

## Original Research Article

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## Effect of Bio-Fertilizers on Growth Behaviour and Quality Parameters of Garlic (*Allium sativum* Linn.)

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### ABSTRACT

#### Keywords

Garlic; Bio-fertilizer; *Azotobacter*; Vascular Arbuscular Mycorrhiza

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An investigation on the project entitled “Effect of bio-fertilizers on growth behaviour and quality parameters of garlic (*Allium sativum* Linn.)” was taken up in the horticultural garden of Janta College, Bakewar, Etawah, U.P. which falls under sub-tropical climatic region during 2011-12 to work out the optimum dose of the three bio-fertilizer and their combination on garlic variety-G1. Fourteen treatments namely, a control receiving FYM as basal dose @ 20 ton/ha + RDF (100:50:50) (T<sub>0</sub>), *Azotobacter* 6 kg/ha (T<sub>1</sub>), *Azotobacter* 8 kg/ha (T<sub>2</sub>), PSB 6 kg/ha (T<sub>3</sub>), PSB 8 kg/ha (T<sub>4</sub>), VAM 6 kg/ha (T<sub>5</sub>), VAM 8 kg/ha (T<sub>6</sub>), *Azotobacter* 6 kg/ha+ PSB 6 kg/ha+ VAM 6 kg/ha (T<sub>7</sub>), *Azotobacter* 6 kg/ha+ PSB 8 kg/ha+ VAM 8 kg/ha (T<sub>8</sub>), *Azotobacter* 6 kg/ha+ PSB 6 kg/ha+ VAM 8 kg/ha (T<sub>9</sub>), *Azotobacter* 6 kg/ha+ PSB 8 kg/ha+ VAM 6 kg/ha (T<sub>10</sub>), *Azotobacter* 8 kg/ha+ PSB 6 kg/ha+ VAM 6 kg/ha (T<sub>11</sub>), *Azotobacter* 8 kg/ha+ PSB 8 kg/ha+ VAM 8 kg/ha (T<sub>12</sub>), *Azotobacter* 8 kg/ha+ PSB 6 kg/ha+ VAM 8 kg/ha (T<sub>13</sub>), *Azotobacter* 8 kg/ha+ PSB 8 kg/ha+ VAM 6 kg/ha (T<sub>14</sub>) applied into soil prior to transplanting of seed cloves. The experiment was carried out in Randomized Block Design with 3 replications having plot size 3 sq.mt. The combination of treatments namely *Azotobacter* 8 kg/ha+ PSB 8 kg/ha+ VAM 8 kg/ha (T<sub>12</sub>) resulted the best optimal dose for garlic giving plant height 79.83 cm, average number of leaves 9.86, average diameter of pseudo stem 1.13 cm, average volume of bulb 48.23 cc and T<sub>12</sub> produced 117.67 numbers of ‘A’ grade bulbs or 67.24% out of 175 bulbs.

### Introduction

Garlic is the second most widely cultivated bulb crop, after onion, and has long been recognized as a valuable spice and condiment throughout India. In India garlic is grown an area of 274000 hectares with a production of 1271000 MT. Garlic possesses highly nutritive value. It has been considered as a rich source of carbohydrates, proteins and phosphorus. Ascorbic acid content was also reported to be very high in green garlic

(Pradhan *et al.*, 1977). Uninjured bulb contains a colourless, odourless water soluble amino acid called “Allin” which, after crushing converts into “Allicin” whose principal ingredient is odoriferous diallyl disulphide.

Garlic contains 0-1% volatile oil, whose chief constituents are diallyl disulphide (60%), allyl alcohol (5.4%), dimethyl trisulphide (2-4%), methyl allyl trisulphide (1.5%), methyl allyl disulphide (1.2%) and diallyl trisulphide (1%)

(Satish and Rajangam, 2011). Garlic has some antifungal, antimicrobial, insecticidal and other medicinal properties. It has hypoglycemic properties. Garlic therapy has also been suggested in flatulence, constipation, faulty digestion, inadequate food intake, leprosy, chronic coughs and many other diseases (Adegoke *et al.*, 1998).

It is grown widely in the country and the state of U.P. and to boost up its per hectare yield the farmers resort to use of inorganic fertilizers containing N, P and K. But use of inorganic fertilizers to obtain higher yield with quality produce is not only costly but also a precursor of health hazards by polluting the environment, soil and water. This anxiety has now led them to devise ways and means to switch over the use of eco-friendly bio-fertilizers in crop production. *Azotobacter* and PSB fix atmospheric nitrogen and solubilize phosphorous to increase soil fertility and biological activities. bio-fertilizers are products having living cells of different types of micro-organism, which have an ability to convert nutritionally important elements and also, bio-fertilizers are known to play principle role in expanding availability of N. and P. besides improving biological fixation of atmospheric nitrogen and build hormones and anti-metabolites (Bhat *et al.*, 2013).

Availability of nitrogen is important for growing plants. It is a main constituent of protein and nucleic acid molecules. It is also a part of chlorophyll molecules. Phosphorus is vital constituent of phospholipids, nucleic acids and several enzymes. It is also needed for the transfer of energy within the plant system and is involved in its various metabolic activities. Phosphorus has its beneficial effect on early root development, plant growth, yield and quality (Verma, 1993). Potassium plays an indispensable role in plant metabolism such as photosynthesis, trans-location of food, regulation of plant

pores, activation of plant catalyst and resistance against pests and diseases. Potassium improves colour, glossiness and dry matter accumulation besides improving keeping quality of the crop (Dorais *et al.*, 2001). Therefore, keeping in view the above facts in mind, an attempt has been made in the present investigation to study the effect of bio-fertilizers on growth and yield of garlic.

## **Materials and Methods**

The experiment was conducted at on the experimental farm of Department of Horticulture of Janta College, Bakewar, Etawah, during rabi season of the year 2011-2012. Etawah falls in the southwestern portion of Uttar Pradesh, between the parallels of 26.21° and 27.1° North latitude and 78.45° and 79.45° East longitude, at the elevation of 150.06 m above the mean sea level in the gangetic plane of central U.P. rainfall of Etawah ranges from 805 mm. per annum. The soil of the experimental field was sandy loam, pH 6.6 and loam in texture, normal in reaction with medium in respect to nitrogen, phosphorus and potassium. The experiment consisting of 15 treatments viz., two levels of *Azotobacter* (6 and 8 kg), two level of P.S.B. (6 and 8 kg) and two levels of VAM (6 and 8 kg), Eight combinations of *Azotobacter*, PSB and VAM with doses and one is absolute control (N:P:K =100:50:50) was laid out in simple RBD with three replications.

## **Results and Discussion**

Application of 3 bio-fertilizers, viz., *Azotobacter*, PSB and VAM each @ 6 kg and 8 kg per hectare applied separately or in combination was either at par with control or were very less effective. The plant height was observed to be significantly affected by the treatment *Azotobacter* 8 kg/ha+ PSB 8 kg/ha+ VAM 8 kg/ha (T<sub>12</sub>).

The height noted in control plants was 73.36 cm, whereas it was noted significantly maximum observed in T<sub>12</sub> (79.83 cm.) (Gaiki *et al.*, 2006, Talware *et al.*, 2012 and Singh *et al.*, 2017). In rest of the treatments it ranged between 73.83 cm. to 78.93 cm. No. of leaves as recorded in control was 6.30. It was significantly enhanced up to 9.86 in T<sub>12</sub> (Talware *et al.*, 2012 and Singh *et al.*, 2017). In rest of treatments it ranged between 6.40 to 9.56. Diameter of pseudostem in control plants was recorded minimum (0.66 cm). It was significantly increased to the maximum in T<sub>12</sub> (1.13 cm) (Bhandari *et.al.* 2014 and Das *et. al.*, 2014).

The diameter of pseudostem in other treatments ranged from 0.70 cm to 1.00 cm. Average volume of bulb (g) was significantly influenced to the maximum in T<sub>12</sub> (48.23cc) whereas volume of control treatment 34.63cc (Yadav 2003, Gowda *et al.*, 2007 and Das *et al.*, 2014).

The average volume of bulb in other treatments ranged from 36.63cc to 47.00 cc. Average number of 'A' grade bulbs was recorded 81.34 in control whereas in T<sub>12</sub> it was 117.67. In other treatments it was recorded to vary between 83.00 to 115.66 (Yadav, 2003 and Singh *et al.*, 2008).

**Table.1** Summarized pooled data on various yield parameters recorded at the time of harvesting

Treatments	Growth Parameters			Yield parameters	
	Plant height (cm)	No. of leaves	Diameter of pseudostem(cm)	Ava. No. of "A" grade bulbs	Volume of bulb(cc)
T <sub>0</sub>	73.36	6.30	0.66	81.34	34.63
T <sub>1</sub>	74.46	6.76	0.76	87.66	37.30
T <sub>2</sub>	75.90	7.46	0.83	91.00	39.00
T <sub>3</sub>	73.83	6.40	0.70	83.00	36.63
T <sub>4</sub>	75.53	6.93	0.83	88.67	38.23
T <sub>5</sub>	74.16	6.46	0.76	86.00	36.93
T <sub>6</sub>	74.70	6.93	0.80	87.66	37.80
T <sub>7</sub>	78.20	8.36	0.96	97.33	41.93
T <sub>8</sub>	78.93	9.56	1.00	115.66	47.00
T <sub>9</sub>	76.13	7.80	0.76	89.66	39.93
T <sub>10</sub>	78.10	8.90	0.93	105.67	45.30
T <sub>11</sub>	76.60	7.96	0.80	93.34	40.06
T <sub>12</sub>	79.83	9.86	1.13	117.67	48.23
T <sub>13</sub>	77.83	8.53	0.90	95.67	41.13
T <sub>14</sub>	77.23	8.10	0.83	95.67	40.63
CD	0.47	0.54	0.21	6.13	1.02

It is concluded that *Azotobacter* 8 kg/ha+ PSB 8 kg/ha+ VAM 8 kg/ha was though most effective in enhancing the vegetative as also the final yield per plot, but with regard to yield it did not vary significantly from the treatment of *Azotobacter* 6 kg/ha+ PSB 8 kg/ha+ VAM 8 kg/ha. Besides, from economy point of view these two treatment combinations with net profit per hectare Rs. 5.551 lakh and Rs. 4.304 lakh along with 1:3.23 and 1:3.06 respectively, were almost at par economically. So *Azotobacter* 8 kg/ha+ PSB 8 kg/ha+ VAM 8 kg/ha appears to be best optimal doze for garlic under Etawah condition for better yield and better profit at less cost.

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