

## The Effect of Chicken Manure and Triple Super Phospat Fertilizer on The Growth of Purple Cabbage (*Brassica oleracea* var. *Capitata*) on Andisol

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### Abstract

Cabbage plants (*Brassica oleracea*) belong to the Brassicaceae family, is a vegetable that is widely cultivated by farmers in rural Indonesia. Andisol is one type of soil that is relatively fertile but has a high level of P absorption so it is necessary to add Chicken Manure and TSP Fertilizer. In an effort to increase the productivity of purple cabbage it is necessary to carry out soil management. The purpose of this study is to determine the effect of treatment and response from the combination of treatment on the application of chicken manure and TSP fertilizer on the growth and production of purple cabbage plants. The research design used was a group randomized design (RAK) with 2 factors arranged factorially. The first factor is chicken manure fertilizer which consists of 3 levels, namely: K1 = chicken manure fertilizer 10 tons / ha (50 grams / polybag), K2 = chicken manure fertilizer 20 tons / ha (100 grams / polybag) and, K3 = chicken manure fertilizer 30 tons / ha (150 grams / polybag). The second factor of TSP fertilizer consists of 3 levels, namely: T1 = TSP 200 kg / ha (1 gram / polybag), T2 = TSP 300 kg / ha (1.5 grams / polybag) and, T3 = TSP 400 kg / ha (2 grams / polybag). Treatment of Chicken Manure (K), TSP fertilizer, and Interaction (KxT) had no real effect ( $P \geq 0.05$ ) on the variables of maximum plant height, maximum leaf count, root length, flower crop diameter and wet weight of crop per plant. The treatment of 20 tonnes/ha (100 grams/polybag) of Chicken Manure Dosage gave the highest crop wet weight yield of 325.67 g. Treatment Dosage of 300 kg/ha (1.5 gram/polybag) of TSP Fertilizer gave the highest crop wet weight yield of 296.4 g. Organic manure and TSP give effect for growing Cabbage plants.

*Keywords: Purple cabbage, andisol soil, fertilizer, TSP, Chicken Manure*

### 1. Introduction

The cabbage plant (*Brassica oleracea*) belongs to the Brassicaceae family, is a vegetable that is widely cultivated by farmers in rural Indonesia because it has various benefits contained in cabbage. Purple cabbage, like many other vegetables, is perishable, seasonal in production and does not last long. This perishability can be caused by soft leaves and high water content, making them easily penetrated by agricultural tools and pests or plant diseases [6]. Some of the factors that affect the high or low production of purple cabbage plants are the level of soil fertility, land area, type of seed used, climate or season, level of knowledge possessed and available capital. In an effort to increase the productivity of purple cabbage, it is necessary to carry out soil management [28].

Andisol soil is one of the soils used in the cultivation of both horticultural crops, plantations and forests. In general, Andisols are found in the highlands (0-3500 masl) [9]. Andisol is a type of soil that is relatively fertile but has a high level of P adsorption because it is dominated by amorphous minerals such as allophane, imogolite, ferrihydrite and hydrated oxides of Al and Fe with a broad

specific surface [8]. Provision of P fertilizer and addition of organic matter can overcome the problem of P deficiency in Andisols. In addition, the addition of organic matter to the soil can increase the release of P from the soil by the decomposition process of additional organic matter [2]. Thus, to obtain maximum purple cabbage growth and improve soil conditions, it is necessary to apply TSP organic and inorganic fertilizers.

TSP fertilizer is a type of inorganic fertilizer that contains a lot of phosphorus (P). TSP fertilizer has a higher P<sub>2</sub>O<sub>5</sub> content, reaching 43-45% so it is better used to increase nutrient P in soils that are poor in phosphate nutrients. In dry land, the availability of P nutrients is generally low to moderate. Application of P fertilizer in the form of TSP (Triple Super Phosphate) on ultisols in the amount of 40 kg/ha can increase the levels of extracted P [11]. Applying TSP fertilizer to Andisol soil can stimulate the growth of plant roots to become thicker and stronger [29]. To increase soil fertility besides using inorganic fertilizers, organic fertilizers such as manure can also be used.

Organic fertilizers come from living things such as decaying plants and animal waste, for example chicken manure. Chicken manure functions to improve the physical, chemical and biological properties of the soil. Chicken manure contains very high levels of nitrogen (N), phosphorus (P) and potassium (K). The balanced nutrient content makes chicken manure compost the best type of manure. Chicken manure has high levels of organic matter. The high organic material content in chicken manure can improve the structure of soil which is very deficient in organic elements and can strengthen plant roots [30]. [10] the use of organic materials such as chicken manure has an important role in improving soil quality and properties, including increasing the binding capacity of sandy soil (improving sandy soil texture), improving clay soil texture so that previously heavy soil becomes light, increase the ability of the soil to hold water so that the soil can provide more water for plants, improve drainage and soil air conditioning (especially heavy soils) so that the water content is sufficient and the soil temperature is more stable, increase the positive effect of artificial fertilizers, increase the binding capacity of the soil so that the soil becomes more resistant, not easily dissolved by irrigation water.

Research on the effect of chicken manure and TSP (Triple Super Phosphate) fertilizer on cucumber production conducted by [1] resulted in the treatment of chicken manure alone having a significant effect on the number of fruits (6.27 per plant) and fruit weight (2019).0 gram planting) with the best treatment was in the treatment of chicken manure 20 tons/ha and the single TSP fertilizer treatment had a significant effect on the number of fruit (6.72 fruit per plant) and fruit weight (2123.8 gram per plant) with the best treatment found in the treatment of TSP fertilizer 100 kg/ha. From this research, the hypothesis put forward in this study is that the administration of a combination of chicken manure and TSP fertilizer can affect growth in purple cabbage plants.

## **2. Materials and Methods**

This research was conducted at Agro Pudak Lestari, Pancasari Village, Sukasada District, Buleleng Regency, Bali with an altitude of 1,282 meters above sea level. The time for conducting the research from September to November 2022. The tools used in this study were books and stationery, rulers, labels, measuring cups, scales, trays, 10 kg polybags measuring 50 cm x 50 cm, spoon, bucket, machete/knife, hoe. The materials used in this study included purple cabbage seeds, andisol soil, chicken manure, TSP fertilizer and water. This research was carried out in the field using polybags on purple cabbage plants from seeds. This study used a randomized block design (RBD) with 2 factors arranged factorially.

The first factor is chicken manure which consists of 3 levels, namely:

K1 = chicken manure (50 grams/poly bag)

K2 = chicken manure (100 grams/polybag)

K3 = chicken manure (150 grams/polybag)

The second factor is TSP fertilizer which consists of 3 levels, namely:

T1 = TSP (1 gram/polybag)

T2 = TSP (1.5 gram/polybag)

T3 = TSP (2 grams/polybag)

Thus, 9 combination treatments were obtained, each of which was repeated 3 times so that 27 polybags of purple cabbage plants were treated.

The implementation of the experiments in this study included: preparation of nursery media and planting land. Giving treatment when filling the planting medium with polybags on purple cabbage plants. Treatment of chicken manure and TSP fertilizer was carried out 1 week before planting. Maintenance by watering, replanting, weeding, pest and disease control. Harvesting is done when the purple cabbage has entered the harvest age, which is 60 HST (days after planting). Harvesting is done in the morning or evening so that the purple cabbage crop remains fresh. Harvesting is done by cutting the stems of purple cabbage plants using a knife.

The variables observed in this experiment were plant height (cm), number of leaves (strands), root length (cm), flower crop diameter (mm), and fresh weight of purple cabbage plants (gr). Research data were analyzed using statistical analysis of variance according to the research design. For a single treatment that had a significant to very significant effect, then it was continued with the LSD test at the 5% level.

Table 1. Results of Soil Analysis of the Research Site

No	Types of Analysis	Unit	Value	Information
<b>1</b>	<b>Texture</b>			
	Sand	%	61,59	Clay
	Dust	%	15,80	Sandy
	Clay	%	22,61	
<b>2</b>	<b>Water Content</b>			
	Air Dry	%	2,44	
	Dry Field	%	31,59	
3	pH H <sub>2</sub> O		6,9	neutral
4	Electrical Conductivity	mmhos/cm	0,53	Very Low
5	N-Total	%	0,27	Keep
6	C-Organic	%	2,44	Keep
7	P-Available	Ppm	154,36	Very High
8	K-Available	Ppm	257,62	Tall

Source: Laboratory of Soil Science, Faculty of Agriculture, Udayana University (2022).

### 3. Results and Discussion

#### 3.1 Research Results

Organic and inorganic fertilizer are important for growing plant. They support vegetative and generative phases among others leaves, root length, flower crop diameter, and wet weight of crop per plant.

##### 3.1.1 Maximum Plant Height

The results showed that chicken manure fertilizer dose, TSP fertilizer dose, and interaction (KxT) had no real effect on maximum leaf count. Table 3.1 shows that the highest average maximum plant height was obtained in the 100 g (K2) chicken manure treatment (K2), which was

46.00 cm, which was not significantly different from the 150 g (K3) chicken manure treatment (45.44 cm) and the manure treatment chicken dose of 50 g (K1) is 44.22 cm. The treatment of 100 g chicken manure (K2) increased 33.91% when compared to the 50 g chicken manure treatment (K1). The highest average maximum plant height was obtained in the TSP fertilizer treatment dose of 2 g (T3), which was 46.00 cm, which was not significantly different from the TSP fertilizer dose of 1 g (T1) which was 45.56 cm and the TSP fertilizer treatment with a dose of 1.5 g (T2) is 44.11 cm. TSP fertilizer treatment at a dose of 2 g (T3) increased 33.90% compared to the treatment at a dose of 1.5 g (T2).

### **3.1.2 Maximum Number of Leaves**

The results of the statistical analysis showed that the dose of chicken manure, the dose of TSP fertilizer, and the interaction (KxT) had no significant effect on the maximum number of leaves. Table 3.1 shows that the highest average number of leaves was obtained in the 100 g (K2) chicken manure treatment (K2), which was 20.67 strands, which was not significantly different from the 50 g chicken manure treatment (K1) and the 150 g (K3) treatment. namely each of 20.56 strands. The treatment of 100 g chicken manure (K2) increased 33.45% when compared to the 50 g chicken manure treatment (K1). The highest average maximum number of leaves was obtained in the TSP fertilizer treatment dose of 2 g (T3), which was 20.78 strands, which was not significantly different from the TSP fertilizer treatment with a dose of 1.5 g (T2) which was 20.56 strands and the treatment with a dose of 1 g (T1) ie 20.44 strands. The TSP fertilizer treatment with a dose of 2 g (T3) increased 33.66% compared to the treatment with a dose of 1 g (T1).

### **3.1.3 Root Length**

The results of statistical analysis showed that chicken manure dose, TSP fertilizer dose, and interaction (KxT) had no significant effect on root length height. Table 3.1 shows that the highest average root length was obtained in the 150 g (K3) chicken manure treatment (K3), which was 33.08 gram, which was not significantly different from the 50 g (K1) chicken manure treatment (K1), which was 29.72 and the chicken manure treatment dose of 100 g (K2) is 31.44 gram. The treatment of 150 g of chicken manure (K3) increased by 35.14% when compared to the treatment of 50 g of chicken manure (K1). The highest average root length was obtained in the TSP fertilizer treatment dose of 1.5 g (T2) which was 33.10 gram which was not significantly different from the chicken manure treatment dose 1 g (T1) which was 31.90 gram and the TSP fertilizer treatment dose 2 g ( T3) is 29.28 gram. TSP fertilizer treatment with a dose of 1.5 g (T2) increased 35.10% compared to the treatment with a dose of 1 g (T1).

### **3.1.4 Flower Crop Diameter**

The results of the statistical analysis showed that the dose of sometimes chicken fertilizer, the dose of TSP fertilizer, and the interaction (KxT) had no significant effect on the diameter of the flower crop. Table 3.1 shows that the highest average number of leaves was obtained in the occasional chicken fertilizer treatment dose of 150 g (K3) which was 96.89 mm which was not significantly different from the sometimes chicken fertilizer treatment dose of 100 g (K2) namely 90.94 mm and the treatment dose of 50 g (K1) which is 89.37 mm. The treatment of 150 g of chicken manure (K3) increased by 34.95% when compared to the treatment of 50 g of chicken manure (K1). The average flower crop diameter was obtained in the TSP fertilizer treatment dose of 1 g (T1), which was 97.92 mm, which was not significantly different from the chicken manure treatment with a dose of 2 g (T3) which was 90.11 mm and the TSP fertilizer treatment with a dose of 1.5 g ( T2) is 89.17 mm. The TSP fertilizer treatment with a dose of 1 g (T1) increased 35.32% compared to the treatment with a dose of 1.5 g (T2).

### **3.1.5 Wet Crop Weight**

The results of the statistical analysis showed that the dose of chicken manure, TSP fertilizer dose, and interaction (KxT) had no significant effect on the fresh weight of the crop. Table 3.1 shows that the highest average crop wet weight was obtained in the 100 g (K2) chicken manure

treatment (K2), which was 325.67 gram, which was not significantly different from the 50 g (K1) chicken manure treatment (297.33 gram) and the manure treatment chicken dose of 150 g (K3) is 221.67 gram. The treatment of 100 g chicken manure (K2) increased 38.54% when compared to the 50 g chicken manure treatment (K1). The highest average wet crop weight was obtained in the TSP fertilizer treatment dose of 1.5 g (T2), which was 296.44 gram, which was not significantly different from the TSP fertilizer treatment with a dose of 1 g (T1) which was 274.78 gram and the TSP fertilizer treatment with a dose of 2 g (T1). T3 is 273.44 gram. The TSP fertilizer treatment with a dose of 1.5 g (T2) increased 35.09% compared to the treatment with a dose of 2 g (T2).

Table 3.1

The effect of chicken manure and TSP fertilizer treatment on the variables of plant height, maximum number of leaves, root length, flower crop diameter and wet weight of crop per plant.

Treatment	Plant height (cm)	Number of leaves (strands)	Root length (cm)	Flower crop diameter (mm)	Wet weight of crop (g)
Chicken manure					
K1	44,22a	20,56a	29,72a	89,37a	221,67a
K2	46,00a	20,67a	31,44a	90,94a	325,67a
K3	45,44a	20,56a	33,08a	96,89a	297,33a
BNT 0,05 %	-	-	-	-	-
TSP Fertilizer					
T1	45,6a	20,4a	31,9a	97,92a	274,8a
T2	44,1a	20,6a	33,1a	89,17a	296,4a
T3	46,0a	20,8a	29,3a	90,11a	273,4a
BNT 0,05 %	-	-	-	-	-

Remarks : The average value followed by the same letter in the same treatment means that the difference is not real in the 5% BNT test

### 3.2 Discussion

Chicken manure as an organic fertilizer that plays a role in improving the physical properties of the soil, it turns out that its application to Andisol soil is not that significant. This is because Andisol soil has good soil physical properties [13][21][22][23]. This opinion is in accordance with the statement [5] that the role of organic matter is not important in soils that interact well. On the chemical aspect of the soil, especially as a source of nutrients for plants purple cabbage probably the effect is not significant. This is due to because the N, P and K content of the soil is in the moderate to very high range high (table 1). [7] added that if nutrients are given to plants in low or excessive doses, the fresh weight of the plants will decrease[24][25][26]. A deficiency or excess of nutrients in plants causes the photosynthesis process to not work properly and the photosynthate produced decreases so that the amount of photosynthate produced in the fruit decreases. In addition to nutrients in plants, the addition of plant fertilizers with different doses affects plant growth. So it is necessary to apply fertilizer taking into account the type, time, dosage and the correct method of administration to meet the nutrient needs of plants [3]. The TSP fertilizer treatment did not have a significant effect either all observed variables. Analysis results against P-available in soil is very high (Table 3.1) so that the response of plants to application of TSP fertilizer is not significant. [12] on nutrient content in soil with high and very high levels high, the response to fertilization ranged from 10-40% and 0-10%, respectively. Although the two treatment factors were not significant for

all observed variables, empirically from this study showed that the treatment of chicken manure and TSP fertilizer with their respective doses was 20 tonnes/ha or 100 g/polybag and 300 kg/ha or 1.5 g/polybag shows the weight of the economic yield, namely the variable wet weight of the highest crops, namely 325.67 g and 296.5 g (Table 3.1). Table 3.1 shows that the increase in the dose of chicken manure and TSP fertilizer up to 30 tons/ha or 150 g/polybag and 400 kg/ha or 2 g/polybag wet crop weight respectively decreased by 297.33 g respectively. and 273, 9. It is possible that this was caused by the disturbance of the balance of nutrients in the soil, especially in the application of TSP fertilizers when available P in the soil was very high [14][15][16][17]. [4] states that an excess of P can cause a deficiency of Zn, Fe and Cu. Micronutrients are generally a constituent of enzymes in the plant body so that all plant biochemical reactions take place properly[18][19][20].

#### 4. Conclusion

Based on the results of this study it can be concluded several things as follows: Treatment of Chicken Manure (K), TSP fertilizer, and Interaction (KxT) had no significant effect ( $P \geq 0.05$ ) on the variable maximum plant height, maximum number of leaves, root length, flower crop diameter and fresh crop crop weight. The treatment of 20 tonnes/ha (100 grams/polybag) of Chicken Manure Dosage gave the highest crop wet weight yield of 325.67 g. Treatment Dosage of 300 kg/ha (1.5 gram/polybag) of TSP Fertilizer gave the highest crop wet weight yield of 296.4 g.

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