



Effect of Organic Fertilizers on Growth, Yield and Quality of Cauliflower (*Brassica oleracea* var. Botrytis.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present experiment was carried out during 2021-22 with an aim to study the different treatments of organic fertilizers on growth, yield and quality of Cauliflower and to work out with economics, in Central Horticulture Research Farm of Department of Horticulture, SHUATS,. The experiment was conducted in Randomized Block Design with 10 treatment_replicated three times. The treatments were T₁ FYM 100% (100:40:100), T₂ Vermicompost (75%) + Poultry manure (25%), T₃ Vermicompost (75%) + Goat manure (25%), T₄ Vermicompost (50%) + Poultry manure (50%), T₅ Vermicompost (50%) + Goat manure (50%), T₆ Vermicompost (25%) + Poultry manure (75%), T₇ Vermicompost (25%) + Goat manure (75%), T₈ {Vermicompost + Poultry manure} (75%) + Goat manure (25%), T₉{Vermicompost + Poultry manure} (50%) + Goat manure (50%), T₁₀{Vermicompost + Poultry manure} (25%) + Goat manure (75%). From the present investigation it was concluded that treatment T₅ Vermicompost (50%) + Goat manure (50%) was found best in the terms of Plant height (cm), Leaf Length (cm), Number of leaves per plant, Head size (cm), Head weight (g), Net weight of head per plot, Yield per plot (kg), TSS, Acidity (%),B:C Ratio.

Keywords: *Vermicompost; poultry manure; goat manure; growth; yield and economics.*

1. INTRODUCTION

Vegetables play an important role in human nutrition. Regular intake of recommended amount of vegetables 300 g per day per capita leads to sound health. Recently, interest in vegetable production has been increased tremendously as a result of greater appreciation of the food value of vegetables and the place of vegetables in the national requirement. Vegetables are an indispensable group of food, providing vitamins, minerals, protein, carbohydrates and fibers in the diet besides having medicinal value and thus provide nutritional security through these nutrients.

India is the second largest producer of vegetables (next to China) and our share in world vegetable production is 10.7 percent. In India, area under vegetable crop cultivation is 10,100 thousand ha with a production of 185883 thousand MT and productivity of 18.40 MT/ha. Cauliflower is grown over an area of 469 thousand ha with production of about 9103 thousand MT per annum [1].

Among the vegetables, cauliflower is one of the most important winter season vegetable among the cole crops which belong to the genus *Brassica* of the family Cruciferae with chromosome number $2n = 18$. The word "cauliflower" derives from the Latin words *caulis* (cabbage) and *floris* (flower). The delicacy cauliflower curd is a modification of inflorescence. It is grown throughout the country for its tender curds which are used as vegetable, soup and for pickling [2]. The crop is reported to be a native of Southern European the Mediterranean region and was introduced in India in 1822 from England [4]

Cauliflower is a cold weather hardy crop and thrives best in cool and moist climate. This had originated from Cyprus and the first crop of cauliflower had been introduced by India in sixth century A.D [5]. There is a great demand for this vegetable on account of its delicious taste. Due to abortive floral parts which are fleshy and closely crowded, these are used for culinary purpose either alone or mixed with potato. Pickle can also be prepared from the firm curd. Cauliflower has high protein and peculiar regarding in stability of Vitamin C after cooking [6]. Raw cauliflower provides good amount of nutrients and vitamins. Hundred grams of cauliflower contains vitamin-C (46.4 mg), vitamin-K 16 µg, folate (57.0µg), vitamin B6 (0.2 mg),

fiber (2.5 g), Potassium (303.0 mg), Manganese (0.2 mg) and Vitamin B5 (0.7 mg). As weather is a limiting factor in the production cauliflower, the plant grows best in cool day time temperature 70-85°F (21-29°C), with plentiful sun shine and moist soil conditions high inorganic matter and sandy soils.

2. MATERIALS AND METHODS

The area of Prayagraj district comes under subtropical belt in the south east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46°C-48°C and seldom falls as low as 4°C- 5°C. The relative humidity ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

3. RESULTS AND DISCUSSION

3.1 Plant Height at 30 DAS

Data reveals that there was a significant effect of various treatments on plant height at 30 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum plant height 28.79 cm, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 26.75 cm, whereas minimum Plant height 20.87 cm was recorded in Control.

3.2 Plant Height at 60 DAS

Data reveals that there was a significant effect of various treatments on plant height at 60 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum plant height 42.35 cm, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 40.12cm, whereas minimum Plant height 36.95 cm was recorded in control.

3.3 Plant Height at 90 DAS

Data reveals that there was a significant effect of various treatments on plant height at 90 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum plant height 48.72 cm, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%)

with 46.32 cm, whereas minimum Plant height 42.89 cm was recorded in Control.

3.4 Leaf Length 30 DAS

Data reveals that there was a significant effect of various treatments on leaf length at 30 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum leaf length 7.89 cm, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 7.51 cm, whereas minimum leaf length 5.64 cm was recorded in Control.

3.5 Leaf Length at 60 DAS

Finding reveals that there was a significant effect of various treatments on leaf length at 60 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum leaf length 21.95 cm, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 20.50 cm, whereas minimum leaf length 17.89 cm was recorded in Control.

3.6 Leaf Length at 90 DAS

Finding reveals that there was a significant effect of various treatments on leaf length at 90 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum leaf length 31.88 cm, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 30.35 cm, whereas minimum leaf length 27.89 cm was recorded in Control.

3.7 Number of Leaves at 30 DAS

Finding reveals that there was a significant effect of various treatments on number of leaves at 30 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum number of leaves 5.95, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 5.13, whereas minimum number of leaves 3.78 was recorded in Control.

3.8 Number of Leaves at 60 DAS

Finding reveals that there was a significant effect of various treatments on number of leaves at 60 days after sowing (DAS). Among the different

levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum number of leaves 12.62, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 11.46, whereas minimum number of leaves 8.18 was recorded in Control.

3.9 Number of Leaves at 90 DAS

Data reveals that there was a significant effect of various treatments on number of leaves at 90 days after sowing (DAS). Among the different levels of organic fertilizer, T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum number of leaves 16.67, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 15.45, whereas minimum number of leaves 12.12 was recorded in Control.

In case of head size, among the different levels of organic fertilizers T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum head size 20.89 cm, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 19.65 cm, whereas minimum size of head 14.25 cm was recorded in Control.

In case of head weight, among the different levels of organic fertilizers T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum head weight of cauliflower 1520.56 g, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 1495.37 g, whereas minimum weight of cauliflower 800.49 g was recorded in Control.

In case of Net head weight among the different levels of organic fertilizers T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum Net weight of head of cauliflower 1275.95 g, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 1200.64 g, whereas minimum Net weight of head of cauliflower 550.19 g was recorded in Control.

In case of Yield per plot among the different levels of organic fertilizers T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum yield per plot of cauliflower 9.28 kg, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 8.43 kg, whereas minimum yield per plot of cauliflower 4.85 kg was recorded in Control.

Among the different levels of organic fertilizers T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum total soluble solid of

Table 1. Effect of different organic fertilizers on plant height, leaf length and number of leaves

Symbol	Treatment	Plant height (cm)			Leaf Length (cm)			Number of Leaves		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T ₁	FYM 100% (100:40:100)	20.87	36.95	42.89	5.64	17.89	27.89	3.78	8.18	12.12
T ₂	Vermicompost (75%) + Poultry manure (25%)	22.75	38.79	44.76	5.89	18.12	28.13	3.95	8.44	12.45
T ₃	Vermicompost (75%) + Goat manure (25%)	24.23	39.01	45.35	5.99	18.85	28.86	4.12	8.65	12.85
T ₄	Vermicompost (50%) + Poultry manure (50%)	23.35	37.12	43.39	6.21	19.12	19.17	4.65	9.45	13.45
T ₅	Vermicompost (50%) + Goat manure (50%)	28.79	42.35	48.72	7.89	21.95	31.88	5.95	12.62	16.67
T ₆	Vermicompost (25%) + Poultry manure (75%)	21.65	37.85	43.52	7.35	20.12	30.01	4.85	10.65	14.67
T ₇	Vermicompost (25%) + Goat manure (75%)	22.21	38.95	44.35	6.98	19.89	29.75	4.78	10.87	14.89
T ₈	{Vermicompost + Poultry manure} (75%) + Goat manure (25%)	25.45	37.14	43.79	7.45	18.85	28.44	3.89	11.08	15.05
T ₉	{Vermicompost + Poultry manure} (50%) + Goat manure (50%)	25.79	39.76	45.85	6.65	19.12	29.13	4.21	10.35	14.25
T ₁₀	{Vermicompost + Poultry manure} (25%) + Goat manure (75%)	26.75	40.12	46.32	7.51	20.50	30.35	5.13	11.46	15.45
	F Ratio	S	S	S	S	S	S	S	S	S
	CD	0.5	0.62	0.32	0.56	0.6	0.51	0.49	0.58	1.03
	S.Ed	1.6	2.1	0.81	0.23	0.18	0.16	0.21	0.23	0.51

Table 2. Effect of different organic fertilizers on Head size, Head weight, Net head weight, Yield per plot, TSS, Ascorbic acid and B:C Ratio

Symbol	Treatment	Head size (cm)	Head weight (g)	Net head weight (g)	Yield per plot (kg)	TSS (^o B)	Ascorbic acid (mg/100g)	Benefit cost ratio
T ₁	FYM 100% (100:40:100)	14.25	800.49	550.19	4.85	4.2	63.45	1.27
T ₂	Vermicompost (75%) + Poultry manure (25%)	14.85	900.61	750.36	5.46	4.8	68.75	2.50
T ₃	Vermicompost (75%) + Goat manure (25%)	16.75	1280.49	1150.35	7.59	5.01	70.50	2.76
T ₄	Vermicompost (50%) + Poultry manure (50%)	18.65	1375.91	1190.46	7.92	5.65	72.75	2.83
T ₅	Vermicompost (50%) + Goat manure (50%)	20.89	1520.56	1275.95	9.28	6.58	89.82	3.88
T ₆	Vermicompost (25%) + Poultry manure (75%)	15.89	1250.64	1000.549	6.24	5.13	75.45	2.84
T ₇	Vermicompost (25%) + Goat manure (75%)	18.12	1385.12	1160.479	7.65	4.89	77.56	3.37
T ₈	{Vermicompost + Poultry manure} (75%) + Goat manure (25%)	17.35	1185.60	975.15	6.61	4.67	69.89	3.07
T ₉	{Vermicompost + Poultry manure} (50%) + Goat manure (50%)	17.95	1320.28	1007.79	7.73	5.35	71.95	3.10
T ₁₀	{Vermicompost + Poultry manure} (25%) + Goat manure (75%)	19.65	1495.37	1200.64	8.43	5.75	78.85	3.59
	F Ratio	S	S	S	S	S	S	
	CD	0.85	6.59	6.59	6.59	0.67	5.12	
	S.Ed	0.29	2.89	2.89	2.89	0.23	2.31	

cauliflower 6.58 °Brix, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 5.75 °Brix, whereas minimum total soluble solid of cauliflower 4.20°Brix was recorded in Control.

Among the different levels of organic fertilizers T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum acidity of cauliflower 89.82 mg/100g, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 78.85 mg/100g, whereas minimum acidity of cauliflower 63.45 mg/100 was recorded in Control.

In case of Economics, among the different levels of organic fertilizers T₅ (Vermicompost (50%) + Goat manure (50%)) recorded maximum B:C Ratio 2.06, followed by T₁₀ (Vermicompost + Poultry manure) (25%) + Goat manure (75%) with 1.38, whereas minimum B:C Ratio of cauliflower 1.14 was calculated in Control.

4. DISCUSSION

4.1 Effect of Organic Fertilizers on Growth of Cauliflower

The increased in the growth of the plant might be due to the using organic fertilizers viz FYM, vermicompost, goat manure and poultry manure which improved the physical, chemical, and biological properties of the soil, resulting in increased root growth, which may have resulted in increased nutrient absorption and efficient translocation of nutrients towards plant system during vegetative growth. It's worth noting that increased nitrogen fixation by organic fertilizer which has the potential to function as a denitrification inhibitor, resulting in increased nitrogen availability in plants [7]. Plants can take up the nutrient according their requirement resulting enhanced growth and development. Phosphorus is called as key of life because it directly involves in all physiological processes in plant and FYM has phosphorus solubilizing properties As a result, it improves the absorption and translocation phosphorus in plant. Similar findings were reported by Chetri et al. [8] in capsicum, Eifediyi et al. [9] in okra, Harmandeep et al. [10] in cauliflower, Devanda [11] in okra, and Sharma et al. [12] in cauliflower.

4.2 Effect of Organic Fertilizers on yield of Cauliflower

The yield parameters of cauliflower were significantly affected by organic manures

application during the course of investigation. The yield parameters like curd size, curd weight, yield per plot were significantly affected by the application of different organic fertilizer. The increased yield might be the enhanced establishment of micro-organism population in rhizosphere as the organic matter in addition providing physical properties also insured nutrient availability and food supply for plants [11]. Phosphorus is important for protein synthesis, chlorophyll and for establishment of good root mass. Similar findings were recorded through using organic manures by Eifediyi et al. [9] in okra, Tripathi et al. [6] in cauliflower, Aechra et al. [13] in cowpea, Miglani et al. [14] and Devanda [11] in okra, Negi et al. [15] in broccoli and Sharma et al. [12] in cauliflower.

4.3 Effect of Organic Fertilizer on Quality Parameters

The effect of organic manures on quality parameters of cauliflower was found significant during the course of experiment. There was a good content of TSS and Ascorbic acid which might be due to the reason that organic form of nitrogen increased TSS content, ascorbic acid in the cauliflower. So, easy availability of nitrogen and organic carbon lead to balanced C:N ratio which improved the quality of produce. Similar findings were also noticed by Thimma [16] in chilli, Atal [17] in bell pepper, Negi et al. [15] in broccoli, Alam et al. [18] and Devanda [11] in okra and Gangadhar et al. [19] in chilli.

5. CONCLUSION

It is concluded from the study that the application of (Vermicompost (50%) + Goat manure (50%)) has increased the yield of cauliflower and also helps to retain the fertility of the soil as avoiding the use of chemical fertilizers. The use of organic manure helps to increase the humus content in the soil and also helpful in up taking of NPK from the soil. Optimum level of organic manure use can lead to the sustainable development.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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