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Response of different dose of organic manures on growth, yield of Cauliflower (*Brassica oleracea* Var. botrytis) in central India

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Abstract
Cauliflower (*Brassica oleracea* var. botrytis Subvar. cauliflora) belongs to the family Cruciferae is one of the most important cole crop. It is a highly nutritious and delicious vegetable, rich in Vitamin A, C and minerals like calcium, iron and iodine. The present investigation entitled title "Response of different dose of organic manures on growth, yield of Cauliflower (*Brassica oleracea* Var. botrytis) in central India" was carried at the Experimental, Organic Research farm Kargunwa ji, Department of Horticulture, Institute of Agricultural Sciences, Bundelkhand University Jhansi (Uttar Pradesh) during *Rabi* season of 2021-2022.

The Cauliflower, *Brassica oleracea* var. botrytis L., cultivar 'PSB (K-1)' were sown at the experimental farm in 25.2 x 10.9 m^2 = 274.68 m^2 seedbeds. The soil of seedbed was prepared to obtain good tilth to provide a feasible condition for vigorous growth of young seedlings. The experiment was laid out in Randomized block design with seven treatments and three replications with spacing 45 × 45 cm^2 and plot size 2.7 × 2.7 m = 7.29 m^2. The Gross experimental area 25.2 x 10.9 m^2 = 274.68 m^2. From the experimental findings it may be concluded that In context to growth, yield and economics parameters studied in the present research the significance levels at 0.05% was quite evident with the treatment T_7 of (33% Cowdung + 33% Sheep manure + 33% Groundnut cake) was in q/ha^{-1}. Similarly, the next best data in terms of growth, yield and economics was significantly higher and was noticed in plot T_6 of (50% Cowdung + 50% Groundnut cake). The last but not less than another was so noticeable in terms of growth, yield and economics which was significantly ranked third and was better was with plot T_5 with recommended dose of (50% Groundnut cake + 50% Sheep manure).

Keywords: Application time, cauliflower, growth, organic manure, yield

Introduction
Cauliflower (*Brassica oleracea* var. botrytis subvar. cauliflora) belongs to the family Cruciferae is one of the most important cole crop. Cauliflower was introduced in India in 1822. The leading cauliflower producing countries of the world are China, Pakistan and India in respect of yield per hectare of land. The total area of cauliflower in Uttar Pradesh is 17.53 000 million hectare with production 400.81 000 MT (NHB, 2017-2018). India is second produced of vegetables in the world and produced (184394.28000 MT) vegetables. The 2755193 ha area of vegetables have been treated with chemical fertilizers. (Agricultural Census 2017-2018).

The yield of cauliflower depends on variety, cultivation methods, climatic conditions, soil fertility as well as edaphic factors etc. The cultivation of cauliflower requires proper supply of nutrient. Besides nitrogen, phosphorous, potassium and sulfur, a considerable amount of micronutrients is also present in organic matter. Utilization of organic matter has been well documented to improve physical, chemical and biological properties of soil and the addition of compost to soil generally improves tilth, soil structure, infiltration, drainage and water holding capacity. On an average, well rotten cowdung contains 0.5% N, 0.2% P_2O_5 and 0.5% K_2O Yawalkar *et al.* (1984) [9].

The use of compost and vermicompost has also been observed to improve plant growth and quality. The vermicompost promote growth from 50-100% over conventional compost and 30-40% over chemical fertilizers Sinha *et al.* (2010) [7].

Vermicompost is full of vitamins, antibiotics, microelements, minerals and enzymes and that lead into plants' growth and performance improvement and even cause the increased resistance of plants against diseases and it has a huge storage of microorganisms fixing atmospheric nitrogen plays a significant role in raising phosphorus of soil.

Cauliflower is a heavy feeder of nutrient, as it requires 120-150 kg N/ha besides 50 kg P_2O_5, 40 kg K_2O, along with 10-15 tonnes of FYM/ha. However under low fertility soils, the requirement of nutrients, especially nitrogen, may go higher. Among the organic manures mustard oil cake contain higher amount of nutrient such as 4.93% N, 0.53% P_2O_5, 0.65% K_2O. It release nutrient slowly and hence plant can get nutrient for long time. Groundnut cake contains high amount of secondary and micronutrients in addition to N, P and K at (7:3:3:2.2) %, respectively, while sheep manure contains 0.7% N, 0.3% P_2O_5, 0.9% K_2O Sinha *et al.* (2001) [7].

Among the organic amendments, oil cakes have been found to be the most prospective because they do not only reduce nematode development but also stimulate plant growth supplying plant nutrients of some sorts Hussain *et al.* (1989) [4] also supply sufficient amount of S, Zn and B for the growth. Timing of nutrient application, therefore, ensures the availability of the nutrients when the crop needs them. This will also avoid nutrient losses which can be before and after periods of crop demand which in the long run result in wastage of resources Ndukwe *et al.*, (2011) [6]. Application timing is a crucial component to maximizing N use efficiency in manures. Application time is also very important for phosphorus use efficiency as it quickly becomes unavailable for the plants in the process called 'Fixation'. Management of manure fertilizers is much more difficult than that of mineral fertilizers, primarily because manure and other organic fertilizers are affected by the handling during storage and application as well as the timing of incorporation and distribution Thomsen *et al.*, (2005) [8].

Materials and Methods

The present investigation entitled title "Response of different dose of organic manures on growth, yield of Cauliflower (*Brassica oleracea* Var. botrytis) in central India" was carried at the Experimental, Organic Research farm Kargunwa ji, Department of Horticulture, Institute of Agricultural Sciences, Bundekhand University Jhansi (Uttar Pradesh) during *Rabi* season of 2021-2022.

The experiment was laid out at Organic Research farm at Karguan ji, Jhansi, Department of Horticulture, Institute of Agricultural Sciences, Bundelkhand University Jhansi (Uttar Pradesh) during *Rabi* season of 2021-2022.Geographically Jhansi is the district of Uttar Pradesh situated between the rivers Pahuj and Betwa at an average elevation of 285 m above mean sea level longitude 78 °, 59' E" and is situated at latitude 25^0'27 03.4" N at an altitude of 271 meters above the mean sea level.

Details of experiment

1. Name of the crop : Cauliflower, *Brassica oleracea* var. botrytis L.,
2. Name of the cultivar : PSB (K-1)
3. Statistical Design : RBD
4. Treatment : 07
5. Replications : 03
6. Total treatments : 21
7. Spacing : 45×45 cm^2
8. Plot size : 2.7×2.7 m = 7.29 m^2
9. Number of plants per plots : 36
10. Gross experimental area : 25.2 x 10.9 m^2 = 274.68 m^2

Details of the treatments

T_1 = 100% Cow dung
T_2 = 100% Sheep manure
T_3 = 100% Groundnut cake
T_4 = 50% Cow dung + 50% Sheep manure
T_5 = 50% Groundnut cake + 50% Sheep manure
T_6 =50% Cowdung + 50% Groundnut cake
T_7 = 33% (Cow dung + Sheep manure + Groundnut cake)

Statistical analysis

Analysis of variance (Anova) The total variations amongst the treatment for different attributes were tested for significance by 'F' test using analysis of variance technique. The degrees of freedom, mean sum of squares and 'F' values were calculated as follows:

Where,
r = number of replication
t = number of treatments.

Each sum of square (S.S) was divided by the corresponding degrees of freedom to get the MSS. To find out the 'F' values from the table Fisher and Yates, (1953) [3] the mean square values were tested, against the error mean squares. The standard error of difference between any two genotype means is expressed by the formula:

$$\text{S.E (m)} = \sqrt{\frac{2MSe}{R}}$$

Where,
MSe = Error mean square
r = Number of replication.

The test of significance of difference between means of two genotypes for a character was done by test and critical difference (CD) was calculated as follows: C.D. = S.E (m) × 't' Where 't' is the table value at 5% level of significance for the error degree of freedom.

Results

Economics of the different treatments

The economics of the treatment is the most important consideration for making any recommendation to the farmer for its wild adoption. For calculating economics, the average treatment yield along with prevailing market rates for inputs and output were used.

Cost of cultivation

Among different organic manure treatments significantly higher cost of cultivation was fetched under plot T_7 (Rs. 11,087 Rs ha^{-1}) while the minimum was with (Rs. 10,800 Rs ha^{-1}) the control plot T_0.

Gross return

Among different organic manure treatments significantly

higher gross return was fetched under T_7 (Rs. 98,807 Rs ha^{-1}) while the minimum gross return was with (Rs. 84,800 Rs ha^{-1}) the control plot T_0.

Net return

Among different organic manure treatments significantly higher net return was fetched under T_7 (Rs. 87,720 Rs ha^{-1}) while the minimum net return was with (Rs. 72,600 Rs ha^{-1}) the control plot T_0.

B: C ratio

Among different organic manure treatments significantly higher B: C ratio (7.911) as compared to preceding treatments. While the minimum B: C ratio was with (Rs.5.950) the control plot T_0.

Discussion

Economics of the treatment

From the present study we derived out the details that among different organic manure treatments significantly higher cost of cultivation was fetched under plot T_7. While the minimum was with (Rs ha^{-1}) in the control plot T_0. Significantly higher gross return was fetched under while the minimum gross return was with (Rs ha^{-1}) the control plot T_0. Significantly higher net return was fetched under T_7 (Rs ha^{-1}) while the minimum net return was with (Rs ha^{-1}) the control plot T_0. While the minimum B: C ratio was with the control plot T_0. These results support the findings with Farzana (2016); Akhtar *et al.* (2019) and Kumar *et al.* (2016) [2, 1, 5].

Table 1: Economics of the different treatments in Cauliflower (*Brassica oleracea var. Botrytis*).

Treatment	Cost of cultivation (Rs ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	B:C ratio
T_1	10,800	84,800	72,600	5.950
T_2	12,200	86,400	75,600	7.001
T_3	10,300	86,047	75,747	6.603
T_4	11,500	86,843	75,343	6.551
T_5	11,250	85,537	74,287	7.354
T_6	10,550	90,777	80,227	7.604
T_7	11,087	98,807	87,720	7.911

T_1 = 100% Cow dung
T_2 = 100% Sheep manure
T_3 = 100% Groundnut cake
T_4 = 50% Cow dung + 50% Sheep manure
T_5 = 50% Groundnut cake + 50% Sheep manure
T_6 = 50% Cowdung + 50% Groundnut cake
T_7 = 33% (Cow dung + Sheep manure + Groundnut cake)

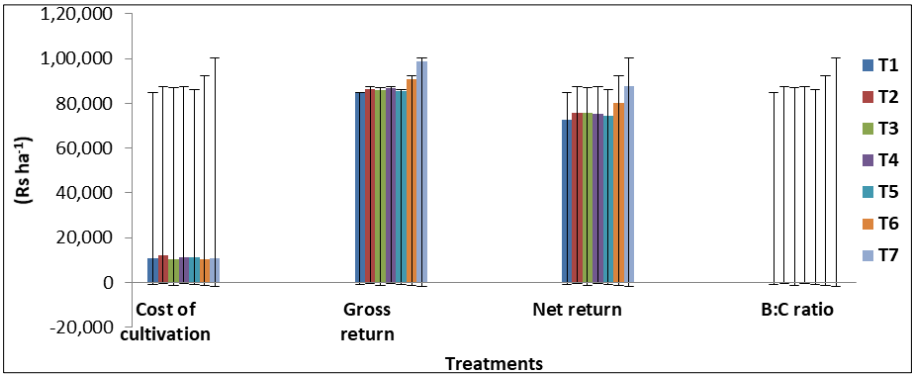

Fig 1: Economics of the different treatments in Cauliflower (*Brassica oleracea* var. *Botrytis*)

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