JRSSEM 2022, Vol. 01, No. 11, 2004 – 2015
E-ISSN: 2807 - 6311, P-ISSN: 2807 - 6494

DEVELOPMENT RESPONSE AND PRODUCTION OF TOSAKAN (BRASSICA JUNCEA L) MUSTARD VARIETIES APPLICATION OF LIQUID ORGANIC NASA FERTILIZER AND NPK FERTILIZER

Nunuk Helilusiatiningsih[1*]
Micko Widiyatmoyo[2]
[1,2]Departemen Agroteknologi, Fakultas Pertanian, UNISKA, Kediri, Indonesia
e-mail: nunukhelilusi@gmail.com
*Correspondence: nunukhelilusi@Gmail.com

Submitted: 26 May 2022, Revised: 06 June 2022, Accepted: 15 June 2022

Abstract. Vegetables that contain vitamins, minerals and fiber to maintain a healthy body. Green mustard is a horticultural crop commodity that is easy to cultivate and is widely consumed by the public because it has a good taste. The purpose of the study was to determine the response to development and production with the application of POC Nasa and NPK Mutiara fertilizer. The experiment was carried out in the rice fields of Sukoharjo Village, Kayen Kidul District, Kediri Regency. The location has an altitude of 91 m above sea level with a tropical climate with an average air temperature of 28 oC and a rainfall of 2,443 mm/year, allivial soil type with a pH of 5.5. The research method used a factorial randomized block design with 2 factors, the first factor was the concentration of liquid organic fertilizer consisting of 4 levels (K), the second factor was NPK fertilizer consisting of 4 levels coded D, repeated 3 times with 48 research plots. The results were analyzed by the F test, followed by the 5% BNT test and 5% DMRT if there was an effect. The results of this study can be concluded as follows: 1. There was an interaction between the concentration of POC Nasa and the dose of NPK on the variables observed for the number of leaves (21, and 28 days), leaf area (28 days), and wet weight per plant (28 days) and the best is K3D2 (POC 18 ml/L and NPK 6 gr/polybag) with 15, 31 leaves, 288 cm2 leaf area, and a wet weight of 163.87 grams/plant.

Keywords: mustard; mutiara NPK fertilizer; nasa POC.

INTRODUCTION

Indonesia is an agricultural country that has abundant natural resources and is very supportive of the agricultural sector. Vegetables are widely consumed by the people of Indonesia both fresh and processed because they have good nutritional value. Green mustard is easy to cultivate and widely consumed because it has a delicious taste and is abundant in the market. Mustard plants contain protein, Ca, fat, P, carbohydrates, Fe, vitamin C (Yusuf et al., 2020). The problem is the increasing population, it is necessary to increase vegetable production by means of proper fertilization. Fertilization is the addition of nutrients for plants to develop and increase their yields. The type of inorganic fertilizer that is often used is NPK 16 16 16 , the composition of which is nitrogen, phosphorus and potassium, as an alternative to single fertilization (Slaton et al., 2013). Excessive use of inorganic fertilizers disturbs soil fertility, so it is balanced with organic fertilizers to make it fertile. Liquid organic fertilizer has a positive effect in improving soil structure, increasing water holding capacity, and stimulating root growth and increasing macro and micro nutrients (Elfarisna et al., 2015); (Agrotan & Haerul, 2015) explained that micro and macro fertilizers must be available in plant cultivation. According to (Zaevi et al., 2014) explained that the application of Nasa liquid organic fertilizer at a dose of 6 cc/l of water resulted in high production of bean (Ernita & Irawan, 2017) plants. According to (Ernita & Irawan, 2017), analyzed the application of NPK to Pagoda mustard had a significant effect on leaf number, wet weight per plant, root volume, plant biomass, and root crown ratio, with the best dose. 5 g/plant. The aim of the research was to study the interaction between the concentration of POC and NPK fertilizer on mustard production. This plant will grow quickly if planted with the right humidity. Thus, this plant is suitable for cultivation at the end of the rainy season (Liu et al., 2021). According to (Ahemad & Khan, 2012), the cultivation of mustard plants in planting media must be fertile. States that pests are animals that disturb plants by eating them or destroying them (Cunniffe et al., 2015). Pests that disturb plants such as grasshoppers, beetles, caterpillars, bugs, leafhoppers, birds. While plant disorders caused by fungi, bacteria, viruses are called diseases that can damage plant organs. Tosakan mustard varieties have the following characteristics: large plants, long and slender leaf stalks, long stems and many shoots, semi-open and erect shape, elliptical leaves and dark green, long, wide, thin, flat leaf surface and margins, the taste is crispy and not fibrous (Dubey et al., 2021). In the study, the Tosakan variety gave the highest yield of fresh weight, which was 198.33 g (Sugeng et al., 2019). The Tosakan variety is significantly different from Mosakot, the application of NPK Mutiara has a good effect on plants, this is due to the availability of balanced and more efficient elements. Nasa liquid organic fertilizer contains essential macro and micro nutrients that can meet plant needs, the nutrient content is N 4.15%, P2O5 4.45%, K 5.66%, Organic C 9.69%, Cu 1179.8%, Mn 1931.1%, Fe 505.5 ppm, Zn 1986.1%, B 806.6%, Mo 2.3 ppm (Maulana,

2011). The importance of this research is to analyze the effect of fertilizer application in order to obtain optimal production of the Tosakan mustard variety.

METHODS

This research was carried out from December 2, 2021 to January 8, 2022 in Sukoharjo Village, Kayen Kidul District, Kediri Regency. This location has an altitude of 91 meters above sea level with a tropical climate with an average air temperature of 280C and rainfall of 203.5 mm/month. Has alluvial soil type with a pH of 5.5 growing media. The materials used in this study include: Mustard Seed of the Tosakan Variety, NASA POC, NPK Fertilizer, Insecticide and Water. The tools used in this study include: Hoe, Sickle, Dipper, Measuring Glass, Drop Pipette, Polybag, Ruler, Camera, Stationery, Digital Scales. This study used a factorial randomized block design (RAK) with 2 factors, the first factor was NASA's POC concentration consisting of 4 levels symbolized by the letter K, the second factor of NPK fertilizer consisting of 4 levels symbolized by the letter D, and each replicated 3 times with 48 research plots.

The first factor is the concentration of liquid organic fertilizer (K): K0 : 0 ml/L , K1 : 6 ml/L , K2 : 12 ml/L , K3 : 18 ml/L The second factor is the application of NPK Fertilizer (N), D0: 0 g/polybag, D1: 3 g/polybag, D2: 6g/polybag, D3: 9g/polybag. Of these factors, there were 9 treatment combinations, namely as follows: K0 D0, K0 D1, K0 D2, K0 D3, K1 D0, K1 D1, K1 D2, K1 D3, K2 D0, K2 D1, K2 D2, K2 D3, K3 D0, K3 D1, K3 D2, K3 D3. The implementation of the research consisted of Soil Processing, Preparation of Seedling Media, Nursery, Preparation of planting media, Planting, Embroidery, Experimental treatment, Maintenance, Pest and disease control. Pest and disease control is carried out by mechanical and chemical methods appropriate to the attack. Harvest. Observation Parameters: Plant Height (cm), Number of Leaves (strands), Leaf Area (cm2), Root Length (cm), Plant Wet Weight (g). Data analysis was carried out by the F test using the variance method with the following criteria: If F Table 5% < F count < F Table 1% then H1 was accepted at 5% significance level or there was a significant effect. If F arithmetic > F Table 1% then accepted H1 at the 1% level of significance or a very real effect occurs. If F count < F Table 5%, then H0 is accepted and H1 is rejected. Follow-up test with DMRT 5% method on the average results of interactions that occur and the BNT test 5% for single treatment.

RESULTS AND DISCUSSION

Based on the observed variance of plant height, there was no interaction between POC concentration treatment and NPK fertilizer. The single treatment of POC concentration had a significant effect on the observed variables of plant height at the age of 14, 21,28 while the single treatment with the addition of NPK Mutiara had a very significant effect on the age of 14, 21, and 28 days, see Table 1.

Table 1. Average Yield of Plant Height

Treatment	Average Plant Height (cm)					
	14		**21**		**28 (Age)**	
K0	11.70	a	20.90	a	32.07	a
K1	12.43	b	22.50	b	32.82	b
K2	12.53	b	22.78	b	33, 88	c
K3	13.43	c	23.32	c	33.97	c
BNT 5%	**0.19**		**0.28**		**0.37**	
D0	10.62	a	20.70	a	31.20	a
D1	13.16	bc	22.60	b	33 ,60	b
D2	13.33	c	23.35	c	34.62	c
D3	12.98	b	22.85	b	33.32	b
BNT 5%	**0.19**		**0.28**		**0.37**	

K3 treatment is the best result with a fertilizer concentration of 18 ml/L) because the nutritional needs are optimally met. Supported by the opinion of (Briat et al., 2020) that the availability of sufficient nutrients for plant growth will support a fast and perfect rate of photosynthesis so that the formation of organs in plants is good. The accumulation of an increase in the number and size of cells will result in a change in the overall size of the plant body (Silalahi & Manullang, 2020). Liquid organic fertilizer is a source of organic nutrients that support the nutritional needs of plants. The results of research conducted by (Ramadhani et al., 2019) showed that the application of organic fertilizer had a significant effect on plant height. Sunlight affects the growth, production and yield of

plants through the process of photosynthesis. In the analysis of the canopy of mustard plants due to K3 treatment at the age of 21 DAP, they have met each other so as to reduce the amount of sunlight that can hit the leaves of the mustard plant. This causes the absorption of sunlight to decrease thereby inhibiting the rate of photosynthesis so that it can inhibit plant growth.

The results of the D2 treatment (NPK 6 g/polybag) were higher when compared to the D3 treatment (NPK 9 g/polybag). This shows that the mustard plant is very responsive to fertilization which can be seen from the growth of the plant height. Nainggolan (2011), argues that normal plant growth requires certain nutrients and must be in optimal amounts and concentrations and in a certain balance. The above statement shows that the application of fertilizers that exceed the limit can potentially cause a decrease in plant growth. In addition, the application of NPK fertilizer 6 g/polybag is the best NPK fertilizer treatment for mustard greens. One of the factors that affect the increase in plant cell size is the age of the plant and the availability of nutrients in the soil (Fitrianah, et al., 2012).

Variables observed the number of leaves interaction between treatments in this experiment can be shown in Table 2.

Table 2. Results of Observation of Leaf Number

Treatment	**Average Number of Mustard Leaves**			
	21		**28 (Age)**	
K0D0	7.93	a	12.27	a
K0D1	8.60	b	12.40	ab
K0D2	9.93	efgh	13.07	bcde
K0D3	9.60	cdef	12 ,93	abcd
K1D0	8.67	b	12.73	abc
K1D1	9.33	cdef	13.33	cde
K1D2	9.67	defg	13.93	fgh

K1D3	9.47	cdef	13.60	defgh
K2D0	9.00	bc	13.13	K2D1
cde	9 ,93	efgh	13.40	cdefg
K2D2	10.07	fgh	14.07	gh
K2D3	10.27	gh	13.60	defgh
K3D0	9.07	bcd	12.47	ab
K3D1	10.27	gh	13.73	efgh
K3D2	11.07	i	15, 13	i
K3D3	10.47	hi	14.27	h
DMRT 5%				

Based on Table 2, the results of the DMRT 5% test concluded that K3D2 (POC Nasa 18 ml/L and NPK 6 g/polybag) was the highest mean number of leaves compared to other treatments. Leaves are important organs for plants, leaves function as a place for photosynthesis to occur so that the number of leaves in plants will affect the rate of photosynthesis of plants. The leaves of the mustard plant grow on the segments of the stem of the mustard plant, so the length of the mustard stem affects the number of leaves that grow on the segments. This is supported by (Briat et al., 2020) the number of leaves is closely related to the length of the plant or it can be said that the growth of the number of leaves is directly proportional to the growth of the length of the plant. Giving POC adds nutrients needed for plant growth. States that the application of organic fertilizers can enrich the content of organic matter, macro-micro nutrients so as to increase plant production. The role of macro nutrients affects the results of photosynthesis which will have an impact on plant growth. The number of leaves is influenced by the nitrogen nutrient contained in the nutrient solution, because nitrogen is the main component of various substances. Another source said that the growth of the number of leaves was influenced by the amount of availability of nutrients N, P, and K in a balanced way.

The results of the calculation of leaf area showed an interaction between the two experimental treatments for the application of NASA POC and NPK concentrations (Table 3).

Table 3. Average Observation of Leaf Area

Treatment	Average Leaf Area (cm^2)	
		Age 28 days
K0D0	169.33	a
K0D1	209.33	b
K0D2	229.33	bcd
K0D3	217.33	b
K1D0	213.33	b
K1D1	237.33	bcd
K1D2	254.67	cd
K1D3	230.67	bcd
K2D0	221.33	b
K2D1	228.00	bc
K2D2	232.00	bcd
K2D3	236.00	bcd
K3D0	217.33	b
K3D1	221.33	b
K3D2	288.00	e

K3D3	258.67	de
DMRT 5%		

The DMRT 5% test explained that the combination of treatments was significantly different to the observed variable leaf area, the best was K3D2 (POC NASA 18 ml/L and NPK 6 g/polybag) because the nutrients absorbed were very effective. This is in line with the opinion photosynthesis produces energy that plants will use for the process of growth and development. Growth is indicated by the increase in plant height, number of leaves, and leaf area. The use of fertilizers pays attention to the right concentration because concentrated concentrations cause plasmolysis so that plant growth is disrupted. Provision of fertilizers that are in accordance with the dosage and needs can increase yields that plants absorb nutrients during their growth to increase the photosynthesis process.

Analysis of root length did not show interaction results, but the single treatment of POC Nasa and NPK concentrations had a very significant effect at age 28, presented in Table 4.

Table 4. Variables Observation of Root Length

Treatment	**Average Root Length (cm)**	
	Age 28 days	
K0	33.03	a
K1	35.40	c
K2	34.87	b
K3	35.38	c
BNT 5%	**0.27**	
D0	34.83	c

D1	35 ,90	d
D2	34,25	b
D3	33,70	a
BNT 5%	**0.27**	

Based on K1 (POC 6 ml/L) and K3 (POC 18 ml/L) treatments. higher mean value compared to other treatments. Mustard plants have a type of fibrous root that is useful for supporting the body of the mustard plant. The growth of mustard roots is strongly influenced by the nutrient content and the porosity of the planting medium. Organic matter can play a direct role in plant growth and can also play an indirect role through changes in soil properties and characteristics. Organic fertilizers can reduce soil density so as to facilitate root development and its ability to absorb nutrients. Material porosity is the ratio of the volume of the pore cavities to the total volume of the entire material. The greater the porosity, the higher the absorption of the fluid. Root growth is influenced by P nutrients from POC and NPK fertilizers 16-16-16 applied to plants. POCNasa concentration treatment gave 4.45% P2O5. while the required dose of NPK provides 16% P2O5. P nutrient for plants is useful for stimulating root growth, especially young plant roots. The formation of these young roots will then increase the uptake of water and nutrients. The P element treatment provided at this time will support the development of young roots which will further support the plant in absorbing nutrients the elongation of plant roots in an effort to find water is one indicator of plants that are tolerant of water shortages.

Based on the average wet weight per plant (Table 5), the combination of K3D2 treatments (POC 18 ml/L and NPK 6 g/polybag) yielded higher yields and was not different from K1D2, K2D2, K3D1, K3D3

Table 5. Observation Variables Wet Weight Per Plant

Treatment	**Average Wet Weight Per Plant (grams)**	
	Age 28 days	
K0D0	K0D1	a
115.20	125.87	ab
K0D2	130.47	bc

K0D3	129.47	bc
K1D0	117.53	ab
K1D1	142.00	cd
K1D2	158.80	e
K1D3	153.33	de
K2D0	118.67	ab
K2D1	153.60	de
K2D2	158.40	e
K2D3	154.13	de
K3D0	119.53	ab
K3D1	156.47	e
K3D2	163.87	e
K3D3	161.47	e
DMRT 5%		

This is because the higher the nutrients given to the plant will trigger the growth and development of plants. The more nutrients are absorbed by plants, the availability of basic materials for the photosynthesis process will be better too. Supported by Elisabeth (2013), the addition of plant size and new leaves on plants can optimally occur, if the needs of plant growth elements are fulfilled. Increasing the dose of fertilizer that exceeds the recommendation will actually reduce crop yields.

CONCLUSIONS

Sunlight affects the growth, production and yield of plants through the process of photosynthesis. This shows that the mustard plant is very responsive to fertilization which can be seen from the growth of plant height. Organic fertilizers can enrich the content of organic matter, macro-micro nutrients so as to increase plant production. The role of macro nutrients affects the results of photosynthesis which will have an impact on plant growth. There was an interaction between the concentration of Nasa POC fertilizer and NPK on the observed variables

of leaf number, leaf area, plant height, and the best wet weight of mustard greens, namely K3D2 (POC 18 ml/L and NPK 6 g/polybag).

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