

## Effect of Organic Manures and Biofertilizers on Growth, Yield and Quality of Garlic (*Allium sativum* L.)

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### ABSTRACT

The field experiment was conducted at Horticultural Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A central university), Vidya-Vihar, Raibareli Road, Lucknow -226 025 (U.P.), during Rabi season of 2017-18. "Effect of organic manures and bio-fertilizers on Growth, yield and quality of garlic (*Allium sativum* L.)" revealed that Plant height, Number of leaves per plant, Length of leaves, length of pseudo stem, thickness of necks, diameter of bulb, number of cloves per bulb, weight of bulb, length of cloves, yield of garlic, number of bulb per kg, total soluble solids were maximized T<sub>7</sub> (25% RDF + 25% Azotobactor + 25% PSB + 25% Azospirillum @ 0.5 kg/ha) and T<sub>8</sub> (25% RDF + 25% Azospirillum + 25% PSB @.5 Kg/ha. + 25% Vermicompost @ 1.5 t/ha).

**Keywords:** Garlic, RDF, Azotobactor, Azospirillum, Vermicompost, yield and quality attributes.

### INTRODUCTION

Garlic (*Allium sativum* L.) belongs to family *Alliaceae* and having chromosome 2n=16. Garlic is the second most widely cultivated bulb crop after onion. Garlic has originated from Central Asia and spread to other parts of the world. India ranks second after China in area (321 thousand hectare) and production (1693 thousand tonnes) of garlic with an average productivity of 5.09 metric tonnes per hectare (Anonymous, 2017). A fresh bulb of garlic contains about (62.8%) moisture, (0.1%) fat, (0.8%) fiber and good source of

carbohydrates, vitamin- C, Selenium, Phosphorous and Manganese (Pamplona Roger, 2001). China, South Korea, Egypt, India, Spain, USA, Thailand and Turkey are the major garlic producing countries of the world. The major garlic growing states of India are Madhya Pradesh followed by Gujrat, Uttar Pradesh, Rajasthan, Assam and Punjab. Garlic is popular in all over the world as a valuable spice for cooking of different dishes. Besides, it is also used for preparing pickles, chutneys, curry powder, vegetables, tomato ketchup etc.

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According to the *Unani and Ayurvedic* medicines it is used in the treatments of disease like chronic infection of the stomach and intestine, dysentery, typhoid, cholera and lung problems (Chopra et al., 1958). Recent research has focused on garlic role in preventing heart disease, enhancing the immune system, preventing cancer and enhancing memory. *Allyl propyl disulphides* in garlic is responsible for cancer fighting ability, *Allicin* present in garlic is strongly moreover, the aqueous extract of garlic cloves (containing *allicin* and related disulphides) reduces cholesterol level in human beings (Augusti, 1977).

The organic manure is an ecofriendly, economically viable and ecologically sound that also played a significant role in soil biology, chemistry and physics. In recent years, vermicompost and FYM are advocated in integrated nutrient management. Vermicompost and FYM acts as a store house of several macro, micro and plant growth regulators which are released during the process of mineralization to release plant nutrients present in the soil it increases the fertilizer use efficiency. Organic manure helps in reducing C: N ratio, increases humic acid content and provide the nutrients in the readily available form to the plants such as nitrate, exchangeable phosphorus, soluble potassium, calcium and magnesium (Talashilkar et al., 1999).

Biofertilizer is a natural product carrying living microorganisms derived from the root or cultivated soil. So they don't have any ill effect on soil health and environment. Besides their roll in atmospheric nitrogen fixation and phosphorous solubilisation, these also help in stimulating the plant growth hormone providing better nutrient uptake and increased tolerance towards drought and moisture stress. A small dose of biofertilizer is sufficient to produce desirable results because each gram of carrier of biofertilizers contains at least 10 million viable cells of a specific strain (Anandaraj and Delapierre, 2010) Thus the present investigation was carried out to find out the Effect of organic manures and bio-

fertilizers on Growth, yield and quality of garlic under Lucknow condition.

## MATERIALS AND METHODS

The field experiment was conducted at Horticultural Research Farm of the Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A central university), Vidya-Vihar, Raibareli Road, Lucknow -226 025 (U.P.), during Rabi season of 2017-18. Geographically, Lucknow is situated at 26° 50' N altitudes, 80° 52' Elongitudes and altitude of 123 meter above mean sea level (MSL). Lucknow is situated in the central part of Uttar Pradesh and comes under Subtropical zones. It has the range of temperature during summer 29.30°C to 45.0°C and during winter 3.5°C to 15°C and with annual rainfall 750 mm and relative humidity (60-90%). The soil of experimental field is sandy loam and slightly alkaline in nature with the soil pH 8.2. Eight level of organic manure an bio-fertilizers are given these are 75% RDF, 75% RDF + Azotobactor, 75% RDF + Azospirillum, 75% RDF + PSB, 75% RDF + Vermicompost, 25% RDF + Azotobactor + PSB + Azospirillum, 25% RDF + Azospirillum + PSB + Vermicompost and Absolute control (no manures & fertilizers) were followed in a Randomized Block Design with three replications. The sowing was done in rows at 15 × 10 cm, cloves of healthy bulbs 8-10 mm in diameter were dibbled 5 - 7.5 cm deep keeping their growing ends upwards, on 28 October during year 2017. After sowing cloves were covered with the thin layer of soil for its proper germination. The observations to be recorded vegetative growth parameters like plant height (cm), number of leaves per plant, length of leaves (cm), diameter of stem (cm), pseudo-stem length (cm) and yield parameters viz; Average weight of bulb (g), Bulb diameter (cm), Neck thickness (cm), Number of cloves per bulb, Length of cloves (cm), Number of bulb/kg, Bulb yield (q/ha<sup>-1</sup>) and quality attributes; total soluble solids (TSS) °Brix of garlic were recorded and subjected to statistical analysis. All the data obtained with regard to the growth, yield and quality

attributing were analyzed statistically using the analysis of variance of Fisher (1958).

## RESULT AND DISCUSSION

### 1. Vegetative attributes

The Effect of different organic manures and bio-fertilizers on vegetative attributes from 30, 60 and 90 DAS has been presented in Table 1. The perusal of data revealed that the maximum plant height at 30, 60 and 90 DAS was found (30.5, 37.55, 69.6 cm) was recorded from treatment T<sub>7</sub> (25% RDF + 25% *Azotobactor* + 25% PSB + 25% *Azospirillum* @ 0.5 kg/ha.) while the minimum plant height at 30, 60 and 90 DAS (25.80, 34.56 and 58.18 cm) was recorded from T<sub>1</sub> (control). The maximum no. of leaves per plant found with the treatment T<sub>7</sub> (25% RDF + 25% *Azotobactor* + 25% PSB + 25% *Azospirillum* @ 0.5 kg/ha.) recorded with (5.47, 6.33 and 7.12 at 30, 60 and 90 DAS, respectively) and while treatment T<sub>1</sub> recorded the minimum number of leaves per plant (3.97, 4.72, and 5.85 at 30, 60 and 90 DAS, respectively) followed by T<sub>8</sub> and T<sub>6</sub> respectively, The results corroborates the finding of Islam et al. (2007), Patil et al. (2007) and Shashidhar et al. (2005) in garlic. The Maximum length of leaves were recorded at T<sub>8</sub> at 30 DAS (26.41cm), 60 DAS (35.87cm) and 90 DAS (46.45) which was followed by T<sub>7</sub>, while the minimum length of leaves per plant 30 DAS (23.51cm), 60 DAS (32.44) and 90 DAS (39.65) was recorded from control T<sub>1</sub>. It indicates that maximum pseudo stem length at 30, 60 and 90 DAS (3.40, 4.31 and 5.36 cm) was found with the treatment T<sub>7</sub> (25% RDF+ 25% *Azotobactor* + 25% PSB + 25% *Azospirillum* @ 0.5 kg/ha.) followed by T<sub>6</sub>, while minimum pseudo stem length was recorded 30, 60 and 90 DAS (2.70, 3.70 and 4.50 cm) under the control treatment. These results were in agreement with those reported by Singh (2002) in onion. It indicates that maximum diameter of stem at 30, 60 and 90 DAS (5.20, 6.25 and 12.09) was found with the treatment T<sub>8</sub> (25% RDF + 25% *Azospirillum* + 25% PSB @ 0.5 Kg/ha. + 25% vermicompost @ 1.5 t/ha.) followed by T<sub>4</sub>. while the minimum stem diameter at 30

DAS (4.60 mm) 60 (4.80 mm) and 90 (9.00 mm) These results are in conformity with the finding of Shashidhar et al. (2005) and Zhu et al., (2005) in garlic.

### 2. Yield and quality attributes

The data present in table 2 showed that that significantly maximum thickness of necks (8.19 mm) was recorded with the treatment 75% RDF +25% Vermicompost@6 t/ha (T<sub>6</sub>) followed by treatment (T<sub>5</sub>) and were found at par with each other. During the investigation minimum thickness of necks (4.98 mm) was found with the control (T<sub>1</sub>). The present findings are also in agreement with the results of Islah (2010) in garlic.

The maximum number of bulb/kg was recorded in treatment T<sub>7</sub> (75% RDF + 25% *Azotobactor* +25% PSB + 25 *Azospirillum* @ 0.5 kg/ha.) 35.90 bulb/kg and followed by T<sub>3</sub>. While minimum was recorded in control treatment T<sub>1</sub> (control) 32.60 bulb/kg. Similar result found Yogita and Ram (2012) in onion reported similar kind of results.

The maximum length of length are recorded under treatment T<sub>8</sub> (25% RDF + 25% *Azospirillum* + 25% PSB @0.5 Kg/ha. + 25% Vermicompost @ 1.5 t/ha.) 4.80 cm and followed by T<sub>5</sub> (75% RDF + 25% PSB@2 kg/ha) 4.20 cm. While minimum in treatment T<sub>1</sub> (control) 3.18 cm. Length of clove was measure after harvesting. T<sub>8</sub> Treatment and T<sub>5</sub> Treatment also show possible significant response for length of cloves. Length of clove show positive response of good yield. These results are in conformity with the findings of Nasreen et al. (2009) in garlic.

Effect of organic manure and bio-fertilizer significantly maximum yield of garlic q/ha were recorded in the treatment RDF along with the *Azospirillum*, PSB and vermicompost application was given. It is clearly indicates that maximum yield q/ha was found with the treatment T<sub>8</sub> (25% RDF + 25% *Azospirillum* + 25% PSB @0.5 Kg/ha. + 25% Vermicompost @ 1.5 t/ha) 77.94 q/ha followed by T<sub>6</sub>. While the minimum T<sub>1</sub> (control) 65.40 q/ha respectively, while minimum yield q/ha was recorded under the control treatment. The application of RDF

*Azospirillum*, PSB and vermin-compost are affected the soil ability and balancing nutrient supply to the plant increase with the result with the study are agreement with the findings of Nasreen et al. (2009), Patil et al. (2007) and Islah (2010) in garlic.

The maximum number of diameter of bulb was recorded in treatment T<sub>8</sub> (25% RDF + 25% *Azospirillum* + 25% PSB @0.5 Kg/ha. + 25% Vermicompost @ 1.5 t/ha) 45.11mm and followed by T<sub>7</sub>. While minimum was recorded in control treatment T<sub>1</sub> (control) 38.85 diameter of bulb. Similar result found

Yogita and Ram (2012) in onion reported similar kind of results.

The maximum number of cloves/ bulb, weight of bulb (g), TSS of bulb was recorded in treatment T<sub>7</sub> (75% RDF + 25% *Azotobacter* +25% PSB + 25 *Azospirillum* @ 0.5 kg/ha.) 29.47 cloves/bulb, 30.14 bulb/g, 40.09<sup>0</sup>brix. While minimum was recorded in control treatment T<sub>1</sub> (control) 21.48 cloves/bulb, 24.00 bulb/g, 31.41<sup>0</sup>brix diameter of bulb. Similar result found Yogita and Ram (2012) in onion and reported similar kind of results.

**Table 1: Effect of organic manures and biofertilizers on Vegetative character of garlic**

| Treatment combinations  | Plant height (cm) |        |        | No. of leaves/plant |        |        | Length of leaves (cm) |        |        | Stem diameter (mm) |        |        | Length of pseudo stem (cm) |        |        |
|---|-------------------|--------|--------|---------------------|--------|--------|-----------------------|--------|--------|--------------------|--------|--------|----------------------------|--------|--------|
|   | 30 DAS            | 60 DAS | 90 DAS | 30 DAS              | 60 DAS | 90 DAS | 30 DAS                | 60 DAS | 90 DAS | 30 DAS             | 60 DAS | 90 DAS | 30 DAS                     | 60 DAS | 90 DAS |
| T <sub>1</sub> -Absolute fertilizers ( no manure & fertilizer)                          | 25.80             | 34.56  | 58.18  | 3.97                | 4.72   | 5.85   | 23.51                 | 32.44  | 39.65  | 4.60               | 4.80   | 9.00   | 2.70                       | 3.70   | 4.50   |
| T <sub>2</sub> -RDF 75%   | 28.68             | 36.5   | 60.23  | 4.39                | 5.80   | 6.78   | 24.11                 | 32.85  | 39.98  | 5.00               | 5.84   | 9.56   | 3.20                       | 4.00   | 4.23   |
| T <sub>3</sub> -75% RDF + 25% AZO @ 2kg/ha.   | 28.5              | 35.83  | 66.26  | 4.93                | 5.97   | 6.89   | 25.5                  | 33.18  | 42.34  | 5.08               | 5.91   | 10.71  | 2.71                       | 3.33   | 4.71   |
| T <sub>4</sub> -75% RDF + 25% AZSP @ 2kg/ha.  | 29.80             | 36.90  | 68.40  | 5.15                | 5.99   | 6.74   | 25.43                 | 33.67  | 43.19  | 5.14               | 6.18   | 11.98  | 3.09                       | 3.90   | 5.03   |
| T <sub>5</sub> -75% RDF + 25% PSB @ 2 kg/ha.  | 27.50             | 35.16  | 67.13  | 5.08                | 6.00   | 6.76   | 25.55                 | 33.20  | 42.44  | 4.75               | 5.98   | 10.17  | 2.86                       | 3.16   | 4.91   |
| T <sub>6</sub> -75% RDF + 25% VERMI-COMPOST @6 t/ha.                                    | 27.66             | 36.63  | 65.33  | 5.13                | 6.02   | 7.03   | 25.9                  | 35.14  | 44.35  | 4.90               | 6.05   | 9.08   | 3.24                       | 4.08   | 5.29   |
| T <sub>7</sub> -25% RDF + 25% AZO + 25% PSB + 25% AZSP @ 0.5 kg/ha.                     | 30.50             | 37.55  | 69.60  | 5.47                | 6.33   | 7.12   | 26.22                 | 35.32  | 46.11  | 4.25               | 5.16   | 11.81  | 3.40                       | 4.31   | 5.36   |
| T <sub>8</sub> -25% RDF + 25% AZSP + 25% PSB @0.5 Kg/ha. + 25% VERMICOMPOST @ 1.5 t/ha. | 28.71             | 34.87  | 67.80  | 5.35                | 6.24   | 7.06   | 26.41                 | 35.87  | 46.45  | 5.20               | 6.25   | 12.09  | 3.01                       | 3.92   | 4.52   |
| S.E.m (±)   | 0.709             | 0.568  | 0.112  | 0.053               | 0.055  | 0.112  | 0.509                 | 0.549  | 1.069  | 0.189              | 0.216  | 0.468  | 0.119                      | 0.149  | 0.197  |
| CD (at 5% level)  | 2.171             | 1.740  | 0.342  | 0.162               | 0.170  | 0.342  | 1.559                 | 1.680  | 3.275  | 0.578              | 0.662  | 1.433  | 0.366                      | 0.456  | 0.602  |

**Table 2: Effect of organic manures and bio-fertilizers on yield and quality character**

| Treatment combinations  | Thickness of necks (mm) | Diameter of bulb (mm) | Number of cloves per bulb | Weight of bulb(g) | Length of cloves(cm) | Yield of garlic q/ha. | Number of bulb per kg | TSS brix |
|---|-------------------------|-----------------------|---------------------------|-------------------|----------------------|-----------------------|-----------------------|----------|
| T <sub>1</sub> -Absolute fertilizers ( no manure & fertilizer)                          | 4.98                    | 38.85                 | 21.48                     | 24.00             | 3.18                 | 65.40                 | 32.60                 | 31.41    |
| T <sub>2</sub> -RDF 75%   | 5.87                    | 39.89                 | 23.85                     | 26.93             | 3.68                 | 68.9                  | 34.95                 | 35.85    |
| T <sub>3</sub> -75% RDF + 25% AZO @ 2kg/ha.   | 6.47                    | 40.43                 | 24.67                     | 27.14             | 3.50                 | 73.44                 | 35.80                 | 36.00    |
| T <sub>4</sub> -75% RDF + 25% AZSP @ 2kg/ha.  | 6.98                    | 40.05                 | 25.65                     | 28.30             | 4.10                 | 75.8                  | 35.48                 | 36.96    |
| T <sub>5</sub> -75% RDF + 25% PSB @ 2 kg/ha.  | 7.48                    | 42.03                 | 25.14                     | 30.11             | 4.20                 | 75.67                 | 33.79                 | 37.40    |
| T <sub>6</sub> -75% RDF + 25% VERMI-COMPOST @6 t/ha.                                    | 8.19                    | 42.39                 | 28.47                     | 29.50             | 4.11                 | 75.39                 | 34.13                 | 38.39    |
| T <sub>7</sub> -25% RDF + 25% AZO + 25% PSB + 25% AZSP @ 0.5 kg/ha.                     | 7.11                    | 44.60                 | 29.47                     | 30.14             | 3.79                 | 76.62                 | 35.90                 | 40.09    |
| T <sub>8</sub> -25% RDF + 25% AZSP + 25% PSB @0.5 Kg/ha. + 25% VERMICOMPOST @ 1.5 t/ha. | 6.81                    | 45.11                 | 27.14                     | 29.28             | 4.80                 | 77.94                 | 35.74                 | 35.60    |
| S.E.m (±)   | 0.274                   | 1.155                 | 1.068                     | 1.167             | 0.165                | 1.232                 | 0.654                 | 1.468    |
| CD (at 5% level)  | 0.838                   | 3.537                 | 3.270                     | 3.573             | 0.506                | 3.774                 | 2.003                 | 4.494    |

**CONCLUSION**

The present investigation clearly revealed that the application of (25% RDF + 25% AZO + 25% PSB + 25% *Azospirillum* @ 0.5 kg/ha) under the treatment T<sub>7</sub> has obtained better response of garlic over the all other treatment combinations. Hence, it is recommended as package of practices for higher production in Lucknow conditions.

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