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Application Of Cow Stage And POC Fertilizer On The Growth And Production Of Red Onion (Allium Cepa L.)

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Abstract:
This study aims to determine the application of cow manure and POC on the growth and production of shallots (Allium cepa L.). This study used a factorial Randomized Block Design (RBD) of 2 factors. The first factor is giving POC (B), which consists of 4 levels: B0= Control, B1= 5 ml/240 ml of water, B2= 10 ml/240 ml of water, and B3= 15 ml/240 ml of water. The second factor is the provision of cow manure (S), which consists of 3 levels, namely: S1= (1.2 kg/plot) 10 tonnes/ha, S2= (2.4 kg/plot) 20 tonnes/ha and S3= (3.6 kg/plot) 30 tonnes/ha. The results showed that POC administration significantly affected the number of tubers per sample, the fresh weight of tubers per sample, the fresh weight of tubers per plot, and the dry weight of tubers per sample. The application of cow manure significantly affected the number of tubers per sample, the fresh weight of tubers per sample, the wet weight of tubers per plot, and the dry weight of tubers per sample.
Key Word*: cow manure, POC, shallots.*

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I. Introduction

Shallot (Allium cepa L.) is a plant used as a kitchen ingredient that can be produced in various places and is easy to grow in the yard. The shallot plant is a horticultural commodity classified as a spiced vegetable with many benefits and high economic value. Shallots are needed, especially as a complement to cooking spices to add to food taste. Shallots are also used as medicines because they contain several beneficial substances, including anti-cancer agents, constipation, coughs, fever, diarrhoea, and even diabetes (1).

Red onion is a leading commodity in several regions in Indonesia, which is used as a cooking spice and contains several substances that are beneficial to health. Based on research results, shallots contain calcium, phosphorus, iron, carbohydrates, and vitamins such as A and C (2).

The Central Statistics Agency (BPS) (3)noted that Indonesia's shallot production will reach 2 million tons in 2021. This number has increased by 10.42% from 2020, which amounted to 1.82 million tons. An increase in shallot production has been seen every year since 2017 when Indonesia only produced 1.47 million tonnes. The number continues to increase, with an average increase of 8% yearly. In 2021, the highest shallot production will occur in August, reaching 218.74 thousand tonnes with a harvested area of 18.07 thousand hectares.

Meanwhile, the lowest production occurred in February, namely 126.7 thousand tons. According to data from the Central Bureau of Statistics, the largest shallot production last year was Central Java, which contributed 564.26 thousand tons or 28.15% to national shallot production with a recorded harvested area of 55.98 thousand hectares. East Java Province is in second place, contributing 24.99%, with shallot production reaching 500.99 thousand tons and a harvest area of 53.67 thousand hectares. West Nusa Tenggara contributed 11.11%, with production reaching 222.62 thousand tonnes and a harvested area of 20.31 thousand hectares (4).

One alternative to increase soil fertility is the application of cow manure. Cow manure is fertilizer produced from livestock manure or waste in nature. Cow manure can increase Cation Exchange Capacity (CEC), increase the ability of the soil and can hold water so that the nutrients in the soil or those added from the outside are not easily dissolved and lost so that these nutrients can be available for plants. Cow manure is a source of nitrogen and other nutrients which are beneficial for the growth and increase of shallot production (5).

Cow manure contains 28% nitrogen, 9.1% phosphorus and 20% potassium. The content of cow manure functions, namely improving soil biological properties and increasing soil fertility. So cow manure

applied to shallots affects stimulating root growth, maximum absorption of water and nutrients to plants, and maximizing the growth and production of shallots (6).

POC is a solution of fermented organic materials derived from the remains of living things, namely the remains of plants, animal and human faeces, which contain more than one nutrient element. Among the advantages of organic fertilizers are being able to overcome nutrient deficiencies quickly, not having problems with leaching nutrients and being able to provide nutrients quickly. Unlike inorganic fertilizers, liquid organic fertilizers generally do not damage soil and plants, even though they are used as often as possible. In addition, liquid organic fertilizer also has a binder so that plants can directly absorb the fertilizer solution applied to the soil surface and can increase plant growth.

Increased productivity can be done by paying attention to fertilization. Based on its form, fertilizer consists of two kinds: solid fertilizer and liquid fertilizer. The advantage of liquid organic fertilizer is that it is easily available and does not damage the soil and plants. The content in Liquid Organic Fertilizer (POC) will be more easily absorbed by plants and more effective and efficient when applied to leaves, flowers and stems compared to the application to the soil. Another role is as a growth stimulant, especially when the plant has transitioned from vegetative to generative phases. Liquid organic fertilizer can help increase crop production, improve crop production quality and reduce inorganic fertilizers (7).

II. Material And Methods

This research was conducted on Jalan Balai, Sempakata Village, Medang Selayang District, Medan City, with a height of ± 30 meters above sea level. This study used a factorial Randomized Block Design (RBD) of 2 factors. The first factor was giving POC (B), which consisted of 4 levels: B0 = Control, B1 = 5 ml/240 ml of water, B2 = 10 ml/240 ml of water, and B3 = 15 ml/240 ml of water. The second factor is the application of cow manure (S), which consists of 3 levels, namely: S1 = (1.2 kg/plot) 10 tonnes/ha, S2 = (2.4 kg/plot) 20 tonnes/ha and S3 = (3.6 kg/plot) 30 tonnes/ha. Data analysis used analysis of variance and Duncan's test. The variables observed were the number of tubers per sample, the fresh weight of tubers per sample, the wet weight of tubers per plot, and the dry weight of the sample.

III. Result

1. Number of Tubers per Sample (cloves)

Data on the number of tubers per sample due to the application of POC and cow manure presented in the list of variances showed that the application of cow manure and POC significantly affected the number of tubers per sample. In contrast, the interaction between the two treatments had no significant effect. Table 1 presents the average number of tubers per sample due to cow manure and POC treatment at different doses.

Table 1. Mean Number of Tubers per Sample (cloves) in the Treatment of Cow Stalls and POC

Treatment	Number of Tubers per Sample (clove)
S1	5,18a
S2	5,52a
S3	6,28b
B0	4,91a
B1	5,60b
B2	5,69b
B3	6,44c
S1B0	4,40
S1B1	5,20
S1B2	5,67
S1B3	5,47
S2B0	4.93
S2B1	5,40
S2B2	5,20
S2B3	6,53
S3B0	5,40
S3B1	6,20
S3B2	6,20
S3B3	7,33

Note: Numbers followed by the same letters in the same column mean that they are not significantly different in the DMRT test at a test level of 5%

Table 4 shows that in the cow manure treatment, the highest number of tubers per sample was found in treatment S3 which was significantly different from S1 and S2. The number of tubers per sample in S2 treatment was not significantly different from S1. The effect of cow manure on the number of tubers per sample can be seen in Figure 3.

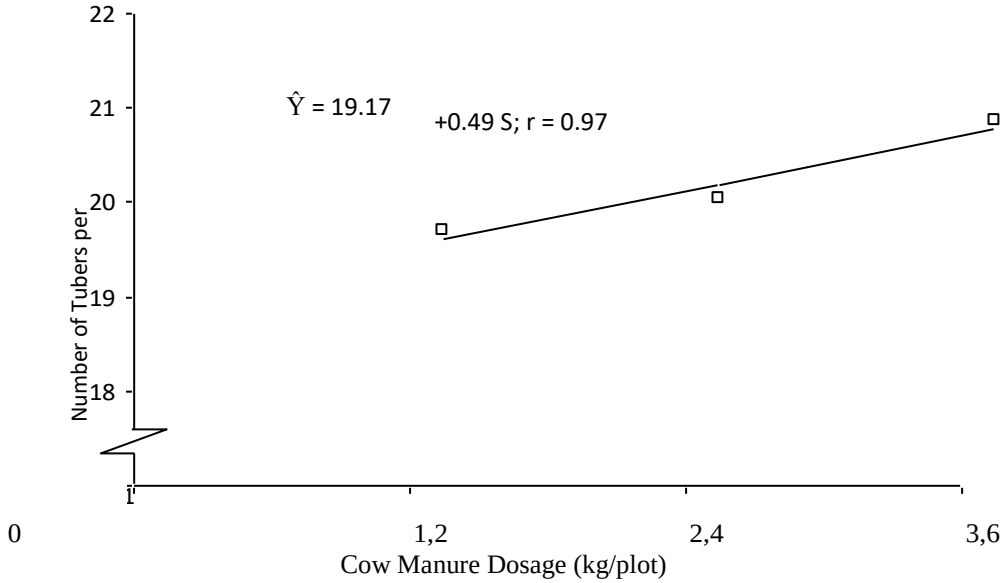

Figure 1. Application of Cow Manure to Number of Tubers per Sample

Figure 1 shows that the higher the dose of cow manure, the number of tubers per sample increases following a positive linear regression curve. Each increase in the dose of cow manure by 1 kg/plot will increase the number of tubers per sample by 0.49 cloves.

Table 1 shows that in the treatment of POC administration, the highest number of tubers per sample was found in treatment B3 which was significantly different from B0, B1 and B2. The number of tubers per sample in treatment B2 differed significantly from B0 but not significantly from B1. The number of tubers per sample in treatment B1 significantly differed from B0. The effect of POC on the number of tubers per sample can be seen in Figure 2.

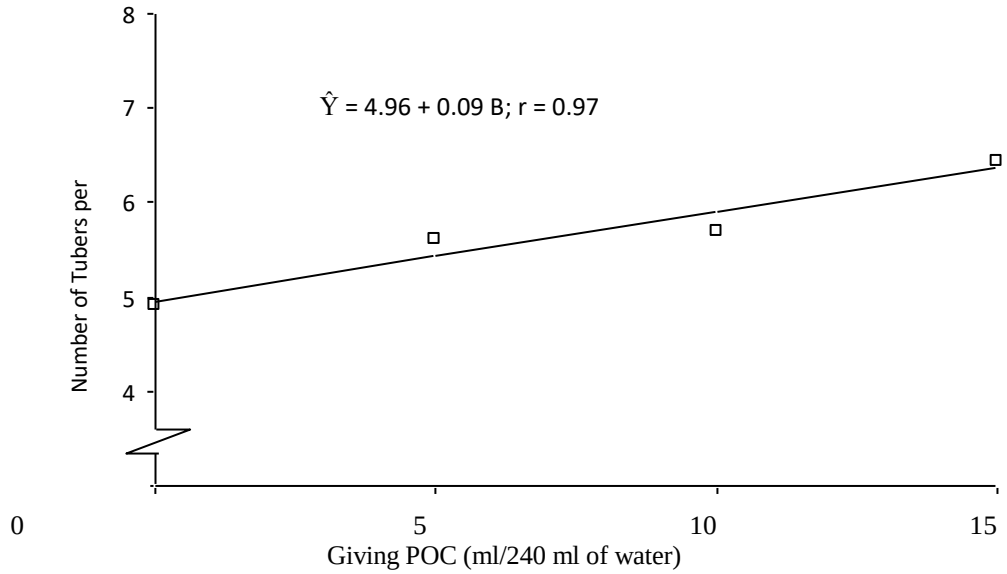

Figure 2. Distribution of POC to the number of tubers per sample

Figure 2 shows that the higher the dose of POC, the number of bulbs per sample of shallot plants increases following a positive linear regression curve. Each increase in the dose of POC with a concentration of 1 ml/240 ml of water can increase the number of tubers per sample by 0.09 cloves.

2. Fresh Weight of Tuber per Sample (g)

Data on the wet weight of tubers per sample due to the application of cow manure and POC presented in the variance list showed that the treatment with cow manure and POC significantly affected the wet weight of tubers per sample. In contrast, the interaction between the two treatments had no significant effect. Table 2 presents the average fresh weight of onion bulbs per sample due to the treatment with different doses of cow manure and POC.

Table 2. Average tuber wet weight per sample (g) in the treatment of bovine stalls and POC

Treatment	Tuber Weight per Sample (g)
S1	25,20a
S2	27,28a
S3	31,18b
B0	24.04a
B1	27,33ab
B2	28,91b
B3	31,27b
S1B0	20,20
S1B1	26,53
S1B2	23,47
S1B3	30,60
S2B0	24,40
S2B1	24,67
S2B2	30,93
S2B3	29,13
S3B0	27,53
S3B1	30,80
S3B2	32,33
S3B3	34.07

Note: Numbers followed by the same letters in the same column mean that they are not significantly different in the DMRT test at a test level of 5%

Table 2 shows that in the cow manure treatment, the wet weight of tubers per sample was heaviest in treatment S3, significantly different from S1 and S2. The wet weight of tubers per sample in the S2 treatment was not significantly different from S1. The effect of cow manure application on tuber wet weight per sample can be seen in Figure 3.

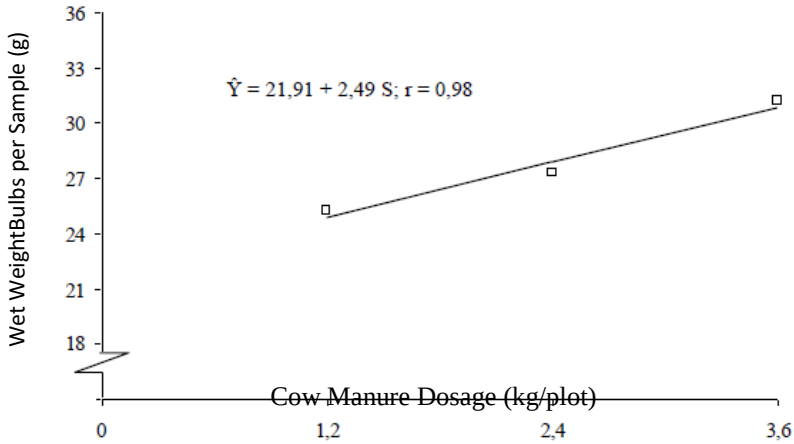

Figure 3. Effect of Cow Manure Fertilizer on Fresh Weight of Tuber per Sample

Figure 3 shows that the higher the dose of cow manure, the fresh weight of tubers per sample increases following a positive linear regression curve. Each increase in the dose of cow manure by 1 kg/plot can increase the wet weight of tubers per sample by 0.49 cloves.

Table 2 shows that in the treatment of POC administration, the heaviest tuber wet weight per sample was found in treatment B3 which was significantly different from B0 but not significantly different from B1 and B2. The wet weight of tubers per sample in treatment B2 differed significantly from B0 but not significantly from B1. The wet weight of tubers per sample in treatment B1 was not significantly different from B0. The effect of POC on the wet weight of tubers per sample can be seen in Figure 4.

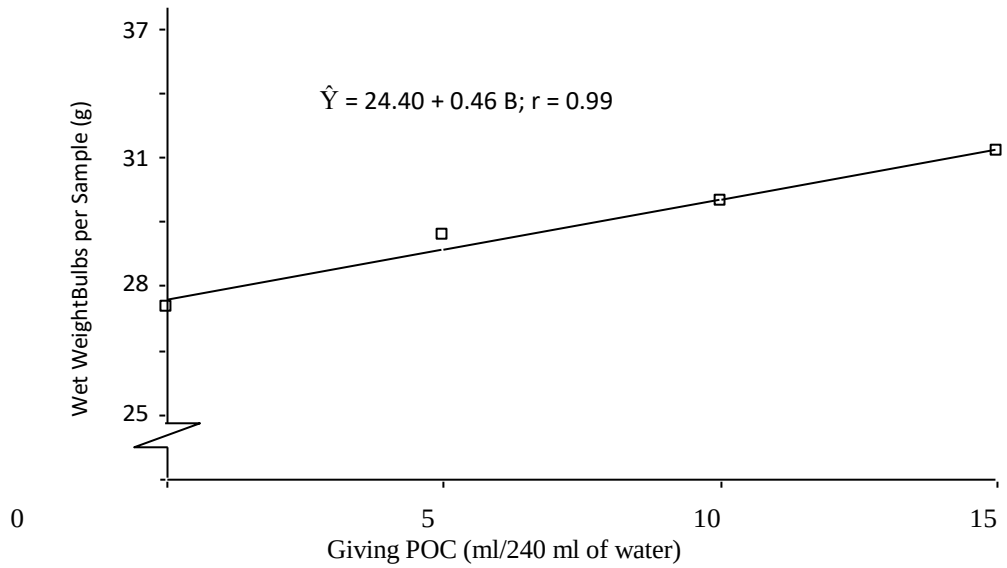

Figure 4. Effect of POC on Fresh Weight of Bulbs per Sample Figure 6 shows that the higher the dose of POC, the wet weight of shallot per sample increases following a positive linear regression curve. Each increase in POC dose of 1 ml/240 ml of water can increase the wet weight of shallot per sample by 0.46 g.

3. Tubers Wet Weight per Plot (g)

Data on the wet weight of tubers per plot due to the application of cow manure and POC presented in the variance list showed that the treatment with cow manure and POC significantly affected the wet weight of tubers per plot. In contrast, the interaction between the two treatments had no significant effect. Table 3 presents the average fresh weight of tubers per plot due to treatment with different doses of cow manure and POC.

Table 3. Average tuber wet weight per plot (g) for cattle sheds and POC

Treatment	Tubers Wet Weight per Plot (g)
S1	261,17a
S2	317,33b
S3	343.00b
B0	263,33a
B1	304,33ab
B2	332,11b
B3	328,89b
S1B0	263.00
S1B1	260.67
S1B2	259.67
S1B3	261.33
S2B0	261.67
S2B1	307,67
S2B2	361.00
S2B3	339.00
S3B0	265,33
S3B1	344.67
S3B2	375,67
S3B3	386,33

Note: Numbers followed by the same letters in the same column mean that they are not significantly different in the DMRT test at a test level of 5%

Table 3 shows that in the cow manure treatment, the heaviest tuber wet weight per plot was found in treatment S3 which was significantly different from S1 but not significantly different from S2. The wet weight of tubers per plot in treatment S2 differed significantly from S1. The effect of cow manure application on tuber wet weight per sample can be seen in Figure 5.

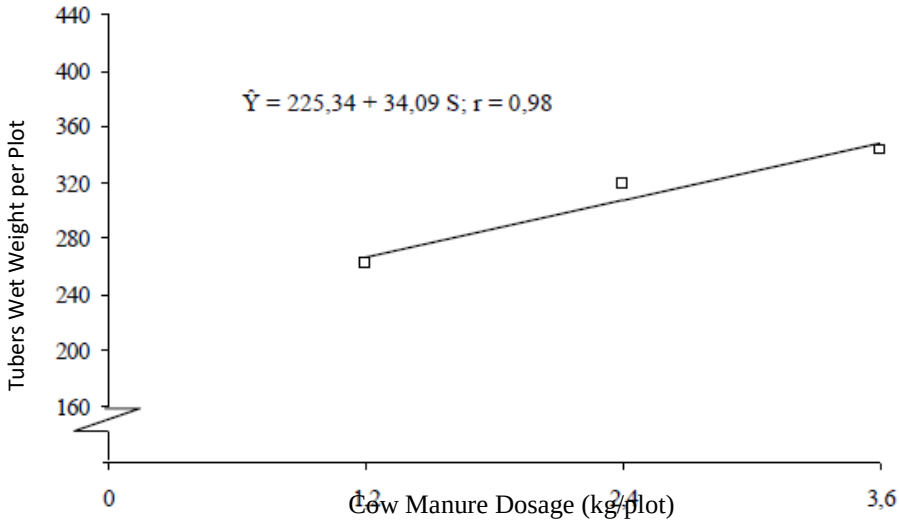

Figure 5. Effect of Cattle Manure Application on Tuber Wet Weight per Plot

Figure 7 shows that the higher the dose of cow manure, the wet weight of tubers per plot increases following a positive linear regression curve. Each increase in the dose of cow manure by 1 kg/plot can increase the wet weight of tubers per plot by 34.09 g.

Table 3 shows that in the treatment of POC administration, the heaviest tuber wet weight per plot was found in treatment B3 which was significantly different from B0 but not significantly different from B1 and B2. The wet weight of tubers per plot in treatment B2 differed significantly from B0 but not significantly from B1. The fresh weight of tubers per plot in treatment B1 was not significantly different from B0.
The effect of POC application on tuber wet weight per plot can be seen in Figure 6.

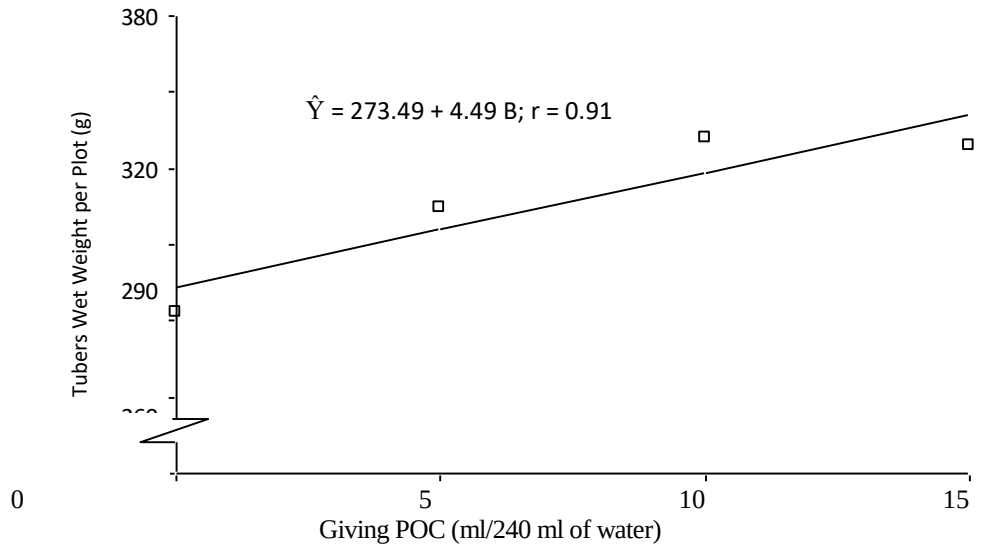

Figure 6. Effect of POC on Fresh Weight of Tubers per Plot

Figure 6 shows that the higher the POC dose , the more the wet weight of tubers per sample increases following the positive linear regression curve. Each increase in POC dose of 1 ml/240 ml of water can increase the wet weight of tubers per plot by 4.49 g.

4. Dry Weight of Tuber per Sample (g)

Data on the dry weight of tubers per sample due to the application of cow manure and POC presented in the variance list showed that the treatment with cattle manure and POC significantly affected the dry weight of tubers per sample. In contrast, the interaction between the two treatments had no significant effect. Table 4 presents the average tuber dry weight per sample due to treatment with cow manure and POC at different doses.

Table 4. The average dry weight of tubers per sample (g) in the treatment of bovine stalls and POC

Treatment	Tuber Dry Weight per Sample (g)
S1	17,17a
S2	18,20ab
S3	19,27b
B0	15,84a
B1	18,13b
B2	19.02b
B3	19,84b
S1B0	14.00
S1B1	18,47
S1B2	16.93
S1B3	19,27
S2B0	16.53
S2B1	16.60
S2B2	20,73
S2B3	18.93
S3B0	17.00
S3B1	19.33
S3B2	19.40
S3B3	21.33

Note: Numbers followed by the same letters in the same column mean that they are not significantly different in the DMRT test at a test level of 5%

Table 4 shows that in the cow manure treatment, the heaviest tuber dry weight per sample was found in treatment S3 which was significantly different from S1 but not significantly different from S2. The tuber dry weight per sample in treatment S2 differed significantly from S1. The effect of cow manure application on tuber dry weight per sample can be seen in Figure 7.

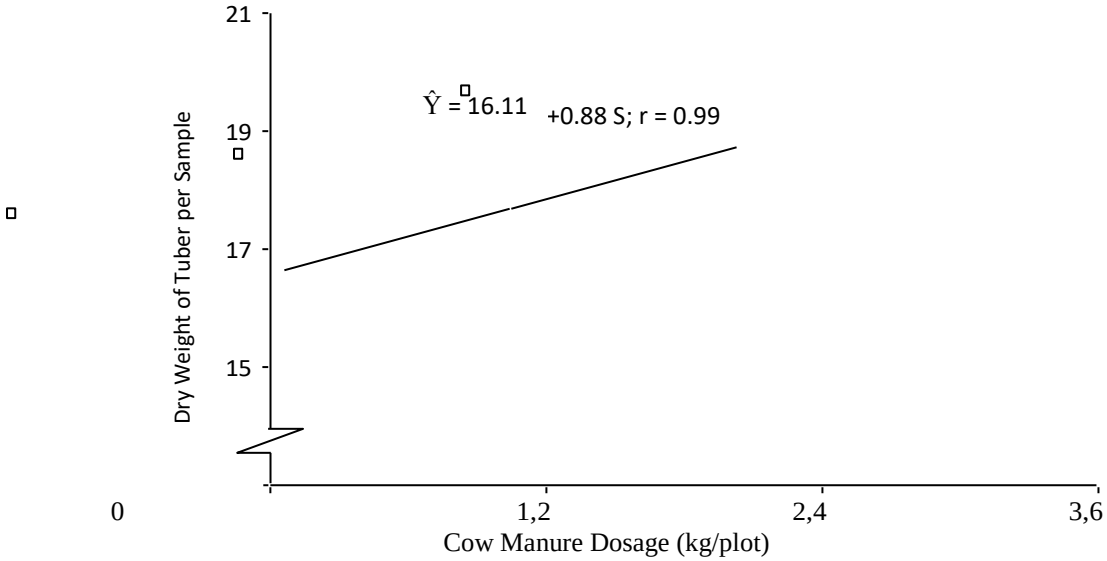

Figure 7. Application of Cow Manure to the Dry Weight of Tuber per Sample

Figure 7 shows that the higher the dose of cow manure, the tuber dry weight per sample increases following a positive linear regression curve. Each increase in the dose of cow manure by 1 kg/plot can increase the dry weight of tubers per sample by 0.88 g.

Table 4 shows that in the treatment of POC administration, the heaviest tuber dry weight per sample was found in treatment B3 which was significantly different from B0 but not significantly different from B1 and B2. The tuber dry weight per sample in treatment B2 differed significantly from B0 but not significantly from B1. The tuber dry weight per sample in treatment B1 was not significantly different from B0. The effect of POC administration on tuber dry weight per sample can be seen in Figure 8.

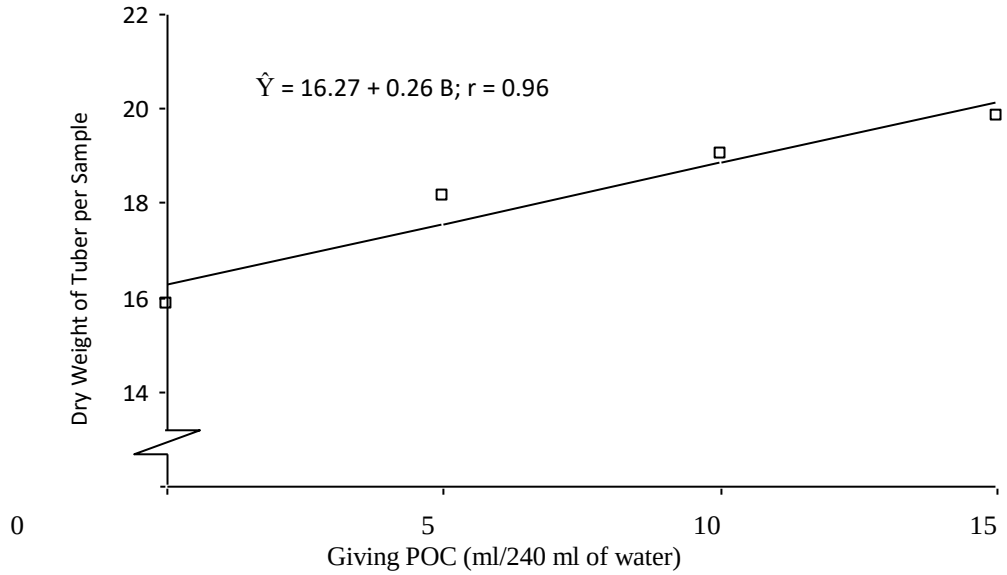

Figure 8. The effect of POC administration on tuber dry weight per sample

Figure 8 shows that the higher the dose of POC, the dry weight of shallot per sample increases following a positive linear regression curve. Each increase in POC dose of 1 ml/240 ml of water can increase the dry weight of tubers per sample by 0.26 g.

IV. Discussion

1. The Effect of Cattle Manure on the Growth and Production of Shallots (Allium cepa L.)

Based on the results of the test of variance, it was shown that the application of cow manure had a significant effect on the number of tubers per sample, the fresh weight of tubers per sample, the wet weight of tubers per plot, the dry weight of tubers per sample. The results showed that the application of cow manure at a dose of 3.6 kg/plot produced a total of 6.28 tubers. This is because the organic matter contained in manure has decomposed to produce humic acid, which will increase soil pH. Cow manure can also add nutrients to the soil and increase microorganisms in the soil. Microorganisms in the soil play a role in helping the decomposition process. In addition, the nutrient composition of solid cow manure contains 0.10-0.96% nitrogen, 0.64-1.15% P2O5 and 0.45-1.00% K2O (8). The availability of nutrients due to the application of cow manure will affect the filling process of shallot bulbs. Onion plants, in general, will grow well in soil with a high organic matter content. Low organic matter content is the main obstacle in shallot production. Increasing the application of cow manure will improve the physical properties of the soil and increase the supply of nutrients which will increase the formation of tubers (9,10).

The results showed that applying cow manure at a dose of 3.6 kg/plot (30 tons/ha) resulted in a fresh tuber weight per sample weighing 31.18 g. It is suspected that a dose of 3.6 kg/plot can meet the nutrient needs of plants to optimize plant growth and production. Cattle manure can increase soil fertility by improving physical, chemical and biological properties. Physically, manure can improve soil structure by forming aggregations so that the soil becomes looser. Chemically, manure can increase pH and cation exchange capacity, providing plant elements. Biologically, cow manure can increase the population of microorganisms in the soil. Organic matter in cow manure can reduce soil weight because organic matter can bind soil grains, which can cause the soil to become loose and granulate. Loose soil can improve porosity and aeration, making it easier for plant roots to develop. Cow manure can increase the quality of shallot bulbs to be bigger. (11) stated that the application of cow manure could make the shallots larger so that the weight produced is also heavier. (12) also stated that the application of 30 tons/ha of manure from cow manure

increased the wet weight of the tubers, with a dose of 30 tons/ha of cow manure per hectare for optimum growth with maximum yields.

The results showed that applying cow manure at a dose of 3.6 kg/plot (30 tons/ha) resulted in a tuber wet weight per plot of 343 g. The formation of shallot bulbs comes from the enlargement of the leaf layers, which then develop into shallot bulbs. The supply of K nutrients from cow manure will further enhance the formation and development of tubers. Element K can increase the number and size of shallot bulbs. Cow manure can store water (water availability), nutrient availability and increase metabolic activity in the soil to help build soil fertility. Cow manure can also increase soil fertility (chemistry) and biology (13). Cow manure contains various macro and micronutrients, which can increase plant growth and production when given to plants in optimal amounts. Nutrients, especially N and K, are important in forming shallot bulbs. The increase in the supply of nutrients N and K due to the increasing application of cow manure will increase the formation of shallot bulbs so that the number and size of the bulbs become larger. Increasing the size and number of tubers per plot will further increase the wet weight of tubers per plot. Administering cow manure will improve soil conditions. Improving soil conditions will affect the growth of plants per plot for the better, so it will increase the production of tuber fresh weight per plot (14).

The results showed that applying cow manure at a dose of 3.6 kg/plot (30 tons/ha) resulted in a tuber dry weight per sample weighing 19.27 g. Cow manure can increase soil fertility and add nutrients needed for plants. Fertile soil supports plant life and provides good growing space and sufficient nutrients. Manure also improves soil conditions so that it will increase the dry weight of tubers. (15–18) stated that cow manure could improve physical, chemical and biological properties and increase the water content in the soil to increase the absorption of nutrients and sufficient water used in metabolic processes. Increased metabolism will further increase the optimal tuber dry weight.

2. Effect of POC on the Growth and Production of Shallots (Allium cepa L.)

Based on the variance test, it was shown that the application of POC significantly affected the number of tubers per sample, the fresh weight of tubers per sample, the fresh weight of tubers per plot, and the dry weight of tubers per sample.

The results showed that applying liquid organic fertilizer of 15 ml/240 ml resulted in the number of tubers per sample of 6.44 cloves. Applying liquid organic fertilizer can increase the number of tubers per sample. This is presumably due to the nutrients from POC in the soil being absorbed well by plant roots so that they can respond to plant growth. Soil fertility also affects plant growth which is determined by the presence of nutrients in the soil, both primary macronutrients, secondary macronutrients and micronutrients. Primary macronutrients include nitrogen (N), phosphorus (P), potassium (K), carbon (C), hydrogen (H), and oxygen (O). Secondary macronutrients include calcium (Ca), magnesium (Mg), and sulfur (S). In contrast, micronutrients include iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), molybdenum (Mo), chlorine (Cl), and boron (B). Micronutrients are essential elements that are always needed by plants, even in small amounts (19).

The results showed that applying 15 ml/240 ml of liquid organic fertilizer resulted in a wet bulb weight per sample of 31.27 g. Increasing the application of liquid organic fertilizer will increase the supply of nutrients to plants, where the increased supply of nutrients will ensure that the process of photosynthesis in plants is higher. (20) stated that the availability of nutrients plays an important role as an energy source, so the level of nutrient availability affects the biomass of a plant. Plant growth will be disrupted unless additional nutrients from fertilizers result in lower biomass.

The results showed that applying 15 ml/240 ml of liquid organic fertilizer resulted in a dry tuber weight per sample of 19.84 g. Increasing liquid organic fertilizer will increase the supply of nutrients to plants used in the process of photosynthesis. The more photosynthate produced, the better the formation of carbohydrates in plants will increase the dry matter in plants. (21) stated that dry weight yield balances photosynthesis and respiration. Maximum photosynthesis and respiration will increase the dry weight of plants. This process will run optimally if the plants get optimal nutrients and other important elements. If there is a lack of nutrients, plants cannot photosynthesize optimally.

V. Conclusion

The application of cow manure had a significant effect on the number of tubers per sample, the fresh weight of tubers per sample, the wet weight of tubers per plot, and the dry weight of tubers per sample, but not significantly different from plant height, number of leaves and tuber dry weight per plot. Giving POC significantly affected the number of tubers per sample, fresh weight of tubers per sample, wet weight of tubers per plot, and tuber dry weight per sample, but not significantly different with plant height, number of leaves and tubers per plot.

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