



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2018; 7(6): 2249-2253  
Received: 07-09-2018  
Accepted: 09-10-2018

**Amit Kumar Singh**  
Department of Horticulture,  
Udai Pratap Autonomous  
College Varanasi, Uttar Pradesh,  
India

**Dharmender Singh**  
Department of Horticulture,  
Udai Pratap Autonomous  
College Varanasi, Uttar Pradesh,  
India

**NK Tiwari**  
Faculty of Agricultural Sciences  
SGT University, Gurgaon,  
Haryana, India

**Diwaker Singh**  
Department of Horticulture,  
Udai Pratap Autonomous  
College Varanasi, Uttar Pradesh,  
India

**Lal Vijay Singh**  
Department of Horticulture,  
Udai Pratap Autonomous  
College Varanasi, Uttar Pradesh,  
India

**Correspondence**  
**NK Tiwari**  
Faculty of Agricultural Sciences  
SGT University, Gurgaon,  
Haryana, India

## Effect of NPK, vermicompost and spacing on growth and yield of broccoli (*Brassica oleracea* L. var. *italica*)

**Amit Kumar Singh, Dharmender Singh, NK Tiwari, Diwaker Singh and Lal Vijay Singh**

### Abstract

The experiment was conducted during *winter* season of during 2016-17 and 2017-18 at the Horticulture farm of Udai Pratap, Autonomous College, Varanasi (U.P.), is situated in the South eastern part of Varanasi city was carried out during winter season. The experimental material used for the "Effect of NPK, Vermicompost and Spacing on growth and yield of Broccoli (*Brassica oleracea* L. var. *italica*)" The materials used, experimental procedures followed and techniques adopted during the course of experimentation were planted at a spacing of 45cm x 45cm and 45cm x 60cm per plot under open conditions. The experiment was laid out in RBD comprising of Sixteen treatments with three replication study F<sub>3</sub> (180:80:80 NPK kg ha<sup>-1</sup>) and minimum in F<sub>1</sub> (140:40:40 NPK kg ha<sup>-1</sup>) and at 45 and 60 DAP the minimum plant height was recorded with F<sub>4</sub> (200:100:100 kg ha<sup>-1</sup>) and minimum with F<sub>1</sub> (200:100:100 kg ha<sup>-1</sup>) and minimum with F<sub>1</sub> (140:40:40 NPK kg ha<sup>-1</sup>) during both the years of study. In case of spacing S<sub>1</sub> (45 x 45 cm) recorded maximum and minimum in S<sub>2</sub> (45 x 60 cm) at all the stages during both the years of experimentation. (T<sub>1</sub>)- 140:40:40 NPK kg/ha + 45x45cm. Spacing + 20kgVermicompost/ha, (T<sub>2</sub>)-140:40:40 NPK kg/ha + 45x45cm. Spacing + 10 kg PSB/ha, (T<sub>3</sub>) -140:40:40 NPK kg/ha + 45x60cm. Spacing + 20 kg Vermicompost/ha (T<sub>4</sub>)-140:40:40 NPK kg/ha + 45x60cm. Spacing + 10kgPSB/ha (T<sub>5</sub>)-160:60:60 NPK kg/ha + 45x45cm. Spacing + 20kgVermicompost/ha, (T<sub>6</sub>)-160:60:60 NPK kg/ha + 45x45cm. Spacing +10kg PSB/ha, (T<sub>7</sub>)-160:60:60 NPK kg/ha + 45x60cm. Spacing + 20kgVermicompost/ha, (T<sub>8</sub>) - 160:60:60 NPK kg/ha + 45x60cm. Spacing + 10kg PSB/ha (T<sub>9</sub>) - 180:80:80 NPK kg/ha + 45x45cm. Spacing + 20 kg Vermicompost /ha (T<sub>10</sub>) - V180:80:80 NPK kg/ha + 45x45cm. Spacing + 10kg PSB/ha (T<sub>11</sub>) - 180:80:80 NPK kg/ha + 45x60cm. Spacing +20kgVermicompost/ha (T<sub>12</sub>) - 180:80:80 NPK kg/ha + 45x60cm. Spacing + 10kg PSB/ha (T<sub>13</sub>) - 200:100:100 NPK kg/ha + 45x45cm. Spacing + 20kgVermicompost/ha (T<sub>14</sub>) - 200:100:100 NPK kg/ha + 45x45cm. Spacing + 10kg PSB/ha (T<sub>15</sub>) - 200:100:100 NPK kg/ha + 45x60cm. Spacing + 20kg Vermicompost/ha (T<sub>16</sub>) - 200:100:100 NPK kg /ha + 45x60cm. Spacing+ 10 kg PSB/ha. The highest yield q ha<sup>-1</sup> was recorded in treatment F<sub>4</sub> (200:100:100 NPK kg ha<sup>-1</sup>), while minimum in F<sub>1</sub> (140:40:40 NPK kg ha<sup>-1</sup>) during 2016-17 and 2017-18. The improvement was observed in yield q ha<sup>-1</sup> in S<sub>1</sub> (45 x 45 cm.) spacing over S<sub>2</sub> (45 x 60 cm.) spacing application of B<sub>2</sub> (PSB) recorded maximum which was at par with B<sub>1</sub> and significantly superior over B<sub>1</sub> (Vermicompost).

**Keywords:** Vermicompost, broccoli *Brassica oleracea* L

### Introduction

Broccoli (*Brassica oleracea* var. *italica* L. sub var. *cymosa* cv. 'Premium crop') are belongs to family cruciferae, is a member of Cole group having 18 chromosomes (2n=18, x=9). The term 'Cole' originated from the word Colewort meaning wild cabbage. They are commonly grown in the vegetables producing countries like USA, UK, New Zealand, Italy, Chiana, India, Egypt, Israel, Thailand and Bangladesh etc. Broccoli has enormous nutritional and medicinal values because raw broccoli (per 100 g) contains energy (34 k cal), carbohydrates (6.64 g), sugars (1.7 g), dietary fiber (2.6 g), fat (0.37 g), protein (2.82 g), water (89.30 g), vit A (4%), a-carotene (3%), lutein and zeaxanthin (1121 µg), vitB<sub>1</sub> (0.071 mg), vitB<sub>2</sub> (0.117 mg) vitB<sub>3</sub> (0.639 mg), vitB<sub>5</sub> (0.573 mg) vitB<sub>6</sub> (0.175 mg) vitB<sub>9</sub> (63 µg). vit C (89.2 mg), vit E (0.78 mg), vit K (101.6 µg), calcium (47 mg), iron (0.73 mg), magnesium (21 mg), phosphorus (966 mg), potassium (316 mg) and zinc (0.41 mg), India is the largest producer of ginger and okra and ranks second in production of potato (10%), onion, cauliflower, brinjal and cabbage and is known as fruit and vegetable basket of the world. The overall growth rate of 2.08% in area, 1.64% in productivity and 3.72% in total production has been achieved during the last five years. Our demand of vegetables will be 225 million tons by 2020 and 350 million tons by 2030 (Singh, 2005) [10].

## Materials and Methods

The present investigation was conducted during 2016-17 and 2017-18 at the Horticulture farm of Udai Pratap, Autonomous College, Varanasi (U.P.), is situated in the South eastern part of Varanasi city was carried out during winter season. The experimental material used for the "Impact of NPK, Vermicompost and Spacing on Growth, Yield and Quality of Broccoli (*Brassica oleracea L. var. italica*)" The materials used, experimental procedures followed and techniques adopted during the course of experimentation have been described in this chapter. Budded plants were planted at a spacing of 45cm x 45cm and 45cm x 60cm per plot under open conditions. All the plants were maintained under uniform cultural practices like irrigation, weeding, pinching, disbudding, etc. except treatments during the course of study (T<sub>1</sub>)- 140:40:40 NPK kg/ha + 45x45cm. Spacing + 20kgVermicompost/ha, (T<sub>2</sub>)-140:40:40 NPK kg/ha + 45x45cm. Spacing + 10kgPSB/ha, (T<sub>3</sub>)-140:40:40 NPK kg/ha + 45x60cm. Spacing + 20kgVermicompost/ha (T<sub>4</sub>)-140:40:40 NPK kg/ha + 45x60cm. Spacing + 10kgPSB/ha (T<sub>5</sub>)-160:60:60 NPK kg/ha + 45x45cm. Spacing + 20kgVermicompost/ha, (T<sub>6</sub>)-160:60:60 NPK kg/ha + 45x45cm. Spacing +10kgPSB/ha, (T<sub>7</sub>)-160:60:60 NPK kg/ha + 45x60cm. Spacing + 20kgVermicompost/ha, (T<sub>8</sub>) - 160:60:60 NPK kg/ha + 45x60cm. Spacing + 10kgPSB/ha (T<sub>9</sub>)- 180:80:80 NPK kg/ha + 45x45cm. Spacing + 20kg Vermicompost/ha (T<sub>10</sub>) - V180:80:80 NPK kg/ha + 45x45cm. Spacing + 10kg PSB/ha (T<sub>11</sub>) - 180:80:80 NPK kg/ha + 45x60cm. Spacing +20kgVermicompost/ha (T<sub>12</sub>) - 180:80:80 NPK kg/ha + 45x60cm. Spacing + 10kgPSB/ha (T<sub>13</sub>) - 200:100:100 NPK kg/ha + 45x45cm. Spacing + 20 kg Vermicompost/ha (T<sub>14</sub>)-200:100:100 NPK kg/ha + 45x45cm. Spacing + 10kgPSB/ha (T<sub>15</sub>) - 200:100:100 NPK kg/ha + 45x60cm. Spacing + 20kg Vermicompost/ha (T<sub>16</sub>) - 200:100:100 NPK kg/ha + 45x60cm. Spacing+ 10 kg PSB/ha times dilution with a total of 16 treatment combinations investigation was analyzed statistically Factorial with Control in Randomized Block Design (RBD) with three replications.

## Result and Discussion

Data pertaining to interaction among NPK, Vermicompost and spacing and their reported in the preceding chapter are being discussed, has been presented in respect of plant height at various stage of crop growth have been presented in table 1 fig. No.1 the perusal of data clearly indicated that the maximum plant height (32.38 and 33.05 cm) was observed with the application of 180:80:80 NPK dose and significantly superior to 140:40:40 NPK dose at 30 DAP during both the years. At 45 DAP maximum plant height (50.20 and 51.22 cm) was noted with 200:100:100 NPK dose which was at par with 180:80:80: and 160:60:60 NPK doses and significantly superior than 140:40:40 NPK dose in both the years of study. At harvest stage the maximum plant height (55.47 and 54.60 cm) was observed with 200:100:100 NPK doses which was statistically at par with 180:80:80 NPK dose and significantly superior to 160:60:60 and 140:40:40 NPK dose. The different plant spacing affected the plant height significantly at 30, 45,

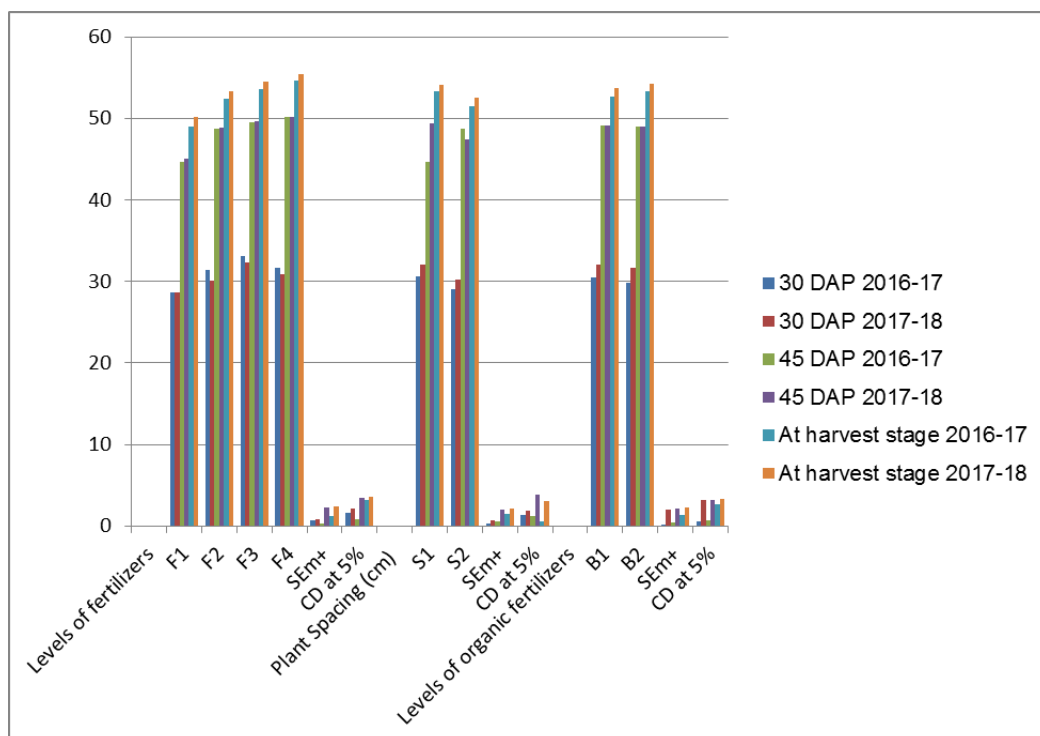
and at harvest stage. The significantly maximum plant height was recorded in closer plant spacing of 45 × 45 cm at all the stages of crop growth. Maximum plant height at 30, 45 and at harvest stage was 30.63, 48.73 and 53.26 cm during 2016-17 and 32.07, 49.43 and 54.17 cm during 2017-18, respectively. These results are also in close conformity with the findings of Kamla *et al.* (2002) <sup>[5]</sup> in cauliflower, Rai *et al.* (2003) <sup>[8]</sup> in Knol – Khol, Sharma *et al.* (2005) <sup>[9]</sup> in Brussels sprout and Khan *et al.* (2009) <sup>[6]</sup> in broccoli.

The data pertaining to Length of cured as influenced by fertilizer levels, spacing and biofertilizer on broccoli have been presented in table 2 fig. no.2 in the perusal of data clearly indicates that the maximum Length of cured (10.11 and 9.00 cm) was observed with the application of 180:80:80 NPK dose which was statistically at par with 200:100:100 NPK dose and significantly superior to 160:60:60 NPK dose in both the years of study. The plant spacing affected the Length of significantly maximum plant height was recorded in wider plant spacing of 45 × 60 cm in both the years of study. The maximum Length of cured was 8.33 cm during 2016-17 and 9.65 cm during 2017-18, respectively. The various biofertilizer doses influence the Length of cured significantly maximum Length of cured (8.80 cm) and (10.03 cm) significantly Width of curd (cm) as influenced by fertilizer levels, spacing and biofertilizer on broccoli have been presented in Table 3 in the perusal of data clearly indicated that the maximum Width of curd (16.23 and 16.93 cm) was observed with the application of 200:100:100 NPK doses which was statistically at par with 180:80:80 NPK dose and significantly superior to 160:60:60 NPK dose during both the years Yadav *et al.* (2012) <sup>[11]</sup> reported that application of biofertilizers significantly increased the yield of cabbage. Kachari and Korla (2012) <sup>[4]</sup> also reported that application of biofertilizers significantly increased the yield of cauliflower. The findings of present experiment are closely related to the findings of Kumar *et al.* (2011) <sup>[7]</sup> and Khan *et al.* (2009) <sup>[6]</sup> in cauliflower.

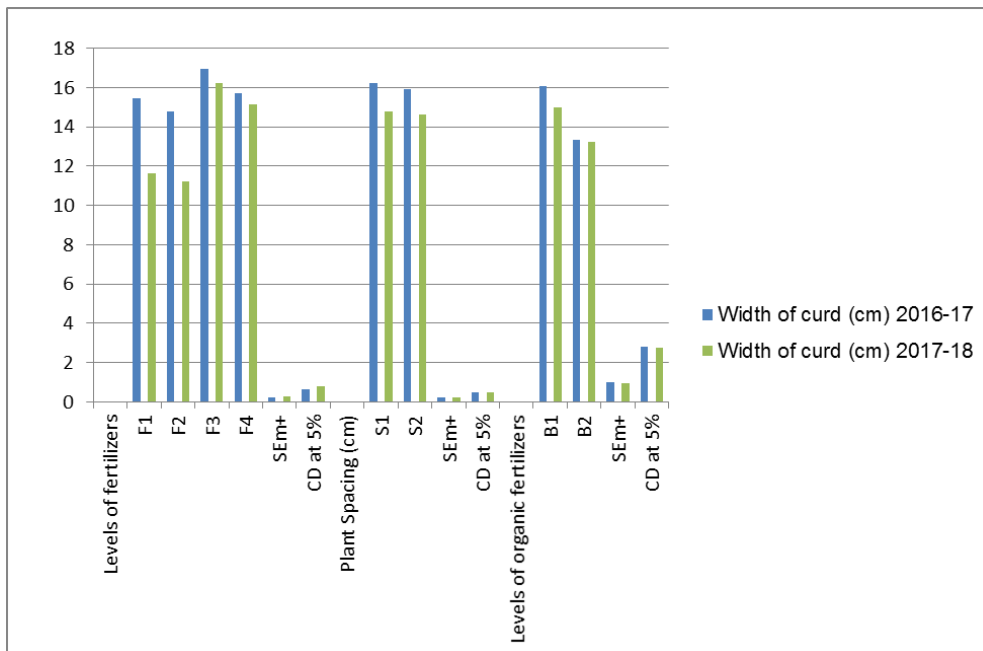
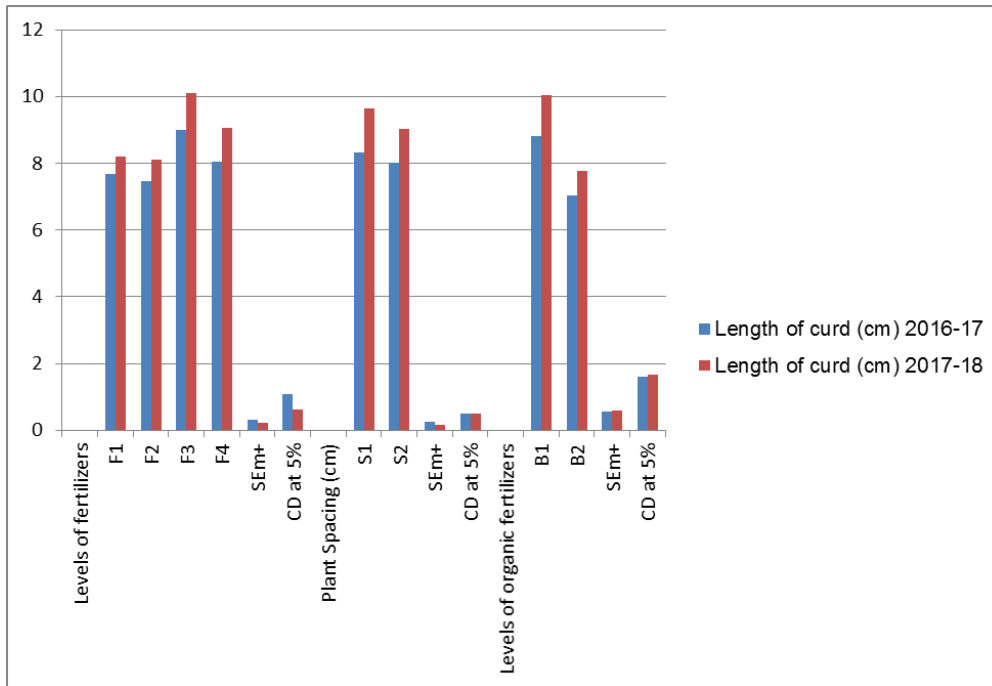
The data indicate that the yield/ ha (q) was significantly influenced due to fertility levels, spacing and biofertilizer but interaction between fertility levels, spacing and biofertilizer was found non-significant and data have been presented in table 3 and fig.3 in perusal of data clearly indicate that the maximum curd yield (214.08 and 215.37 q/ha) was observed with the application of 200:100:100 NPK dose which was statistically at par with 180:80:80 NPK dose and significantly superior to rest of the treatment in the significantly maximum yield/ha (q) was recorded in closer plant spacing of 45 × 45 cm at harvest stage. The maximum yield /ha (q) was (217.71 and 218.82 q/ha) the various biofertilizer doses influence the yield/ha (q) significantly at harvest stage However, maximum yield /ha (q) of (212.51 and 213.88 q/ha) which was found at par with (186.58 and 189.25 q/ha) and significantly superior during the years of study. The findings of present study are supported by the findings of Chatterjee (2006) <sup>[3]</sup> in cauliflower, Agarwal *et al.* (2007) <sup>[1]</sup> and Bhangre *et al.* (2011) <sup>[2]</sup> in broccoli.

**Table 1:** Effect of inorganic fertilizer and bio-fertilizer levels and spacing on height (cm) of broccoli at different growth stages

| Treatments                           | 30 DAP  |         | 45 DAP  |         | At harvest stage |         |
|--------------------------------------|---------|---------|---------|---------|------------------|---------|
|                                      | 2016-17 | 2017-18 | 2016-17 | 2017-18 | 2016-17          | 2017-18 |
| <b>Levels of fertilizers</b>         |         |         |         |         |                  |         |
| F <sub>1</sub>                       | 28.67   | 28.67   | 44.71   | 45.01   | 49.00            | 50.15   |
| F <sub>2</sub>                       | 31.39   | 30.15   | 48.73   | 48.82   | 52.43            | 53.35   |
| F <sub>3</sub>                       | 33.05   | 32.38   | 49.56   | 49.61   | 53.55            | 54.47   |
| F <sub>4</sub>                       | 31.71   | 30.94   | 50.2    | 50.22   | 54.6             | 55.47   |
| SEm+                                 | 0.64    | 0.81    | 0.28    | 2.23    | 1.26             | 2.38    |
| CD at 5%                             | 1.55    | 2.16    | 0.86    | 3.41    | 3.20             | 3.63    |
| <b>Plant Spacing (cm)</b>            |         |         |         |         |                  |         |
| S <sub>1</sub>                       | 30.63   | 32.07   | 44.71   | 49.43   | 53.26            | 54.17   |
| S <sub>2</sub>                       | 28.98   | 30.22   | 48.73   | 47.4    | 51.53            | 52.55   |
| SEm+                                 | 0.28    | 0.71    | 0.56    | 2.05    | 1.48             | 2.18    |
| CD at 5%                             | 1.32    | 1.88    | 1.21    | 3.88    | 0.52             | 3.07    |
| <b>Levels of organic fertilizers</b> |         |         |         |         |                  |         |
| B <sub>1</sub>                       | 30.50   | 32.09   | 49.06   | 49.14   | 52.72            | 53.68   |
| B <sub>2</sub>                       | 29.89   | 31.73   | 48.94   | 49.02   | 53.36            | 54.29   |
| SEm+                                 | 0.10    | 2.05    | 0.38    | 2.15    | 1.37             | 2.29    |
| CD at 5%                             | 0.50    | 3.17    | 0.74    | 3.17    | 2.60             | 3.38    |

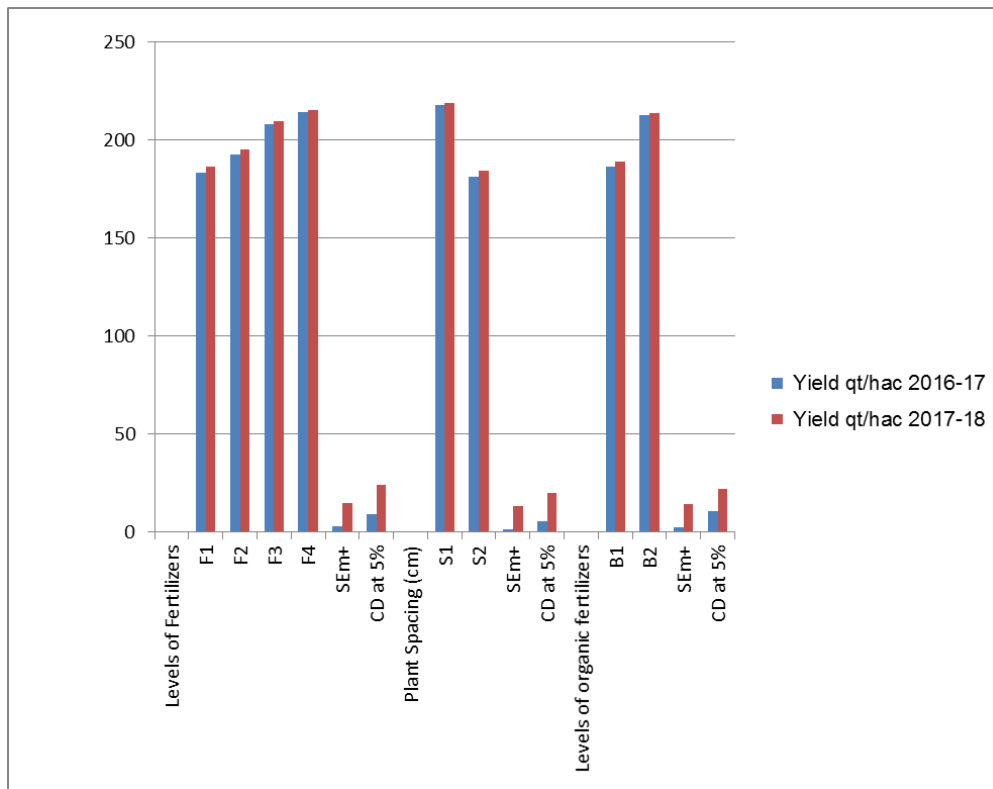
**Table 2:** Effect of inorganic fertilizer and bio-fertilizer levels and spacing on length of curd (cm) and width of curd (cm) of broccoli at different growth stages

| Treatments                           | Length of curd (cm) |         | Width of curd (cm) |         |
|--------------------------------------|---------------------|---------|--------------------|---------|
|                                      | 2016-17             | 2017-18 | 2016-17            | 2017-18 |
| <b>Levels of fertilizers</b>         |                     |         |                    |         |
| F <sub>1</sub>                       | 7.68                | 8.20    | 15.46              | 11.63   |
| F <sub>2</sub>                       | 7.46                | 8.12    | 14.79              | 11.23   |
| F <sub>3</sub>                       | 9.00                | 10.11   | 16.93              | 16.23   |
| F <sub>4</sub>                       | 8.04                | 9.06    | 15.70              | 15.13   |
| SEm+                                 | 0.30                | 0.22    | 0.22               | 0.26    |
| CD at 5%                             | 1.08                | 0.63    | 0.63               | 0.81    |
| <b>Plant Spacing (cm)</b>            |                     |         |                    |         |
| S <sub>1</sub>                       | 8.33                | 9.65    | 16.24              | 14.78   |
| S <sub>2</sub>                       | 8.00                | 9.04    | 15.90              | 14.64   |
| SEm+                                 | 0.24                | 0.17    | 0.24               | 0.24    |
| CD at 5%                             | 0.49                | 0.49    | 0.49               | 0.51    |
| <b>Levels of organic fertilizers</b> |                     |         |                    |         |
| B <sub>1</sub>                       | 8.80                | 10.03   | 16.07              | 15.01   |
| B <sub>2</sub>                       | 7.02                | 7.77    | 13.33              | 13.25   |
| SEm+                                 | 0.56                | 0.58    | 0.98               | 0.96    |
| CD at 5%                             | 1.60                | 1.66    | 2.82               | 2.76    |



**Table 3:** Effect of inorganic fertilizer and bio-fertilizer levels and spacing on Yield qt/ha of leaf of broccoli

| Treatments                           | Yield qt/ha. |         |
|--------------------------------------|--------------|---------|
|                                      | 2016-17      | 2017-18 |
| <b>Levels of Fertilizers</b>         |              |         |
| F <sub>1</sub>                       | 183.41       | 186.24  |
| F <sub>2</sub>                       | 192.69       | 195.05  |
| F <sub>3</sub>                       | 208.27       | 209.85  |
| F <sub>4</sub>                       | 214.08       | 215.37  |
| SEm+                                 | 3.23         | 14.99   |
| CD at 5%                             | 9.08         | 24.22   |
| <b>Plant Spacing (cm)</b>            |              |         |
| S <sub>1</sub>                       | 217.71       | 218.82  |
| S <sub>2</sub>                       | 181.52       | 184.44  |
| SEm+                                 | 1.67         | 13.53   |
| CD at 5%                             | 5.63         | 20.05   |
| <b>Levels of organic fertilizers</b> |              |         |
| B <sub>1</sub>                       | 186.58       | 189.25  |
| B <sub>2</sub>                       | 212.51       | 213.88  |
| SEm+                                 | 2.52         | 14.33   |
| CD at 5%                             | 11.05        | 22.32   |



## References

- Agarwal A, Gupta S, Ahmed Z, Yadav AK. Nitrogen nutrition and plant density influencing marketable head yield of broccoli in cold arid desert of Ladakh. *Acta Horticulturae*. 2007; 756:299-307
- Bhangre KK, Sonawane PC, Warade SD. Effect of different varieties and spacing on growth and yield parameters of broccoli (*Brassica oleracea* L. var. *Italica* Plenck) under Pune conditions. *Asian Journal of Horticulture*. 2011; 6(1):74-76.
- Chatterjee, Ranjit. Effect of transplanting dates and spacing on seed yield and quality of cauliflower (*Brassica oleracea* var. *botrytis* L.) cv. Pusa Early Synthetic. *Seed Research*. 2006; 34(1):104-106
- Kachari M, Korla BN. Studies on influence of biofertilizers on quality economics of cauliflower cv. PSB K-1 production. *Indian Journal of Horticulture*. 2012; 69(2):215-220.
- Kamla K, Paliyal SS, Nandal TR. Integrated nutrient management in cauliflower (Pusa Snow Ball K-1). *Research on Crop*. 2002; 2(2):144-147.
- Khan N, Dubey A, Ram P, Mishra A. integrated nutrient management in broccoli (*brassica oleracea* l. *italic* plenck). *Plant Archives*. 2009; 9(1):423-425.
- Kumar S, Verma MK, Yadav YC. Studies on effect of biofertilizers with chemical fertilizer on growth and yield of cauliflower (*Brassica oleracea* L var *botrytis*) cv pusa Snowball K\_1. *Annals of Horticulture*. 2011; 4(2):205-205
- Rai N, Patel RK, Dongra R. Effect of various spacings and fertilizer combination on growth and yield of knol – Khol cv. White vienna. *Agricultural Science Digest*. 2003; 23(1):41-43
- Sharma A, Sood Sonia, Sharma J, Kumar Rakesh K. Effect of planting date, plant density and fertilizer level on sprout yield and yield –attributing characters of brussels-sprout (*Brassica oleracea* L. VAR. *Gemmifera*) under high hill dry temprerat condition of north-western Himalayas. *Indian journal of Agriculture Sciences*. 2005; 75(5):292-293.
- Singh VN, Singh SS. Effect of inorganic and biofertilizers on production of cauliflower (*Brassica oleracea* L. var. *botrytis*). *Vegetable science* 2005; 32(2):146-149.
- Yadav LP, Kavita A, Maurya IB. Effect of nitrogen and biofertilizers on growth of cabbage (*Brassica oleracea* L. var *capitata*) var *Pride of India*. *Progressive Horticulture*. 2012; 44(2):318-320.