IJSSR
International Journal of Social Service and Research

Vol. 03, No. 01, January 2023
e-ISSN: 2807-8691 | *p*-ISSN: 2807-839X

THE EFFECT OF BIO-PHOPHATE FERTILIZER AT LOWLANDS ON THE GROWTH AND RESULTS OF CAULIFLOWER IN POLYBAGS

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Article Information
Received: December 18, 2022
Revised: December 27, 2022
Approved: January 11, 2023
Online: January 25, 2023

Keywords
Bio-Phophate; Growth; Cauliflower; Polybags

ABSTRACT
This study aims to examine the Effect of Bio-Phosphate Fertilizer Application in the Lowlands on the Growth and Yield of Flower Cabbage (Brassica oleracea var. Botrytis L.) in Polybags. This research was carried out at SMK-PP Negeri Sembawa Kec. Sembawa, Banyuasin Regency, Palembang City, South Sumatra Province. This research was conducted from December 2020 to March 2021. The method used in this study was the experimental method (experiment), using a randomized block design (RBD) with 5 (five) treatments and 5 (five) groups/replications. Each experimental unit consisted of 10 plants so that the number of plants studied was 250 plants. Based on the research results, it can be concluded that the application of Bio-phosphate fertilizer has a good effect on the growth and yield of cauliflower (Brassica oleracea var. Botrytis L.) in polybags. The application of Bio Phosphate fertilizer had a good effect on the growth of plant height and number of leaves with a fertilizer dose of 15 g/polybag, the best plant height was 36.69 cm, and the number of leaves was 22.20. The application of Bio Phosphate fertilizer had a good effect on the yield of flower diameter, fresh weight of plants and fresh weight of flowers per plant with a fertilizer dose of 30 g/polybag obtained a flower diameter of 91.56 mm, plant fresh weight of 236.50 g and flower fresh weight per plant of 90.30 g.

INTRODUCTION

The prospects for the development of cauliflower cultivation are quite bright. The attractiveness of this commodity besides being able to be developed in the tropics, one of which is Indonesia, also has high economic and social value. The demand for cauliflower is increasing, both domestically and abroad (Anonymous, 2009).

According to (Rahmat, 1994), cauliflower is a vegetable plant in the Brassicaceae family (a type of cabbage with small white flowers) in the form of soft-stemmed plants. People in Indonesia call cauliflower cauliflower or blumkol (derived from the Dutch Bloemkool).

This plant originates from subtropical Europe in the Mediterranean region. Cabbage white flowers with a compact flower mass as found at this time was developed in 1866 by Mc.Mohan a seed expert from America. It is suspected that cauliflower entered Indonesia from India in the XIX century (Putra, 2018).

Cabbage is a vegetable plant in the Brassicaceae family in the form of a soft-stemmed plant which has been known since ancient times (2500-2000 BC) and was a plant that was revered and venerated by the people of Ancient Greece (Rahmat, 1994).

According to (Safitri, 2018), the composition of the nutrients contained in every 100 g of wet weight of cauliflower plants is in the form of 2.4 g Protein, 0.2 g Fat, 4.9 g Carbohydrates, 22 mg Ca, 72 mg P2O5, 1.1 mg Zn, 90.0 mg Vitamin A , Vitamin B1 0.1 mg, Vitamin C 69 mg and water 91.7 mg.

https://doi.org/10.46799/ijssr.v3i1.221

The development and progress of science and technology in the field of agricultureian, cauliflower varieties have been found that are suitable for planting in the low to medium (medium) plains. Many researchers have produced cultivation technology packages and are ready or feasible to be applied at the farmer level. In recent years cauliflower has been included in the top six groups of fresh vegetables exported by Indonesia, namely shallots, tomatoes, potatoes, chilies and cabbage heads. Countries waiting for cauliflower supplies include Malaysia, Singapore, Taiwan and Japan, while domestically the demand for cauliflower is increasing, especially in tourism areas such as Jakarta, Cipanas (peak), Bandung, Malang, Denpasar, etc. (Sutarya & Grubben, 1995).

According to the (Statistics Indonesia, 2017),Cauliflower production in Indonesia from 2015 to 2017 was 118394 tonnes, 142851 tonnes and 152869 tonnes respectively. The data shows that from 2015 to 2017 there was an increase in the production of cauliflower, while the production of cauliflower in South Sumatra Province in 2015 to 2017 was 103 tons, 211 tons and 124 tons, respectively. Cauliflower plants in South Sumatra experienced a decrease in production.

The decline in cauliflower production can be caused by soil fertility and environmental factors. Efforts should be made for less fertile soil to increase productivity for better growth and crop yields.Other obstacles to cauliflower cultivation include not being resistant to environmental stress, either in the form of waterlogging or drought (Widarma, 2016).

The cultivation technique that can be used to maximize plant growth and yield is by means of fertilization. Fertilization can be done as an effort to meet the needs of plant nutrients so that production goals can be achieved.Excessive use of fertilizers can cause problems for cultivated plants, such as poisoning, susceptibility to pests and diseases and low production quality. Fertilization can use inorganic fertilizers and organic fertilizers (Wijaya, 2008).

According to (Sutejo, 2002), organic fertilizers have an important function compared to inorganic fertilizers, namely they can loosen the topsoil, increase the population of microorganisms, increase the absorption and storage capacity of water, which as a whole can increase soil fertility. In organic farming activities most farmers use manure. Manure comes from animal manure such as cows, goats and chickens.

Fertilizer is a material that contains one or more nutrients or nutrients for plants to support plant growth and development. The nutrients needed by plants are as follows: C, H, O (availability in nature is abundant), N, P, K, Ca, Mg, S (macronutrients), and Fe, Mn, Cu, Zn, Cl, Mo , B (micronutrients). Fertilizers can be given through the soil, leaves or plant stems, the types of fertilizers are in solid or liquid form. Fertilizers serve as a source of nutrients to meet the nutritional needs of plants and improve soil structure. Applying fertilizer to the planting medium can increase nutrient levels and fertility. Agricultural activities that are continuously carried out cause the soil to lose nutrients, therefore to restore the availability of nutrients in the planting medium it is necessary to apply fertilizer (Anonymous, 2017).

According to (Putra, 2013), based on the compounds, fertilizers are divided into organic fertilizers and inorganic fertilizers. Organic fertilizers are all plant residues, green manure and animal manure that have low nutrient content. Organic fertilizers are available after these substances undergo a process of decomposition by microorganisms, while inorganic fertilizers or artificial fertilizers (from inorganic compounds) are fertilizers that are deliberately made by humans in factories and contain high levels of certain nutrients. Inorganic fertilizers are used to overcome the shortage of pure minerals from nature that plants need to live normally. Inorganic fertilizers can produce green grains and are needed in the process of photosynthesis. One of the fertilizers used for this research is Bio Phosphate fertilizer.

Bio Phosphate Fertilizer is a phosphate fertilizer combined with phosphate solubilizing microorganisms. Made from natural phosphate which is reformulated into a superior product, by injecting Bio micro organisms in the form of groups of fungi and bacteria. The content of Bio Phosphate fertilizer includes elements of P2O5 as much as 17% to 20%, CaO as much as 33%, S, Mg, Zn, Cu, Mn, B, Mo with a pH ranging from 7. Instructions for using bio phosphate fertilizer in cabbage plants, namely 450 kg / ha up to 550 kg/ha accompanied by phosphate solubilizing microorganisms (Tjandra, 2017).

According to (Kartika, 2017), in the Javamas Agrophos Agricultural Extension material, cauliflower plants with a double row or tram line planting system with a bed width of 90 cm, a height of 30 cm to 40 cm and a ditch width of 40 cm to 50 cm. The spacing between rows is 50 cm and within rows is 40 cm with a population of 30,000 plants/ha. The dose of Bio Phosphate fertilizer for cauliflower plants is 30 g/plant. Bio Phosphate

fertilizer is put at the bottom of the planting hole as a base fertilizer and/or follow-up fertilizer, it can withstand bacterial and fungal attacks such as club root (Plasmodiophora brassicae) which are detrimental to plants. Fertilizer application by spreading it on the planting hole or stirring it on the bed in the row to be planted to a depth of approximately 10 cm to 20 cm from the surface of the bed soil. Cauliflower plants produce a production of 1.5 tonnes/ha equivalent to 1 kg to 1.5 kg per plant.

This study aims to examine the effect of applying Bio Phosphate fertilizer in the lowlands on the growth and yield of Cabbage (Brassica oleraceae var. Botrytis L.) in Polybags. The use of this research is expected to be useful for the development of cauliflower vegetable cultivation techniques using Bio Phosphate fertilizer in lowland areas.

METHODS

This research was carried out at Sembawa State Vocational High School, Sembawa Village, Sembawa District, Banyuasin Regency, South Sumatra Province. This research was carried out from December 2020 to March 2021.

The materials used in this study were flower cabbage seeds of the PM 126 F1 variety, Bio Phosphate fertilizer, top soil planting medium, cow dung manure, shade houses, and polybags measuring 30 cm x 30 cm.

The tools used in this study were aqua cups for sowing seeds, hoes, machetes, knives, bamboo, nails, hammers, buckets, bells, tape measure, ruler, calipers (sigmat), digital scales, cameras, rulers, stationery and equipment. others needed in this research.

This study used an experimental method with a randomized block design (RBD), namely 5 (five) treatments and 5 (five) repetitions, each experimental unit contained 10 plants so that the number of plants studied was 250 plants. The number of samples studied in each experimental unit were 3 sample plants. The research site was in a shaded house area that had been sterile from weeds, with a length of 16 m and a width of 7.5 m. Using a spacing between rows of 30 cm and spacing in rows of 30 cm with a polybag size of 30 cm x 30 cm.

RESULTS

The results of the analysis of diversity for all variables are shown in Table 1 below:

Table 1
Results of the Analysis of Diversity for All Observed Variables

Observed Variables	F Count	households (%)
Plant Height (cm)		
Age 7 hst	2.37tn	15.55
Age 14 hst	0.12tn	14.69
Age 21 hst	0.11tn	8.46
Age 28 hst	2.72tn	5.89
Age 35 hst	6.64sn	4.64
Age 42 hst	4.07n	4.42
Age 49 hst	4.26n	4.34
Number of Leaves (Streams)		
Age 7 hst	0.24tn	14.16
Age 14 hst	0.37tn	17.11
Age 21 hst	2.57tn	10.45
Age 28 hst	2.31tn	7.22
Age 35 hst	3.38n	7.12
Age 42 hst	6.01sn	8.95
Age 49 hst	8.85sn	6.95
Flowers Appear (hst)	0.93tn	7.04
Flower Diameter(mm)	5.33sn	5.68
Plant Fresh Weight (g)	3.06n	11.03
Fresh Weight of Flowers (g)	4.70n	13.14
F table 0.05	3.01	
0.01	4.77	

Information:

n = Real Influence
KK = Coefficient of Diversity
mr = Influence is not real
hst = days after planting
sn = Affectedoh so real

The results of the analysis of diversity in Table 1 show that the application of Bio-Phosphate fertilizer had no significant effect on the growth of cauliflower plants, namely plant height at the age of 7 to 28 HST, number of leaves at the age of 7 to 28 HST and flower appearance, but had a significant effect on height. plant age 42 and 49 hst, number of leaves aged 35 hst, fresh weight of plants, and fresh weight of flowers and very significant effect on plant height aged 35 hst, number of leaves aged 42 and 49 hst, flower diameter.

1. Plant Height (cm)

The results of the analysis of diversity in Table 2 show that the treatment of applying Bio Phosphate fertilizer had no significant effect on plant height aged 7 hst, 14 hst, 21 hst, 28 hst, but had a very significant effect at age 35 hst and had a significant effect on plant height aged 42 hst and age 49 hst. In tabulation of application of Bio Phosphate fertilizer to plant height aged 7 hst, 14 hst, 21 hst and 28 hst can be seen in Figure 1.

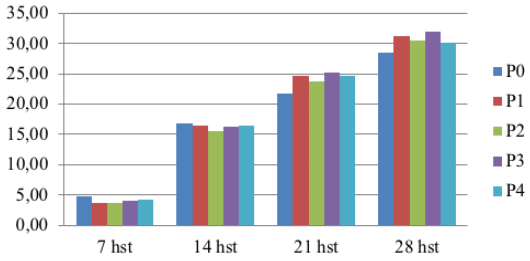

Figure 1. Graph of Plant Height Development aged 7 hst, 14 hst, 21 hst and 28 hst affected by fertilizerBio Phosphate

The results of the BNJ0.05 test for differences between treatments for plant height at 35 HST are shown in Table 2 below:

Table 2
Effect of Bio Phosphate fertilizer on plant height aged 35 HST

Treatment	Average	BNJ0.05=3.00
P0	30.49	A
P4	32.74	Ab
P2	34.01	B
P1	34.61	B
P3	34.81	B

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

The results of the BNJ0.05 test differed between treatments for plant height aged 42 DAP and 49 DAP in Table 3 and Table 4 as follows:

Table 3
The effect of applying Bio Phosphate fertilizer on plant height aged 42 hst

Treatment	Average	BNJ0.05=2.98
P0	32.93	A
P4	34.38	Ab
P1	35.96	B
P3	36.04	B
P2	36.09	B

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

Table 4
The effect of applying Bio Phosphate fertilizer on plant height aged 49 hst

Treatment	Average	BNJ0.05 = 2.98
P0	33.70	A
P4	35.42	Ab
P1	36.69	Ab
P3	36.90	B
P2	37.18	B

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

2. Number of leaves (strands)

The results of the analysis of variance in Table 2 show that the treatment of applying Bio Phosphate fertilizer had no significant effect on the number of leaves at the age of 7 hst, 14 hst, 21 hst and 28 hst, but had a significant effect at the age of 35 hst and had a very significant effect on the number of leaves at the age of 42 hst and age 49 hst. Tabulating the application of Bio Phosphate fertilizer to the number of leaves can be seen in Figure 2.

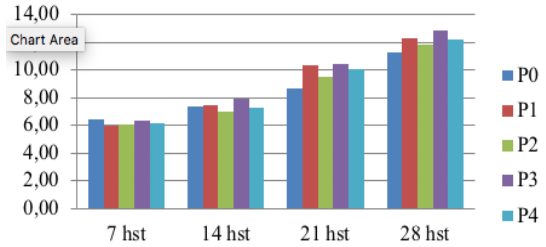

Figure 2. Graph of the development of the number of leaves aged 7 hst, 14 hst, 21 hst and 28 hst affected by fertilizerBio Phosphate.

The results of the BNJ0.05 test differed between treatments on the number of leaves aged 35 HST in Table 5 below:

Table 5
The effect of applying Bio Phosphate fertilizer on the number of leaves aged 35 hst

Treatment	Average	BNJ0.05 = 1.99
P0	13.53	A
P2	14.80	Ab
P4	15.00	Ab
P1	15.66	B
P3	15.66	B

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

The results of the BNJ0.05 test differed between treatments for the number of leaves aged 42 days after planting and 49 days old as shown in Table 6 and Table 7 as follows:

Table 6
The effect of applying Bio Phosphate fertilizer on the number of leaves aged 42 hst

Treatment	Average	BNJ0.05 = 3.16
P0	15.33	A
P2	18.20	Ab
P1	19.26	B
P4	19.33	B
P3	19.80	B

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

Table 7
The effect of applying Bio Phosphate fertilizer on the number of leaves aged 49 hst

Treatment	Average	BNJ0.05 = 2.77
P0	17.66	A
P2	20.99	B
P4	21.86	B
P1	22.20	B
P3	22.33	B

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

3. Flower Emergence Day (hst)

The results of the analysis of variance in Table 1 show that the treatment with Bio Phosphate fertilizer had no significant effect on the day the flowers appeared. Tabulating the application of Bio Phosphate fertilizer to the day flowers appear can be seen in Figure 3.

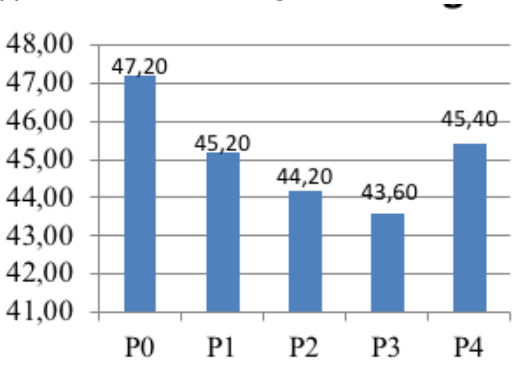

Figure 3. Graph of Flowers Appearing Days Development (HST) which is influenced by Bio Phosphate fertilizer

4. Flower Diameter (mm)

The results of the analysis of diversity in Table 1 show that the treatment of applying Bio Phosphate fertilizer has a very significant effect on flower diameter. The differences between treatments based on the BNJ Test of 0.05 can be seen in Table 8 below:

Table 8
Effect of Bio Phosphate fertilizer on flower diameter (mm).

Treatment	Average	BNJ0.05 = 9.70
P0	79.67	a
P3	88.50	ab
P1	91.30	b
P2	91.56	b
P4	92.07	b

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

5. Plant Fresh Weight (g)

The results of the analysis of variance in Table 1 show that the treatment with Bio Phosphate fertilizer had a significant effect on plant fresh weight. The difference between treatments based on the BNJ Test of 0.05 can be seen in Table 10 below:

Table 9
Effect of Bio Phosphate fertilizer on plant fresh weight (g).

Treatment	Average	BNJ0.05 = 46.98
P0	187.98	a
P3	219.42	ab
P1	225.62	ab
P4	230.56	ab
P2	236.50	b

Note: Numbers followed by the same letter indicate that different treatments were not significant at the 5% test level

6. Fresh Weight of Flowers Per Plant (g)

The results of the analysis of variance in Table 1 show that the treatment with Bio Phosphate fertilizer had a significant effect on fresh flower weight per plant. The differences between treatments based on the BNJ Test of 0.05 can be seen in Table 10 below:

Table 10
Effect of Bio Phosphate fertilizer on fresh flower weight per plants (g)

Treatment	Average	BNJ0.05= 21.08
P0	64.70	a
P1	84.44	ab
P3	85.34	ab
P4	90.24	b
P2	90.30	b

Note: The numbers followed by the same letter indicate that the different treatments are not significant at the 5% test level.

DISCUSSION

Based on the analysis of diversity, Table 2 shows that the treatment of Bio Phosphate fertilizer had no significant effect on plant height aged 7 hst, 14 hst, 21 hst, 28 hst. According to (Jaenudin & Sugesa, 2019) this is presumably because vegetative growth in plants is still relatively slow, so that plants have not optimally absorbed the nutrients available in the soil or those given through treatment. Plants need optimum nutrients for metabolic processes in the vegetative phase, the optimal amount of macro and micro nutrients will encourage better plant growth and yields.

Based on the results of the analysis of diversity in Table 2, it shows that the application of Bio Phosphate fertilizer had a very significant effect on plant height at 35 HST and had a significant effect on plant height at 42 HST and 49 HST. The results of the BNJ0.05 test in Tables 3,4 and 5 show that the P1 treatment (fertilizer dose of 15 g/polybag) produced the best plant height of 36.69 cm. According to (Lingga, 2004) the element P is also able to increase the ability of roots to absorb nutrients such as N, P, and K. Where the function of nitrogen and potassium is to form chlorophyll which is very useful in the process of photosynthesis, with this photosynthetic process, plants can produce carbohydrates and protein that is useful for fruit formation which can affect fruit enlargement which includes size and weight.

Based on the analysis of variance in Table 2, it shows that the treatment of applying Bio Phosphate fertilizer had no significant effect on the number of leaves aged 7 hst, 14 hst, 21 hst, 28 hst. Other factors that cause an insignificant effect, especially on the number of leaves due to differences in the formation of crop leaves, which will cause inhibition of leaf formation and the effect of lack of irrigation which causes inhibition of the process of photosynthesis that occurs in leaves. According to (Cahyono, 2001) the need for water for cauliflower plants is very dependent on the growth phase of the plant, the climate and the type of soil.

Based on the results of the analysis of diversity in Table 2, it shows that the application of Bio Phosphate fertilizer had a significant effect on the number of leaves aged 35 days after planting and had a very significant effect on the number of leaves aged 42 days after planting and 49 days after planting. The BNJ0.05 test results in Tables 6.7 and 8 show that the P1 treatment (15 g/polybag fertilizer dose) produced the best number of leaves, namely 22.20 strands. According to (Marliah et al., 2013) that the availability of nutrients needed by plants is sufficient, the results of their metabolism will form proteins, enzymes, hormones, and carbohydrates so that enlargement, elongation and cell division will take place quickly.

Based on the analysis of variance, Table 2 shows that the treatment with Bio Phosphate fertilizer had no significant effect on the day of flower emergence (DAP). This is presumably because the sun's irradiation is not optimal so that it slows down the generative process. Formation of flower mass will be hampered due to less optimum temperature in the experimental field. The daily temperature range of 290C is too high for cauliflower cultivation, thus inhibiting the process of growth and development of cauliflower. According to (Pracaya, 2005) cauliflower planted in areas with temperatures above 250C will fail to form heads. Cauliflower also absorbs a lot of water, which affects the production factor.

Based on the analysis of diversity, Table 2 shows that the treatment of applying Bio Phosphate fertilizersignificant and very significant effect on the variables of flower diameter, fresh weight of plants and fresh weight of flowers per plant. The results of the BNJ0.05 test in Tables 9, 10 and 11 showed that the application of Bio Phosphate fertilizer in the P2 treatment (fertilizer dose of 30 g/polybag) produced the best flower diameter of 91.56 mm. The fresh weight of the plants showed that the application of Bio Phosphate fertilizer in the P2 treatment (fertilizer dose of 30 g/polybag) produced the best plant fresh weight of 236.50 g. The fresh weight of flowers per plant showed that the application of Bio Phosphate fertilizer in the P2 treatment (fertilizer dose of 30 g/polybag) produced the best fresh weight of flowers per plant of 90.30 g. According to (Lakitan, 2001) the element P functions to convert carbohydrates such as in the conversion of flour to sugar. The results of these carbohydrate changes will play a role in the formation of both fruit size and weight, if the availability of P elements in the soil is available for plants, it will increase the size and weight of the crop.

Bio Phosphate Fertilizer is a phosphate fertilizer combined with phosphate solvent microorganism. According to (Torus, 2012) phosphorus (P) is a nutrient needed in large quantities (macro nutrient). The amount of Phosphorus in plants is smaller than Nitrogen and Potassium. But Phosphorus is considered as the source of life. This element is a component of every living cell and tends to be concentrated in the seeds and growth points of plants. The element P in phosphate is (Phosphorus) very useful for plants because it functions to stimulate root growth, especially in the early stages of growth, accelerate flowering, ripen seeds and fruit.

CONCLUSION

Based on the results of the research conducted, it can be concluded that the application of Bio Phosphate fertilizer providespositive effect on the growth and yield of cauliflower (Brassica oleracea var. BotrytisL.). The application of Bio Phosphate fertilizer had a good effect on the growth of plant height and number of leaves with a fertilizer dose of 15 g/polybag, the best plant height was 36.69 cm, and the number of leaves was 22.20. The application of Bio Phosphate fertilizer had a good effect on the yield of flower diameter, fresh weight of plants and fresh weight of flowers per plant with a fertilizer dose of 30 g/polybag obtained a flower diameter of 91.56 mm, plant fresh weight of 236.50 g and fresh flower weight per plant of 90.30 g and Cauliflower production potential is 10.03 tons/ha.

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