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Effect of spacing and biofertilizers on growth and yield of garden cress (*Lepidium staivim* L.)

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Abstract
Garden cress (*Lepidium sativum* L.) is a medicinal plant, belonging to the family cruciferae. A field experiment was conducted with the combination of biofertilizers and spacing levels in a factorial RCBD with three replications to study their effects on growth and yield of garden cress. Maximum plant height (75.40 cm), biomass production per hectare (7.19 t) and seed yield per hectare (1.85 t) were recorded when garden cress was supplied with *Azotobacter chroococcum* @ 5 kg ha^{-1} + phosphate solubilizing bacteria @ 5 kg ha^{-1} with spacing of 30 cm x 10 cm. Significantly highest number of primary branches (19.12), number of leaves (44.0) and total dry matter accumulation per plant (44.90 g) were observed with the application of *Azotobacter chroococcum* @ 5 kg ha^{-1} + phosphate solubilizing bacteria @ 5 kg ha^{-1} with spacing of 45 cm x 20 cm.

Keywords: Garden cress, biofertilizers, spacing levels, growth and yield

Introduction
Garden cress (*Lepidium sativum* L.) is a polymorphous species believed to have originated primarily in the high land region of Ethiopia and Eritrea and it is an erect annual edible herb belonging to the family cruciferae. The diploid forms (2n = 2x = 16) and tetraploid forms (2n = 4x = 32) exist in garden cress [1]. Garden cress is popularly known as sialoo in local, alave in kannada, asalia in Hindi and chandrasoor in Sanskrit. However, the crop is mainly cultivated for seeds in India. The seeds are known to contain a light yellow colored fixed oil and alkaloids such as lepidin, glucotropeolin, besides sinapin and sinapic acid. They are mainly used in Ayurveda, Unani and Siddha systems of medicine as thermogenic, depurative, galactogouge, tonic, aphrodiasiac, ophthalmic, antiscorbutic, antiasthamatic, diuretic etc. Garden cress seeds contain 22 per cent protein, 27.5 per cent fat and 30.0 per cent dietary fibre. Seeds are also reported to be rich in linolenic acid (30.2%) followed by glutamic acid (19.3%) and leucine (8.2%) [2]. It can be used in traditional tonic to increase the children height, to increase the milk in lactating mothers and as an eye tonic apart from using seeds against chronic bronchial asthma [3]. Seeds are also fed to cattle to enhance the quality and quantity of milk.

The bio fertilizers application not only reduce the fertilizer requirement and cost of crop production but also improves soil health, yield and quality of produce. The application of *Azotobacter* sp. and phosphate solubilizing bacteria helped to increase the growth and yield. The optimum plant population per unit area is important to get the higher economic yield and very little research work has been carried out on such an important medicinal crop, the garden cress. Hence, keeping this in mind above research work was conducted to know the suitable biofertilzer and optimum spacing levels for getting higher growth and yield in garden cress.

Material and Methods
An investigation was carried out to study the "Effect of spacing and biofertilizers on growth, yield and quality of garden cress (*Lepidium sativum* L.)" during *rabi*, 2017-18 at Main Horticultural Research and Extension Centre (MHREC), UHS, Udyangiri, Bagalkot which comes under Northern Dry Zone of Karnataka. Garden cress was sown in the month of November, 2017. The experimental site located at 16^{0} 10^{0} North latitude, 74^{0} 42^{0} East longitude and at an altitude of 542.0 meters above the mean sea level.

Soil of experimental site was clayey in texture, slightly sodic in nature. Healthy seeds of local variety were used for sowing. The experiment consists of biofertilizers combinations viz., B_1 (*Azotobacter chroococcum* (5 kg/ha) + PSB (5 kg/ha)) and B_2 (*Azotobacter chroococcum* (5 kg/ha) + VAM (25 kg/ha)) and six spacing levels viz., S_1 (30 cm x 10 cm), S_2 (30 cm x 15 cm), S_3 (30 cm x 20 cm), S_4 (45 cm x 10 cm), S_5 (45 cm x 15 cm) and S_6 (45 cm x 20 cm). FYM @ 10 ton per hectare and RDF @ 80:80:30 kilogram per hectare was applied to all the treatments. Soil application of *Azotobacter chroococcum* and PSB both @ 5 kg ha^{-1} and VAM @ 25 kg ha^{-1} were made at the time of sowing as per the treatments. Observations on growth and yield parameters were recorded using five plants per plot and the data collected during the study were subjected to statistical analysis using the Fischer's method of analysis of variance technique [4].

Results and discussion

Significant increase in plant height (75.40 cm) was recorded with application of *A. chroococcum* + PSB with spacing of 30 cm x 10 cm (T_1) (Table 1). The reason for highest plant height recorded by *Azotobacter chroococcum* and phosphate solubilising bacteria, might be better root and shoot development, better uptake of water, nutrients and their transportation [5, 6]. In closer spacing plant population per plot was more and as the plant population increased availability of land per plant decreased. So with increase in spacing, there was significant reduction in plant height. It is well known fact that when availability of land area per plant reduces, competition among crop plants for solar radiation interception increases [7, 8].

Significantly highest number of primary branches (19.12), number of leaves (44.0) per plant and dry matter accumulation per plant (44.90 g) was recorded by application of *A. chroococcum* and PSB with the spacing of 45 cm x 20 cm (T_6) (Table 1). The increase in number of primary branches and number of leaves per plant could be due to enhanced vegetative growth, because of increased cell division and cell elongation in the auxiliary buds triggered by various activities and increased photosynthesis and growth promoting substances produced by the biofertilizers which inturn increased the laterals due to arrest of apical dominance [5]. With increase in spacing, availability of land area per plant also increases which encourages the production of number of branches and leaves per plant [7, 9, 10].

Significantly highest biomass production per hectare (7.19 t) was noticed with the application of *A. chroococcum* and PSB with spacing of 30 cm x 10 cm (T_1) (Table 2). The overcrowding of plants at closer spacing the growth attributes of the crop reduced but significantly higher biomass was obtained due to more number of plants per unit area. The increased biomass production per unit area might be due to the higher plant population per hectare in closer spacing than at wider spacing [7, 11].

Significantly highest seed yield per hectare (1.85 t) was recorded with application of *A. chroococcum* and PSB with spacing of 30 cm x 10 cm (Table 2). Higher seed yield was due to more translocation of food materials from source to sink. It was due to production of higher number of branches, higher number of leaves and higher number of siliquae per plant. Finally the yield contributing parameters helped to increase the seed production. Larger canopy development associated with profuse branching has increased interception, absorption and utilization of solar energy resulting in formation of higher photosynthates [10, 11, 7].

Table 1: Plant height (cm), number of primary branches per plant and number of leaves per plant in garden cress at harvest as influenced by biofertilizers and spacing levels

Treatments	Plant height (cm)	No. of primary branches per plant	No. of leaves per plant
Factor A: Biofertilizers			
B_1: *Azotobacter chroococcum* (5 kg/ha) + PSB (5 kg/ha)	71.14^a	14.78^a	40.58^a
B_2: *Azotobacter chroococcum* (5 kg/ha) + VAM (25 kg/ha)	66.18^b	13.08^b	38.04^b
S.Em±	0.34	0.21	0.35
C.D at 5%	0.99	0.62	1.02
Factor B: Spacing levels			
S_1: 30 cm x 10 cm (3,33,333 pl/ha)	73.43^a	9.79^e	35.00^e
S_2: 30 cm x 15 cm (2,22,222 pl/ha)	71.05^b	12.08^d	37.34^d
S_3: 30 cm x 20 cm (1,66,666 pl/ha)	69.17^c	12.75^d	38.70^d
S_4: 45 cm x 10 cm (2,22,222 pl/ha)	67.83^d	14.85^c	39.13^c
S_5: 45 cm x 15 cm (1,48,148 pl/ha)	66.32^e	16.35^b	41.75^b
S_6: 45 cm x 20 cm (1,11,111 pl/ha)	64.17^f	17.75^a	43.92^a
S.Em±	0.59	0.37	0.60
C.D at 5%	1.72	1.07	1.76
Interactions (A x B)			
T_1 : B_1S_1- *A. chroococcum* + PSB with spacing 30 cm x 10 cm	75.40^a	10.58^e	38.17^{bc}
T_2 : B_1S_2- *A. chroococcum* + PSB with spacing 30 cm x 15 cm	72.17^b	12.00^{de}	38.70^{bc}
T_3 : B_1S_3- *A. chroococcum* + PSB with spacing 30 cm x 20 cm	71.00^{bc}	13.00^d	39.75^{bc}
T_4 : B_1S_4- *A. chroococcum* + PSB with spacing 45 cm x 10 cm	70.33^{bc}	16.50^{bc}	40.00^b
T_5 : B_1S_5- *A. chroococcum* + PSB with spacing 45 cm x 15 cm	69.97^{bc}	17.50^b	42.83^b
T_6 : B_1S_6- *A. chroococcum* + PSB with spacing 45 cm x 20 cm	68.00^d	19.12^a	44.00^a
T_7 : B_2S_1- *A. chroococcum* + VAM with spacing 30 cm x 10 cm	71.47^c	9.00^f	31.83^e
T_8 : B_2S_2- *A. chroococcum* + VAM with spacing 30cm x 15 cm	69.93^c	12.17^d	35.99d
T_9 : B_2S_3- *A. chroococcum* + VAM with spacing 30 cm x 20 cm	67.33^{de}	12.51^d	37.65^{cd}
T_{10} : B_2S_4- *A. chroococcum* + VAM with spacing 45 cm x 10 cm	65.33^e	13.20^d	38.25^{bc}
T_{11} : B_2S_5- *A. chroococcum* + VAM with spacing 45 cm x 15 cm	62.67^f	15.20^c	40.67^b
T_{12} : B_2S_6- *A. chroococcum* + VAM with spacing 45 cm x 20 cm	60.33^f	16.38^{bc}	43.84^a
S.Em±	0.83	0.52	0.85
C.D at 5%	2.43	1.52	2.49
CV (%)	7.49	6.01	5.9

PSB: Phosphate solubilizing bacteria, VAM: Vesicular arbuscular mycorrhiza

Table 2: Total dry matter accumulation per plant (g), biomass production per hectare (tons) and seed yield per hectare (tons) in garden cress at harvest as influenced by biofertilizers and spacing levels

Treatments	Total dry matter accumulation per plant (g)	Biomass production per hectare (t)	Seed yield per hectare (t)
Factor A: Biofertilizers			
B_1: *Azotobacter chroococcum* (5 kg/ha) + PSB (5 kg/ha)	38.78^a	6.03^a	1.47^a
B_2: *Azotobacter chroococcum* (5 kg/ha) + VAM (25 kg/ha)	33.37^b	5.51^b	1.38^b
S.Em±	0.55	0.09	0.02
C.D at 5%	1.61	0.26	0.07
Factor B: Spacing levels			
S_1: 30 cm x 10 cm (3,33,333 pl/ha)	30.50^d	6.93^a	1.78^a
S_2: 30 cm x 15 cm (2,22,222 pl/ha)	30.50^d	5.41^c	1.67^a
S_3: 30 cm x 20 cm (1,66,666 pl/ha)	35.10^c	6.01^b	1.52^b
S_4: 45 cm x 10 cm (2,22,222 pl/ha)	37.60^b	5.36^c	1.33^c
S_5: 45 cm x 15 cm (1,48,148 pl/ha)	39.30^b	5.49^c	1.15^d
S_6: 45 cm x 20 cm (1,11,111 pl/ha)	43.45^a	5.44^c	1.09^e
S.Em±	0.95	0.16	0.04
C.D at 5%	2.79	0.46	0.12
Interactions (A x B)			
T_1 : B_1S_1- *A. chroococcum* + PSB with spacing 30 cm x 10 cm	36.00^e	7.19^a	1.85^a
T_2 : B_1S_2- *A. chroococcum* + PSB with spacing 30 cm x 15 cm	36.00^e	4.44^f	1.70^{ab}
T_3 : B_1S_3- *A. chroococcum* + PSB with spacing 30 cm x 20 cm	37.20^{de}	6.44^{abc}	1.56^{bc}
T_4 : B_1S_4- *A. chroococcum* + PSB with spacing 45 cm x 10 cm	39.20^{cd}	5.63^{cd}	1.25^e
T_5 : B_1S_5- *A. chroococcum* + PSB with spacing 45 cm x 15 cm	39.40^c	6.22^{bc}	1.22^e
T_6 : B_1S_6- *A. chroococcum* + PSB with spacing 45 cm x 20 cm	44.90^a	6.28^{bc}	1.21^e
T_7 : B_2S_1- *A. chroococcum* + VAM with spacing 30 cm x 10 cm	25.00^g	6.67^{ab}	1.70^{ab}
T_8 : B_2S_2- *A. chroococcum* + VAM with spacing 30cm x 15 cm	25.00^g	6.37^{abc}	1.63^{bc}
T_9 : B_2S_3- *A. chroococcum* + VAM with spacing 30 cm x 20 cm	33.00^f	5.59^{cd}	1.48^{cd}
T_{10} : B_2S_4- *A. chroococcum* + VAM with spacing 45 cm x 10 cm	36.00^e	5.08^{def}	1.41^{de}
T_{11} : B_2S_5- *A. chroococcum* + VAM with spacing 45 cm x 15 cm	39.20^{cd}	4.76^{ef}	1.07^f
T_{12} : B_2S_6- *A. chroococcum* + VAM with spacing 45 cm x 20 cm	42.00^b	4.59^f	0.96^f
S.Em±	1.35	0.22	0.06
C.D at 5%	3.95	0.64	0.17
CV (%)	6.46	6.65	6.95

PSB: Phosphate solubilizing bacteria, VAM: Vesicular arbuscular mycorrhiza

Conclusion

From the present investigation, it can be concluded that the garden cress supplied with *A. chroococcum* @ 5 kg ha^{-1} and PSB @ 5 kg ha^{-1} with spacing of 30 cm x 10 cm is beneficial for obtaining the maximum growth and higher seed yield.

References

1. Anonymous. The Wealth of Ind. Raw Materials, Publication and information Directorate, Council of Scientific Information and Research, New Delhi. 1972, 71-72.
2. Gokavi S, Nagappa G, Malleshi, Guo M. Chemical Composition of Garden Cress (*Lepidium sativum*) Seeds and Its Fractions and use of Bran as a Functional Ingredient. Plant Foods for Human Nutrition. 2004; 59:105-11.
3. Archana, Singh A, Sikarwar RS, Mishra US. Effect of different dates of sowing on yield and biochemical parameters of *Lepidium sativum* Linn. Biomed. 2009; 4(1):23-27.
4. Panse VG, Sukhatme PV. Stastical Methods for Agricultural Workers, Indian council of Agricultural Research, New Delhi, 1967
5. Hnamte V, Chatterjee R, Hatterjee, Tania C. Growth, flowering, fruit setting and maturity behaviour of coriander with organics. The Bio scan (An int. Quarterly J. of life sci.). 2013; 8(3):791-793.
6. Vyas SP. Interactive Effects of Nitrogen and Bio-fertilizers on Indian Mustard. Ann. Arid Zone. 2005; 44(2):147-150.
7. Sharma A, Naruka IS, Shaktawat RP. Effect of row spacing and nitrogen on growth and yield of coriander (*Coriandrum sativum* L.). J Krishi Vigyan. 2016; 5(1):49-53.
8. Nayak BR, Samanta PK, Dash AK, Swain SK. Growth and yield of coriander (*Coriandrum sativum* L.) as influenced by different levels of farm yard manure, nitrogen and plant spacings. An Asian J of Soil Sci. 2013; 8(2):198-201.
9. Rana SC, Pandita VK, Sirohi S. Influence of spacing and number of leaf cuttings on seed yield in fenugreek. Legume Res. 2015; 38(6):858-860.
10. Naruka IS, Singh PP, Barde M, Rathore SS. Effect of spacing and nitrogen levels on growth, yield and quality of ajwain (*Trachyspermum ammi* L. Sprague). Int. J Seed Spices. 2012; 9(1):111-115.
11. Kumar R, Meena SS, Kakani RK, Mehta RS, Meena NK. Response of crop geometry fertilizer levels and genotypes on productivity of fenugreek (*Trigonella foenum-graecum* L.). Int. J Seed Spices. 2015; 5(1):63-67.