

THE EFFECT OF PROVISION OF CHICKEN MANURE AND N-FERTILIZER ON THE GROWTH OF PAKCOY PLANTS (*Brassica rapa L.*) USING THE PARALON VERTICULTURE SYSTEM

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Abstract. The research was conducted in the greenhouse of the Faculty of Agriculture, Islamic University of North Sumatra, Jl. Eka Warni, Medan Johor District, Medan City. With a height of place ± 25 masl with flat tofografi. This research was conducted in April 2017 until June 2017. The aim of this research is to know the effect of chicken manure and N fertilizer on growth and production of mustard pakcoy plant with parallon vertikultur system. The design of this study used a Completely Randomized Design (CRD) Factorial consisting of two factors and repeated three times. The first factor is the provision of chicken coop (A) which consists of 4 levels, namely: A0 = 0 g / parallon (Control); A1 = 1000 g / parallon; A2 = 2000 g / parallon; A3 = 3000 g / parallon. The second factor is N (N) fertilizer consisting of 4 levels, namely: N0 = 0 g / parallon (Control); N1 = 1.8g / plant; N2 = 3.7g / plant; N3 = 5.6g / plant. The results showed that chicken manure gave a very significant effect on all parameters observed. The provision of chicken manure has a very significant effect on the parameters of plant height, the number of leaves, the diameter of the cob. The results showed that N fertilizer gave very significant effect on the parameters of plant height, leaf number, diameter of cob. The interaction of chicken manure and N fertilizer gave a very real effect on the diameter of the hump. However, the effect is not significant on the parameters of plant height, number of leaves.

Key Words : Chicken Manure, N Fertilizer, Parallon Vertikultur System

INTRODUCTION

Vegetables for Indonesian people cannot be abandoned in daily life because they have so many benefits, including being a source of vitamins and protein. Pakcoy mustard greens are a vegetable that has been known for a long time and is one of the vegetables that is popular with various groups of people. Another advantage of Pakcoy mustard greens is that they are relatively cheap, easy to obtain in traditional markets and supermarkets (Hernowo, 2010).

Pakcoy plants are horticultural vegetables that have quite high production. Judging from the average production in Indonesia, this vegetable is still quite low, namely 20 tonnes/ha, compared to countries in China 40 tonnes/ha, the Philippines 25 tonnes/ha, Taiwan 30 ton/ha. Based on data from the Central Statistics Agency (2014), pak choy vegetable production in Indonesia from 2010 to 2013 was 583,770 tons, 580,969 tons, 594,934 tons and 600,961 tons. This data shows that in 2011 there was a decline in the production of pakcoy plants. One of the causes of the low level of productivity of this plant is the limited availability of superior varieties that are resistant to dangerous diseases such as soft rot and leaf spot, and there are still very few varieties that are resistant to temperature. hot (Eko, 2007).

Furthermore, Kurniadi (2005) said that apart from being a vegetable, pak choy mustard greens can also be beneficial for human health, especially those who consume them continuously. Mustard greens can relieve itching in the throat of cough sufferers, cure headaches because they contain vitamins and nutrients that are important for human health.

Pakcoy production can be increased through good cultivation, namely proper maintenance and fertilization. Fertilizing using organic and inorganic fertilizers is very good for growing mustard greens with good quality and can increase pak choy production (Lingga, 2003).

Several research results show that the application of chicken manure always provides the best plant response in the first season. This happens because chicken manure decomposes relatively quickly and has sufficient nutrient levels when compared with the same number of units as other manure (Widowati *et al.* , 2005).

Chicken manure is a solid fertilizer that contains a lot of water and mucus. Chicken manure is a cold fertilizer because the change from the ingredients contained in the fertilizer to those available in the soil takes place slowly (Musnamar, 2003).

Apart from providing organic fertilizer, providing urea fertilizer as a source of N nutrients is an effort that is often carried out to increase the productivity of vegetables, especially pak choy. Urea fertilizer as a source of N nutrients can improve plant vegetative growth, where plants that grow in soil with sufficient N are greener (Hardjowigeno, 2001).

RESEARCH METHODS

Place and time of research

This research was carried out in the greenhouse of the Faculty of Agriculture, Islamic University of North Sumatra, Jl. Eka Warni, Medan Johor District, Medan Municipality. With a height of ± 25 meters above sea level with flat topography. This research was conducted from April 2017 to June 2017.

Research Design

This research used a Completely Randomized Design (CRD) with 2 Factorials , namely: the first factor is Chicken Manure (A) which consists of four levels, namely: A₀: 0 g/paralon, A₁: 1000 g/paralon, A₂: 20 00 g/paralon, A₃: 3000 g/paralon. The second factor is Fertilizer N (N) which consists of four levels, namely: N₀: 0 g/plant, N₁: 1.8 g/plant, N₂: 3.7 g/plant, N₃: 5.6 g/plant. The parameters observed were plant height (cm), number of leaves (pieces), tuber diameter (cm) .

RESEARCH RESULTS

Plant Height (cm)

The results of statistical analysis showed that the treatment of giving chicken manure and N fertilizer had a very significant effect at the ages of 1, 2 and 3 WAP. Meanwhile, the interaction between the two treatment factors had no significant effect at ages 1, 2 and 3 WAP.

Table 1. Average Height of Pakcoy Mustard Plants (cm) in the Treatment of Giving Chicken Manure and N Fertilizer at the Age of 3 WAP

Chicken	N fertilizer				Average
	N0	N1	N2	N3	
A0	5.27	5.88	7.39	8.10	6.66A
A1	8.27	9.37	9.96	10.49	9.52B
A2	9.60	10.22	10.49	11.27	10.39C
A3	11.54	12.48	12.53	13.82	12.60D
			10.09C		
Average	8.67A	9.49B		10.92D	

Note: Numbers followed by letters that are not the same in the same treatment group are significantly different at the 1 % level based on the DMRT test, while those without notations are not significantly different.

In Table 1, it can be seen that the treatment of providing chicken manure had a very significant effect on the height of the Pakcoy mustard greens. The highest plants were obtained in treatment A₃ (3000 g/paralon) namely 12.60 cm, which was very significantly different from treatment A₂ (2000 g/paralon) namely 10.39 cm, treatment A₁ (1000 g/paralon) namely 9 .52 cm and treatment A₀ (0 g/paralon) which is 6.66 cm. The treatment of providing N fertilizer had a very significant effect on the height of the Pakcoy mustard greens. The highest plants were obtained in the treatment N₃ (5.6 g/plant), namely 10.92 cm, which was significantly different from the treatment N₂ (3.7 g/plant), namely 10.09 cm, the treatment N₁ (1.8 g) . /plant) namely 9.49 cm and treatment N₀ (0 g/plant) namely 8.67 cm. The interaction of the two treatment factors had no significant effect on the height of the Pakcoy mustard plant. The highest plants were obtained in the treatment A₃N₃ (3000 g/paralon and 5.6 g/plant), namely 13.82 cm, while the lowest plants were obtained in the treatment A₀N₀ (0 g/paralon and 0 g/plant), namely 5.27 cm.

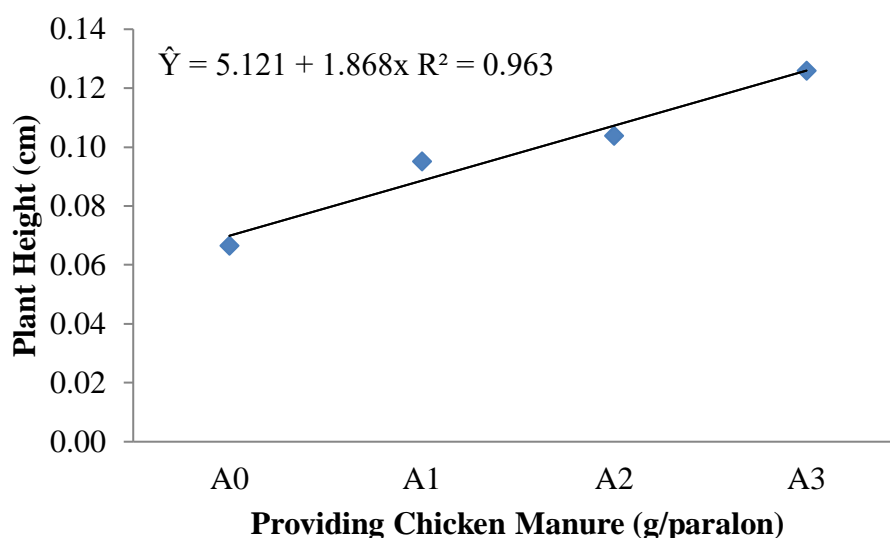


Figure 1. Relationship between the height of Pakcoy mustard greens (cm) and the provision of chicken manure (g/paralon)

From Figure 1, it can be seen that there is a relationship between the height of the Pak Choy mustard plant and the provision of chicken manure with the equation $\hat{Y} = 5.121 + 1.868x$ and $R^2 = 0.963$. From the picture we can see that the higher the application of chicken manure, the higher the pak choy mustard plant will be. On the other hand, the lower the amount of chicken manure given, the lower the height of the pak choy mustard plant. This can be seen from the coefficient of determination (R) of the relationship between the height of the Pak Choy mustard plant and the application of chicken manure , namely 0.963, which means that 96.3% of the diameter of the head of the Pak Choy mustard plant is influenced by the application of chicken manure, while 3.7% is influenced by other factors.

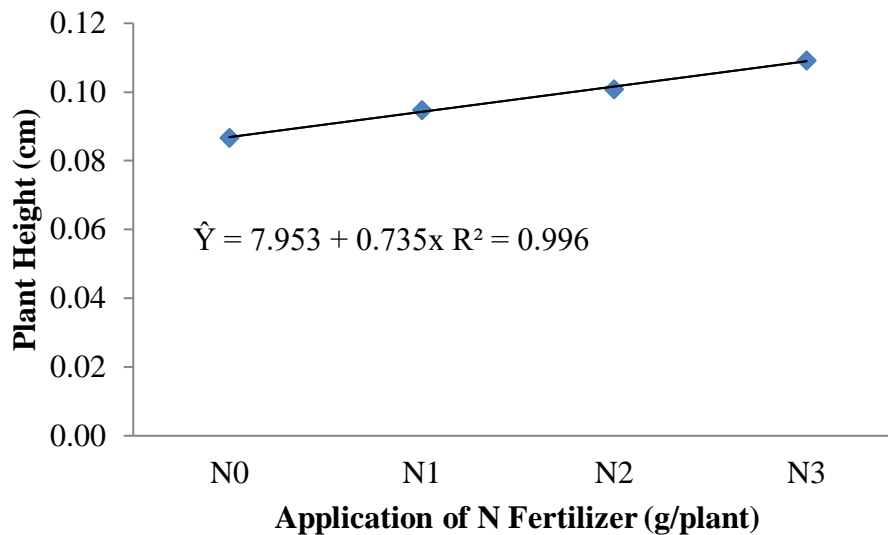


Figure 2 . Relationship between Pakcoy Mustard Plant Height (cm) and N Fertilizer Application (g/plant)

In Figure 2 it can be seen that the highest plants were obtained in the treatment N₃ (5.6 g/plant) namely 10.82 cm, and the lowest plants were obtained in the treatment N₀ (0 g/plant) namely 8.67 cm.

Number of Leaves (pieces)

The results of statistical analysis showed that the treatment of giving chicken manure and N fertilizer had a very significant effect at the ages of 1, 2 and 3 WAP. Meanwhile, the interaction of the two treatment factors had no significant effect at the age of 3 WAP and had a very significant effect at the ages of 1 and 2 WAP.

Table 2. Average Number of Pakcoy Mustard Leaf Plant Leaves (strands) in the Treatment of Giving Chicken Manure and N Fertilizer at the Age of 3 WAP

Chicken	N fertilizer				Average
	N0	N1	N2	N3	
A0	6.00	6.00	6.00	7.00	6.25A
A1	7.00	7.00	7.00	7.00	7.00B
A2	7.33	7.00	7.33	7.67	7.33C
A3	7.00	7.67	7.67	7.67	7.50C
Average	6.83A	6.92A	7.00A	7.33B	

Note: Numbers followed by letters that are not the same in the same treatment group are significantly different at the 1 % level based on the DMRT test, while those without notations are not significantly different.

In Table 2 it can be seen that the treatment of giving chicken manure had a very significant effect on the number of leaves of the Pak Choy mustard plant. The highest number of leaves was obtained in treatment A₃ (3000 g/paralon), namely 7.50 strands, which was not very significantly different from treatment A₂ (2000 g/paralon) namely 7.33 strands, and very significantly different from treatment A₁ (1000 g/paralon) which is 7.00 strands and treatment A₀ (0 g/paralon) which is 6.25 strands. The treatment of providing N fertilizer had a very significant effect on the number of leaves of Pakcoy mustard plants. The highest number of leaves was obtained in the treatment N₃ (5.6 g/plant), namely 7.33 pieces, and was very significantly different from the treatment N₂ (3.7 g/plant), namely 7.00 pieces, the N₁ (1, 8 g/plant) namely 6.92 strands and treatment N₀ (0 g/plant) namely 6.83 strands. The interaction of the two treatment factors had no significant effect on the number of

leaves of Pakcoy mustard plants. The highest number of leaves was obtained in the A₃N₃ (3000 g/paralon and 5.6 g/plant), namely 7.67 pieces, while the smallest number of leaves was obtained in the treatment A₀N₀ (0 g/paralon and 0 g/plant) namely 6.00 strands.

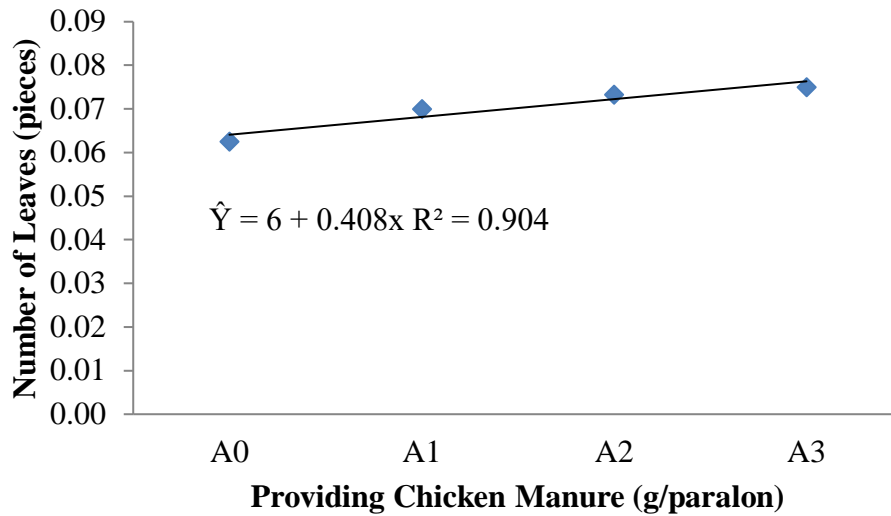


Figure 3. Relationship between the number of leaves of Pakcoy mustard plants (cm) and the provision of chicken manure (g/paralon)

From Figure 3, it can be seen the relationship between the number of leaves of Pak Choy mustard plants and the provision of chicken manure with the equation $\hat{Y} = 6 + 0.408x$ and $R^2 = 0.904$. From the picture we can see that the more chicken manure is given, the greater the number of leaves and pak choy mustard plants. Likewise, vice versa, the lower the amount of chicken manure, the smaller the number of leaves on the Pak Choy mustard plant. This can be seen from the coefficient of determination (R) of the relationship between the diameter of the head of the Pak Choy mustard plant and the application of chicken manure, namely 0.904, which means that 90.4% of the diameter of the head of the Pak Choy mustard plant is influenced by the application of chicken manure, while 9.6% is influenced by other factors. .

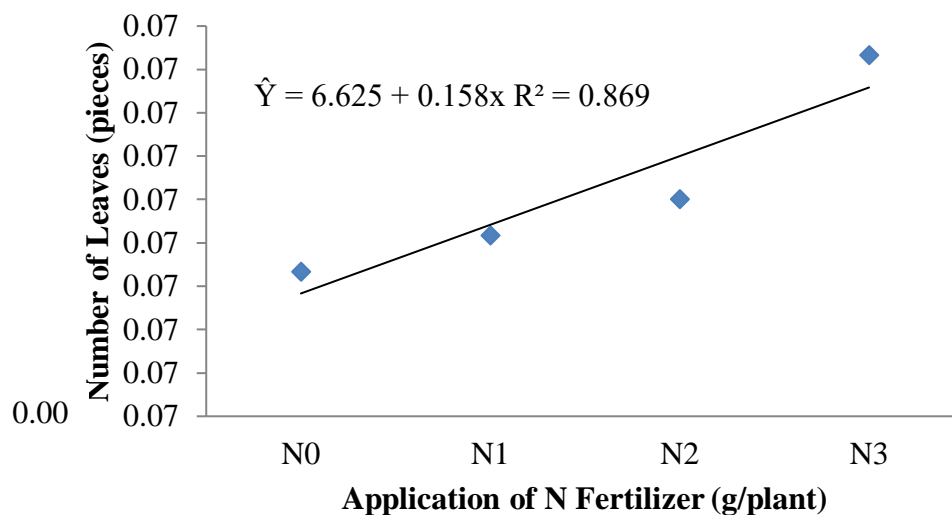


Figure 4 . Relationship between the number of leaves of Pakcoy mustard plants (strands) and the application of N fertilizer (g/plant)

In Figure 4 it can be seen that the highest number of leaves was obtained in the treatment N₃ (5.6 g/plant), namely 7.33 pieces, and the smallest number of leaves was obtained in the treatment N₀ (0 g/plant), namely 6.83 pieces.

Hump Diameter (cm)

The results of the statistical analysis showed that the treatment of providing chicken manure, N fertilizer and the interaction of the two factors had a very significant effect.

Table 3. Average diameter of the hump of Pakcoy mustard plants (cm) in the treatment of giving chicken manure and N fertilizer at harvest time

Chicken	N fertilizer				Average
	N0	N1	N2	N3	
A0	4.38A	4.71A	4.63A	6.46B	5.04A
A1	6.59B	6.38B	6.19B	6.69B	6.46B
A2	6.97B	6.43B	6.72B	6.94B	6.76C
A3	6.41B	7.24B	7.39B	6.85B	6.97C
Average	6.08A	6.19A	6.23A	6.73B	

Note: Numbers followed by letters that are not the same in the same treatment group are significantly different at the 1 % level based on the DMRT test, while those without notations are not significantly different.

In Table 3 it can be seen that the treatment of giving chicken manure had a very significant effect on the diameter of the hump of the Pakcoy mustard plant. The largest tuber diameter was obtained in treatment A₃ (3000 g/paralon) namely 6.97 cm, which was not very significantly different from treatment A₂ (2000 g/paralon) namely 6.76 cm, but was very significantly different from treatment A₁ (1000 g/paralon) which is 6.46 cm and treatment A₀ (0 g/paralon) which is 5.04 cm. The treatment of providing N fertilizer had a very significant effect on the diameter of the hump of the Pakcoy mustard plant. The largest tuber diameter was obtained in the treatment N₃ (5.6 g/plant), namely 6.73 cm, which was very significantly different from the treatment N₂ (3.7 g/plant), namely 6.23 cm, the treatment N₁ (1.8 g/plant) namely 6.19 cm and N₀ treatment (0 g/plant) namely 6.08 cm. The interaction of the two treatment factors had a significant effect on the tuber diameter of Pakcoy mustard greens. The largest tuber diameter was obtained in the treatment A₃N₂ (3000 g/paralon and 3.7 g/plant), namely 7.39 cm, while the lowest plant was obtained in the treatment A₀N₀ (0 g/paralon and 0 g/plant) namely 4.38 cm.

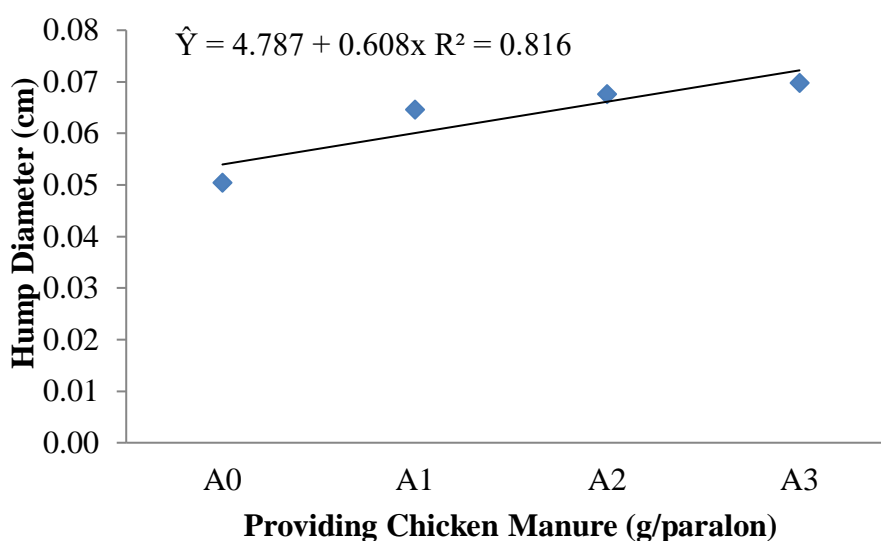


Figure 5. Relationship between the diameter of the hump of the Pakcoy mustard plant (cm) and the provision of chicken manure (g/paralon)

From Figure 5, it can be seen that there is a relationship between the diameter of the tuber of saw i pak choy plants and the provision of chicken manure with the equation $\hat{Y} = 4.787 + 0.608x$ and $R^2 = 0.816$. From the picture we can see that the higher the application of chicken manure, the larger the diameter of the hump of the Pak Choy mustard plant. On the other hand, the lower the amount of chicken manure, the smaller the diameter of the pak choy mustard plant's bulb. This can be seen from the coefficient of determination (R) of the relationship between the diameter of the head of the Pak Choy mustard plant and the application of chicken manure, namely 0.816, which means that 81.6% of the diameter of the head of the Pak Choy mustard plant is influenced by the application of chicken manure, while 18.4% is influenced by other factors.

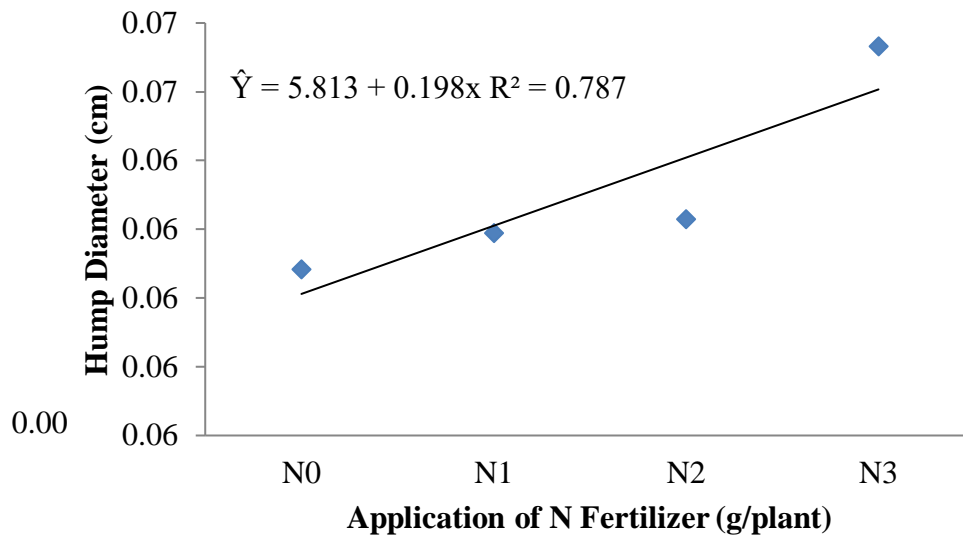


Figure 6 . Correlation between the diameter of the hump of Pakcoy mustard plants (cm) and the application of N fertilizer (g/plant)

In Figure 6 it can be seen that the largest tuber diameter was obtained in the treatment N₃ (5.6 g/plant), namely 6.73 cm, and the smallest tuber diameter was obtained in the treatment N₀ (0 g/plant), namely 6.08 cm.

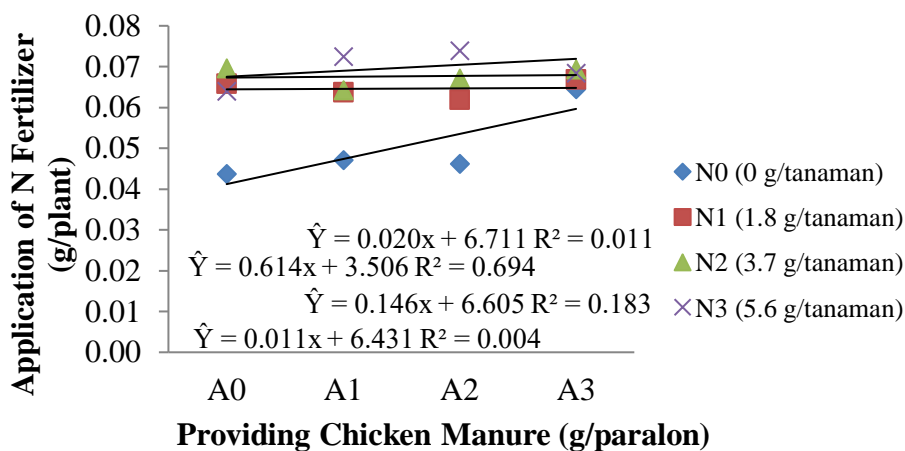


Figure 7. Relationship between the diameter of the hump of Pakcoy mustard plants (cm) and the interaction between giving chicken manure and N fertilizer

From Figure 7 it can be seen that the interaction relationship between the treatment of giving chicken manure and N fertilizer shows that giving chicken manure 3000 g/paralon (A_3) with N fertilizer 3.7 g/plant (N_2) has the largest tuber diameter, namely 7, 39 cm, while when applying 0 g/plant chicken manure (A_0) with 0 g/plant N Fertilizer (N_0) the smallest bulb diameter was 4.38 cm. So by administering 3000 g of chicken manure/paralon (A_3) with 3.7 g of N fertilizer/plant (N_2) it will increase the diameter of the tuber on pak choy mustard plants. Soil that is suitable for planting sa wi pakcoy is loose soil, contains lots of humus, is fertile, and has good water drainage. The optimum degree of soil acidity (pH) for growth is between pH 6 to pH 7.

DISCUSSION

The Effect of Providing Chicken Manure on the Growth of Pakcoy Mustard Plants Using the Paralon Verticulture System

The results of the study showed that the application of chicken manure had a very real influence on all the parameters observed. Providing chicken manure has a very significant effect on the parameters of plant height, number of leaves, and tuber diameter.

This research used chicken manure at a dose of 3000 g/paralon (A_3), 2000 g/paralon (A_2), 1000 g/paralon (A_1) and 0 g/paralon (A_0). Chicken manure has a positive impact on the growth of pakcoy mustard greens. Treatment A_3 (3000 g/paralon) produces the highest plant height, namely 12.60 cm, the highest number of leaves, namely 7.50, the largest tuber diameter, namely 6.97 cm.

Providing chicken manure has a very significant effect on the growth of Pakcoy mustard plants using a verticulture system. This is because chicken manure contains complete macro and micro nutrients, even in small amounts. In accordance with Retno and Susi (2013) who said that poultry (chicken) manure is useful in the mineralization process which will release complete nutrients (N, P, K, Ca, Mg, S and micro nutrients), and can increase the nutrient content of the soil. Apart from that, chicken manure can also improve the physical and chemical properties of soil, improve soil structure, make the soil easier to process, increase water resistance, improve soil permeability, and increase cation exchange capacity, so that it is able to bind high levels of cations. Susanti (2009) added that there is a very real influence on plant height because chicken manure contains complete nutrients to loosen the soil. This results in optimal plant growth and chicken manure can increase water absorption capacity so that the plant's need for water is met.

The Effect of N Fertilizer on the Growth of Pakcoy Mustard Plants Using the Paralon Verticulture System

The results of the research showed that the application of N fertilizer had a very significant effect on the parameters of plant height, number of leaves, and tuber diameter. Fertilizer treatment with N 5.6 g/plant (N_3) produced the highest plant height, namely 10.92 cm, the largest number of leaves, namely 7.33, and the largest tuber diameter, namely 6.73 cm.

Providing N fertilizer has a very significant effect on the growth of pak choy mustard plants. This is because mustard plants require nutrients for the vegetative growth process, especially the element N. This is in accordance with the opinion of Prihmantoro (1999) who states that the nutrient N is needed for the vegetative growth of plants, especially stems, branches and leaves. If the need for N elements is met, it can increase plant growth. In line with Novizan (2002) that the element N is very useful for plants for plant growth and development, including: 1. Making plants fresher green and containing lots of chlorophyll which has a role in the photosynthesis process 2. Accelerating plant growth (height, number of leaves, stem diameter and others) 3. Increases plant protein content.

Nitrogen is an essential nutrient for plants, so it is very important for their growth and development. In line with Lakitan (2008) that in plant tissue, nitrogen is an essential nutrient and a building block for amino acids, proteins and enzymes. Apart from that, nitrogen is also contained in chlorophyll, the hormone cytokinin and auxin.

The N element in plants functions to increase plant growth, one of which is increasing the number of leaves and they will become wider with a greener color which will increase protein levels in the plant body (Dora, 2009).

The Effect of Providing Chicken Manure and N Fertilizer on the Growth of Pakcoy Mustard Plants Using the Paralon Verticulture System

The results of the research showed that the interaction of giving chicken manure and N fertilizer had a very real influence on the tuber diameter parameters. But it has no real effect on the parameters of plant height and number of leaves.

The largest tuber diameter was obtained in the treatment A_3N_0 (3000 g/paralon and 0 g/plant), namely 7.39 cm. Meanwhile, the highest plant height and number of leaves were obtained in the treatment A_3N_3 (3000 g/paralon and 5.6 g/plant), respectively, the highest plant was 13.82 cm and the highest number of leaves was 7.67 pieces.

This is in accordance with Fajar (2011) who said that the combination of chicken manure and reduced inorganic fertilizer resulted in high N availability and constant release of NO_3 during the planting period, which shows that there is harmony between the availability and uptake of N by plants. Therefore, efforts need to be made to increase the efficiency of using inorganic fertilizers through integrated fertilizer management, namely combining organic fertilizers and appropriate chemical fertilizers, so that the cost of using fertilizers can be reduced, but production levels remain high.

It can be seen from table 3 that the tuber diameter has a very significant effect on the treatment A_3N_0 (3000 g/paralon and 0 g/plant). In accordance with the previous description, the application of high amounts of chicken manure and a reduction in urea (N) causes harmony between the availability and uptake of N by plants.

CONCLUSION

Providing chicken manure has a very real influence on the parameters of plant height, number of leaves and tuber diameter. Providing N fertilizer has a very significant effect on the parameters of plant height, number of leaves and tuber diameter. The interaction of giving chicken manure and N fertilizer had a very real influence on the weevil diameter parameters. However, there was no significant effect on the parameters of plant height and number of leaves.

REFERENCES

- Dora, F.N. 2009. Pengaruh Pemberian Pupuk Organik Terhadap Pertumbuhan Dan Hasil Tanaman Sawi Caisim (*Brassica juncea* L). FP Universitas Baturaja.
- Eko, 2007. Budidaya Tanaman Sayuran Sawi Pakcoy. Penerbit Swadaya. Jakarta
- Fajar, R.P. 2011. Pengaruh Kombinasi NPK dan Pupuk Kandang Terhadap Sifat Tanah Dan Pertumbuhan Serta Produksi Tanaman Bayam. IKIP PGRI. Semarang.
- Hardjowigeno, 2001. Perbedaan Antara Pupuk Anorganik dan Pupuk Organik. <http://repository.ipb.ac.id/bitstream/handle/12345689/52826/BAB%20I%20Pendahuluan.pdf?sequence=3>. *Jurnal Ilmu-ilmu Pertanian*, 6 (2):142-156.
- Kurniadi, A. 2005. Sayuran Yang Digemari. Jakarta: Harian Suara Tani.
- Lakitan, B. 2008. Dasar-Dasar Fisiologi Tumbuhan. PT Raja Grafindo Persada. Jakarta.
- Lingga, P. 2003. Kotoran Ternak Penyubur Tanah. Jakarta: Penebar Swadaya.
- Musnamar, E. 2003. Pupuk Organik. Penebar Swadaya. Jakarta.
- Novizan. 2002. Pupuk Pemupukan Yang Efektif. Agromedia. Jakarta
- Prihantoro, H. 1999. *Memupuk Tanaman Sayuran*. Penebar Swadaya, Jakarta.
- Retno, S dan Susi, S. 2013. Pengaruh Macam dan Dosis Pupuk Kandang Terhadap Pertumbuhan dan Hasil Tanaman Petsai (*Brassica chinensis* L). Fakultas Pertanian. Probolinggo.
- Widowati, L.R., S. Widati, U. Jaenudin, dan W. Hartatik. 2005. Pengaruh Kompos Pupuk Organik Yang Diperkaya Dengan Bahan Mineral dan Pupuk Hayati terhadap Sifat – Sifat Tanah,

Serapan Hara dan Produksi Sayuran Organik. Laporan Proyek Penelitian Program Pengembangan Agribisnis, *Balai Penelitian Tanah* 11(2): 1 – 23.