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Effect of bio-fertilizers on growth and yield response of garlic (*Allium sativum* L.) garlic

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Abstract

A field experiment entitled 'Effect of Bio-Fertilizers on Growth and Yield Response of Garlic (*Allium sativum* L.) was conducted during the rabi season in 2022-23 and 2023-24 at the Research Farm-I of the Department of Horticulture, Mansarovar Global University, Bilkishganj Sehore (Madhya Pradesh). The experiment was laid out in Randomized Block Design with ten treatments and three replications. The maximum plant height (65.62 cm), number of leaves (7.495), length of leaves (48.015 cm), diameter of bulb (4.945 cm), number of cloves (28.375) per plant, length of cloves (4.94 cm) per plant, yield of bulb (81.75 q/ha), Total Soluble Solids (41.95) per plant, were recorded under T₉ (Azospirillum + Phosphobacteria) treatments. Application of T₉ (Azospirillum + Phosphobacteria) may be considered as best treatment in terms of all growth and yield characters.

Keywords: Garlic, bio-fertilizers, yield, total soluble solids

Introduction

Garlic 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. In America about 50% of the entire output of fresh garlic is dehydrated and sold to food processors. Recently, spray dried garlic products are also available for some year (Pruthi, 1979)^[11].

The area covered by garlic exceeds 1,142,000 ha and its average productivity is estimated to be 12t ha⁻¹ in the world (FAO, 2003). World production of garlic is ranked 14th among vegetables with a total of 14.5 million ton. In Mexico, its consumption is about 400 g per capita (Chavez, 2008), and the production is considered low as compared to other countries such as China (80% world production), India, Korea and (20%) the rest of the world.

Garlic contains moisture 62.8%, protein 6.3%, mineral matter 1.0%, carbohydrate 29.0%, fat 0.7%, fibre 0.8%, calcium 0.03%, phosphorus 0.31%, iron 0.0013%, calorific value 141, vitamin C 13 mg per 100 g, nicotinic acid 0.4 mg, thiamine 0.16 mg, riboflavin 0.23 mg its 100 gyible portion contains: Na 32 mg, Mg 36 mg and fibre 1.1% (Chatfield, 1954)^[4].

Materials and Methods

The experiments were conducted during rabi season 2022-23 and 2023-24 at the field of Horticulture department, Mansarovar Global University, Bilkishganj Sehore (Madhya Pradesh) India. The site is situated in part of Madhya Pradesh and covers geographical area of 25.60 lakh ha and represents 8.71 per cent of the total geographical area of the state. The zone is located between 23016' North latitudes and 77036' East longitudes. This zone possesses typically sub-tropical climatic conditions characterized by mild winters and moderate summers associated with high relative humidity during the months of July to September. The annual rainfall of the region is 650 – 1000 mm, most of which is contributed by south west monsoon from July to September. The experiment consisting of 10 treatments viz., T₁- Control (No fertilizer), T₂- RDF 100%, T₃-RDF 90%, T₄- RDF 80%, T₅- Control (un-inoculated), T₆- *Azotobacter*, T₇- Phosphobacteria, T₈- *Azospirillum*, T₉- *Azospirillum* + Phosphobacteria, T₁₀ *Azotobacter*+Phosphobacteria, was laid out in RBD with three replications.

Results and Discussion

Growth attributes

Observation on plant height, number of leaves and length of leaves as influenced by various treatments was recorded at different stages of plant growth viz. 30, 60 and 90 days after planting during 2022-23 and 2023-24. The perusal of data revealed that the plant height, number of leaves and length of leaves at 90 DAP was significantly affected by various bio-fertilizers. The maximum plant height (65.62cm), the maximum number of leaves (7.49) and the maximum length of leaves (48.015cm) was recorded under T₉ (Azospirillum + Phosphobacteria), while minimum plant height (43.13 cm), minimum number of leaves (5.35) and minimum length of leaves (40.045 cm) was recorded under T₁ (control) treatments during 2022-23- 2023-24 Pool mean. Similar results were also reported by Bahadur *et al.* (2006) ^[1] in pea, Biswas and Patra (2007) ^[2] in green gram, Djebali *et al.* (2010) ^[8] in common

bean, pea, alfalfa and Ramana *et al.* (2010) ^[13] in French bean.

Yield attributes

Observation on Diameter of bulb (cm), Number of cloves per bulb, Length of clove (cm) and Bulb yield (q/ha) influenced by various treatments was recorded at after harvest during 2022-23 and 2023-24. The maximum diameter of bulb (4.94 cm), the maximum number of cloves per plant (28.37), the maximum length of cloves (4.94 cm) and the maximum yield of bulb (81.75 q/ha) was recorded under T₉ (Azospirillum + Phosphobacteria), while minimum diameter of bulb (2.55 cm), minimum number of cloves per plant (22.58), minimum length of cloves (3.14 cm) and minimum yield of bulb (67.44 q/ha) was recorded under T₁ (control) treatments during 2022-23- 2023-24 Pool mean. Similar findings were also reported by Singh *et al.* (2004) in pea, Narayan *et al.* (2005) ^[10] in cauliflower, Dadhich *et al.* (2006) ^[7] in soybean.

Table 1: Effect of Bio-Fertilizers on the plant height (cm) of garlic

Treatment	30 DAP		Pool mean	60 DAP		Pool mean	90 DAP		Pool mean
	2022-23	2023-24		2022-23	2023-24		2022-23	2023-24	
T ₁ -Control (No fertilizer)	12.01	14.53	13.27	29.95	34.35	32.15	40.73	45.54	43.13
T ₂ -100% RDF	13.08	14.69	13.885	34.62	38.86	36.74	49.23	56.35	52.79
T ₃ -90% RDF	16.78	18.33	17.555	33.89	38.75	36.32	51.51	58.18	54.84
T ₄ -80% RDF	15.92	17.86	16.89	34.55	38.79	36.67	51.33	57.93	54.63
T ₅ -Control (un-inoculated)	16.29	16.02	16.155	36.81	39.73	38.27	53.49	59.99	56.74
T ₆ -Azotobacter	13.88	16.68	15.28	34.62	38.86	36.74	55.11	61.96	58.53
T ₇ -Phosphobacteria	16.88	18.94	17.91	35.83	41.32	38.575	53.46	62.54	58
T ₈ -Azospirillum	18.41	21.25	19.83	33.55	37.65	35.6	57.3	62.99	60.14
T ₉ -Azospirillum + Phosphobacteria	18.84	21.18	20.01	38.79	43.62	41.205	62.02	69.23	65.62
T ₁₀ -Azotobacter + Phosphobacteria	18.13	20.42	19.275	37.25	42.9	40.075	59.04	68.08	63.56
S.Em+	0.460	0.510	0.485	1.01	1.14		1.53	5.22	
CD	1.376	1.528	1.452	3.03	3.42		4.58	1.74	

Table 2: Effect of Bio-Fertilizers on the number of leaves of garlic

Treatment	30 DAP		Pool mean	60 DAP		Pool mean	90 DAP		Pool mean
	2022-23	2023-24		2022-23	2023-24		2022-23	2023-24	
T ₁ -Control (No fertilizer)	3.06	3.45	3.255	4.04	4.65	4.345	5.04	5.63	5.335
T ₂ -100% RDF	4.15	4.65	4.4	5.04	5.73	5.385	5.48	6.01	5.745
T ₃ -90% RDF	3.49	3.92	3.705	4.43	4.97	4.7	5.13	5.72	5.425
T ₄ -80% RDF	4.47	4.9	4.685	5.13	5.75	5.44	6	6.85	6.425
T ₅ -Control (un-inoculated)	4.43	4.95	4.69	5.02	5.63	5.325	6.11	6.88	6.495
T ₆ -Azotobacter	5.11	5.71	5.41	6.03	5.67	5.85	6.62	7.37	6.995
T ₇ -Phosphobacteria	4.36	4.91	4.635	5.34	6	5.67	6.38	7.49	6.935
T ₈ -Azospirillum	4.58	5.14	4.86	5.39	6.05	5.72	6.98	7.86	7.42
T ₉ -Azospirillum + Phosphobacteria	5.74	6.36	6.05	6.11	6.82	6.465	7.07	7.92	7.495
T ₁₀ -Azotobacter + Phosphobacteria	5.02	5.65	5.335	5.99	6.73	6.36	6.9	7.8	7.35
S.Em+	0.38	0.14		0.15	0.16		0.17	0.20	
CD	1.12	0.42		0.45	0.50		0.53	0.60	

Conclusion

On the basis of the results obtained in the present investigation, it may be concluded that application of different RDF and bio-fertilizers enhanced the growth; yield and quality of garlic except days take bulb initiation in comparison to control. Application of T₉ (Azospirillum+Phosphobacteria) may be considered as best treatment in terms of all growth and yield characters. It is recommended for higher production of garlic under Bilkishganj Sehere (Madhya Pradesh) conditions.

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