

## Effect of organic manures and biofertilizers on growth, yield and economics of cauliflower (*Brassica oleracea* L. var. botrytis)

DINESH BABOO TYAGI<sup>1</sup>, NIKITA NEHAL<sup>2</sup> AND SHAILESH KUMAR SINGH<sup>3</sup>

Department of Agriculture, ITM University Gwalior, M.P.

Received: January, 2022; Revised accepted: March, 2022

### ABSTRACT

The field experiment was conducted at Agricultural Research Farm, ITM University Gwalior M.P. during rabi season of 2019-21. The experiment was deliberated in randomized block design with eight treatments replicated thrice. Results revealed that application of 50% vermicompost resulted in maximum growth attributes (plant height 33.1cm, green leaves per plant 8.2, length of longest leaf 33.9cm, width of longest leaf 21.3cm, spread of plant across row length 34.2cm, spread of plant along row 35.0 cm). Yield attributes and curd yield of cauliflower (36.6 q ha<sup>-1</sup>) were recorded with the application of 50% vermicompost. The net return of Rs. 157950 ha<sup>-1</sup> and B:C ratio (4.031) were noted highest with 50% vermicompost. Application of 80% poultry manure proved next best treatment with respect to yield and economics of cauliflower. The lowest values of these parameters were recorded under control.

**Key Words:** Cauliflower, organic manure, biofertilizer, yield, economics

### INTRODUCTION

The cauliflower (*Brassica oleracea* L. var. *botrytis*) is one of the most important cole crops grown widely throughout the country. The major cauliflower growing states are Bihar, U.P. Orissa, West Bengal and Maharashtra. Cauliflower being a heavy feeder and exhaustive crop responds very well to nutrients application. Among various factors responsible for low production of cauliflower, nutrition is of prime importance. The increasing use of chemical fertilizers to increase vegetable production has been widely recognized but in long run impact on soil health, ecology and other natural resources are detrimental which affect living organisms including beneficial soil microorganism and human being. The escalating prices of chemical fertilizers and its detrimental impact on the soil health, environment and human health required alternative source of nutrients for vegetable production. Growing of crops by the combined package of organic manures and bio-fertilizers brings forth the organic farming which is in vogue today. Vermicompost is a nutritive 'organic fertilizer' rich in nitrogen 23%, potassium 1.85-2.25% and phosphorus 1.55-2.25%, and micronutrients, beneficial soil microbes like 'nitrogen-fixing bacteria' and 'mycorrhiza fungi' and are scientifically proving as miracle growth promoters and protectors (Kumar *et al.*, 2013).

Bio-fertilizers improve the quantitative and qualitative features of many plants. Inoculation of these bacteria has synergic and additive effects on plant growth besides reducing the cost of cultivation. *Azospirillum* is Corresponding author email: dineshtyagi.soag@itmuniversity.ac.in an effective micro-aerophilic nitrogen fixer. Its inoculation helps the plants in better vegetative growth due to production of growth hormones such as auxins, gibberellins and cytokinins. Vascular Arbuscular Mycorrhiza (VAM) is the phosphorus absorber bio-fertilizer. Combined use of organic manures (FYM, vermicompost) and biofertilizer helps to maintain soil productivity on sustainable basis. The information on the conjunctive use of organic manures and biofertilizer on the productivity of cauliflower is limited in this region. Therefore, the present research work was taken up using cauliflower test group.

### MATERIALS AND METHODS

The field experiment was carried out at Agricultural Research Farm, ITM University Gwalior, M.P., during Rabi season of 2019-21. Cauliflower variety 'NHV Sarita' was sown in nursery on October 13<sup>th</sup>. Four weeks old seedlings were transplanted at spacing 50 × 50cm. The full doses of FYM, Poultry manure and Vermicompost were applied before

transplanting as per treatment. The bio-fertilizer VAM and Azotobacter was applied before planting as per treatments each at the rate of 5 kg ha<sup>-1</sup>. The eight treatments were evaluated in randomized block design with three replications. The soil was deficient in available nitrogen (178 kg ha<sup>-1</sup>) and medium in available phosphorus (27 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) and available potash (286 kg K<sub>2</sub>O ha<sup>-1</sup>). The pH of surface soil was 8.2. The growth parameters observed were plant height, number of leaves per plant, length of longest leaf, width of longest leaf, spread of plant across row, and spread of plant along row, while, the yield parameters studied were fresh weight of whole plant, fresh weight of trimmed curd, longitudinal curd length, equatorial curd length, gross curd yield and net curd yield. The economic parameters analyzed were net income and B:C ratio. The statistical analysis of data in respect of the growth and yield components was done according to the standard procedure given for randomized block design by Panse and Sukhatme (1967).

## RESULTS AND DISCUSSION

### Growth parameters

Plant height and number of green leaves per plant at peak stage were found to be significantly higher with 50% vermicompost which was closely followed by 80% poultry manure. The lowest number of leaves per plant was observed in control. Possible reason for increased number of leaves per plant may be due to improvement in growth related attributes because of certain growth promoting substances secreted by organic manures, better uptake of water, nutrients and their transportation. Similar results

were also observed by Chatterjee *et al.* (2012), Moakala *et al.* (2015) Kaur *et al.* (2020). Length of cauliflower leaf significantly increased with the application of 50% Vermicompost followed by 80% poultry manure and 80% biofertilizers + Vermicompost as compared to rest of the treatments. The increase in these growth parameters may be due to availability of nutrients and production of growth promoting substances by application organic manures and biofertilizers which might have caused increased cell elongation and multiplication. These results are in accordance with the findings of Gorakh *et al.* (2011), Chatterjee *et al.* (2012) and Kanaujia and Singh (2012). Use of vermicompost and poultry manure exerted significant effect on leaf width of the crop. Application of 50 % vermicompost produced significantly maximum width of leaf followed by 80 % poultry manure. Increase in leaf width with organic manure could be due to better growth of plants which enhanced by the production of bioactive substances and their effects as growth regulators. Application of 50 % vermicompost increased plant spread of cauliflower across and along the row followed by 80 per cent poultry manure. Increase in plant spread in both the direction is the consequence of better plant height, number of leaves, length and width of biggest leaf with the application of organic manure which not only supplies the major nutrient but also made available many of the trace elements which are necessary for better plant growth. Better aeration in the soil also responsible for better overall development in growth of cauliflower plant. Similar findings were also reported by Thilagam *et al.* (2011) and Chatterjee *et al.* (2012).

Table 1: Growth attributes of cauliflower as influenced by organic manures and bio-fertilizers at peak stage (mean of 2 years)

Treatments	Plant height (cm)	Green leaves plant <sup>-1</sup>	Length of longest leaf (cm)	Width of longest leaf (cm)	Spread of plant across row (cm)	Spread of plant along row (cm)
T <sub>0</sub> Control	27.1	6.7	27.6	16.1	31.7	32.1
T <sub>1</sub> FYM (80%)	28.7	7.2	30.0	18.2	31.3	32.4
T <sub>2</sub> 50% Vermicompost	33.1	8.2	33.9	21.3	34.2	35.7
T <sub>3</sub> 80% Poultry manure	31.8	7.7	32.9	18.3	32.5	34.4
T <sub>4</sub> 50% Biofertilizers (Azotobacter + VAM)	31.1	7.6	31.7	18.3	32.8	33.2
T <sub>5</sub> 80% Biofertilizers + Vermicompost	31.1	7.7	32.5	18.3	30.9	33.9
T <sub>6</sub> 80% Biofertilizers + FYM	29.8	7.4	30.2	19.3	32.8	32.9
T <sub>7</sub> 50% Biofertilizers + Poultry manure	30.0	7.5	30.9	18.4	30.9	32.9
SEM±	0.44	0.158	0.422	0.43	0.488	0.475
SD at 5%	1.32	0.48	1.28	1.30	1.48	1.44

### Yield parameters and yield

The maximum fresh weight of the whole cauliflower plant was noted with 50% vermicompost over control. The application of organic manure stimulated the assimilation of carbohydrates and proteins which in turn enhanced cell division and formation of more tissues resulting in luxuriant vegetative growth and more photosynthetic area which has resulted in more vegetative growth hence higher

fresh weight of plant. This might be because of more production of photosynthates in plants as a result more leaf area. Besides, biofertilizers is also associated with the production of growth promoting substances, antifungal compounds and cytokinins which in turn might have led to better root development, better transport and uptake of nutrient which resulted in increasing weight of plant. Similar trend was reported by Bashyal (2011) and Sarangthem *et al.* (2011).

Table 2: Yield and yield attributes of cauliflower as influenced by organic manures and bio-fertilizers (mean of 2 years)

Treatments	Fresh weight of whole plant (kg)	Fresh weight of trimmed curd (kg)	Longitudinal head length (cm)	Equatorial curd length (cm)	Gross Curd yield (t ha <sup>-1</sup> )
T <sub>0</sub> Control	0.81	0.486	12.92	11.85	19.58
T <sub>1</sub> FYM (80%)	0.95	0.563	14.12	13.02	28.34
T <sub>2</sub> 50% Vermicompost	1.36	0.769	15.96	15.41	36.69
T <sub>3</sub> 80% Poultry manure	1.24	0.739	15.48	14.94	34.60
T <sub>4</sub> 50% Biofertilizers (Azotobacter + VAM)	1.07	0.694	14.68	14.32	21.08
T <sub>5</sub> 80% Biofertilizers +Vermicompost	1.08	0.700	14.69	14.63	31.45
T <sub>6</sub> 80% Biofertilizers + FYM	0.99	0.565	14.20	13.69	24.20
T <sub>7</sub> 50% Biofertilizers + Poultry manure	1.08	0.684	14.64	14.26	24.20
SEM±	0.046	0.018	0.251	0.294	0.95
SD at 5%	0.14	0.055	0.76	0.89	2.87

The longitudinal and equatorial curd length was recorded with the application of 50 % vermicompost i.e. 15.96 cm and 15.41, respectively. Maximum curd yield was recorded with 50% vermicompost (36.69 t ha<sup>-1</sup>) which was significantly higher than other treatments. The magnitude of increase in yield with 50% vermicompost and 80 % poultry manure was to the tune of 16.6 to 87.3 and 10.0 to 76.7 %, respectively over control. This increase in curd weight may be attributed to the controlled environmental conditions like temperature, relative humidity and light under protected condition might also be the reason and also due to the better nutritional environment in the root zone for growth and development of the plant. N, P and K are considered as major nutrients required for proper growth and development of the plants. These nutrients play important role in plant metabolism by virtue of being an essential constituent of diverse type of metabolically active compounds like amino acids, proteins, nucleic acids, phytylins, flavins, purine and pyrimidine, nucleotide, flavin nucleotides, enzymes, coenzymes and alkaloid. The findings pertaining

to yield and its attributes are in close agreement with those reported by Bashyal (2011) and Dhakal (2016) in cauliflower and Jaiswal, *et al.* (2020) in cabbage and Imkongsunep Wallang *et al.* (2022) in broccoli.

Table 3: Economic of cauliflower as influence by organic manures and bio-fertilizers (mean of 2 years)

Treatments	Gross income (Rs. ha <sup>-1</sup> )	Cost of cultivation (Rs. ha <sup>-1</sup> )	Net income (Rs. ha <sup>-1</sup> )	B:C ratio
T <sub>0</sub>	76000	30800	45200	2.47
T <sub>1</sub>	162000	70800	91200	2.29
T <sub>2</sub>	210000	52050	157950	4.03
T <sub>3</sub>	198000	54800	143200	3.61
T <sub>4</sub>	120000	35450	84550	3.39
T <sub>5</sub>	180000	84660	95340	2.13
T <sub>6</sub>	138000	74560	63440	1.85
T <sub>7</sub>	138000	48150	89850	2.87

Sale price of cauliflower=Rs.6000/t

### Economics

It is evident from the data (Table 3) that a significantly maximum net return of Rs 157950

ha<sup>-1</sup> and benefit cost ratio of 4.03 were recorded with 50 % vermicompost addition followed by 80% poultry manure (Rs. 143200 ha<sup>-1</sup> and 3.61, net return and benefit cost ratio, respectively). The lowest net profit (Rs.45200 ha<sup>-1</sup>) and B:C ratio (2.47) were recorded under control.

From the results, it may be concluded that the combined application of organic manure

and biofertilizer recorded higher growth, yield attributes and yield of cauliflower over control. Application of 50% vermicompost produced the maximum curd yield and fetched maximum net return and B:C ratio. Thus, it may be recommended to the farmers of Gwalior, (M.P) For cultivation of cauliflower.

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