The Pharma Innovation Journal 2020; 9(4): 345-347

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2020; 9(4): 345-347

www.thepharmajournal.com
Received: 04-02-2020
Accepted: 06-03-2020

Vikas Kumar
Department of Horticulture, School of Agriculture Sciences, Career Point University Kota, Rajasthan, India

Krishan Kumar Singh
Department of Horticulture, H.N.B. Garhwal University, Srinagar, Garhwal, Uttarakhand, India

Corresponding Author:
Vikas Kumar
Department of Horticulture, School of Agriculture Sciences, Career Point University Kota, Rajasthan, India

Effect of bio-fertilizers on growth and yield of garlic (*Allium sativum* L.) under Kota region in Rajasthan

Vikas Kumar and Krishan Kumar Singh

Abstract
The field experiment conducted at Research Farm-I of the Department of Horticulture, School of agriculture Science, Career Point University Kota, Rajasthan during the year 2017-18. The experiment was laid out in Randomized Block Design with ten treatments and three replications. Significant the maximum height of plant (63.29 cm), number of leaves/ plant (7.21 cm), length of leaves (45.16 cm), Stem diameter (11.817 mm), number of cloves per bulb (27.420), diameter of bulb (5.000 cm), length of clove (4.980 cm), bulb yield (78.727 Q/ha.), T.S.S. of bulb (40.317), weight of bulb / plant (30.450g) was observed under T_9 (PAB + VAM + 50 kg/ha P_2O_5) treatment.

Keywords: Garlic, bio-fertilizers, yield, quality attributes

Introduction
Garlic (*Allium sativum* L.) belongs to the family Amaryllidaceae. It is the second most widely used cultivated *Allium* after onion. It has long been recognized all over the world as a valuable spice for food and a popular remedy for various ailments and physiological disorder. It is grown throughout the plains of India and consumed by most of the people. It is used practically all over the world for flavoring various dishes (Pruthi, 1979) [9]. The major garlic producing states of India are Maharashtra, Madhya Pradesh, Orissa, Rajasthan, Karnataka, U. P. and Gujarat.

Bio-fertilizer secretes certain growth promoting substances. Further, they are harmless, eco-friendly and low cost agro- input supplementary to chemical fertilizers. They increase the soil fertility, improve soil structure, porosity and water holding capacity and also enhance seed germination. Under certain conditions they exhibit anti- fungal activities and thereby protect the plants from pathogenic fungi. The phosphate solubilizing bacteria are aerobic and heterotrophic in nature. Large numbers of microorganism have been tested and inoculants of *Bacillus megaterium*, *Pseudomonas striata*, *Bacillus polymyxa* are found suitable and available for seed inoculation. These bacteria solubilize phosphate in excess quantities for their own requirements and thus make it available to plants for their healthy growth. VAM belongs to endomycorrhiza group which penetrate in the cell wall of roots. These fungi enter in root cells and form hyphal masses within the cells. This group is most common and widespread. These micro-organisms have extensive mycelial network and can increase the transport of other mineral elements such as zinc and copper. VAM can also play an important role in enhancing phosphorus availability to the plants particularly in phosphorus deficient soils. VAM fungi can save phosphorus fertilizer by 25-30% (Somani *et al.,* 2004) [12].

Materials and methods
The present investigation entitled, Effect of Bio-fertilizers on Growth and Yield of Garlic (*Allium sativum* L.)" Under Kota Region in Rajasthan was carried out to evaluate the effect of Bio-fertilizers on growth, yield, and quality traits of garlic at the Research Farm-I of the Department of Horticulture, School of agriculture Science, Career Point University Kota, Rajasthan during the year 2017-18. Experimental soil was sandy loam and slightly alkaline in nature pH less than 8.2, Electrical conductivity more then 4.0 and Sodium exchangeable % less than 15.0. The field was thoroughly prepared. The experiment was conducted in a Randomized Block Design with ten treatments replicated thrice. Treatment combination T_1- Control, T_2- RDF 100%, T_3- RDF 90%, T_4- RDF 80%, T_5- VAM + 40 kg/ha P_2O_5, T_6- VAM + 50 kg/ha P_2O_5, T_7- VAM + 75 kg/ha P_2O_5, T_8- PSB + VAM+ 40 kg/ha P_2O_5, T_9- PAB + VAM + 50 kg/ha P_2O_5, T_{10}- PAB + VAM + 50 kg/ha P_2O_5. The observation will be recorded

Plant height (cm), number of leaves, length of leaves (cm), number of cloves per bulb, diameter of bulb (cm), Thickness of necks (mm), length of clove (cm), bulb yield ha. (q), T.S.S. of bulb, fresh weight of bulb / plant (g), dry matter content in bulb (%). The recorded data were analysed through statistical software for observation the parameter were statically significant (0.05%) statically difference (RBD) as described by Cochran and Cox (1992) [2].

Results and discussion

1. Vegetative attributes

The data obtained at 90 DAP, the maximum height (63.29 cm) of plant was noted under the treatment T9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T10 (PSB + VAM + 75 kg/ha P_2O_5) (60.24 cm) and minimum plant height (41.56 cm) was recorded under T1 (Control). The results corroborate the finding of Ghanti and Sharangi (2009) [4] in onion. The maximum number of leaves/ plant (7.21 cm) was noted under the treatment T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P2O5) (7.12 cm) and minimum number of leaves (5.14 cm) was recorded under control T_1(Control). The maximum length of leaves (45.16 cm) was observed under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P2O5) while the minimum length of leaves (38.56 cm) recorded under T_1 (Control). These results are in conformity with the findings of Meena *et al*. (2019) [6] in Garlic. The increase in the vegetative growth of garlic plants by bio-fertilizers might be due to its effect on increasing availability of nitrogen and phosphorus beside improving biological fixation of atmospheric nitrogen and produce hormones and anti-metabolites in root zone (Zaki *et al*., 2014) [15]. The maximum Stem diameter (11.817 mm) was observed under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P2O5) and the minimum Stem diameter was recorded under T_1(Control). The present findings are also in agreement with the results of Kumar, *et al*., (2019) [10] in Garlic.

2. Yield and quality attributes

The maximum number of cloves per bulb (27.420) was recorded under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P_2O_5) and the minimum number of cloves per bulb (20.527) was observed under T_1(Control). These results are in conformity with the findings of Mohmoud and Amera (2000) [7] in tomato. The maximum diameter of bulb (5.000 cm) was recorded under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P2O5) while the minimum diameter of bulb (2.450 cm) was observed under T_1(Control). The maximum thickness of necks (8.113 mm) was recorded under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_8 (PSB + VAM+ 40 kg/ha P2O5) and the minimum thickness of necks (4.450 mm) was observed under T_1(Control). The present findings are also in agreement with the results of Khandelwal and Pareek (2007) [5] in onion. VAM inoculation plays significant and unique role in phosphate mobilization and uptake of phosphorus, zinc, sulphur and water by plant. Although, there is limitation with the use of VAM due to difficulty in producing clean pure inoculation on a large scale as the fungi are obligatory symbiotic and have to be maintained and multiplied on living plant. VAM inoculation helps in uniform crop growth, increased yield of crop and also enhance resistance to root disease and improve hardiness of transplant stock. So due to its obligatory symbiotic nature and above discussed characteristics, increases its use in various crops (Yawalkar *et al*., 1996) [14].

The maximum length of clove (4.980 cm) was recorded under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_8 (PSB + VAM+ 40 kg/ha P_2O_5) and the minimum length of clove (3.120 cm) was observed under T_1(Control) The highest bulb yield (78.727 Q/ha.) was recorded under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P2O5) while the lowest bulb yield was recorded under T_1(Control). The results find support from the work of Singh and Singh (2005) [11] in cauliflower. Microorganisms such as *Azotobacter, Azospirillum and Kelbsiella*; can secrete growth promoting substance similar to gibberellic acid and indole acetic acid, cytokinins and auxins which could stimulate plant growth, increased the surface area/ plant unit root length and were responsible for root hair branching with an eventual increase in absorption of nutrients and improving plant growth (Gomaa, 1995). Many investigators reported that Bio-fertilizers application increased growth of garlic plants (El-Morsy *et al*., 2009) [3].

The maximum T.S.S. of bulb (40.317) observed under T_9 (PAB + VAM + 50 kg/ha P_2O_5) followed by T_{10} (PSB + VAM + 75 kg/ha P2O5) and the minimum T.S.S. of bulb (32.210) was recorded under T_1(Control). The maximum weight of bulb / plant (30.450g) was recorded under T_9 (PAB + VAM + 50 kg/ha P2O5) followed by T_8 (PSB + VAM+ 40 kg/ha P2O5) and the minimum weight of bulb / plant (25.420 g) was recorded under T_1 (Control).These results are in conformity with the findings of Narayanamma *et al.* (2005) [8] in cauliflower. Inoculation of seed with PSB also significantly enhanced the yield and yield attributes in garlic. The beneficial effect of phosphate solubilizing bacteria as explained earlier is due to increase in the availability of phosphorus. Greater root extension under higher availability of phosphorus might have helped in greater uptake of other nutrients, especially micronutrient and secondary nutrients, enhanced photosynthesis, production of photosynthates and their partitioning between vegetative and reproductive structure might have helped in improving the yield attributes. PSB + VAM provide avenues for improving P use efficiency. The increase in uptake was more pronounced with respect to PSB and VAM or their combinations. This may be ascribed to solubilization and mineralization of organic phosphorus, containing substances by production of aliphatic, aromatic acids, phytasis, phosphatic lipases by VAM and PSB (Chadha and Prabhakar, 1997) [1]. The maximum dry matter content in bulb (35.450%) was recorded under T_9 (PAB + VAM + 50 kg/ha P2O5) followed by T_1(Control). and the minimum dry matter content in bulb (31.260 g) was recorded under T_5 (VAM + 40 kg/ha P2O5). These results are in conformity with the findings of Vimala and Natarajan (2000) [13] in pea.

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

Treatments		Plant height (cm)			Number of leaves			Length of leaves (cm)			Stem diameter (mm)		
		30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
T1	Control	12.26	30.56	41.56	3.12	4.12	5.14	22.51	31.23	38.56	4.500	4.900	8.560
T2	RDF 100%	13.35	35.33	50.23	4.23	5.14	5.59	23.56	31.45	39.64	4.600	5.480	9.120
T3	RDF 90%	17.12	34.58	52.56	3.56	4.52	5.23	24.12	32.45	41.12	5.120	5.810	9.450
T4	RDF 80%	16.24	35.26	52.38	4.56	5.23	6.12	24.52	33.12	43.45	4.450	4.817	9.540
T5	VAM + 40 kg/ha P_2O_5	16.62	37.56	54.58	4.52	5.12	6.23	25.37	33.15	41.45	5.080	5.890	10.120
T6	VAM + 50 kg/ha P_2O_5	14.16	35.33	56.23	5.21	6.15	6.75	24.82	34.45	43.24	4.230	5.850	9.417
T7	VAM + 75 kg/ha P_2O_5	17.22	36.56	54.55	4.45	5.45	6.51	25.23	35.45	44.12	4.560	5.450	10.350
T8	PSB + VAM+ 40 kg/ha P_2O_5	18.79	34.23	58.47	4.67	5.50	7.12	26.12	34.60	45.15	4.260	6.120	10.120
T9	PAB + VAM + 50 kg/ha P_2O_5	19.22	39.58	63.29	5.86	6.23	7.21	26.56	35.56	46.12	5.450	6.450	11.817
T10	PSB + VAM + 75 kg/ha P_2O_5	18.50	38.007	60.24	5.12	6.11	7.04	25.59	34.35	45.16	5.100	6.080	10.450
SEm+		0.305	0.072	0.138	0.07	0.05	0.07	0.15	0.11	0.15	0.001	0.101	0.060
CD(P=0.05)		0.914	0.214	0.414	0.21	0.16	0.23	0.46	0.34	0.46	0.004	0.303	0.178

Table 2: Effect of bio-fertilizers on yield and quality of garlic

Treatments		Number of cloves per bulb	Diameter of bulb (cm)	Thickness of necks (mm)	Length of clove (cm)	Bulb yield ha. (q)	T.S.S. of bulb	Fresh weight of bulb / plant (g)	Dry matter content in bulb (%)
T1	Control	20.527	2.450	4.450	3.120	64.630	32.210	25.420	34.007
T2	RDF 100%	21.250	3.220	5.420	3.720	67.473	33.450	28.360	31.450
T3	RDF 90%	22.703	3.450	6.590	4.020	74.590	36.340	29.320	33.120
T4	RDF 80%	24.320	3.707	7.487	3.747	76.150	35.540	26.967	32.450
T5	VAM + 40 kg/ha P_2O_5	24.340	3.480	6.693	3.210	76.330	36.603	27.820	31.260
T6	VAM + 50 kg/ha P_2O_5	23.487	3.207	6.247	4.273	76.513	37.527	28.867	32.250
T7	VAM + 75 kg/ha P_2O_5	25.273	4.040	7.460	4.220	78.097	38.427	27.480	33.450
T8	PSB + VAM+ 40 kg/ha P_2O_5	26.317	3.450	7.247	4.450	77.633	37.613	29.300	31.450
T9	PAB + VAM + 50 kg/ha P_2O_5	27.420	5.000	8.123	4.980	78.727	40.317	30.450	35.450
T10	PSB + VAM + 75 kg/ha P_2O_5	26.633	4.387	7.150	4.350	78.213	38.360	28.333	33.083
SEm+		0.150	0.033	0.038	0.072	0.540	0.054	0.009	0.015
CD(P=0.05)		0.449	0.099	0.112	0.216	1.617	0.160	0.028	0.046

Conclusion

The present investigation clearly revealed that the application of T_9 (PAB + VAM + 50 kg/ha P_2O_5) under the treatment T_9 has obtained best response of garlic over the all other treatment combinations.

References

1. Chadha KL, Prabhakar BS. A critical review of plant nutrient supply need, efficiency, policy issues for vegetable crops for the year 2000-2025. National Academy of Agricultural Sciences, New Delhi, 1997.
2. Cochran WG, Cox MG. Experimental design. J. Wiley Sons, Inc, New York, 1992, 106-117.
3. El-Morsy AHA, Moghazy AM, Saif El-Deen UM. Effect of certain NP-rates and application methods of biofertilizers (microbein) on productivity and storability of garlic. J. Agric. Sic. Mansoura Univ. 2009; 34(5):5053-5065.
4. Ghanti S, Sharangi AB. Effect of bio-fertilizers on growth, yield and quality of onion cv. Sukhsagar. Journal of Crop and Weed. 2009; 5(1):120-123.
5. Khandelwal RB, Pareek DK. Effect of integrated nutrient management along with bio-fertilizers on yield attributing characters and seed yield of onion. International Symposium on Organic Farming and Renewable Sources of Energy for Sustainable Agriculture, Nov. held at MPUAT, Udaipur. 2007; 19(21):42p.
6. Meena FR, Meena ML, Singh R, Ram Vilas, Meena ML, Mauriya SK *et al*. Effect of Organic Manures and Biofertilizers on Growth, Yield and Quality of Garlic (*Allium sativum* L.), Ind. J. Pure App. Biosci. 2019; 7(5):405-409.
7. Mohmoud HAF, Amera MAJ. Response of tomato to biological and mineral fertilization under calcareous soil condition. Bulletin of Agriculture University of Canada. 2000; 51(2):151-174.
8. Narayanamma M, Chiranjeevi CH, Reddy IP, Riazuddinahmed S. Integrated nutrient management in cauliflower (*Brassica oleracea* var. *botrytis* L.). Vegetable Science. 2005; 32(1):62-64.
9. Pruthi JS. Spices and Condiments (Second ed.), National Book Trust of India, New Delhi, 1979, 87-99.
10. Kumar S, Naruka IS, Shaktawat RPS, Singh OP, Meena KC. Response of Garlic (*Allium sativum* L.) to Organic and Inorganic Fertilizers. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107. 2019; 11(7):8209-8211.
11. Singh VN, Singh SS. Effect of inorganic and bio-fertilizers on production of cauliflower (*Brassica oleracea*var. Var. botrytis). Vegetable Science. 2005; 32(2):146-149.
12. Somani LL. Handbook of Bio-fertilizer. Agrotech Publishing Academy, Udaipur, 2004, 1168.
13. Vimala B, Natarajan S. Effect of nitrogen, phosphorus and biofertilizers on pod characters, yield and quality in pea (*Pisum sativum* L. spp. *hortense*). South Indian Horticulture. 2000; 48:60-63.
14. Yawalkar KS, Agarwal JP, Bokde S. Manures and fertilizers. Edn. VIII., Agri-Horticultural Publishing House 52, Nagpur. 1996; 8:297-299.
15. Zaki HEM, Toney HS, Abd Elraouf RM. Response of two garlic cultivars (*Allium sativum* L.) to inorganic and organic fertilization. Nature and Science. 2014; 12(10):52 -60.