

Effect of fertilizers and bio-fertilizers on growth, yield and quality of cauliflower (*Brassica oleracea* var. *Botrytis*L.)

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ABSTRACT

The field experiment was conducted during rabi season of 2018-2019 at Raja Balwant Singh College, Bichpuri, Agra, U.P. to find out the effect of fertilizers and bio-fertilizers on vegetative growth, yield and quality of cauliflower (*Brassica oleracea* var. *botrytis*L.). Eight treatments were evaluated in randomized block design with three replications. The growth components viz. plant height (51.7 cm), diameter of stem (1.88 cm), spread of the plant along the row (56.4cm), spread across the row (55.5 cm), fully opened leaves per plant (13.66.), length (41.4cm) width of longest leaf (25.0 cm) were recorded with the application of 80% RDF+Azotobacter + VAM treatment. Combined application of 80 % RDF + Azotobacter + VAM also significantly increased yield attributed of cauliflower over control. The yield of cauliflower curd was maximum (370.80 q ha⁻¹) with 80 % RDF + Azotobacter + VAM. The increase in yield with this treatment was 57.9 % higher than obtained with control (234.80 q ha⁻¹). The lower values of growth, yield attributes and yield were recorded under control. In general combined application of RDF+Azotobacter + VAM proved significantly superior over alone application of Azotobacter or VAM with fertilizers.

Key words: Biofertilizer, fertilizers, cauliflower, quality, curd yield.

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L.) is an important cole crop and belongs to Brassicaceae or Cruciferae family in Mediterranean region having chromosome number 2n=18. The edible part of cauliflower is known as curd which is made from numerous divided hypertrophic branches which terminate the main stem of the plant. It is a popular vegetable in India both tropical as well as temperate regions. Cauliflowers is rich source of minerals like potassium, iron, phosphorus, magnesium, sodium, and calcium etc and play an important role in the body's metabolism. Cauliflower, being a heavy feeder and exhaustive crop, responds very well to nutrients (Pusham *et al.* 2019). Bio-fertilizers is more beneficial in vegetables production. Bio-fertilizers are also capable of mobilizing nutrient elements from non-usable to usable form. Bio-fertilizers are also capable to fix atmospheric nitrogen or solubilization of insoluble phosphate, vitamins and other growth factors required for plant growth. Azotobacter is a broad spectrum bio-fertilizer and can be used as inoculants for most horticultural crops. It is non-symbiotic in nature and fixes nearly 20 to 40kg N/ha. It produces growth promoting substances like vitamins of B

group. VAM (Vesicular Arbuscular Mycorrhiza) increase the vegetative growth and yield by improving the uptake of phosphorus by the crop. Also enhance resistance to rust disease and improve hardiness of transplant stock, recommended for fruits and vegetables. The bio-fertilizers are useful to improve yield and quality of product with suppressing the pathological attack. It also increases the physico-chemical and biological properties of soil. Keeping in view the facts stated above, the present investigation was planned and conducted using cauliflower as test crop.

METHODS AND MATERIALS

The experiment was conducted at Research farm Raja Balwant Singh College, Bichpuri, Agra during rabi season of 2018-19. The research farm is situated at latitude of 27°2' N and longitude of 77°2' E at an elevation of 163.4 m above the mean sea level. The Agra tracts have a tropical and subtropical climate with hot dry summer and severe winter. Under normal climate condition the area receives about 670 mm. annual rain fall, around 80% of which occurs from July to September. The mean annual maximum and minimum atmospheric temperature are 46°C and 1-2°C, respectively.

The soil of experimental plot was Gangetic alluvial with calcareous layer at the depth of about 1.5-2.0 meter. It was sandy loam, well drained and slightly alkaline in reaction (7.9 pH). The soil was sufficient in available potassium (168.0 kg ha^{-1}), medium in available phosphorus (14.0 kg ha^{-1}) but low in available nitrogen (147 kg ha^{-1}) and organic carbon (3.1 g kg^{-1}). The investigation was laid out in randomized block design having 8 treatments namely T_0 Control, T_1 100% Recommended dose of fertilizers NPK, T_2 80% RDF + Azotobacter, T_3 50% RDF + Azotobacter, T_4 80% RDF + VAM, T_5 50% RDF + VAM, T_6 80% RDF + Azotobacter + VAM and T_7 50% RDF + Azotobacter + VAM which were replicated thrice. The recommended dose of NPK (150:80:60kg/ha) was given by urea, diammonium phosphate and muriate of potash. VAM (6 kg ha^{-1}) and Azotobacter (2 kg ha^{-1}) were mixed in the soil before transplanting. The seedling of cauliflower about 33 days in age were lifted carefully and those found healthy, vigorous and true to type of cauliflower cv. Pusa Shubhra were transplanted on the main field on 16.10.2018 followed by light irrigation. The spacing from plant to plant was kept 50 cm and line to line 50 cm. The observations on vegetative growth characters viz. plant height, diameter of stem, spread of the plant along and across the row, number of fully opened leaves, length and weight of longest leaf and yield as well as quality characters i.e. fresh weight of leaves, curd and whole plant, diameter of curd, yield of curd, dry matter of leaves and curd were recorded. Data on different parameters were

analysed statistically as suggested by Panse and Sukhatme (1995).

RESULTS AND DISCUSSION

Data (Table 1) indicated that different treatments showed significant beneficial effect on vegetative characters over control. The maximum plant height of cauliflower (51.76 cm), and diameter of stem (1.88 cm) were recorded with T_6 (80% RDF + Azotobacter + VAM) followed by T_4 (80% RDF + VAM) which were found statistically at par to each other. The maximum number of fully opened leaves per plant (13.66) was counted with 80% RDF + Azotobacter + VAM followed by 80% RDF + VAM. The maximum spread of plant along the row and across the row (56.4 cm) and (55.5 cm) were measured with 80% RDF + Azotobacter + VAM. The maximum length and width of longest leaf (41.4 cm) and (25.0 cm) were measured with 80% RDF + Azotobacter + VAM treatment and minimum with control. However, significantly minimum plant height (43.1 cm), diameter of stem (1.54 cm), number of leaves (10.94), length of longest leaf (32.0 cm) and width of longest leaf (20.77 cm) were recorded with control. These findings are in the close proximity to the results reported by Kumar *et al.* (2013) and Rawat *et al.* (2018). The higher values of these growth parameters with 80% RDF + Azotobacter + VAM may be attributed to increased availability of nutrients in soil (Pusham *et al.* 2019).

Table 1: Effect of different treatments on vegetative growth of cauliflower

Treatments	Plant height (cm)	Diameter of stem (cm)	Spread of plant along the row (cm)	Spread of plant across the row (cm)	Number of fully opened leaves per plant	Length of longest leaf (cm)	Width of longest leaf (cm)
T_0	43.1	1.54	47.4	50.5	10.94	32.0	20.7
T_1	49.5	1.76	55.2	54.2	12.97	38.2	23.3
T_2	46.3	1.57	55.3	53.9	12.11	35.8	21.6
T_3	50.3	1.85	55.6	54.7	13.07	40.3	24.2
T_4	50.8	1.83	54.7	53.8	13.10	40.1	24.5
T_5	49.3	1.77	53.6	53.2	12.66	39.5	23.5
T_6	51.7	1.88	56.4	55.5	13.66	41.4	25.0
T_7	47.7	1.79	48.3	51.5	12.11	39.4	23.5
CD (P=0.05)	4.19	0.17	NS	NS	1.63	3.94	2.07

T_0 (Control), T_1 (100% RDF), T_2 (80% RDF + Azotobacter), T_3 (50% RDF + Azotobacter), T_4 (80% RDF + VAM), T_5 (50% RDF + VAM), T_6 (80% RDF + Azotobacter + VAM) and T_7 (50% RDF + Azotobacter + VAM)

Data (Table2, Fig.1) revealed that all the treatments had significant beneficial effect on fresh weight of trimmed curd, fresh weight of fully opened leaves, fresh weight of whole plant, and diameter of trimmed curd north to south and east to west and yield of curds as compared to control. The non significant response was found in the maximum dry matter content in trimmed curd (5.7%) and leaves (7.7%) with T₆ (80%RDF + Azotobacter + VAM) and minimum (5.0%) and (7.2%) in control (T₀). Although, significantly maximum fresh weight of trimmed curd (0.97 kg) was observed from T₆ (80%RDF + Azotobacter + VAM) followed by T₄. The maximum fresh weight of fully opened leaves (1.07 kg), fresh weight of whole plant (2.04 kg), diameter of curd north to south (14.16 cm) and East to West (13.97 cm) and total yield of curd (370.80 q ha⁻¹) were recorded with T₆ treatment (80%RDF + Azotobacter + VAM) followed by T₄ (80% RDF

+ VAM), T₃ and T₅. The increase in curd yield with 80 % RDF +Azotobacter + VAM was 57.9 % over control. However The significantly minimum fresh weight of trimmed curd (0.72 kg), fresh weight of fully opened leaves (0.75 kg), fresh weight of whole plant (1.47 kg), diameter of curd North to South (11.31 cm) and East to West (10.69 cm) and yield of curds (234.80 q ha⁻¹) were observed in control. It may be due to balanced application of NPK and bio-fertilizers which makes the availability of almost all the major nutrients in available form and improve the physico-chemical properties of soil. These findings are in consonance with the results of Pandey *et al.* (2007), Pawar *et. al* (2017) and Kumar *et.al* (2017). Combined application of Azotobacter + VAM along with fertilizers proved superior than these Azotobacter or VAM alone in respect of yield attributes and yield of cauliflower.

Table 2: Effect of different treatments on curd yield and quality of cauliflower

Treatments	Fresh weight of trimmed curd (kg)	Fresh weight of fully opened leaves (kg)	Fresh weight of whole plant (kg)	Diameter of curd (cm) North to South	Diameter of curd (cm) East to West	Yield of curd (q ha ⁻¹)	Dry matter content in trimmed curd (%)	Dry matter content in leaves (%)
T ₀	0.72	0.75	1.47	11.3	10.6	234.80	5.04	7.27
T ₁	0.79	0.87	1.66	12.8	12.7	297.47	5.09	7.50
T ₂	0.82	0.77	1.59	11.4	11.7	310.40	5.09	7.37
T ₃	0.84	0.88	1.72	13.0	12.7	317.47	5.66	7.73
T ₄	0.92	0.94	1.86	13.6	13.3	348.13	5.56	7.50
T ₅	0.77	0.79	1.56	12.8	12.9	288.67	5.56	7.44
T ₆	0.97	1.07	2.04	14.1	13.9	370.80	5.77	7.77
T ₇	0.79	0.85	1.64	12.5	12.0	299.73	5.59	7.43
CD (P=0.05)	0.14	0.16	0.18	1.34	1.57	56.57	NS	NS

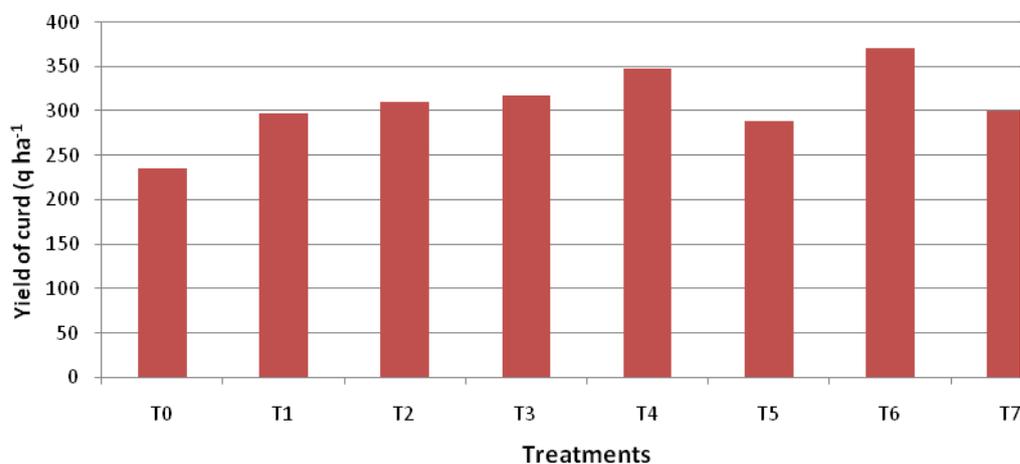


Fig. 1 Effect of different treatments on curd yield of cauliflower

The findings of the present investigation indicated that the combined use of 80% RDF + Azotobacter + VAM produced the maximum

curd yield under agro climatic conditions of Agra region.

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