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Research Article

The Effect of Cultiving Media and N Fertilizer Application on the Growth and Results of Flowering Cabbage (Brassica oleracea var. botrytis L.)

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ABSTRACT

Research to study the effect of a good combination of growing media and application of N fertilizer on the growth and yield of cauliflower (Brassica oleracea, L.). The research time was carried out from June 2022 to October 2022 at Raya Village garden, Berastagi District, Karo Regency, North Sumatra Province, with an altitude of 1,300 above sea level with latosol soil type and soil pH 6.8. This research was conducted from June 2022 to October 2022. This research was conducted with a factorial experiment of 3x2 = 6 + 1 controls arranged in a factorial randomized block design (RAK). The first factor was the composition of the planting medium (M), which consisted of 3 treatment levels, namely: Mo: Control (without mixture), **M1: Soil +** husk charcoal with a volume ratio (1:1), M2: Sand + charcoal husk with a volume ratio (1:1) , M3: Soil + sand + husk charcoal by volume ratio (1:1:1) . The second factor was the dose of ZA (N) fertilizer which consisted of 3 treatment levels, namely: N1 : 50 kg/ha, N2 : 100 kg/ha, N3 : 150 kg/ha . The observed variables were plant height, number of leaves, number of roots, fresh weight of plants, fresh weight of flowers/plant, dry weight of plants, initiation of flowering, flower diameter. Mixing plant media and N fertilizer can increase the growth and yield of cauliflower plants. M3N3 treatment (Soil + sand + husk charcoal with volume ratio (1:1:1) + Nitrogen fertilizer 150 kg/ha, is the best treatment that can increase growth and yield of cauliflower on the number of roots (7.27 fruit), fresh weight of plants (7.95 g), dry weight of plants (2.69 g), initiation of flowering (6.00 hst), fresh weight of flowers/plant (6.98 g), flower diameter (3.09 mm).

Keywords*: Flower cabbage, Growing media, N fertilizer*

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Introduction

Cabbage (*Brassica oleracea, L*) is a vegetable plant that is included in horticultural commodities. In general, our society calls cauliflower vegetables as cauliflower, cauliflower, or in a foreign language it is called *cauliflower* (Wen et al., 2022). Cauliflower (*Brassica oleraceae var brotrytis* L.) has an important role for human health because it contains vitamins and minerals that are needed by the body, so that the demand for this vegetable continues to increase (Liu et al., 2022). Cabbage is also needed by the community as a cooking ingredient, such as soup, pickles, fresh vegetables and so on.

Cauliflower cultivation is a very good business opportunity because of high demand, relatively short harvest period and simple cultivation techniques (Wang et al., 2019). The prospect of cauliflower cultivation is quite bright, has a fairly high commercial value and high social value. The demand for cauliflower is always increasing, both domestically and abroad. In 2020, the national cabbage yield reached 1,406,985 tonnes. This figure is the third highest in total vegetable yields in Indonesia in 2020 after mushrooms and shallots (Ji et al., 2020). Cabbage yields decreased in 2017 by 4.67 percent compared to the previous year, and in 2018 decreased by 2.40 percent compared to 2017 (N. S. Gruda, 2022).

Yield decline caused by the conversion of land from agriculture to non-agriculture, which is increasingly worrying (Shao et al., 2021). One way to overcome this problem is by cultivating plants by utilizing narrow land such as using polybags. There are several advantages of using polybags as planting containers, namely, they are easy to move, plant development is easy to control, the nutrients given to plants are also directly absorbed by the roots, cultivated plants do not know the season, the composition of the planting media can be adjusted, saving space and planting space and efficient fertilization (Jia et al., 2019). According to Hayati (in Jin et al., 2022) growing media is one of the environmental factors that need to be considered. A good planting medium for plants is usually used in the form of a mixture of sand, soil and manure (Gusta & Same, 2022). A mixture of several materials for planting media must produce an appropriate structure because each type of media has a different effect on plants (Bhunia et al., 2023).

Another way to increase the yield or yield of cabbage plants is fertilization. Fertilization is an attempt to add or supply the nutrients needed by plants. In the growth of cabbage plants require nitrogen nutrients (Farjana et al., 2023). The function of nitrogen is in the formation of amino acids as the main ingredient in forming protein for plant growth. Nitrogen has a role in the metabolic reduction of nitrate and N assimilation. Nitrogen plays a role in the formation of plant cells. In addition, nitrogen functions in the synthesis of chlorophyll (Ma et al., 2023). While the element nitrogen is only available in small amounts in nature, to meet the needs of nitrogen in cabbage plants it is necessary to apply fertilization, especially fertilizers containing nitrogen elements such as ZA fertilizers. ZA fertilizer contains nitrogen as much as 21% in the form of NH_4^+ (Kiruba N & Saeid, 2022). In the provision of fertilizer must pay attention to the right dose. Insufficient doses result in a deficiency or lack of nutrients needed by plants, resulting in stunted growth. Excessive doses will have a toxic effect and cause plasmolysis in plants which will lead to death (Hariyadi, Nizak, et al., 2019). For this reason, the application of N fertilizer must pay attention to the right dosage so that the yield of cabbage plants is optimal (Shalaby et al., 2022). The purpose of this study was to determine the effect of growing media and application of the best N fertilizer on the growth and yield of cauliflower (Brassica oleracea *var. botrytis L.)*.

Methods

This research was carried out in the Raya Village garden, Berastagi District, Karo Regency, North Sumatra Province, with an altitude of 1,300 asl with latosol soil type and soil pH 6.8. This research was conducted from June 2022 to October 2022 (Yamuangmorn et al., 2022). This research was conducted with a factorial experiment of 3x2 = 6 + 1 controls arranged in a factorial randomized block design (RAK). The first factor is the composition of the planting medium (M), which consists of 3 treatment levels, namely:

Mo: Control (no mix), husk charcoal with a volume ratio (1:1)
M2: Sand + charcoal husk with a volume ratio (1:1)
M3: Soil + sand + husk charcoal by volume ratio (1:1:1).
The second factor is the dose of ZA fertilizer (N) which consists of 3 levels of treatment, namely:
N1 : 50 kg/ha,
N2 : 100 kg/ha,
N3 : 150 kg/ha .

The observed variables were plant height, number of leaves, number of roots, fresh weight of plants, fresh weight of flowers/plant, dry weight of plants, initiation of flowering, flower diameter. The tools used in this research are hoe, *knapsack sprayer*, bucket, hammer, label paper, plastic, stationery, ruler, soil tester, scales, knife. The materials used in this study were cauliflower seeds, latosol soil , husk charcoal, sand, manure, water , ZA fertilizer, nebijin fungicide, antracol fungicide, and matador insecticide (Chrysargyris et al., 2021).

Results and Discussion

From the results of variance (F-test) it was found that the interaction of planting media and fertilizers N significant effect on the variables of plant wet weight (g), plant dry weight (g), number of roots, flowering speed (DST), flower wet weight (g), and flower diameter (mm), but had no significant effect on plant height (cm) and the number of leaves (strands). The single treatment for growing media without N fertilizer had a significant effect on all variables except for plant height (cm) which had no significant effect (Table 1).

The results of the F test can be concluded that the interaction and single factors have an effect significant in increasing the growth and yield of cauliflower plants. This is suspected of mixing the planting medium and N fertilizer (ZA) can improve the physical, chemical and biological properties of the soil and can provide the nutrients needed by plants so that it plays an important role in the growth and yield of cauliflower plants (N. Gruda, 2019). According to Anggraini (2014), mixing planting media can improve soil structure, increase soil resistance in holding water so that drainage is not excessive, and can increase the number and activity of soil microorganisms causing more optimal growth and yield of cauliflower plants. This is shown in Table

Table 1. Average value of interactions and single factors in mixing planting media and nitrogen fertilizers on plant height variable (cm)

Fertilizer Dosage Treatment	Planting Media Treatment				Average
	M0	M1	M2	M3	
N1	30,33	30, 66	30, 55	30, 77	30, 58
N2	30, 77	3 1.66	3 2,22	3 1.44	3 1.53
N3	30, 88	3 2,22	3 2 ,55	3 3,11	3 2,19
Average	30, 67	3 1.52	3 1 ,7 8	3 1.78	3 2,19

According to Fatimah Siti and Handarto Budi Meryanto (2008) plant growth media is a factor that must be considered, because it affects the growth and development of plants to obtain optimal results. Buntoro et al. (2014) stated that on wide leaves, plants will absorb more sunlight. If the leaf area value increases, it will cause the rate of assimilation to increase and produce a high dry weight. According to Marliah et al. (2013), applying inorganic fertilizers to the soil can increase the availability of nutrients quickly for plants. Plants require optimum nutrients at the beginning of their growth. The need for optimal amounts of macro and micro nutrients can facilitate metabolic processes in the vegetative phase so that it will encourage better growth and yield of cauliflower plants. The availability of nutrients needed by plants is sufficient and balanced, so the results of their metabolism will form good proteins, enzymes, hormones and carbohydrates, so that enlargement, elongation and cell division will take place quickly and can increase plant growth and yields well. Marliah et al., 2013).

The results of the combination tabulation of M 3 N3 produced the highest plants. Plant height in the M 2 and M 3 treatments was the same (Table 1). M 3 N3 produced more leaves than other treatments (Table 2). The M3N3 treatment was significantly different from the other treatments on the plant wet weight variable. The single treatment of M3 was significantly different from M0, M1 and M2. The N3 treatment was significantly different from N1 and N2 in the plant wet weight.

variable (Table 3). The M3N3 treatment combinations were different significantly with other treatments on plant dry weight variables. The single treatment of M3 was significantly different from M0, M1 and M2. The treatment of N3 was significantly different from N1 and N2 in the plant dry weight variable (Table 4). The M3N3 treatment combination was significantly different from the other treatments but not significantly different from M2N3 on the number of roots variable. The single treatment of M3 was significantly different from M0, M1 and M2. The treatment of N3 was significantly different from N1, N2 in the number of roots (Table 5).

The M3N3 treatment combinations were different significantly with other treatments on flowering initiation variables. The M3 single treatment was significantly different from the M0, M1 and M2 treatments. The treatment of N3 was significantly different from N1 and N2 in the initiation of flowering variables (Table 6). The M3N3 treatment combination was significantly different from the other treatments, but not significantly different from the M2N3 treatment on the wet weight variable of interest. The single treatment of M3 was significantly different from M0, M1 and M2 (Shekari et al., 2019). The treatment of N3 was significantly different from N1 and N2 on the wet weight of flowers (Table 7). Combinations M3N3 Treatment is different not significant with M3N2 treatment, but significantly different from other treatments on flower diameter variables. The single treatment of M3 was significantly different from M0, M1 and M2. The treatment of N3 was significantly different from that of N1 and N2 in the flower diameter variable (Table 8).

D concluded that the combination of M3N3 treatment (planting media Soil + sand + husk charcoal with a volume ratio (1:1:1) + Nitrogen fertilizer ZA 150 kg/ha), is a better combination treatment that produces the highest value in increasing the growth and yield of cauliflower plants, as well as for

single treatment M3 and N3 was better than other treatments in increasing growth and yield cauliflower. This is presumably because the dose dose in the M3N3 treatment was the highest so that the content of inorganic materials and nutrients was higher.

Table 2. The average interaction value and single factor in the 5% BNT test was the treatment of mixing the planting medium and nitrogen fertilizer on the variable number of leaves (strands)

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N1	17,22	17.56	18,22	18.44	17,87a	0.39
N2	17.45	18,67	19,11	19.33	18,64b	
N3	17.78	19	19.33	19,44	18,89b	
Average	17,48a	18,41b	18.89c	19.07c	18,47	
BNT 5 %	0.45					

Table 3. The average interaction value and single factor in the 5% BNT test was the treatment of mixing the planting medium and nitrogen fertilizer on the plant wet weight variable (g)

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N1	233,33a	280b	318.78bc	365.56de	299.42a	20.08

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N2	328.89cd	419.99f	464.44g	485.56gh	424,72b	
N3	395.56ef	473.33g	570h	678,89i	529.44c	
Average	319.25a	391,11b	451.07c	510.01d	417.86	
BNT 5%	23,18					40,15

Table 4. The average interaction value and single factor in the 5% BNT test was the treatment of mixing the planting medium and nitrogen fertilizer on variables plant dry weight (g)

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N1	20.03a	25.73ab	28.51bc	32.86bcd	26,78a	3.78
N2	27,69b	40.22de	45.03ef	47.64ef	40.15b	
N3	35.59cd	44.69ef	49,81f	65.35g	48,86c	
Average	27,77a	36,88b	41,11b	48,62c	38.59	BNT I (5%)
BNT 5%	4.37					7.56

Table 5. The average interaction value and single factor in the 5% BNT test, the treatment of mixing planting media and nitrogen fertilizers on the variable number of roots

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N1	34,78a	37,11bc	39.78de	40.44def	38.02a	0.93
N2	36,56ab	43.44g	44.55gh	45.22 ghi	42,44b	
N3	39,22d	45,44ij	48.56k	52.22kl	46,36c	
Average	36,85a	42.0b	44,29c	45,96d	42,27	BNT I (5%)
BNT 5%	1.07					1.86

Table 6. The average interaction value and single factor in the 5% BNT test was the treatment of mixing the planting medium and nitrogen fertilizer on the flowering initiation variable (hst)

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N1	56l	53.67k	52.33fghij	52fgh	53,50a	0.42
N2	52.22fghi	51.56bcdef	51bcde	50,89bc	51,42b	
N3	51.89fg	51bcd	50,89b	49,44a	50,80c	
Average	53,37a	52,07b	51,41c	50,78d	51.91	BNT I (5%)
BNT 5%	8.79					0.82

Table 7. The average interaction value and single factor in the 5% BNT test, the treatment of mixing planting media and nitrogen fertilizers on the variable wet weight of flowers (g)

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N1	167,77a	205,55b	215,56b	222,22b	202.78a	9,29
N2	243,33c	330de	321.11cd	346.67fg	310,27b	
N3	326.67de	343.33efg	353.33gh	363.33h	346,67c	
Average	245.92a	292.96b	296,67b	310.74c	286.57	BNT I (5%)
BNT 5%	10.72					18.58

Table 8. The average interaction value and single factor in the 5% BNT test, the treatment of mixing planting media and nitrogen fertilizers on the flower diameter variable (cm)

Fertilizer Dosage Treatment	Planting Media Treatment				Average	BNT 5%
	M0	M1	M2	M3		
N1	10.83a	11,21ab	11.9bcd	12.25cd	11.55a	0.51
N2	11.74abc	11.84abcd	12.62cd	14.74fg	12,74b	
N3	11.95bcd	12.80de	13.82ef	15.67g	13,56c	
Average	11.51a	11.95a	12,78b	14,22c	12.62	BNT I (5%)
BNT 5%	0.60					1.034

Treatment M 3 (planting medium soil + sand + husk charcoal with a ratio of 1:1:1) gave higher yields than treatment M 2 (planting medium sand + charcoal husk with a ratio of 1:1:1) and M 1 (planting medium soil + husk charcoal with a ratio of 1:1:1). This is presumably because husk charcoal can improve the physical, chemical and biological properties of the soil. Chaff charcoal is also able to increase.

the porosity of the soil so that the soil becomes loose while also increasing the ability of the soil to absorb water. Chemically, husk charcoal contains important nutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca) and magnesium (Mg), a pH range of 6.5-7 and does not contain salts which are detrimental to plants (Disha et al., 2020).

In addition, the use of sand in the planting media mixture to improve soil aeration. The presence of sand can cause the media to not decompose easily. Root damage due to rot can disrupt nutrient absorption and result in plant death (Esmaielpour et al., 2020). These two elements play a role in the formation of new cells and are the main components of organic compounds in plants such as amino acids, nucleic acids, chlorophyll, ADP and ATP.According to Fatimah Siti and Handarto Budi.

Meryanto (in Zeng et al., 2022) plant growth media is a factor that must be considered, because it affects the growth and development of plants to obtain optimal results. Buntoro et al (in Zargar Shooshtari et al., 2020) stated that on wide leaves, plants will absorb more sunlight. If the leaf area value increases, it will cause the rate of assimilation to increase and produce a high dry weight (N. Gruda et al., 2019).

The application of N fertilizer has an effect on all observation parameters. This is because the application of N fertilizer increases the content of nitrogen elements in the soil. Nitrogen plays a role in vegetative growth, as the main element of protein formation (Atzori et al., 2021). The protein formed is used in plant cell division. Plant cells divide continuously and make the number of leaves, leaf area and leaf thickness increase. In addition, N fertilizer functions in the synthesis of chlorophyll. More chlorophyll can increase the process of photosynthesis and produce photosynthates in large quantities. Photosynthate is distributed to all parts of the plant and is used for growth (Reza et al., 2019). The main role of nitrogen for plants is to stimulate overall growth, especially stems, branches and leaves. In addition, Sarief (in Hariyadi, Huda, et al., 2019), an adequate amount of nitrogen can increase the protoplasm, increase in size and number of cells, resulting in enlarged plant organs

Conclusion

The results showed that the combination of a mixture of M3 planting media (soil + sand + husk charcoal with a ratio of 1:1:1) with Nitrogen ZA (N3) 150kg/ha capable of producing optimal growth and yields on cauliflower plants.T M3 mixed planting medium (soil + sand + husk charcoal with a ratio of 1:1:1) had a significant effect on increasing the growth and yield of cauliflower plants.

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