro District, Metro City, Lampung. The altitude of the place is 60 m above sea level, red yellow podzolic soil type or ultisol soil that has a low organic matter content with a soil pH of < 4.50. This study was conducted from October to November 2022. The tools used in this study were meters, hoes, chores, ajir, measuring cups, hand sprayers, drills, analytical scales, ovens, calculators, cameras, rulers, envelopes, and stationery. The ingredients used in this study were seeds of land kale varieties Bangkok LP-1, NPK Mutiara 16-16-16, cow manure, vegetable pesticides (Escavator EC), and water.

DISCUSSION

The height development of kale plants aged 5 HST, 10 HST, 15 HST, 20 HST, and 25 HST can be seen in (Figure 1).

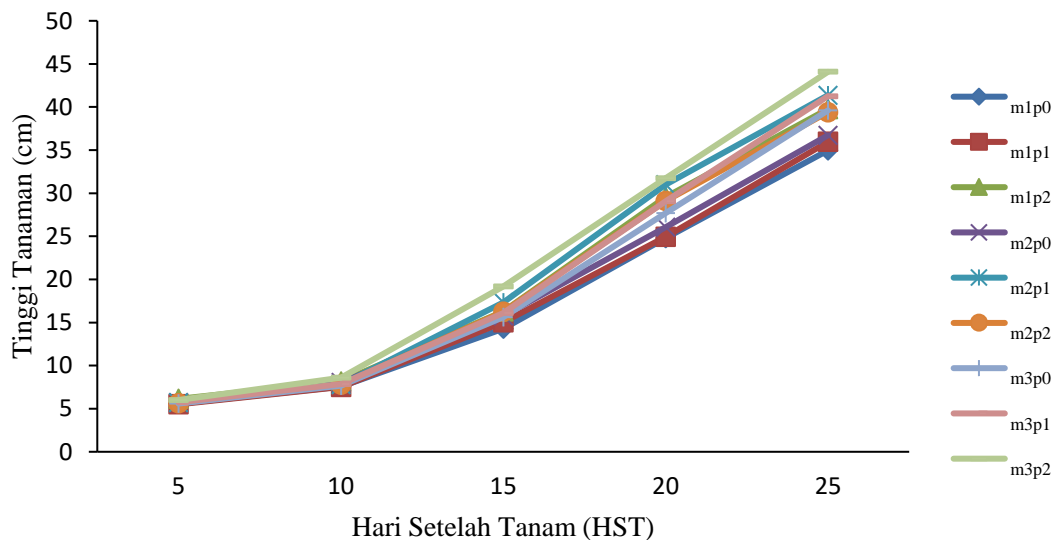


Figure 1. Kale Plant Height Curve

Figure 1 shows that the height growth of land kale plants of all treatments has increased relatively equally from 5 HST to 25 HST according to the gradient image.

The results of fingerprint analysis of kale plant height of 25 HST, fresh weight of plants, fresh weight of headers, fresh weight of roots, yield of plants per plot, marketable yield, and yield can be seen in table 1. The results of variety analysis show that NPK Mutiara

16-16-16 has a real influence on plant height variables, plant fresh weight, header fresh weight, root fresh weight, yield per plot, and yield. The results of the 5% BNT test show that the increasing dose of NPK Mutiara fertilizer increases the yield, this is clearly seen in the plant height and crop yield per plot with the administration of NPK Mutiara dose of 300 kg/ha (m₃). And the application of cow manure exerts a noticeable influence on plant height variables, plant fresh weight, header fresh weight, yield per plot, and marketable yield. The results of the 5% BNT test showed that the dose of 20 tons/ha (p₂) of cow manure was no different from the dose of 10 tons/ha (p₁) in plant height variables. However, dosing 20 ton/ha (p₂) gave higher yields compared to dosing 10 ton/ha (p₁) in crop fresh weight modifiers, header fresh weight, yield per plot, and marketable yield. This shows that the higher the dose of cow manure, the more availability of nutrients released from manure decomposition, so that the availability of nutrients needed by plants in the vegetative phase so that it can increase plant growth.

Table 1. Average Plant Height Age 25 HST, Plant Fresh Weight, Header Fresh Weight, Root Fresh Weight, Plant Yield Per Plot, Sellable Yield, and Kale Plant Yield Due to NPK Fertilization and Cow Manure Under the Shade of Citrus Plants

Effect of NPK Dose (M)	Average Plant Height (cm)	Average Fresh Weight of the Plant (g)	Average Fresh Weight of the Header (g)	Average Fresh Weight of Roots (g)	Average Hasi Plants Per Plot (g)	Average Sellable Results (g)	Average Yield (%)
100 kg/ha (m ₁)	36.94 A	18.22 A	15.42 A	2.81 A	733.31 A	689.96 A	92.47 B
200 kg/ha (m ₂)	39.16 B	26.62 B	22.41 B	4.08 B	740.22 A	678.02 A	92.19 B
300 kg/ha (m ₃)	41.65 C	29.84 B	25.64 B	4.22 B	910.49 B	740.76 A	87.12 A
Effects of Dosage Cow manure (P)							
Control (p ₀)	37.14 a	20.88 a	17.61 a	3.27 a	734.27 a	649.56 A	89.19 a
10 ton/ha (p ₁)	39.53 b	24.12 a	20.42 a	3.57 a	761.36 A	672.13 a	88.97 a
20 ton/ha (p ₂)	41.08 b	29.68 b	25.44 b	4.27 a	888.40 b	787.04 b	89.34 a

Remarks : The numbers followed by the same letter did not differ markedly in the 5% BNT test.

The results of fingerprint analysis of the variety of fresh root volume, plant growth rate, and dry weight ratio of root header can be seen in table 2. The results of variety analysis

showed that the administration of various doses of NPK Mutiara 16-16-16 had an intangible effect on root volume modifiers, plant growth rate (LTT), root crown dry weight ratio, and marketable yield. Although the results of the variety analysis show an unreal effect, but increasing the dose will produce increased results as well. This is thought to be influenced by plant characteristics and environmental factors. And applying various doses of cow manure exerts an intangible influence on root volume modifiers, plant growing rate (LTT), root wet weight, root crown dry weight ratio, and yield.

Table 2. Volume of Fresh Roots, Plant Growth Rate, and Dry Weight Ratio of Root Canopy of Kale Plants Due to NPK Fertilization and Cow Manure Under the Shade of Citrus Plants

Effect of NPK Dose (M)	Average Volume of fresh roots (ml)	Average Plant Growing Rate (g/m ² /day)	Average Root header dry weight ratio (g)
100 kg/ha (m ₁)	3,14	0,03	4,48
200 kg/ha (m ₂)	4,22	0,05	4,76
300 kg/ha (m ₃)	4,47	0,07	5,16
Effects of Dosage Cow manure (P)			
Control (p0)	3,58	0,04	4,48
10 ton/ha (p1)	3,89	0,06	4,71
20 ton/ha (p2)	4,36	0,06	5,22

DISCUSSION

In this study that the administration of NPK Mutiara dose of 300 kg / ha (m₃) can increase the growth of kale plants. According to Haryadi et al (2015), the occurrence of high growth of a plant due to the event of cell division and extension is dominated at the tip of the plant's shoot. This process is the synthesis of proteins obtained by plants from the environment such as organic matter in the soil. The addition of organic matter containing N will affect total N levels and help activate plant cells and maintain the course of photosynthesis process which in turn plant height growth can be affected.

In this study before planting, the land had been applied with mycorrhiza at doses of 20g (m₁), 40g (m₂), and 60g (m₃) it turned out that there were still residues from the mycorrhiza so that the roots of kale plants were infected with Arbuscular Mycorrhizal Fungi (FMA). From the results of the root infection test obtained from nine samples randomly produced higher root infections in m₂p₀ treatment. This is in accordance with the opinion of Sari et al (2017), stating that Arbuscula Mycorrhizal Fungi (FMA) can be found in most soils and generally do not have a specific host. However, species population levels vary greatly

and are influenced by plant characteristics and environmental factors such as temperature, soil pH, soil moisture, phosphorus content, and nitrogen. This shows that each ecosystem may contain the same type of FMA, because the diversity and distribution of FMA varies greatly due to different environmental conditions.

In this study, the media used was ultisol soil. Ultisol soil is classified as a soil that is poor in organic matter and nutrients. It is suspected that NPK Mutiara fertilizer with the dose given has not met the nutrient needs by plants. Low organic matter in ultisol soil affects nutrients in the soil, so it is necessary to apply fertilizers that meet the needs of plants. This is in line with the opinions of Kurniati and Sudartini (2015), plants require different amounts of fertilizer which are influenced by the type of soil, climate and type of plant itself. This is in accordance with the opinion of Pobela et al (2022), NPK Mutiara fertilizer is one type of fertilizer whose use is very dominant and almost every type of plant needs it. The need for NPK Mutiara fertilizer in kale plants according to the results of this study shows that the dose of NPK fertilizer 300 kg / ha (m₃) can produce increased growth in plant height.

According to Yuniarti et al (2012), the application of cow manure is very important, because cow manure can improve soil structure, as a provider of macro and micro nutrients, increase the ability of the soil to hold water, increase the ability of the soil to hold nutrients, and as a source of energy for microorganisms that are very useful for increasing agricultural production both quality and quantity. The application of cow manure can increase the nutrient content in the soil to get high production yields. The results of this study by giving a dose of 20 tons / ha (p₂) increased the growth of kale plants. This is in accordance with the opinion of Zalna et al (2018), cow dung bokashi fertilizer has a high prospect to be used as organic fertilizer, because it has a high nutrient content, can improve soil physical properties, and increase the ability of the soil to bind nutrients. Thus the addition of a higher dose will improve results, as in this study.

The results of variety analysis showed that there was no interaction between the application of NPK Mutiara 16-16-16 and cow manure. It is suspected that plant growth and development are more influenced by the environment, as in this study the location of kale planting plants is under the shade of orange plants, so that sunlight will be blocked by orange trees which can cause plant growth and development to be less optimal. According to Sufardi (2020) climatic elements that can affect plant growth are air temperature, rainfall (water supply), humidity (humidity), sunlight, and atmospheric air arrangement

CONCLUSION

Based on the results of the study, it can be concluded that the administration of NPK Mutiara various doses shows that the increasing dose of NPK Mutiara fertilizer increases yields, this is clearly seen in plant height and plant yield per plot with the administration of NPK Mutiara dose of 300 kg / ha (m_3). Manure application showed that the dose of 20 tons/ha (p_2) of cow manure was no different from the dose of 10 tons / ha (p_1) in plant height variables. However, dosing 20 ton/ha (p_2) gave higher yields compared to dosing 10 ton/ha (p_1) in the plant fresh weight modifiers, header fresh weight, yield per plot, and marketable yield. There is no interaction between the application of NPK Mutiara 16-16-16 and cow manure.

That we need to conduct a similar study by giving NPK Mutiara with a higher dose to find out the right dose for land kale plants. It is necessary to apply higher doses of cow manure to promote better growth and yield of kale plants.

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