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Study the effect of organic and inorganic source on nutrient and their combined effect on growth and yield of broccoli cv. Princess (F1-Hybrid)

Jay Shankar Dhurwey, Mukesh Meena, Mahendra Jadia and Krapal Singh Verma

Abstract

A field experiment was conducted during winters 2014-15 to study the effect of inorganic and organic fertilizers on growth and yield of broccoli cv. Princess (F1-Hybrid). The maximum curd compactness was noted in the treatment combinations of T2, T6, T10, and T14. The treatment combinations T4 (150:80:60kg/ha + Poultry manure 5t/ha) (M4xF2) were observed significantly maximum curd length (18.36cm), curd diameter (18.59cm), but these are non-significant gross plant weight (1262.00g), marketable curd weight (793.60g), net curd weight (578.00 g), curd yield per plot (18.32kg) and curd yield per hectare (308.06q/ha). The plant height 19.03, 35.10 and 45.89 cm were recorded significantly increased in the treatment F2 (150:80:60kg/ha) at 30, 45 and 60 DAT respectively. The 8.06, 13.94 and 16.43 cm leaves per plant were noted in the treatment F2 (150:80:60kg/ha) at 30, 45 and 60 DAT respectively. The maximum leaf length (40.83 cm), leaf width (16.80 cm), stalk length (23.39 cm) and stalk diameter (41.20 cm) were exhibited in the treatment F2 (150:80:60kg/ha) at 30, 45 and 60 DAT respectively. Amongst the different treatments of inorganic curd, F2 (150:80:60kg/ha) were found significantly maximum curd length (17.83 cm), curd diameter (18.00 cm), gross plant weight (1116.86 g), marketable curd weight (799.33g), net curd weight (634.33 g), curd yield per plot (18.93g) and curd yield per hectare (308.06 q/ha). Maximum net return of Rs 185286/ha with cost benefit ratio of 1:4.00 was recorded in treatment combination T4 (150:80:60kg/ha + Poultry manure 5t/ha) (M4xF2).

Keywords: Broccoli, Vermicompost, Curd, Fertilizers and Yield

Introduction

Broccoli (*Brassica oleracea* L. var. *Italica* Plenck) is an important cole crop vegetable. The word *broccoli* comes from the Latin word *brachium* and Italian word *brocco* meaning "arm", or "branch". It is a new crop in India which is nutritious among cole crops being rich in vitamins and minerals. It is also a rich source of sulphoraphane compound which is associated with reducing the risk of cancer (Kalia, 1995). Broccoli also contains the compound glucoraphanin, leading to an anticancer compound. It provides substantial amounts of nutrients such as pro-vitamins A (567IU), C (81.2mg) and E, magnesium, selenium which are important for human health (Munger, 1999).

It is a high value exotic vegetable and cultivated for its tender flowering head and the secondary heads *i. e.* spears. It was a rare cole crop in India but now it is gaining popularity in metropolitan cities, reputed hotels and restaurants (Maurya, 2008) [1]. Generally it can be classified into three distinct group viz., white purple and green, out of which green type is highly nutritious (Yoldas *et al.*, 2008) [2]. Broccoli is rich source of vitamins, minerals and essential amino acids, also contains the compound glucoraphanin which have anticancerous properties (Swarup, 2012) [3]. To increase the yield, plenty of chemical fertilizers along with a small quantity of organic once are being used by different workers which ultimately affects the health of soil as well as human (Meena *et al.*, 2017) [4].

Due to excess use of chemical fertilizers a decline pattern is observed in soil fertility, therefore integrated nutrient management is an important demand of present era (Attigah *et al.*, 2013) [5]. The main aim of integrated nutrient management is to cultivate a land in such a way that the soil should remain sustainable with maximum quality production of crop (Mishra *et al.*, 2014) [6]. manures provide a source of all necessary macro and micro-nutrients in available forms, thereby improving the physical and biological properties of the soil (Abou El-Magd *et al.*, 2006) [7]. Considering the above factors, the present experiment was undertaken to determine the best inorganic and organic fertilizer combination for maximum yield and net profit in broccoli.

Materials and Methods

The present experiment was conducted near Hi-Tech Horticulture area, Department of Horticulture, College of Agriculture, Indore (M.P.) during the rabi season 2014-2015. Indore is situated in the malwa plateau in western part of M.P. at 22° 43' N latitude and 75° 66' E longitudes with an altitude of 555.7m above mean sea level. The climate of this region is semi-arid and sub tropical having mild winter and summer with uncertain winter rains. The soil of the experimental field was medium black clay (vertisols) with uniform topography. The treatments included T1 (F2 M1) N.P.K (150:80:60kg/ha.)+FYM 20t/ha. T2 (F2 M2) N.P.K (150:80:60kg/ha.)+Neem cake 5t/ha. T3 (F2 M3) N.P.K (150:80:60kg/ha.)+Vermicompost 5t/ha. T4 (F2 M4) N.P.K (150:80:60kg/ha.)+Poultry manure 5t/ha. T5 (F2 M5) N.P.K (150:80:60kg/ha.)+FYM 10t/ha. T6 (F2 M6) N.P.K (150:80:60kg/ha.)+Neem cake 2.5t/ha. T7 (F2 M7) N.P.K (150:80:60kg/ha.)+Vermicompost 2.5t/ha. T8 (F2 M8) N.P.K (150:80:60kg/ha.)+Poultry manure 2.5t/ha. T9 (F1 M1) N.P.K (75:40:30kg/ha.)+FYM 20t/ha. T10 (F1 M2) N.P.K (75:40:30kg/ha.)+Neem cake 5t/ha. T11 (F1 M3) N.P.K (75:40:30kg/ha.)+Vermicompost 5t/ha. T12 (F1 M4) N.P.K (75:40:30kg/ha.)+Poultry manure 5t/ha. T13 (F1 M5) N.P.K (75:40:30kg/ha.)+FYM 10t/h. T14 (F1 M6) N.P.K (75:40:30kg/ha.)+Neem cake 2.5t/ha. T15 (F1 M7) N.P.K (75:40:30kg/ha.)+Vermicompost 2.5t/ha. T16 (F1 M8) N.P.K (75:40:30kg/ha.)+Poultry manure 2.5t/ha. The crop was raised with a spacing of 45 cm × 45 cm and plot size of 2.70m X 2.25m. Standard cultural practices recommended for Broccoli was followed uniformly for all the experimental plots. After selection of the proper site, the soil was dug with pickaxe and the soil was pulverized and made into fine tilth. All the gross root, bricks and stones were collected and thrown out. The bed was prepared and finally level. One basket full of leaf mould and FYM was added into bed. After the soil of bed has reached to fine tilth, seeds of broccoli were sown 20 September 2014 in lines at the depth of 2 cm. Before sowing seeds were treated with Thiram @ 2g/kg of seeds. After sowing the seeds were covered with a fine mixture of soil and

FYM. Immediately after watered with the help of water can. The seeds germinated in about 7-10 days after sowing. In the beginning, light watering was given daily with the help of water can but slowly the frequency of watering was reduced. 40 days old, healthy, stocky and uniform seedlings of broccoli were transplanted on 31 October 2014 in the experimental field.

Results and Discussion

The experimental findings obtained during the course of investigation. The data were statistically analyzed by using the analysis of variance technique in order to find out the significant difference among the various treatments. The means and analysis of variance table for different characters are presented.

1.1 Plant height (cm) at 30, 45 and 60 DAT

The mean plant height of different treatments of organic, inorganic fertilizer and their interaction at 30, 45 and 60 DAT are given in Table 1, 2 & 3. The plant height increased significantly with the different treatment of organic and inorganic fertilizer at 30, 45 and 60 days of crop growth stage. It is observed from the data that at 30 days after transplanting, the plant height ranged from 15.63 to 21.43 cm. Amongst different treatment of inorganic fertilizer, significantly maximum plant height recorded (19.25 cm) was in the treatment F2 (150:80:60kg/ha) followed by F1 (75:40:30kg/ha) (16.61cm). In organic manure, significantly maximum plant height (19.46 cm) was noted under the treatment M4 (PM 5t/ha) followed by M3 (VC 5t/ha) (18.80 cm), M1 (FYM 20t/ha) (18.46 cm), M8 (PM 2.5t/ha) (17.97 cm). The treatment M4 was found at par with, however the minimum plant height (16.67 cm) was observed under the M6 (NC 2.5t/ha). The plant height of broccoli was influenced significantly with different treatment combination of inorganic and organic manures. The maximum plant height (21.43 cm) was recorded in the treatment T4 (M4x F2) followed by T3 (M3x F2) (20.41 cm), while it was minimum plant height (15.63cm) was recorded in T14 (M6x F1).

Table 1: Effect of different inorganic and organic manures level on plant height (cm) at 30 DAT.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	20.3	16.89	18.46
2	M2 (NC 5t/ha)	19.30	16.56	17.93
3	M3 (VC 5t/ha)	20.41	17.19	18.18
4	M4 (PM 5t/ha)	21.43	17.50	19.46
5	M5 (FYM 10t/ha)	17.80	15.79	16.79
6	M6 (NC 2.5 t/ha)	17.72	15.63	16.67
7	M7 (VC 2.5 t/ha)	18.20	16.50	17.35
8	M8 (PM 2.5 t/ha)	19.11	16.83	17.97
	Mean	19.25	16.61	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.12	0.24	0.34
	CD at 0.5%	0.35	0.71	1.01

Inorganic fertilizer

F1 (75:40:30 kg/ha) NPK

F2 (150:80:60 kg/ha) NPK

Similar trend was observed at 45 and 60 days after transplanting in plant height. The plant height varied from 27.85 cm to 37.93 cm. Amongst different treatment of inorganic fertilizer, significantly maximum (34.92 cm) plant height was recorded in the treatment F2 (150:80:60kg/ha) followed by F1 (75:40:30kg/ha) (30.57 cm). In organic

manure, significantly maximum plant height was recorded in M4 (PM 5t/ha) (35.82 cm), followed by M3 (VC 5t/ha) (33.71cm), while the minimum plant height (30.65 cm) was observed under treatment M6 (NC 2.5 t/ha). Table 2: Effect of different inorganic and organic manures level on plant height (cm) at 45 DAT.

Table 2: Effect of different inorganic and organic manures level on plant height (cm) at 45 DAT.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	34.83	31.84	33.33
2	M2 (NC 5t/ha)	34.06	31.38	32.72
3	M3 (VC 5t/ha)	35.17	32.26	33.71
4	M4 (PM 5t/ha)	37.93	33.70	35.82
5	M5 (FYM 10t/ha)	34.23	29.17	31.70
6	M6 (NC 2.5 t/ha)	33.46	27.85	30.65
7	M7 (VC 2.5 t/ha)	33.90	28.50	31.20
8	M8 (PM 2.5 t/ha)	35.78	29.91	32.85
	Mean	34.92	30.57	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.21	0.42	0.60
	CD at 0.5%	0.62	1.25	1.76

Inorganic fertilizer**F1** (75:40:30 kg/ha) NPK**F2** (150:80:60 kg/ha) NPK

The effect of interaction of organic and inorganic fertilizer on the plant height varied significantly. The maximum plant height (37.93 cm) was observed in the treatment T4 (M4xF2) followed by T3 (M3xF2) (35.17 cm), T1 (M1xF2) (34.83 cm), T8 (M8xF2) (35.78 cm), however the minimum plant height (27.85 cm) was noted in T13 (M5xF1). At 60 days

after transplanting, the plant height ranged from 37.90 to 47.59 cm. Amongst different treatments of inorganic fertilizer, significantly maximum plant height (45.89 cm) was recorded in the treatment F2 (150:80:60kg/ha) followed by F1 (75:40:30kg/ha) (41.30 cm).

Table 3: Effect of different inorganic and organic manures level on plant height (cm) at 60 DAT.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	46.96	42.93	44.94
2	M2 (NC 5t/ha)	46.67	42.80	44.73
3	M3 (VC 5t/ha)	47.06	83.30	45.18
4	M4 (PM 5t/ha)	47.59	44.03	45.81
5	M5 (FYM 10t/ha)	44.43	04.63	42.53
6	M6 (NC 2.5 t/ha)	44.00	37.90	40.95
7	M7 (VC 2.5 t/ha)	44.90	38.96	41.93
8	M8 (PM 2.5 t/ha)	45.49	39.84	42.66
	Mean	45.89	41.30	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.20	0.10	0.28
	CD at 0.5%	0.29	0.59	0.83

The different treatment of organic manure the highest plant height 45.81 cm was exhibited in the treatment M4 (PM 5t/ha), followed by M3(VC 5t/ha) (45.18 cm), M1 (FYM 20t/ha) (44.94 cm), while the minimum plant height (40.95 cm) was observed under the M6 (NC 2.5 t/ha). The effect of interaction of organic and inorganic fertilizer on the plant height of broccoli varied significantly with the different treatments combination of inorganic and organic manures. The maximum (47.59 cm) plant height was recorded in the treatment T4 (M4xF2) followed by T3 (M3xF2) (47.06 cm), T1 (M1xF2) (46.96 cm), and which were at par with each other, however T14 (M6xF1) recorded the minimum plant height (37.90cm).

1.2 Number of leaves per plant at 30, 45 and 60 DAT

The number of leaves per plant of different treatments of

inorganic, organic manure and their interaction is given in the Table 4, 5, 6 and At 30 DAT, the numbers of leaves per plant of different treatment of inorganic fertilizer significantly (8.06) maximum numbers of leaves recorded in the treatment F2 (150:80:60kg/ha) while minimum was recorded in F1 (75:40:30kg/ha) (7.19). With regards to organic manure, treatment recorded significantly M4 (PM 5t/ha) maximum numbers of leaves of (8.50) followed, while the minimum number of leaves (7.08) was noted in M6 (NC 2.5 t/ha). The effect of interaction of organic and inorganic fertilizer on the numbers of leaves varied significantly the maximum (9.60) numbers of leaves was recorded in the treatment T4 (M4xF2) followed however the minimum numbers of leaves (6.73) was noted in T14 (M6xF1).

Table 4: Effect of different inorganic and organic manures level on number of leaves per plant at 30 DAT.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	8.16	7.49	7.83
2	M2 (NC 5t/ha)	7.90	7.10	7.50
3	M3 (VC 5t/ha)	8.17	7.37	7.77
4	M4 (PM 5t/ha)	9.60	7.40	8.50
5	M5 (FYM 10t/ha)	7.69	6.90	7.29
6	M6 (NC 2.5 t/ha)	7.43	6.73	7.08
7	M7 (VC 2.5 t/ha)	7.46	7.17	7.31
8	M8 (PM 2.5 t/ha)	8.06	7.42	7.74
	Mean	8.06	7.19	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.07	0.14	0.42
	CD at 0.5%	0.21	0.20	0.60

In case of 45 DAT different treatment of inorganic fertilizer, significantly maximum numbers of leaves per plant (13.94) was noted in the treatment F2 (150:80:60kg/ha) followed by F1 (75:40:30kg/ha) (12.56). With regards to different treatment of organic manure, the highest numbers of leaves (14.51) was recorded in the treatment M4 (PM 5t/ha), while the minimum number of leaves (12.51) was noted in M6 (NC

2.5 t/ha). The combined effect of both organic and inorganic fertilizer on the numbers of leaves were recorded significantly maximum (15.77) numbers of leaves was recorded in the treatment T4 (M4x F2), followed all treatments. While minimum numbers of leaves (11.93) was noted in T14 (M6x F1).

Table 5: Effect of different inorganic and organic manures level on number of leaves per plant at 45 DAT.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	14.03	12.96	13.49
2	M2 (NC 5t/ha)	13.901	12.73	13.31
3	M3 (VC 5t/ha)	14.16	12.89	13.53
4	M4 (PM 5t/ha)	15.77	13.25	14.51
5	M5 (FYM 10t/ha)	13.16	12.10	12.63
6	M6 (NC 2.5 t/ha)	13.10	11.93	12.51
7	M7 (VC 2.5 t/ha)	13.33	12.13	12.73
8	M8 (PM 2.5 t/ha)	14.06	12.47	13.26
	Mean	13.94	12.56	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.06	0.13	0.19
	CD at 0.5%	0.19	0.39	0.55

At 60 DAT the effect of different inorganic fertilizer exerted significant impact on numbers of leaves per plant at every stage of observation. Among the treatments significantly maximum numbers of leaves per plant (16.46) was noted in the treatment F2 (150:80:60kg/ha) followed by F1

(75:40:30kg/ha) (14.73). The various treatments under organic manure was recorded numbers of leaves per plant the significantly highest numbers of leaves (17.10) was recorded in the treatment M4 (PM 5t/ha), while the minimum number of leaves (14.53) was noted in M6 (NC 2.5 t/ha).

Table 6: Effect of different inorganic and organic manures level on number of leaves per plant at 60 DAT.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	16.70	15.10	15.90
2	M2 (NC 5t/ha)	16.60	14.96	15.78
3	M3 (VC 5t/ha)	16.77	15.20	15.98
4	M4 (PM 5t/ha)	18.86	15.33	17.10
5	M5 (FYM 10t/ha)	15.53	14.26	14.89
6	M6 (NC 2.5 t/ha)	15.30	13.76	14.53
7	M7 (VC 2.5 t/ha)	15.76	14.43	15.10
8	M8 (PM 2.5 t/ha)	16.20	14.80	15.50
	Mean	16.46	14.73	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.20	0.10	0.28
	CD at 0.5%	0.29	0.59	0.83

The different combination of organic and inorganic fertilizer was also found to have significant impact on treatments In general; the increasing dose of nutrients from both the sources increases the numbers of leaves per plant. Significantly maximum numbers of leaves (18.86) was recorded in the treatment T4 (M4x F2) followed, while the minimum numbers of leaves (13.76) was noted in T14 (M6x F1).

1.3. Length of leaf at marketable stage (cm)

The length of leaf significantly increases due to different treatments under inorganic, organic manures and their interaction. The data were subjected to statistical analysis and then highlighted in Table 7. and Application of inorganic fertilizer significantly affected the length of leaf the maximum length of leaf (40.83 cm) was recorded in the treatment F2

(150:80:60kg/ha) followed by F1 (75:40:30kg/ha) (38.64 cm). In case of organic manure, the significantly maximum length of leaf (40.86 cm) was observed in the treatment M4 (PM 5t/ha), followed by M1 (FYM 20t/ha) (40.53 cm), which were at par with each other, however the minimum length of leaf (38.67) was observed the M6 (NC 2.5 t/ha). Among the different treatments combinations of inorganic and organic

manures, significantly maximum length of leaf was noted in the treatment T4 (M4xF2) (41.73 cm) followed by T1 (M1xF2) (41.23 cm), and T3 (M3xF2) (41.40 cm) and were at par with each other. However the minimum length of leaf (37.04 cm) noted was in T14 (M6xF1).

Table 7: Effect of different inorganic and organic manures level on leaf length (cm) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	41.23	39.89	40.53
2	M2 (NC 5t/ha)	40.93	39.23	40.08
3	M3 (VC 5t/ha)	41.40	39.73	40.44
4	M4 (PM 5t/ha)	41.73	40.00	40.86
5	M5 (FYM 10t/ha)	40.43	37.36	38.90
6	M6 (NC 2.5 t/ha)	40.29	37.04	38.67
7	M7 (VC 2.5 t/ha)	40.30	37.80	39.05
8	M8 (PM 2.5 t/ha)	40.73	38.10	39.41
	Mean	40.83	38.64	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.06	0.12	0.18
	CD at 0.5%	0.18	0.37	0.53

1.4 Leaf width at marketable stage (cm)

The average leaf width of various treatments of inorganic, organic manures and their interaction were recorded treatment wise. The data have be depicted in the Table 8. It is obvious from the table that average leaf width was significant influenced by the different treatments of inorganic and

organic manures. The various treatments in inorganic fertilizer exerted significantly impact on leaf width. Among the treatments significantly maximum leaf width (16.64 cm) was observed in the treatment F2 (150:80:60kg/ha) followed by (15.57 cm) F1 (75:40:30kg/ha).

Table 8: Effect of different inorganic and organic manures level on leaf width (cm) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	16.76	15.67	16.21
2	M2 (NC 5t/ha)	16.60	15.60	16.10
3	M3 (VC 5t/ha)	17.07	15.73	16.40
4	M4 (PM 5t/ha)	18.47	15.93	17.20
5	M5 (FYM 10t/ha)	16.46	15.43	15.65
6	M6 (NC 2.5 t/ha)	16.03	15.10	15.56
7	M7 (VC 2.5 t/ha)	16.49	15.46	15.58
8	M8 (PM 2.5 t/ha)	16.56	15.63	16.10
	Mean	16.64	15.57	
		Inorganic Fertilizer(F)	Organic Manure(M)	Interaction
	SEm±	0.06	0.13	0.19
	CD at 0.5%	0.19	0.39	0.78

Among the different treatments under organic manure, leaf width (17.20 cm) was found significantly maximum in the treatment M4 (PM 5t/ha), while the minimum leaf width (15.56 cm) was noted in M6 (NC 2.5 t/ha). With regards to treatment combinations of inorganic and organic manure, T4 (M4xF2) recorded significantly maximum leaf width (18.47 cm). However the minimum leaf width (15.10 cm) was noted in the T14 (M6xF1).

1.5 Stalk length (cm) at marketable stage

The average stalk length of various treatments under inorganic, organic manures and their interaction was recorded treatment wise. The data have been depicted in the Table 9.

The various treatments under inorganic fertilizer exerted significant impact on stalk length. Among the treatments significantly maximum (23.39 cm) stalk length was observed in the treatment F2 (150:80:60kg/ha) followed by (20.59 cm) F1 (75:40:30kg/ha). In case of organic manure, significantly maximum stalk length (23.81 cm) was reported in the treatment M4 (PM 5t/ha). While the minimum stalk length (20.02 cm) noted was in M6 (NC 2.5 t/ha). With regards to interaction of different treatment combinations of inorganic and organic manure, T4 (M4xF2) recorded the maximum stalk length (25.95 cm). While the minimum stalk length (18.69 cm) was noted in T14 (M6xF1).

Table 9: Effect of different inorganic and organic manures level on stalk length (cm) of broccoli

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	24.40	21.43	22.91
2	M2 (NC 5t/ha)	23.73	21.22	22.47
3	M3 (VC 5t/ha)	24.76	21.37	23.06
4	M4 (PM 5t/ha)	25.95	21.67	23.81
5	M5 (FYM 10t/ha)	22.00	19.49	20.74
6	M6 (NC 2.5 t/ha)	21.36	18.69	20.02
7	M7 (VC 2.5 t/ha)	22.06	19.66	20.86
8	M8 (PM 2.5 t/ha)	22.87	21.23	22.05
	Mean	23.39	20.59	
		Inorganic fertilizer(F)	Organic manure (M)	Interaction
	SEm±	0.09	0.19	0.27
	CD at 0.5%	0.28	0.56	0.80

1.6 Stalk diameter (cm) at Marketable stage

Stalk diameter was recorded at the time of harvesting. The mean of stalk diameter as affected by different treatments is presented in Table 10. The various treatments in inorganic fertilizer exerted significant impact on stalk diameter. Among the treatments significantly maximum (41.20 cm) stalk diameter was observed in the treatment F2 (150:80:60kg/ha) followed by (39.98 cm) F1 (75:40:30kg/ha). Among different

treatments of organic manure, stalk diameter (41.01 cm) was produced in the treatment M4 (PM 5t/ha), while the minimum stalk diameter (39.14 cm) was noted in M6 (NC 2.5 t/ha). In case of interaction of inorganic and organic manure was significant superior as it gives maximum stalk diameter (41.73 cm) in T4 (M4xF2). While the minimum stalk diameter (37.90 cm) noted was in T14 (M6xF1).

Table 10: Effect of different inorganic and organic manures level on stalk diameter (cm) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	41.20	39.98	40.59
2	M2 (NC 5t/ha)	41.15	39.80	40.47
3	M3 (VC 5t/ha)	41.56	39.85	40.70
4	M4 (PM 5t/ha)	41.73	40.30	41.01
5	M5 (FYM 10t/ha)	40.20	38.54	39.37
6	M6 (NC 2.5 t/ha)	40.38	37.90	39.14
7	M7 (VC 2.5 t/ha)	40.90	38.78	39.84
8	M8 (PM 2.5 t/ha)	41.29	39.51	40.40
	Mean	41.20	39.98	
		Inorganic fertilizer(F)	Organic manure (M)	Interaction
	SEm±	0.11	0.22	0.31
	CD at 0.5%	0.32	0.65	N.S.

Inorganic fertilizer

F1 (75:40:30 kg/ha) NPK

F2 (150:80:60 kg/ha) NPK

1.7 Gross plant weight (g)

Gross plant weight of broccoli was recorded at the time of

harvesting without removing leaves and stalk.

Table 11: Effect of different inorganic and organic manures level on gross plant weight (g) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	1100.07	1028.80	1064.43
2	M2 (NC 5t/ha)	1052.52	1019.91	1036.21
3	M3 (VC 5t/ha)	1142.35	1033.69	1088.02
4	M4 (PM 5t/ha)	1262.18	1041.45	1151.81
5	M5 (FYM 10t/ha)	1073.40	982.31	1027.86
6	M6 (NC 2.5 t/ha)	1069.38	977.32	1023.35
7	M7 (VC 2.5 t/ha)	1083.01	987.91	1035.46
8	M8 (PM 2.5 t/ha)	1151.97	997.96	1074.96
	Mean	1116.86	1008.67	
		Inorganic fertilizer(F)	Organic manure (M)	Interaction
	SEm±	20.83	10.41	29.46
	CD at 0.5%	30.90	60.40	N.S.

The average gross plant weight produced by different treatments is presented in Table 11. the various treatments in inorganic fertilizer showed significant impact on gross plant weight. Among the treatments significantly maximum (1116.86 g) gross plant weight was observed in the treatment F2 (150:80:60kg/ha) followed by F1 (75:40:30/ha) (1008.67g). It was observed that the gross plant weight of

broccoli was significantly affected by the applications of organic manure, significantly maximum gross plant weight (1151.81g) was in the treatment M4 (PM 5t/ha). Over all other treatments, while minimum was recorded in M6 (NC 2.5 t/ha) (1023.35). In case of interaction of inorganic and organic manure was no significant as it gives maximum gross plant weight (1262.18g) in T4 (M4xF2), over all other

treatments. While minimum gross plant weight (977.32g) was noted in T14 (M6x F1).

1.8 Marketable curd weight (g)

Marketable curd weight of broccoli was recorded at the time of harvesting of curd and leaves (pruned to at curd level). The average marketable curd weight produced by different treatments is presented in Table 12. Likewise, the different treatments of inorganic fertilizer exerted significant impact on marketable curd weight. Among the treatments significantly maximum marketable curd weight (720.32 g) was observed in the treatment F2 (150:80:60kg/ha) followed by F1

(75:40:30/ha) (683.61g). Among different treatments of organic manure, marketable curd weight of broccoli curd was significantly affected by the applications of organic manure significantly maximum marketable curd weight (746.16 g) was observed in the treatment M4 (PM 5t/ha), over all other treatment. While the minimum marketable curd weight (710.98 g) noted in M3 (VC 5t/ha). With regards to interaction among different treatment combinations of inorganic and organic manure, T4 (M4xF2) recorded the maximum marketable curd weight (793.60 g), over all other treatments. While minimum marketable curd weight (668.50 g) was noted in T14 (M6xF1).

Table 12: Effect of different inorganic and organic manures level on marketable curd weight (g) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	720.32	683.61	701.96
2	M2 (NC 5t/ha)	713.91	677.21	695.56
3	M3 (VC 5t/ha)	731.69	690.28	710.98
4	M4 (PM 5t/ha)	793.60	698.73	746.16
5	M5 (FYM 10t/ha)	708.70	670.30	689.50
6	M6 (NC 2.5 t/ha)	705.54	668.50	687.02
7	M7 (VC 2.5 t/ha)	713.97	672.20	693.09
8	M8 (PM 2.5 t/ha)	740.97	680.21	710.59
	Mean	720.32	683.61	
		Inorganic fertilizer(F)	Organic manure (M)	Interaction
	SEm±	0.31	6.63	9.3
	CD at 0.5%	9.70	19.40	27.44

1.9 Net curd weight (g)

Net curd weight of broccoli was recorded at the time of harvesting of curd and weight of curd only (exclusive leaves and stalk) at marketable stage. The average net curd weight produced by different treatments is presented in Table 13. Likewise, the various treatments under inorganic fertilizer significantly influence net curd weight. Among the treatments significantly maximum net curd weight (601.27g) was

observed in the treatment F2 (150:80:60kg/ha) followed by F1 (75:40:30/ha) (554.55g).

Among different treatments of organic manure, net curd weight of curd was significantly affected by the applications of organic manure, net curd weight (596.52 g) was reported maximum in the treatment M4 (PM 5t/ha), followed by M3 (VC 5t/ha) (585.91 g), M1 (FYM 20t/ha) (581.54 g), M8 (PM 2.5t/ha) (580.47), and were at par with each other. While minimum value was noted in M6 (NC 2.5t/ha) (562.13g).

Table 13: Effect of different inorganic and organic manures level on net curd weight (g) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	602.65	560.43	581.54
2	M2 (NC 5t/ha)	600.68	553.69	577.19
3	M3 (VC 5t/ha)	607.26	564.56	585.91
4	M4 (PM 5t/ha)	622.50	570.54	596.52
5	M5 (FYM 10t/ha)	590.80	543.37	567.09
6	M6 (NC 2.5 t/ha)	585.65	538.61	562.13
7	M7 (VC 2.5 t/ha)	597.00	547.89	572.44
8	M8 (PM 2.5 t/ha)	603.65	557.29	580.47
	Mean	601.27	554.55	
		Inorganic fertilizer(F)	Organic manure (M)	Interaction
	SEm±	3.05	6.11	8.65
	CD at 0.5%	8.94	17.89	N.S.

In case of interaction of inorganic and organic manure was no significant as it gives maximum net curd weight (622.50 g) in T4 (M4xF2) followed by T3 (M3xF2) (607.26 g), T8 (M8xF2) (603.65 g), T1 (M1xF2) (602.65 g), T2 (M2xF2) (600.00 g), and which were at par with each other, while minimum net curd weight (538.61 g) was noted in T14 (M6xF1).

1.10 Yield per plot (kg)

The mean performance of curd yield per plot of different treatments of inorganic, organic manure and their interaction has been presented.

Table 14: Effect of different inorganic and organic manures level on yield per plot (kg) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	18.12	16.53	17.26
2	M2 (NC 5t/ha)	18.00	16.20	17.10
3	M3 (VC 5t/ha)	18.21	16.90	17.55
4	M4 (PM 5t/ha)	18.67	17.10	17.80
5	M5 (FYM 10t/ha)	17.72	16.30	17.01
6	M6 (NC 2.5 t/ha)	17.52	16.15	16.83
7	M7 (VC 2.5 t/ha)	17.91	16.41	17.16
8	M8 (PM 2.5 t/ha)	18.10	16.70	17.40
	Mean	18.00	16.53	
		Inorganic fertilizer(F)	Organic manure (M)	Interaction
	SEm±	0.20	0.05	0.08
	CD at 0.5%	0.08	0.16	N.S.

Among different treatments of inorganic fertilizer maximum 18.00 kg yield per plot was noted in the treatment F2 (150:80:60kg/ha) followed by (16.53 kg) F1 (75:40:30/ha). The data indicate that the yield of curd was found to influence up to significantly extent due to application of organic manure, significantly maximum yield per plot of 17.80 kg was recorded under the treatment of M4 (PM 5t/ha), over all other treatments. On other hand, the interaction of inorganic and organic manure was non-significant as it gives maximum yield per plot (18.67 kg) in T4 (M4x F2), over all other treatments. While minimum yield per plot (16.15 kg) was noted in T14 (M6x F1).

1.11 Yield (q/ha)

The yield is the most important factor which indicates final results of the experiment and superiority of any treatment is judged by the ultimate effect upon the yield of crop. With this view, the yield of broccoli curd per plot was recorded. The

yield/plot under different treatments were recorded at the time of subsequent picking and converted into yield q/ha and presented in Table 15. The various treatments in inorganic fertilizer exerted significantly impact on yield per ha. Among the treatments significantly maximum 297.60 q/ha yield was observed in the treatment F2 (150:80:60kg/ha) followed by F1 (75:40:30/ha) (275.66) q/ha. A close look on the analysis of variance reveals that yield of broccoli was significantly affected by different applications of organic manure, significantly maximum yield of 293.31 q/ha was recorded under the treatment of M4 (PM 5t/ha), over all other treatments. With regards to interaction of different treatment combinations of inorganic and organic manure, significantly the maximum yield 307.13 q/ha was recorded under the treatment combination of T4 (M4x F2), over all other treatments. While minimum yield per ha (266.06 q/ha) was noted in T14 (M4x F1).

Table 15: Effect of different inorganic and organic manures level on Yield (q/ha) of broccoli.

s.no.	Treatment	F2	F1	Mean
1	M1 (FYM 20t/ha)	297.60	275.60	286.63
2	M2 (NC 5t/ha)	296.61	273.93	285.27
3	M3 (VC 5t/ha)	299.82	276.90	288.36
4	M4 (PM 5t/ha)	307.13	279.49	293.31
5	M5 (FYM 10t/ha)	291.73	269.10	280.41
6	M6 (NC 2.5 t/ha)	289.21	266.06	277.63
7	M7 (VC 2.5 t/ha)	294.53	271.33	282.93
8	M8 (PM 2.5 t/ha)	298.10	274.06	286.08
	Mean	297.60	275.66	
		Inorganic fertilizer(F)	Organic manure (M)	Interaction
	SEm±	0.25	0.51	1.50
	CD at 0.5%	0.75	1.50	2.13

Conclusion

On the basis of present investigation, it is concluded that the broccoli responded well in terms of growth, yield and net profit, to application of inorganic, organic manure and their interaction. The best treatment combination is T4 (150:80:60 kg/ha NPK + PM 5t/ha) the maximum nutrient uptake by plant NPK ratio is 210:65:260 kg/ha. Soil application of 150:80:60 kg NPK/ha + poultry manure 5t/ha gave the highest curd yield of 307.13q/ha with maximum net return of Rs185286/ha and C:B ratio of 1:4.00 in comparison to the other treatments.

References

1. Maurya AK, Singh MP, Srivastava BK, Singh YV, Singh DK, Singh S *et al.* Effect of organic manures and inorganic fertilizers on growth characters, yield and

economics of sprouting broccoli cv. Fiesta. Indian J. Horticulture. 2008; 65(1):116-118.

2. Yoldas F, Ceylan S, Yagmur B, Mordogan N. Effects of nitrogen fertilizer on yield quality and nutrient content in broccoli. J Plant Nutri. 2008; 31(7):1333-1343.
3. Swarup V. Vegetable science and technology in India. Kalayani Publishers, New Delhi, 2012. 370-371.
4. Meena VK, Dubey AK, Jain VK, Tiwari A, Negi P. Effect of plant growth promoters on flowering and fruiting attributes of okra [*Abelmoschus esculentus* (L.) Moench]. Crop Res. 2017; 52(1-3):37-40
5. Attigah AS, Asiedu EK, Agyarko K, Dapaah HK. Growth and yield of okra (*Abelmoschus esculentus* L.) as affected by organic and inorganic fertilizers. ARPN: J Agri. Biol. Sci. 2013; 8(12):766-770.

6. Mishra PP, Das AK, Mishra N. Effect of integrated nutrient management on yield, quality and economics of knolkhol (*Brassica oleracea* L. cv. *gongylodes*). Asian J Horticulture. 2014; 9(2):382-385.
7. Abou El-Magd MM, El-Bassiony AM, Fawzy ZF. Effect of organic manure with or without chemical fertilizers on growth, yield and quality of some varieties of broccoli plants. J Appl. Sci. Res. 2006; 2(10):791-798