http://journal.uir.ac.id/index.php/JGEET

E-ISSN : 2541-5794
P-ISSN : 2503-216X

Journal of Geoscience,
Engineering, Environment, and Technology
Vol 8 No 2 2023

RESEARCH ARTICLE

The Effect of Vermicompost Fertilizer and Mutiara Npk 16:16:16 on the Growth and Production of Pakcoy Plant (Brassica Rapa L.)

Antonio Carlos Dias Santos[1*], Jose Guimaraes Fonseca[1], Diki Ramadhan[1]

[1]*Material Sciences and Engineering Department, Universidade Federal de Santa Catarina, Santa Catarina, Brazil.*

* Corresponding author : diasantoscarlos3@gmail.com
Tel.:+55-798237611
Received: Mar 12, 2236; Accepted: Jun 06, 2023.
DOI: 10.25299/jgeet.2023.8.2.14493

Abstract

The design used was a factorial complete randomized design (CRD), it consisted of 2 factors. The first factor was vermicompost fertilizer which consisted of 4 levels (0, 0.5, 1, 1.5 kg/plot) The second factor was NPK Mutiara 16:16:16 which consisted of 4 levels (0, 10, 20, 30 g /plots). The results showed that vermicompost fertilizer and NPK Mutiara 16:16:16 gave a significant interaction on plant height, number of leaves, harvest age, economic wet weight, dry weight of plants and root volume with the best treatment of castor fertilizer 1.5 kg/plot and giving Pearl NPK 16:16:16 20 g/plot (K3N2). The main effect of vermicompost fertilizer on parameters of harvest age with the best dose of vermicompost fertilizer 1.5 kg/plot (K3). The main effect of NPK Mutiara 16:16:16 on harvest age parameters with the best dose of NPK Mutiara 16:16:16 20 g/plot (N2).

Keywords: Pakcoy, Production, Experimental, Growth.

1. Introduction

Food is a source of energy for humans, and this food directly or indirectly comes from plants, most of which are included in the vegetable group. Vegetables are absolutely necessary in people's daily consumption because of their nutritional content, especially vitamins and minerals that can support the nutritional adequacy of the community, causing demand for vegetable commodities to occur every day. This is what makes vegetable commodities have a great opportunity to be developed (Prawoto, et al, 2012).

Pakcoy is a vegetable commodity that has bright prospects for cultivation. The community's continuous demand for vegetables has the potential to increase the income of farming communities, minimize imports and increase export capabilities, expand employment opportunities and improve community nutrition (Firmansyah, et al, 2009).

Dealing with the Central Statistics Agency for Riau Province, data obtained from mustard greens from 2011 saw a decrease in mustard production to 2424 tons, in 2012 there was a very good increase reaching 3266 tons, in 2013 it reached 3484 tons, in 2014 it reached 3190 tons, mustard plants from year to year experienced an increase and in 2015 mustard plants experienced a decrease in production reaching 1540 tons (Central Bureau of Statistics, 2018).

Fertilization is one way to increase soil fertility through the provision of macro and micro nutrients needed by plants. The principle of proper fertilization can provide maximum crop production through both organic and inorganic fertilizers (Lingga and Marsono, 2007).

Vermicompost organic fertilizer is an organic fertilizer plus, because it contains macro and micro nutrients and growth hormones that are readily absorbed by plants. Every 100 g vermicompost contains C 20.20%, N 1.58%, C/N 13%, P 70.30 mg/kg, K 21.80 mg/kg, Ca 34.99 mg/kg, Mg 21, 43 mg/kg, S 153.70 mg/kg, Fe 13.50 mg/kg, Mn 661.50 mg/kg, Al 5.00 mg/kg, Na 15.40 mg/kg, Cu 1.7 mg /kg, Zn 33.55 mg/kg, Bo 34.37 mg/kg, CEC 35 mg/100 and pH 6.6-7.5 quality vermicompost characterized by brownish black to black color, odorless, crumbly texture and mature (C/N <20) (Fahrudin, 2009).

Vermicompost fertilizer or worm manure (faces) in the form of powder, black in color which is smaller in size than ordinary soil particles, making it more suitable for plant growth which is useful for increasing productivity, speeding up harvest time, loosening the planting medium (Mulat, 2003).

Earthworm excrement contains a lot of microorganisms, minerals and organic matter in a form available for consumption by plants compared to surrounding plants. Vermicompost fertilizer also contains many enzymes such as proteose, amylase, cellulose which are able to continue the process of disintegrating the organic matter contained in the worm's excrement after being excreted from their intestines. Applications with vermicompost generally do not interfere with the availability of N nutrients and when absorbing N the decomposition of organic matter is not complete. Kascing is full of nutrients that can be absorbed much higher (Khrisnawati, 2000).

2. Literature Review

Pakcoy (Brassica rapa L.) is a plant originating from China and has been widely cultivated after the 5th century in South China and Central China and Taiwan. This vegetable is a recent introduction in Japan and is still in the same family as the Chinese vegetable. Currently pakcoy is widely developed in the Philippines, Malaysia, Indonesia and Thailand. The taxonomy of the pakcoy plant is Kingdom: Plantae, Divisio: Spermatophyta, Class: Dicotyledonae, Order: Rhoeadales, Family: Brassicaceae, Genus: Brassica, Species: Brassica rapa L. (Suhardiyanto and Purnama, 2011).

Yogiandre, et al, (2011) stated that the pakcoy plant is one of the important vegetables in Asia, or especially in China. Pakcoy leaves are stalked, oval in shape, dark green and shiny, do not form a head, grow slightly upright or semi-horizontally. Arranged in tight spirals, attached to depressed stems. The petioles are white or light green, fat and fleshy.

Kascing is an organic fertilizer derived from the excrement of earthworms (Lumbricus rubellus) and contains the nutrients needed for plant growth. Vermicompost is very beneficial for plants because it contains organic matter and inorganic matter in a form available to plants compared to the soil itself (Sirwin, et al, 2007).

The results of Rahayu's research (2015) has indicated that the effect of NPK Mutiara 16:16:16 singly had a significant effect on plant height, number of leaves, widest leaf area, and wet weight of mustard plants with the best treatment, namely application of NPK Mutiara 16:16:16 fertilizer 2.7 grams/plant.

Efforts to combine the use of organic and inorganic fertilizers applied to plants will provide opportunities to increase production in a sustainable manner, because organic fertilizers have benefits, among others, being able to provide macro and micro nutrients, increase aeration, improve soil drainage, increase the ability to store water, improve soil structure, increase soil CEC and increase the activity of soil microorganisms. While chemical fertilizers are able to provide the nutrients needed by plants and the nutrients are easily available.

The ability of pure organic fertilizer is needed even though the quantity is very small but it has a big influence on the soil which can be useful for increasing productivity, accelerating harvests, stimulating the growth of roots, stems, leaves and flowers. This is because organic fertilizers are natural ingredients that have complete macro and micro nutrients with their use more effectively and efficiently.

3. Research Method

3.1 Research Setting

The research was carried out in an experimental garden, Faculty of Agriculture, Riau Islamic University, Jl. Kaharuddin Nasution KM 11, Air Cold Village, Bukit Raya District, Pekanbaru City. The research was conducted for two months, from September to October 2018 (Appendix 1).

3.2 Material and Tool

The materials used in this study were the seeds of the pakcoy plant described in (Appendix 2), vermicompost fertilizer, NPK Mutiara fertilizer 16:16:16, Dithane M-45, Furadan, Decis 25 EC, Curacron 1 cc/l water, zinc, nails and polybags measuring 18 x 20 cm. The tools used in this study were hoes, machetes, sickles, gembor, buckets, plastic ropes, hand sprayers, scales, hammers, cameras, and stationery.

3.3 Experimental Design

The design used in this study was a completely randomized design (CRD) factorial consisting of 2 factors, the first factor was vermicompost fertilizer (K) with 4 treatment levels and the second factor was NPK Mutiara 16:16:16 (N) fertilizer with 4 levels treatment, so that there were 16 treatment combinations. In each treatment, 3 replications were carried out to obtain 48 plots. Each plot contains 25 plants with 3 plants as observation samples. The treatments are as follows: Factor K (Kascing Fertilizer) which consists of 4 levels, namely:

K0 : Without giving vermicompost fertilizer
K1 : Kascing Fertilizer 0.5 kg/plot (5 tons/ha)
K2 : Castor Fertilizer 1 kg/plot (10 tons/ha)
K3 : Kascing Fertilizer 1.5 kg/plot (15 tons/ha)

Factor N (Dose of NPK Mutiara 16:16:16) which consists of 4 levels, namely:

N0 : Without applying NPK Mutiara fertilizer 16:16:16
N1 : Pearl NPK (16:16:16) 10 g/plot (100 kg/ha)
N2 : Pearl NPK (16:16:16) 20 g/plot (200 kg/ha)
N3 : Pearl NPK (16:16:16) 30 g/plot (300 kg/ha)

The combination of Vermicompost Fertilizer and NPK Mutiara 16:16:16 treatments can be seen in Table 1 below.

Table 1. Combination of Vermicompost Fertilizer Treatment and Pearl NPK 16:16:16

Kascing Fertilizer	NPK Mutira 16:16:16			
	N0	N1	N2	N3
K0	K0N0	K0N1	K0N2	K0N3
K1	K1N0	K1N1	K1N2	K1N3
K2	K2N0	K2N1	K2N2	K2N3
K3	K3N0	K3N1	K3N2	K3N3

In the table, there are 16 treatment combinations, where each treatment consists of 3 replications so that 48 experimental plots are obtained, the total number of plants is 1200 plants. From the results of observations of each treatment were analyzed statistically. If the calculated F is greater than the F table, then it is continued with a further test of honest significant differences (BNJ) at the 5% level.

3.4 Research Implementation

1. Land Preparation

The land where the research was carried out was cleared of all weeds, then 2 tillages were carried out, the first processing was clearing the land from weeds and then the second stage was carried out with a hentractor to turn the soil over.

2. Creating Plot

After tillage, 48 plots measuring 1 x 1 m were made with a distance between plots of 50 cm. Each plot contains 25 plants and 3 plants are used as observation samples.

3. Installation of Labels

Labels that have been prepared are attached according to each treatment on the plots that have been prepared and then adjusted to the layout of the research in the field. Labeling was done one day before giving treatment (Appendix 3).

4. Giving Treatment
   a. Giving vermicompost fertilizer
      The vermicompost fertilizer treatment was given only once, namely one week before planting. By sprinkling vermicompost fertilizer evenly on the plot made according to the treatment.
   b. Giving NPK Pearls 16:16:16
      The NPK used in this study was NPK Pearls of 16:16:16. NPK was given 1 time, at the time of planting, it was given by running and then covered with soil.
5. Nurseries/Seedbed

The seedbed was carried out on a small 18 x 20 cm polybed. This seedbed was carried out before the pakcoy seeds were ready to be placed on the research plot at the age of 2 weeks with the seed criteria having 4-5 leaves.

6. Planting

In each hole, 1 pakcoy plant seed was planted by digging into the plot, there were 25 planting holes, of which 3 plants were used as sample plants, with a distance between plants of 20 x 20 cm.

7. Maintenance
   a. Watering
      Watering was done 2 times a day in the morning and evening. If the soil around the research area was still moist, watering was only done once a day.
   b. Weeding
      Weeding was done to remove competing plants (weeds). Weeding was carried out when weeds showed significant growth around the plants and around the experimental plot.
   c. Hoarding

Hoarding aims to prevent overturning of the pakcoy plants which is done when the plants are 3 weeks old. This aims not to interfere with the absorption of nutrients by plant roots by piling up around the base of the plant stems with soil around the plants until harvest.

d. Pest and Disease Control

Pest control was carried out in a preventive and curative way. Preventive methods are carried out by maintaining the cleanliness of the research location starting from the time the pakcoy plant is being planted until harvest. While the curative way is by mechanical and chemical means. At the time of research the pests that attacked the pakcoy plants were caterpillars, grasshoppers, crickets, snails, and caterpillars. Pest control was carried out by spraying insecticides Decis 25 EC with a dose of 2 cc/l of water and Curacron with a dose of 1 cc/l of water which was carried out at the age of 21 days after planting alternately with an interval of 5 days. Spraying was stopped 1 week before harvest.

8. Harvest

The criteria for harvesting pakcoy plants are if the shape of the leaf blade is maximized and before the pakcoy plant flowers appear. The stems and leaves don't look old yet, the size of the plants has reached its maximum, and the stems are of maximum size and haven't hardened. Harvesting is done by dismantling all parts of the pakcoy plant to the roots. Harvesting is done in the morning or when the soil is still moist so it will make it easier to remove.

3.5 Observation Parameter

1. Plant Height (Cm)

Plant height was measured once at the end of the study by measuring the base of the stem that had been given a standard stake to the highest plant leaf using a ruler. Data measurement results were analyzed statistically and displayed in table form.

2. Number of Leaves (Streams)

The total number of leaves observed at the end of the study was counted on the sample plants. The leaves that are counted are the leaves that have formed or opened completely. The data obtained was analyzed statistically and displayed in tabular form.

3. Age of Harvest (Hst)

Observation of harvest age was carried out starting from planting until the plants were transferred to the plot, after the plants had 50% harvest criteria from the population. The data obtained were analyzed statistically and displayed in tabular form.

4. Economical Wet Weight (g)

Observation of the economic wet weight of plants was carried out at the end of the study immediately after harvest, the pakcoy plants were cleaned of adhering soil, the roots were cut, then weighed as soon as possible. The data obtained was then analyzed statistically and presented in tabular form.

5. Dry Weight Per Plant (g)

Pengamatan berat kering per tanaman dilakukan akhir penelitian, tanaman dibersihkan dari tanah yang menempel, kemudian di oven selama 2 x 24 jam dengan suhu 70o C. Setelah tanaman kering dilakukan penimbangan dengan timbangan analitik. Data yang diperoleh kemudian dianalisis secara statistik dan ditampilkan dalam bentuk tabel.

6. Root Volume (Cm3)

Observation of plant root volume was carried out at the end of the study on sempel plants. The roots of the pakcoy plant are disassembled, then cleaned and cut, then put into a measuring cup containing water with an initial volume of 80 ml. The addition of the volume of water in the measuring cup indicates the volume of the roots. The data obtained was then analyzed statistically and displayed in tabular form.

4. Finding and Discussion

4.1 Plant Height (cm)

Data on the observation of pakcoy plant height after analysis of variance (Appendix 4.a), shows that both the interaction and the main effect of vermicompost fertilizer and NPK Mutiara 16:16:16 had a significant effect on plant height. The average results of observations of pakcoy plant height after the BNJ follow-up test at the 5% level can be seen in Table 2.The data in Table 2 shows that the effect of applying vermicompost fertilizer and NPK Mutiara fertilizer 16:16:16 had an effect on the height of the pakcoy plant where the highest plant height was produced by the combination of casting fertilizer 1.5 kg/plot and NPK Mutiara 16:16:16 20 g/plot (K3N2) with a plant height of 27.21 cm which was not significantly different from the treatment (K3N3) with a plant height of 24.88 cm but significantly different from the other treatments, with the lowest treatment (K0N0) with a pakcoy plant height of 19.18 cm.

The height of the pakcoy plants produced by applying 1.5 kg/plot vermicompost fertilizer and 20 g/plot (K3N2) Pearl NPK fertilizer with a plant height of 27.21 cm, this shows that at 1.5 kg of vermicompost fertilizer /plot combined with NPK Pearl 16:16:16 20 g/plot fertilizer has been able to provide a good response to plants and soil conditions where the soil becomes more fertile and loose through the activity of microorganisms in the soil so that plant roots can absorb nutrients properly can help in the growth of pakcoy plants and in the end the increase in plant height can go well.

The K0N0 treatment was the treatment that produced the lowest plant height, namely 19.18 cm. This was due to the absence of vermicompost fertilizer and NPK Pearl fertilizer 16:16:16, so the required nutrients could not be met, thereby inhibiting the plant's metabolic processes and also resulting in plant growth. slower plants. Because plants really need optimal nutritional intake at the beginning of plant growth, if a lack of nutrients in its growth will inhibit the growth of the plant itself.

Table 2. The average height of pakcoy plants with casting fertilizer and NPK Pearl was 16:16:16 (cm). The numbers in the columns and rows followed by the same lowercase letters are not significantly different according to the BNJ test at the 5% level.

Kascing Fertilizer (kg/plot)	NPK Mutiara 16:16:16 (g/plot)				Average
	N0 (0)	N1 (10)	N2 (20)	N3 (30)	
K0(0)	19,18 g	20,40 e	21,76 de	21,48 d	20,71 c
K1(0,5)	22,14 cde	21,66 de	22,43 cde	22,84 cde	22,27 b
K2(1)	20,95 efg	23,15 bc	22,96 cd	23,24 b	22,58 b
K3(1,5)	20,83 efg	23,16 bc	27,21 a	24,88 ab	24,02 a
Average	20,78 c	22,09 bc	23,59 a	23,11 ab	
KK = 5,40%	BNJ K&N = 1,33		BNJ KN = 3,28		

a. Number of Leaves (strands)

The observed data on the number of pakcoy leaves after analysis of variance (Appendix 4.b), shows that both the interaction and the main effect of the application of vermicompost fertilizer and NPK Mutiara 16:16:16 had a

significant effect on the number of leaves of the pakcoy plant. The average results of observations on the number of leaves of the pakcoy plant after the BNJ follow-up test at the 5% level can be seen in Table 3.

Table 3 . The average number of leaves of the pakcoy plant with the application of vermicompost fertilizer and NPK Pearl 16:16:16 (strands). The numbers in the columns and rows followed by the same lowercase letters are not significantly different according to the BNJ test at the 5% level.

Kascing Fertilizer (kg/plot)	NPK Mutiara 16:16:16 (g/plot)				Average
	N0 (0)	N1 (10)	N2 (20)	N3 (30)	
K0(0)	8,04 f	9,67 ef	10,24 e	10,52 de	9,62 d
K1(0,5)	10,41 de	11,00 cde	11,85 cde	12,00 bc	11,32 c
K2(1)	12,11 bc	12,33 bc	12,66 bc	12,25 bc	12,34 b
K3(1,5)	12,11 bc	13,59 ab	14,93 a	12,52 b	13,29 a
Average	10,67 c	11,65 b	12,42 a	11,82 ab	
KK = 6,50%	BNJ K&N = 0,84		BNJ KN = 2,07		

Parameters observed The number of leaves had a significant effect with the dose of 1.5 kg/plot vermicompost fertilizer and NPK Pearl 16:16:16 20 g/plot (K3N2) fertilizer. responds well to plants and soil conditions where the soil becomes more fertile and loose through the activity of microorganisms in the soil so that plant roots can absorb nutrients properly then combined with NPK Pearl fertilizer 16:16:16 20 g/plot which can assist in growth pakcoy plants and in the end the number of pakcoy plant leaves becomes more.

Musnawar (2003) suggests that the implementation of organic fertilizers combined with inorganic fertilizers can increase the productivity and efficiency of fertilizer use. NPK 16:16:16 fertilizer is a very good compound fertilizer for plant growth which can provide a balance of nitrogen, phosphorus and potassium elements. Mardawilis (2004) suggests that by providing nitrogen elements, plants will contain a lot of green leaf elements which are important in the process of photosynthesis and accelerate plant growth.

b. Age of Harvest (hst)

Observational data on the age of the pakcoy harvest after analysis of variance (Appendix 4.c) showed that the interaction between the application of vermicompost fertilizer and NPK Mutiara 16:16:16 had no significant effect on the harvesting age of the pakcoy plant. the main effect of fertilizer

vermicompost and NPK Mutiara 16:16:16 had a significant effect on the age of the pakcoy harvest. The mean of observations of the age of harvesting pakcoy after the BNJ follow-up test at the 5% level can be seen in Table 4.

Table 4. The average age of harvesting pakcoy plants with the application of vermicompost fertilizer and NPK Mutiara 16:16:16 (dap). The numbers in the columns and rows followed by the same lowercase letters are not significantly different according to the BNJ test at the 5% level.

Kascing Fertilizer (kg/plot)	NPK Mutiara 16:16:16 (g/plot)				Average
	N0 (0)	N1 (10)	N2 (20)	N3 (30)	
K0(0)	40,67	40,67	40,33	40,67	40,59 c
K1(0,5)	40	39,67	37,67	39	39,09 b
K2(1)	40	39,33	38,67	38,67	39,17 b
K3(1,5)	40	37,67	35,33	36	37,25 a
Average	40,17 c	39,34 b	38,00 a	38,59 ab	
KK = 2,70%	BNJ K&N = 1,17				

The data in the table above, on the parameters of harvesting age show that the main effect of giving vermicompost fertilizer 1.5 kg/plot affects the harvesting age of pakcoy plants where the fastest crop harvesting age is produced in K3 with a harvest age of 37.25 days after planting and is significantly different from the treatment K2, K1 and K0 this shows that the application of organic fertilizers has been able to provide a good response to plants and is able to improve the physical, chemical and biological properties of the soil where the soil becomes more fertile and loose through the activity of microorganisms in the soil so that plant roots can absorb nutrients by good, which can help in the growth of pakcoy plants and can increase the process of photosynthesis, in the end the age of harvesting pakcoy plants becomes faster.

Vermicomposting increases soil nutrient content such as N, P, K, Ca, Mg in a balanced and available amount (Sutanto, 2002) improves soil physical properties, soil structure, porosity, permeability and increases water holding capacity (Kartini, 2005).

NPK 16:16:16 fertilization with a balanced ratio between the elements N, P and K will be able to stimulate plant growth and development. The main role of nitrogen N for plants is to stimulate overall growth, especially branches, stems and leaves. Nitrogen also plays an important role in the formation of green leaf substances which are very useful in the process of photosynthesis. Another function is to form proteins, fats and various other organic compounds. Element P can accelerate the age of plant harvest. Phosphorus present in the form of nuclein is part of the protoplasm and the cell nucleus. As part of the cell nucleus, phosphorus is very important in cell division, as well as for the development of meristem tissue. The element phosphorus P for plants is useful for root growth, especially seed roots and young plants. Phosphorus functions as a raw material for the formation of certain proteins, helps assimilation and respiration, and accelerates flowering, seed and fruit ripening (Asripah, 2003).

c. Economical Wet Weight (g)

Data from observations of the economic wet weight of the pakcoy plants after analysis of variance (Appendix 4.d) showed that both the interaction and the main effect of the application of vermicompost fertilizer and NPK Mutiara 16:16:16 had a significant effect on the economic wet weight of the pakcoy plants. The average observed results of the economic wet weight of pakcoy plants after the BNJ follow-up test at the 5% level can be seen in Table 5.

Table 5. The average economic wet weight of pakcoy plants with the application of vermicompost fertilizer and NPK Pearl 16:16:16 (g). The numbers in the columns and rows followed by the same lowercase letters are not significantly different according to the BNJ test at the 5% level.

Kascing Fertilizer(kg/plot)	NPK Mutiara 16:16:16 (g/plot)				Average
	N0 (0)	N1 (10)	N2 (20)	N3 (30)	
K0(0)	38,71 f	47,55 ef	54,17 def	49,27 e	47,42 d
K1(0,5)	61,43 d	58,63 def	64,18 cde	59,28 def	60,88 c
K2(1)	65,20 cde	61,00 cde	81,56 b	78,93 bcd	71,67 b
K3(1,5)	70,84 c	79,03 bc	92,17 a	88,43 ab	82,62 a
Average	59,05 c	61,55 b	73,02 a	68,97 ab	
KK = 7,30%	BNJ K&N = 4,32		BNJ KN = 11,70		

The data in Table 5, on the economic wet weight parameter, shows that the effect of the application of vermicompost fertilizer and Mutiara NPK fertilizer 16:16:16 has an effect on

the economic wet weight of the pakcoy plant where the best economic wet weight of the plant is produced by the combination of casting fertilizer 1.5 kg/ plot and NPK Mutiara 16:16:16 20 g/plot (K3N2) with an economic wet weight of 92.17 grams, which was not significantly different from the K3N3 treatment with an economic wet weight of 88.43 and significantly different from the other treatments, the lowest treatment (K0N0) with an economic wet weight of 38.71 grams.

The economic wet weight of the pakcoy plants produced by applying 1.5 kg/plot vermicompost fertilizer and 20 g/plot NPK Pearl fertilizer (K3N2) this shows that 1.5 kg/plot vermicompost fertilizer has been able to respond which is good for plants and soil conditions where the soil becomes more fertile and loose through the activity of microorganisms in the soil so that plant roots can absorb nutrients properly then combined with NPK Mutiara 16:16:16 20 g/plot fertilizer which can help in the growth of pakcoy plants and in the end the economic wet weight of the pakcoy plant becomes more.

From Table 5, it can also be seen that the K1 and K2 treatments were significantly different with an average K1 of 60.88 grams and K2 with an average of 71.67 grams. Significantly different from the K3 treatment with an average of 82.62 grams higher than the other treatments. This is because the provision of vermicompost fertilizer and NPK Mutiara 16:16:16 has been sufficient for plants to absorb nutrients so that plants quickly respond to the doses and nutrients given. given to plants.

Nitrogen absorbed by the roots is then used for N compounds, including amino acids which are then synthesized into proteins, then enzymes and nucleotide molecules as compounds that provide energy and growth hormones. Protein is hydrophilic resulting in increased water absorption thereby increasing plant fresh weight. In addition to the above factors, the auxin content is also an important factor in growth regulation. The number of leaves affects the fresh weight of the plant. Plant fresh weight increased with the use of vermicompost fertilizer. Increase in plant fresh weight due to additional doses of vermicompost fertilizer.

The results obtained in this study in hectares from the best K3N2 treatment, namely 92.17 g on the economic wet weight parameter, obtained results of 23 tons/hectare.

d. Planting Dry Weight (g)

Data from observations of the dry weight of pakcoy plants after analysis of variance (Appendix 4.e) showed that both the interaction and the main effect of the application of vermicompost fertilizer and NPK Mutiara 16:16:16 had a significant effect on the dry weight of pakcoy plants. The mean of the observed dry weight of pakcoy plants after the BNJ follow-up test at the 5% level can be seen in Table 6.

The data in Table 6. on the dry weight parameter of the plants shows that the effect of the implementation of vermicompost fertilizer and NPK Mutiara 16:16:16 fertilizer has an effect on the dry weight of the pakcoy plant where the best plant dry weight is produced by the combination of casting fertilizer 1.5 kg/plot and NPK Mutiara 16:16:16 20 g/plot (K3N2) with a plant dry weight of 10.22 grams, which was significantly different from all other treatment combinations and the lowest plant plant dry weight was produced without the application of vermicompost fertilizer and NPK Mutiara 16 fertilizer: 16:16 (K0N0) with a dry weight of pakcoy plants which is 1.29 grams.

The dry weight of the pakcoy plants produced by applying 1.5 kg/plot vermicompost fertilizer and Mutiara 16:16:16 NPK fertilizer was 20 g/plot (K3N2). which is good for plants and soil conditions where the soil becomes more fertile and loose through the activity of microorganisms in the soil so that plant roots can absorb nutrients properly then combined with NPK Mutiara 16:16:16 20 g/plot fertilizer which can help in the growth of pakcoy plants and in the end the dry weight of planting pakcoy plants becomes more.

The water content lost from the economic wet weight to the dry weight of the plants in the highest K3N2 treatment was 82% from the wet weight of 92.17 g to 10.22 g. The availability of sufficient phosphorus elements increases the rate of photosynthesis so that the resulting assimilation is partially utilized for the formation and arrangement of plant organs such as stems, leaves and the rest is stored in the form of protein and carbohydrates in the form of plant organs.

Table 6. The average dry weight of planting pakcoy plants with vermicompost fertilizer and NPK Pearl 16:16:16 (g). The numbers in the columns and rows followed by the same lowercase letters are not significantly different according to the BNJ test at the 5% level.

Kascing Fertilizer (kg/plot)	NPK Mutiara 16:16:16 (g/plot)				Average
	N0 (0)	N1 (10)	N2 (20)	N3 (30)	
K0(0)	1,29 j	1,96 ij	2,67 ghij	3,14 ghi	2,27 d
K1(0,5)	1,61 ij	3,11 ghi	3,45 ghi	4,36 fe	3,13 c
K2(1)	2,87 ghij	4,12 fe	7,49 c	6,54 de	5,26 b
K3(1,5)	4,17 fe	6,09 de	10,22 a	8,19 b	7,17 a
Average	2,49 c	3,82 b	5,95 a	5,55 a	
KK = 8,10% BNJ K&N = 0,40 BNJ KN = 1,09					

e. Root Volume (Cm^3)

The observed data on the root volume of the pakcoy plant after analysis of variance (Appendix 4.f), shows that both the interaction and the main effect of the application of vermicompost fertilizer and NPK Mutiara 16:16:16 had a significant effect on the root volume of the pakcoy plant. The mean results of observing the root volume of the pakcoy plant after the BNJ follow-up test at the 5% level can be seen in Table 4.6

Table 4.6 The average root volume of pakcoy plants with the implementation of vermicompost fertilizer and NPK Pearl 16:16:16 (Cm^3). The numbers in the columns and rows followed by the same lowercase letters are not significantly different according to the BNJ test at the 5% level.

Kascing Fertilizer(kg/plot)	NPK Mutiara 16:16:16 (g/plot)				Average
	N0 (0)	N1 (10)	N2 (20)	N3 (30)	
K0(0)	82,00 d	81,55 e	82,22 cd	82,77 cd	82,14 d
K1(0,5)	82,00 d	84,00 bce	83,66 def	83,44 def	83,28 c
K2(1)	84,33 bc	84,00 bce	84,00 bce	84,55 b	84,22 b
K3(1,5)	83,00 def	85,55 abc	87,00 a	86,22 ab	85,44 a
Average	82,83 c	83,78 b	84,22 a	84,25 a	
KK = 0,80% BNJ K&N = 0,75 BNJ KN = 2,05					

Data in Table 4.6 on the root volume parameter shows that the effect of casting fertilizer and NPK Mutiara fertilizer 16:16:16 has an effect on the root volume of the pakcoy plant where the best root volume is produced by the combination of casting fertilizer 1.5 kg/plot and NPK Mutiara 16:16:16 20 g/plot (K3N2) with a plant root volume of 87.00 cm3, which was not significantly different from treatment (K3N3) with a root volume of 86.22 cm3 but significantly different from the

other treatments, with the lowest treatment (K0N0) with a plant root volume of 82.00 cm3.

The volume of pakcoy plant roots produced by applying 1.5 kg/plot vermicompost fertilizer and 20 g/plot NPK Mutiara 16:16:16 fertilizer (K3N2). good for plants and soil conditions where the soil becomes more fertile and loose through the activity of microorganisms in the soil so that plant roots can absorb nutrients properly then combined with NPK Mutiara 16:16:16 20 g/plot fertilizer which can help in the growth of pakcoy plants and in the end the root volume of the pakcoy plant becomes more.

Mubandono (2003) suggests that the advantages of using organic fertilizers besides being able to add the nutrients needed by plants can also improve soil texture, increase CEC, increase the soil's ability to hold water and increase soil biological activities.

NPK Pearl Fertilizer 16:16:16 plays an important role in various plant metabolic processes. The element nitrogen (N) has the function of stimulating overall plant growth. Phosphorus (P) functions to transfer energy in plant cells, for example ADP and ATP, stimulates the growth of young plant roots. Meanwhile, potassium (K) functions to strengthen plant tissue so that flowers and leaves do not fall easily, helps the translocation of protein formation.

5. Closing

a. Conclusion

Dealing with the results of research that has been done, it can be concluded that

1. The interaction of vermicompost fertilizer and NPK Pearl 16:16:16 had a significant effect on the parameters of plant height, number of leaves, economic wet weight, dry weight of plants and root volume with the best treatment of castor fertilizer 1.5 kg/plot and NPK Pearl 16:16:16 20 g/plot (K3N2).
2. The main effect of casting fertilizer on parameters of harvest age with the best treatment being the application of casting fertilizer 1.5 kg/plot (K3).
3. The main effect of giving NPK Pearl 16:16:16 on harvest age parameters, with the best treatment being the application of NPK Mutiara 16:16:16 20 g/plot (N2).

b. Suggestion

In research the use of organic fertilizers is very good for plants, especially vegetable plants which can fulfill nutrients for plants as well as the addition of inorganic fertilizers which helps in fulfilling complete nutrients for plants.

References

Anonimus. 2010. Petunjuk Penggunaan Pupuk. Penebar Swadaya. Jakarta. 2010. Budidaya Anthorium. Agromedia Pustaka. Jakarta.

Arifin. 2010. Dasar Nutrisi Tanaman. PT. Rineka Cipta, Jakarta. Asripah. 2003. Bertanam Kacang Sayur. Penebar Swadaya. Jakarta.

Badan Pusat Statistik Riau, 2018. Jenis Tanaman Pangan dan Produksi. BPS Provinsi Riau.

Budiastuti. M. S. 2000. Penggunaan triakontanol dan jarak tanam pada tanaman kacang hijau (Phaseolus radiates L.). jurnal agrosains. Universitas 11 Maret. Surakarta. 2 (2) :59-63.

Citra Yulia. 2018. Pengaruh Pemberian Ampas Teh dan NPK 16:16:16 Terhadap Pertumbuhan dan Hasil Baby Kailan. Skripsi Fakultas Pertanian. Universitas Islam Riau. Pekanbaru.

Djuarni. 2005. Efektif Mikroorganisme Pupuk Organik Menyehatkan Dan Menyuburkan Tanah Secara Biologis. Yayasan Tani Membangun. Jakarta.

Doni agustian. 2014. Pengaruh Pupuk NPK Mutiara 16:16:16 dan Hormon Etilen Pada Tanaman Kacang Panjang (Vigna sinensis, L). Skripsi Faperta Universitas Islam Riau. Pekanbaru.

Fahrudin. 2009, Budidaya Caisim (Brassica juncea L.) Menggunakan Ekstrak Teh dan Kascing FertilizerSkripsi Fakultas Pertanian Universitas Sebelas Maret. Surakarta.

Firmansyah, F., T. M. Anngo., dan A.M. Akyas. 2009. Pengaruh umur pindah tanam bibit dan populasi tanaman terhadap hasil dan kulalitas sayuran pakcoy (Brassica camprestis L. Chinensis Group) yang ditanam dalam naungan kasa di dataran medium. Jurnal Agrikultura. 20 (3) :216-224.

Hadisuwito. S. 2007. Membuat Pupuk Kompos Cair. Agromedia Pustaka. Jakarta.

Hardjowigeno, S. 2009. Ilmu Tanah. Akademika Pressindo. Jakarta.

Haryanto B, Suhartini, Rahayu E dan Sunarjo. 2006. Sawi dan Selada. Penebar Swadaya. Jakarta.

Hilman. 2011. Pakcoy Sawi Sendok. http://www.bebeja.com/Pakcoy-Sawi- Sendok.html. Diakses Pada Tanggal 10 Januari 2019.

Haryanto, W., T. Suhartini, dan E. Rahayu. 2007. Teknik Penanaman Sawi dan Selada Secara Hidroponik. Penebar Swadaya. Jakarta.

Hamim. 2004. Underlaying Drought Stress Effect on Plant: Inhibition of Photosynthesis. Journal of Biosciences.11(4) : 164-169.

Hendri, M., M. Napitupulu dan A. P. Sujalu. 2015. Pengaruh Pupuk Kandang Sapi Dan Pupuk Npk Mutiara Terhadap Pertumbuhan dan Hasil Tanaman Terung Ungu (Solanum Melongena L.). Jurnal Agrifor 14 (2) : 213-220.

Intara, Y.S., A. Sapei., Erizal., N. Sembiring., dan M. H. B. Djoefrie. 2011. Pengaruh Pemberian Bahan Organik Pada Tanah Liat dan Lempung Berliat Terhadap Kemampuan Mengikat Air. Jurnal Ilmu Pertanian Indonesia. 16(2): 130 135.

Isdarmanto. 2009. Pengaruh Macam Pupuk Organik dan Konsentrasi Pupuk Daun Terhadap Pertumbuhan dan Hasil Tanaman Cabai Merah (Capsicum annum L.) Dalam Budidaya Sistem Pot. Skripsi Universitas Sebelas Maret. Surakarta.

Junita, Y. Satyawibawa. I dan Hartono. 2002. Sawi Pakcoy Kaya Manfaat, PT. Penebar Swadaya. Jakarta.

Kariada, I.K dan I.M Sukadana. 2000. Sayuran Organik. http://www.pustaka_deptan. go.id/agritek/bali0208.pdf. Diakses tanggal 10 Januari 2019.

Kartini, N.L. 2005. Kascing Fertilizerkurangi pencemaran lingkungan. http:// kascing.com. Diakses 10 Januari 2019. Krishnawati. 2003. Pengaruh Pemberian Kascing Terhadap Pertumbuhan Vegetatif Tanaman Kentang (Solanum tuberosum Linn) Jurnal Kanpa Lembaga 4(1)-9-12.

Lili, W. 2010. Pengaruh Penggunaan Pupuk NPK Mutiara 16:16:16 dan Dekamon Terhadap Produksi Pare (Momordica charantia, L). Skripsi Faperta. Universitas Islam Riau. Pekanbaru.

Lahadassy. J., A.M Mulyati dan A.H Sanaba. 2007.Pengaruh Konsentrasi Pupuk Organik Padat Daun Gamal terhadap Tanaman Sawi, Jurnal Agrisistem, 3 (6) : 51-55.

Lingga dan Marsono . 2009. Petunjuk Penggunaan Pupuk. Jakarta. Penebar Swadaya.

Lakitan, B. 2011.Dasar-dasar Fisiologi Tumbuhan. Raja Grafrindo Persada. Jakarta.

Liptan. 2001. Pertanian Organik. Balai Pengkajian Teknologi

Pertanian (BPTP). Pekanbaru.
Mubandono. 2003. Membuat Kompos. Penebar Swadaya. Jakarta.
Maharani, C. R. L. 2003. Pengaruh media tanam dan pupuk NPK terhadap produk tanaman pak-choi (Brassica chinensis) varietas green pak-choi. Fakultas Pertanian Jurusan Budidaya Pertanian. Institut Pertanian Bogor.
Mulat. 2003. Membuat dan Memanfaatkan Kascing Pupuk Organik Berkualitas. Agromedia pustaka. Jakarta.
Marsono dan Sigit . 2011. Teknik Pembuatan Pupuk Kompos. Agromedia Pustaka. Jakarta.
Manan, A. 2006. Pengaruh Fospor dan Bahan Organik Terhadap Sifat Kimia dan Fisika Tanah Selama Masa Pertumbuhan Padi Tabur Benih Langsung Di Sumatra Utara. Jurnal Penelitian Bidang Ilmu Pertanian. 5 (1) :26 29.
Mardawilis. 2004. Pemanfaatan Tanaman Optimal dan Efisient Penggunaan Pupuk Nitrogen Pada Beberapa Varietas Jagung (Zeaa May) Di Lahan Kering. Jurnal Dinamika Pertanian Fakultas Pertanian .19(3) : 303-314.
Mulyani S,M. 2010. Pupuk dan Pemupukan. Rineka Cipta. Jakarta.
Musnawar. 2003. Pupuk Organik dan Tehnik Aplikasi. Penebar Swadaya. Jakarta.
Nuryati, S. 2004. Memanfaatkan Cacing Tanah Untuk Hasilkan Pupuk Organik. http://WWW.beritabumi.or,id/berita3.php?idberita. diakses tanggal 10 Januari 2019.
Novizan. 2007. Petunjuk Pemupukan Yang Efektif. Agromedia Pustaka. Jakarta. Palungkun, R. 1999. Sukses Berternak Cacing Tanah Lumbricus rubellus. Penebar Swadaya, Jakarta.
Perwitasari, B., M. Tripatmasari., dan C. Wasonowati. 2012. Pengaruh Media Tanam Dan Nutrisi Terhadap Pertumbuhan Dan Hasil Tanaman Pakcoy (Brassica juncea L.) Dengan Sistem Hidroponik. Jurnal Agrovigor. 5(1): 14-25.
Prayudyaningsih, R dan H. Tikupadang. 2008. Percepatan pertumbuhan Tanaman Bitti (Vitex cofasuss reinw) dengan Aplikasi Mikoriza Arbuskula (FMI). Balai Penelitian Kehutanan Makassar.
Prawoto. H.R. 2012. Pengelolaan Proses Produksi dan Pasca Panen Selada (Lactuca sativa L.) Secara Aeroponik dan Hidroponik Deep Flow Technique di Amazing Farm, Lembang. Bandung.
Rahayu, A. 2015. Uji Pemberian Kompos Tricho-Jagung serta NPK Mutiara 16:16:16 pada Tanaman Sawi (Brassica junsea L.) di Tanah Gambut. Skripsi Fakultas Pertanian Universitas Islam Riau. Pekanbaru.
Rukmana. R. 2004. Bertanam Petsai, Sawi dan Kanisius, yogyakarta. Sastrosayono. S. 2003. Budidaya Kacang Panjang. Agromedia Pustaka. Tangerang.
Sirwin, R. M, Mulyati, dan E. S. Lolita. 2007. Peranan kascing dan inokulasi jamur mikoriza terhadap serangan hama tanaman jagung. Jurusan Ilmu Tanah. Fakultas Pertanian. Unram.
Srilaba, N. 2013. "Pengaruh Dosis Kascing FertilizerDan Dosis Pupuk Fosfat Terhadap Hasil Jagung Manis (Zea mays) Dilahan Kering Andisol Candikuning" (Tesis). Denpasar Universitas Udayana.
Sugiyanta , F. Rumawan, M.A. Chorizin, W.Q. Mugnisyah, M. Ghulamahdi. 2008. Studi serapan hara N,P,K dan potensi hasil lima varietas padi sawah (Oryza sativa L) pada pemupukan anorganik dan organik . Jurnal Agron Staf Pengajar Depertemen Agronomi dan Hortikultura Fakultas Pertanian Institut Pertanian Bogor . Bogor . 36(3):16 20.
Sukmawati, S. 2012. Budidaya Pakcoy (Brassica chinensis. L.) Secara Organik Dengan Pengaruh Beberapa Jenis Pupuk Organik. Karya Ilmiah. Politeknik Negeri Lampung.
Sutarya R. 2005. Daftar Koleksi Isolat Mikroba Sayuran di Laboratorium Entomologi Phytopatology. Balai Penelitian Tanaman Sayuran.
Setyaningrum, H. D dan Saparinto, C. 2011. Panen Sayur Secara Rutin di Lahan Sempit. Jakarta: Penebar Swadaya. Sunarjono, H. 2013. Bertanam 36 Jenis Sayur. Penebar Swadaya. Jakarta. Sutanto, R. 2002. Penerapan Pertanian Organik. Kanisius. Yogyakarta.
Syafrizal Hasibuan, Lokot Ridwan Batubara, Iwan Sunardi, 2017, Pengaruh Pemberian Pupuk Majemuk Intan Super Dan Pupuk Npk Mutiara Terhadap Pertumbuhan Dan Produksi Tanaman Sawi (Brassica Juncea L.), Fakultas Pertanian Universitas Asahan. 13 (1) : 6 – 20
Usmardiono, A. 2013. Pengaruh Pemberian Urin Sapi Dan NPK Organik Terhadap Pertumbuhan dan Produksi Tanaman Pare (momordica chorantia). Skripsi. Fakultas Pertanian. Universitas Islam Riau. Pekanbaru.
Winten, K.T.I. 2006. Pengaruh Dosis Kascing FertilizerDan Nitrogen Terhadap Pertumbuhan Dan Hasil Selada (Lactuca sativa L) (tesis). Program Pascasarjana Universitas Udayana Denpasar.
Yuwono, D. 2006. Kompos, Seri Agritekno. Penebar Swadaya. Jakarta.
Yogiandre, R., W. Irawan., M. Laras., F. Cantika., C. Naomi., D. Pratama., R. Rahendianto., S. N. Cholidah. dan E. Rahayu. 2011. Komoditas Pakcoy Organik. Laporan Praktikum. Program Studi Agribisnis. Universitas Padjadjaran.
Yulianti. N. 2009. Cara Menghasilkan Pupuk Organik. Lily Publisher. Yogyakarta