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EFFECT OF BIO-FERTILIZERS ON YIELD AND QUALITY PARAMETERS OF CAULIFLOWER (*Brassica oleracea* L. var. botrytis) CV. PUSA SNOWBALL K-1

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ABSTRACT : The present study examined the effect of bio-fertilizers on growth of cauliflower (*Brassica oleracea* L. var. *botrytis*) cv. Pusa Snowball K-1. The study was conducted during Rabi 2015-2016 at Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh. The treatment combination of bio-fertilizers was studied with different doses as T_1 (Control), T_2 (FYM, 20 t/ha.), T_2 (Vermicompost, 5 t/ha.), T_4 (*Azotobacter*, 2 kg/ha.), T_5 (PSB, 2 kg/ha.), T_6 (Neem Cake, 10 t/ha.), T_7 (FYM + Vermicompost, 5 t/ha.), T_8 (FYM + *Azotobacter*), T_9 (FYM + PSB), T_{10} (FYM + Neem Cake), T_{11} (FYM + Vermicompost + *Azotobacter*) and T_{12} (FYM + Vermicompost +*Azotobacter* + PSB). Cauliflower growth including yield and quality parameters i.e. curd weight (g), curd diameter (cm), length of stalk (cm), yield per plot (kg) , yield (q/ha) ascorbic acid and acidity respectively. Significant differences were observed for all the above mentioned parameters across the biofertilizer doses in cauliflower under Lucknow conditions.

Keywords : *Bio-fertilizers, cauliflower, vermicompost, Azotobacter, Pusa Snowball K-1*

Cauliflower (*Brassica oleracea* L. var. *botrytis*) is an important member of Cruciferae family and has probably been rightly described as an aristocrat of Cole group. The name cauliflower consists of two Latin words namely 'caulis' means cabbage and 'floris' means flower. It is grown throughout the country for its tender curds which are used as vegetable, soup and for pickling. It is the only vegetable crop which is next to potato. India is the largest producer of cauliflower in the world. In India, area under cauliflower is 434 thousand hectares with production potential of 8573 thousand metric tones and productivity 19.8 million tones/ha (NHB, 2013-14). This data shows that cauliflower productivity is more in India than the world. Important cauliflower growing states in India are Bihar, Uttar Pradesh, Orissa, West Bengal, Assam, Haryana and Maharashtra. It is also commonly grown in Northern Himalayas and Nilgiri Hills in South India.

Integrated Nutrient Management (INM) is the maintenance of soil fertility and plant nutrient supply to an optimum level for sustaining the desired crop productivity. The appropriate combination of inorganic fertilizers, organic manures and bio-fertilizers varies according to the system of land use, ecological, social and economic conditions. The integrated plant nutrient supply and management system aims at sustaining productivity with minimum deleterious effect on soil health and environment. The system enhances nutrient use efficiency, maintains soil health, enhances yield and reduces cost of cultivation. Integrated nutrient management is more important and relevant in the hills where inorganic fertilizer consumption is much less than in the plains. Integrated nutrient management is a balanced use of inorganic fertilizers, organic manures, crop residues and bio-fertilizers in combination to maintain the desired crop production along with maintenance of soil health. The integrated nutrient management paves the way to overcome these problems, which involves conjunctive use of chemical fertilizers and organic manures to sustain crop production as well as maintenance of soil health (Nanjappa *et al.,* 6).

Systematic approach to nutrient management by tapping all possible sources of organic and inorganic in a judicious manner to maintain soil fertility and crop productivity is the essence of integrated nutrient management (INM). In addition, utilization of bio-fertilizers, which have ability to enrich the soil with beneficial microorganisms as well as to mobilize the nutritionally important elements from non-usable to usable forms through biological processes resulting in enhanced production of fruits and vegetables offer an alternative (Purkayastha *et al.,* 8). The use of bio-fertilizers in combination with organic manures offers a great opportunity to increase the production as well as quality of cauliflower. Among the Farm Yard Manure (FYM), Vermicompost, Azotobacter, Phosphorus Solubilizing Bacteriya (PSB), Neem cake also helps in plant growth and increases the yield of

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crops by improving root development, mineral uptake etc. The positive role of these bio-fertilizers has been recorded in many vegetables and spice crops by different scientists. To maintain long term soil health and productivity there is a need for integrated nutrient management through manures and bio-fertilizers apart from costly chemical fertilizers for better yield of the crop. The use of compost and vermicompost has also been observed to improve plant growth and quality. Numerous studies on vermicompost and compost from various sources have been found to promote root formation, increase fruit setting and yield (Arancon *et al.,* 2) and also increase plant dry mass (Subler *et al.,* 10). It has also been reported that the increase in yield, chlorophyll production and fruit quality of tomatoes was due to improvement of uptake of N, P and K from vermicompost (Tejada *et al.,* 11). In addition, vermicompost and manure were reported to affect the chemical composition and quality of the marketable produce (Lazcano *et al.,* 4).

MATERIALS AND METHODS

The present experiment the aim of work was to study the impact of bio-fertilizers on vegetative growth of cauliflower cv. Pusa Snowall K-1 was carried out during November 2015 to January 2016. The experiment was carried out at the Horticulture Research Farm, Babasaheb Bhimrao Ambedkar University (A Central University) Vidhya Vihar, Raebareli Road, Lucknow. The experiment was laid out in Randomized Block Design (RBD) and replicated in thrice. The treatment combination are T_1 (Control), T_2 (FYM, 20 t/ha.), T_2 (Vermicompost, 5 t/ha.), T_4 (*Azotobacter*, 2 kg/ha.), T_5 (PSB, 2 kg/ha.), T_6 (Neem Cake, 10 t/ha.), T_7 (FYM + Vermicompost, 5 t/ha.), T_8 (FYM + *Azotobacter*), T_9 (FYM + PSB), T_{10} (FYM + Neem Cake), T_{11} (FYM + Vermicompost + *Azotobacter*) and T_{12} (FYM + Vermicompost + *Azotobacter* + PSB). The observation was made on the following parameters curd weight (g), curd diameter (cm), length of stalk (cm), yield per plot (kg) and yield (q/ha), respectively. Ascorbic acid content was determined by diluting the known volume of juice with 3% meta-phosphoric acid and titrating with 2, 6-dichlorophnenol-indo-phenol solution with (AOAC, 1). All the parameters were collected from five randomly selected plants of each treatment and statistical analysis of the data obtained in different set of experiments was calculated following the standard procedure as stated by (Panse and Sukhatme, 7).

RESULTS AND DISCUSSION

Yield and yield attributing character

The cauliflower yield parameters under investigation such as curd weight (g), curd diameter (cm), length of stalk (cm), yield per plot (kg) and yield (q/ha) respectively were represented in Table 1. The maximum curd weight was recorded (484.16 g) under treatment T_{12} (FYM + Vermicompost + *Azotobacter* + PSB) followed (460.21 g) under treatment T_{11} (FYM + Vermicompost + *Azotobacter*). The minimum in the case was (257.29 g) T_1 [Control (RDF)].The maximum curd diameter was recorded (17.35 cm) under treatment T_{12} (FYM + Vermicompost + *Azotobacter* + PSB) followed (16.9 g) under treatment T_{11} (FYM + Vermicompost + *Azotobacter*). The minimum in the case was (14.17 g) T_1 [Control (RDF)].The maximum length of stalk was recorded (14.71 cm) under treatment T_{12} (FYM + Vermicompost + *Azotobacter* + PSB) followed by (13.86 cm) under treatment T_{11} (FYM + Vermicompost + *Azotobacter*). The minimum in the case was (9.92 cm) T_1 [Control (RDF)].Maximum yield per plot (6.75 kg) was recorded under treatment T_{12} (FYM + Vermicompost + *Azotobacter* + PSB) followed by (6.63 kg) under treatment was T_{11} (FYM + Vermicompost + *Azotobacter*). The minimum yield per plot (4.12 kg) was observed under treatment T_1 [Control (RDF)]. Maximum yield quintal per hectare (312.34 q) was recorded under treatment T_{12} (FYM + Vermicompost + *Azotobacter* + PSB) followed by (306.95 q) under treatment was T_{11} (FYM + Vermicompost + *Azotobacter*). The minimum yield per hectare (190.58 q) was observed under treatment T_1 [Control (RDF)].The value obtained in each plot was converted into quintal per hectare. These results corroborate the finding of (Narayanamma et al. 5) application of bio-fertilizers (*Azotobacter, Azospirillum*, PSB and AM) along with inorganic produced significantly higher yield (18.6 t to 22.6 t ha^{-1}) in cauliflower.

Quality parameters

The cauliflower quality parameters under investigation such as vitamin-C and acidity respectively were represented in Table 1. The highest Vitamin–C (56.09 mg/100g) obtained was recorded under treatment T_{11} (FYM + Vermicompost + *Azotobacter*) followed by (56.08 mg/100g) under treatment was T_9 (FYM + PSB). The minimum vitamin-C (55.96) was observed under treatment T_1 [Control (RDF)]. The similar result found (Singh *et al.,* 9) that Farm Yard Manure at high levels (45 t/ ha) increased vitamin-C in cauliflower. Acidity (0.88%) obtained maximum was

Table 1 : Impact of bio fertilizer on yield and quality of cauliflower (*Brassica oleracea* L. Var. *botrytis*).

Treatment Details	Curd weight (g)	Diameter of curd (cm)	Length of stalk (cm)	Yield per plot (kg)	Yield (q/ha)	Vitamin -C	Acidity
T_1 (Control)	257.29	14.17	9.92	4.12	190.58	55.96	0.86
T_2 (FYM, 20 t/ha.)	373.12	14.35	10.12	5.76	266.82	55.99	0.88
T_3 (Vermicompost, 5 t/ha.)	373.54	14.43	10.46	5.98	276.69	56.04	0.77
T_4 (*Azotobacter*, 2 kg/ha.)	374.16	14.69	11.06	5.99	277.16	56.03	0.78
T_5 (PSB, 2 kg/ha.)	382.08	14.72	11.31	6.01	278.08	56.02	0.51
T_6 (Neem Cake, 10 t/ha.)	410.21	14.90	12.01	6.11	283.03	56.04	0.79
T_7 (FYM + Vermicompost, 5 t/ha.)	412.71	16.14	13.62	6.58	299.07	56.04	0.62
T_8 (FYM + *Azotobacter*)	407.12	14.59	13.18	6.18	286.11	56.07	0.82
T_9 (FYM + PSB)	389.37	15.71	12.98	6.23	288.42	56.08	0.68
T_{10} (FYM + Neem Cake)	397.08	16.03	13.52	6.35	294.02	56.01	0.85
T_{11} (FYM + Vermicompost +*Azotobacter*)	460.21	16.90	13.85	6.63	306.94	56.09	0.79
T_{12} (FYM + Vermicompost +*Azotobacter* + PSB)	484.16	17.35	14.70	6.75	312.34	56.05	0.68
CD (P = 0.05)	103.48	1.13	0.26	0.26	13.70	0.05	0.19

recorded under treatment T_2 (FYM t/ha) followed by (0.86%) under treatment was T_1 [Control (RDF)]. The minimum acidity (0.51%) was observed under treatment T_5 (PSB 2 kg/ha). (Kanwar *et al.,* 3) reported significant increase in acidity of cauliflower with application of 50% NPK + organic manure.

CONCLUSION

Our experiment was combination to the effect of various biofertilizer on the trial plant cauliflower in the tropic region of Lucknow. Result show that the combined use of (FYM + Vermicompost + *Azotobacter* + PSB] increase the yield and quality attributes significantly increases total yield 312.34 q/ha. These result are own experiment and unique and can be very useful in research from trial to field, so it will be of interest to implement these result to the field to harvest good yield of cauliflower.

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