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Research Note

COMBINED EFFECT OF ORGANIC MANURES AND BIO-FERTILIZERS ON GROWTH AND YIELD OF BROCCOLI UNDER GARHWAL HIMALAYAN REGION

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ABSTRACT : A field trial was conducted at Horticulture Research Centre, Chauras Campus H.N.B University, Garhwal, Uttarakhand, during October 2014 to February 2015 to study the growth and yield potential of broccoli influenced by combined effect of organic manures and bio-fertilizer under Garhwal Himalayan region. The experiment was laid out in randomized block design with three replications. The experiment consist of two organic manures and biofertlizer with their combinations *viz.,* Vermicompost (T_1), Poultry manures (T_2), *Azotobacter* (T_3), Vermicompost + Poultry manure (T_4), Vermicompost + *Azotobacter* (T_5), Poultry manure + *Azotobacter* (T_6), Vermicompost + Poultry manure + *Azotobacter* (T_7), Control (T_8). All the organic manures were applied at the field before one month of transplanting but *Azotobacter* were applied as root treatment before transplanting. Results were found to be significant in all the growth and yield parameters of broccoli. T_7 (Vermicompost + Poultry manure + *Azotobacter*) showed maximum plant height (57.13 cm), leaf length (48.17 cm), plant spread (56.16 cm^2), days to curd initiation (65.89), days to 50% curd initiation (75.23) and days taken to 50% curd maturity (88.51), where as maximum number of leaves (22.58), curd weight (315.69 g) and yield/ha (120.12 q) recorded in T_6 (Poultry manure + *Azotobacter*), while minimum under T_8 (Control). The results showed that the combined use of organic and bio-fertilizer significantly effective on growth and yield characters.

Keywords : *Broccoli, organic manure, vermicompost, Azotobacter, bio-fertilizer.*

Broccoli (*Brassica oleracea* var. *italica* L.) is an important cole crops belonging to the family Brassicaceae. There are three classes of broccoli viz., green, white and purple among them green type broccoli is the most popular (Shoemaker, 8). It is an important vegetable and also high value crop in India. The commercial cultivation of broccoli has increased day by day due to increasing the demand. Broccoli contains high amount of vitamin A, ascorbic acid and appreciable amounts of thiamin, riboflavin, niacin, calcium and iron (Thompson and Kelly, 9; Lincolin, 6). Successful cultivation of broccoli depends on various factors *viz.,* temperature, light, soil condition and fertilizer management is one of the most important factor, which assured good crop production. Broccoli can be grown on a wide range of soil types, ranging from light sand to heavy loam or even clay that are well supplied organic matter (Katyal, 4). Organic manure and biofertilizers offer an alternative source of chemical fertilizers and are being increasingly used in vegetable production. Bio-fertilizers are important beneficial microorganisms, which have ability to mobilize the nutritionally important elements from non-unstable to stable form through biological processes and are known to increase yield in several vegetables (Kumar *et al.,* 5). Bio-fertilizers are cost effective and renewable source of plant nutrient. Organic manure is a source of food for the innumerable number of micro-organisms and creature like earthworms who break down these micronutrients, which are easily absorbed by the plants. Organic manures play major role in plant growth as sources of all necessary macro and micro nutrients in available form during mineralization and improving the physical and chemical properties of soil (Chaterjee *et al.,* 2). Organic such as vermicompost and poultry manure improve the soil structure, aeration, slow release nutrient which support root development leading to higher growth and yield of broccoli (Abou *et al.,* 1). Considering the above circumstances, this work was undertaken to investigate the performances of different organic manures and bio-fertilizers on growth and yield of broccoli.

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The experiment was carried out at Horticultural Research Centre, Chauras Campus, H.N.B Garhwal

University, Srinagar (Garhwal), Uttarakhand during rabi season, 2014-2015. Srinagar (Garhwal) is located in the Alaknanda valley (78° 47' 30" E longitude and 30° 13' 0" N latitude and at an elevation of 540 m above MSL), a semi-arid, subtropical climate with dry summer and rigorous winters with occasional dense fog in the morning hours from mid December to mid February. The experiment consist of two organic manures and one bio-fertilizer *viz.,* Vermicompost, Poultry manure and *Azotobacter* and their combinations *viz.,* Vermicompost + Poultry manure, Vermicompost + *Azotobacter*, Poultry manure + *Azotobacter*, Vermicompost + Poultry manure + *Azotobacter* and Control. The experiment was laid out in Randomized Block Design with three replications. The entire experimental field was divided into three blocks of equal size and each block possessed 9 plots. Five weeks old seedlings of broccoli cv. Palam Samridhi were inoculated in thick slurry of *Azotobacter* and full doses of vermicompost and poultry manures were applied at the last ploughing. The seed of broccoli cv. Palam Samridhi was collected from Solan, Himachal Pradesh and nursery was raised on flat beds. The five week old seedling of broccoli cv. Palam Samridhi was transplanted in flat beds during the mid November, 2014-2015. Each plot measured $3.0 \times 3.0\ m^2$ area with 75 cm $\times$ 50 cm spacing. All the intercultural operations and plant protection measures recommended for the successful crop growth were followed and irrigation was given to maintain the proper moisture in the field for better growth and development of the plants. Randomly five plants from each plot were selected to record the data on the following observations *viz.,* plant height (cm), number of leaves/ plant, leaf length (cm), plant spread (cm^3), days to curd initiation, days to 50% curd initiation, days to 50% curd maturity, curd weight (g) and yield (q/ha). The obtained data were analyzed using analysis of variance (ANOVA) under RBD following the procedure as stated by Panse and Sukhatme (7).

As evident from the Table 1, the maximum plant height (57.13 cm) was recorded with combined application of vermicompost + poultry manure + *Azotobacter* (T_7) followed by (55.89 cm) with application of vermicompost (T_1) whereas, minimum plant height (32.85 cm) was recorded under the treatment control (T_8). Similar results were also found by Kumar *et al.* (5) in cowpea. Katiyar *et al.* (3) also found favourable results by the application of inorganic fertilizers. The maximum leaf length (48.19 cm) was recorded with application of vermicompost + poultry manure + *Azotobacter* (T_7) followed by 46.79 cm with application of poultry manure + *Azotobacter* (T_6) while, minimum leaf length (28.62 cm) was recorded under the treatment control (T_8) .With respect to leaf number, the highest number of leaves (22.58) was observed with application of poultry manure + *Azotobacter* (T_6) followed by 21.96 with the application of poultry manure (T_2). The lowest number of leaves (12.19) was observed in control (T8). The maximum plant spread (56.16 cm^2) was found when application of vermicompost + poultry manure + *Azotobacter* (T_7) followed by 55.09 cm^2 with application of vermicompost (T_1) while minimum plant spread (31.25 cm^2) was found in control (T_8). The minimum days (65.81) taken for curd initiation was recorded in case of application of vermicompost + poultry manure + *Azotobacter* (T_7) which was at par (67.80) with application of vermicompost + poultry manure (T_4). The maximum days (81.23) taken to curd initiation was recorded in case of control (T_8). With respect to days taken for 50% curd initiation the minimum number of days (75.23) was recorded with application of vermicompost + poultry manure + *Azotobacter* (T_7) while maximum (90.63) days taken for 50% curd initiation was recorded with application of control (T_8). The minimum number of days (88.51) taken for 50% of curd maturity was recorded in case of application of vermicompost + poultry manure + *Azotobacter* (T_7) whereas maximum number of days (104.56) taken for 50% of curd maturity was recorded in control (T_8). The maximum curd weight (315.69 g) was recorded with application of poultry manure + *Azotobacter* (T_6) which was at par (286.23 g) with application of vermicompost + poultry manure + *Azotobacter* (T_7) while the minimum curd weight (99.39 g) was recorded in control (T_8). As observed in case of yield, the maximum (120.28 q/ha) yield of curd/ha was recorded in case of application of poultry manure + *Azotobacter* (T_6) followed by 86.96 q/ha with application of vermicompost + poultry manure (T_4). The minimum (32.15 q/ha) yield of curd/ha was recorded in control (T_8).

Conclusion

From the above study, it can be concluded that the application of combined use of organic manures and bio-fertilizers can have profound influence on the growth and yield of broccoli. A judicious combination strategy of using organic manures and bio-fertilizers may be helpful in increasing the vegetable productivity as well as quality.

Table 1 : Growth and yield potential of broccoli as influenced by combined effect of organic manures and bio-fertilizers.

Treatment	Plant height (cm)	Leaf length (cm)	Number of leaves	Plant spread (cm^2)	Days to curd initiation	Days to 50% curd initiation	Days to 50% curd maturity	Curd weight (g)	Yield (q/ha)
Vermicompost	55.89	44.59	21.09	55.09	72.18	85.78	97.74	235.89	84.51
Poultry Manure	54.23	42.63	21.96	54.12	70.15	82.69	98.85	237.30	82.96
Azotobacter	52.12	45.19	21.02	53.69	69.32	81.23	94.69	217.18	84.21
Vermicompost + Poultry manure	55.19	43.17	20.69	52.12	67.80	77.01	96.12	286.13	86.96
Vermicompost + *Azotobacter*	51.96	41.96	20.82	50.69	68.12	79.32	99.86	241.32	83.12
Poultry manure + *Azotobacter*	53.39	46.79	22.58	51.39	67.89	78.69	94.64	315.69	120.28
Vermicompost + Poultry manure + *Azotobacter*	57.13	48.19	19.69	56.16	65.81	75.23	88.51	259.23	85.89
Control	32.85	28.62	12.19	31.25	81.23	90.63	104.56	99.39	32.15
C.D (P=0.05)	3.12	3.30	1.04	4.19	2.51	2.15	1.60	32.36	11.96

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