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Effect of biofertillizers [Azatobacter and Phosphorus Solubilizing Bacteria (PSB)] and their combinations on germination and survival of *Brassica campestris*

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ABSTRACT: The investigation was carried out on *Brassica campestris L.*, two varieties (YS-66 and K-88) cultivated with the treatment of two biofertillizers Azatobacter and phosphorus solubilizing bacteria (PSB). In varieties YS-66 and K-88, effect of Azatobacter 15g inoculation showed 97 ± 1.1 and 97 ± 1.2% germination with survival of 99 ± 1.2 and 98 ± 1.2% respectively. PSB 15g inoculation showed 98 ± 1.2 and 99 ± 1.1% germination with survival of 96 ± 1.1 and 97 ± 1.2% respectively. Azatobacter +PSB, 15g+15g inoculation showed 98 ± 1.2 and 99 ± 1.2 % germination with survival of 98 ± 1.1 and 98 ± 1.1% respectively . Control seeds of both varieties showed 96 ± 1.2 % germination and 94 ± 1.2 survival respectively.

Keywords: *Brassica campestris*, Azatobacter, phosphate solubilizing bacteria (PSB), variety YS-66, variety K-88 and germination.

INTRODUCTION

Brassica campestris belongs to the family *Brassicaceae*. *Brassica* is an important crop of the Indian continent. The diploid chromosome number is 2n =20. *Azatobacter* culture is one of the important bio-fertilizer[1] which has been used worldwide for oil crop culture. It is free living gram negative rod shaped nitrogen fixing bacterium. *Azatobacter Chroococcum* [2 &14] is most effective and useful. The number of chroococcum in Indian soils is 10^4 to 10^5/g soil. Atmosphere contains 78% of nitrogen which is most essential plant nutrient for plant growth and crop yield nitrogen[6,9,10,11 &13].Phosphorus is an important primary plant nutrient which helps root formation and plant growth and thereby better yield. The Phosphate solubilizing microorganism mainly are bacteria (Bacillus polymyxa, Pseudomonas Striata) and Fungi (*Aspergillus awamori Pencillium digitatium*)[7&8]. Solubilizing phosphate increase uptake efficiency of plants. Both nitrogenous and phosphatic bio-fertilizers are to be used to get the best results. Several phosphate solubilizing micro organisms have been isolated and the very promising culture have been identified as *Pseudomonas striata, Pseudomonas rathonals, Bacillus polymyxa, Aspergillus awamori, Penicillium, Fusarium and Trichodrima spp.*

Its seeds have the oil and medicinal values. It is a bushy annual plant of the *Brassicaceae* family and grown for oil. *Brassica* are relatively tolerant to drought and grown throughout the world. About half of the worldwide production of *Brassica* is from India, most of which is consumed in the domestic market. *Brassica campestris* contains 28.6% proteins, 3.1 % ash, 4.6% crude fibres, 44.3% starch, 36.1% amylase 63.1% total carbohydrates and 420 cal .100 g gross energy. This crop is valued as a high oil source, the residue straw, and pod wall used for animal feeding. *Brassica campestris* is the only species that is cultivated in India for its seeds used for oil. Small erect pubescent herb 15-75 cm high with surplus leaves and yellow flowers borne or in racemes pod smooth, oblong or rhomboid,1-15 cm long. It is widely grown in the Mediterranean countries, its food value is from biblical times. India and Pakistan is the major producer of *Brassica* .Medicinally *Brassica* oil is used as preservative and in intestinal

infections. Biofertillizers play an important role in the improvement of soil. The use of biofertillizers is also useful to reduce the pollution rate in the soil and water[4]. The objective of this work was to study the effect of biofertillizers[3,5 & 12]. Azatobacter chrococcum and phosphate solubilizing bacteria (PSB) singly or in combination with rhizobium on growth and survival percentage of *Brassica campestris.*

MATERIAL AND METHODS

Collection of seeds: The seeds of two common cultivars YS-66 and K-88 *Brassica campestris* L. Sarson were collected from Sehore Agriculture College, Sehore.

Collection of bio-fertilizers: Bio-fertilizers, Azatobacter and PSB used in seed inoculation were brought from M.P. Agro Industries, Bhopal.

Experimental Site: Two experiments were conducted, one in laboratory, pot experiment and second field experiment, simultaneously in October to Middle of February. The chemical analysis of soil and nutrient content of seeds were analysed at Indian Institute of Soil Science (IISS), Bhopal. It is generally grown mixed with wheat or barley.

Geographic location and Climate: District Bhopal is located in the western part of Madhya Pradesh. Running from the extreme North West for a considerable distance towards the south to about 23^{o} of latitude, on the southern side to about 77^{o} of longitude. In point of situation, Bhopal lies between 23.16' north latitude and 72.25' east longitude and possesses an area of 2774 square kilometers. In summer season (March - middle June) temperature varies from the lowest 9.9- 45.1^{0}C. The average annual rainfall in this area is about 919 mm with about 92% of the precipitation during monsoon months of June to September. The relative humidity varies from 10%. During the South West Manson season, humidity is generally above 70%. During rest of the period, the air is generally dry. Winds are generally light except in late summer and early part of the monsoon season.

Collection of soil samples: The soil of the experimental site field was black loamy Soil sample were collected and filling the pots and after harvesting for analysis of physico-chemical and available nutrients in soil. The soil samples were collected randomly from 10 - 15 cm depth with the help of soil auger. The samples were air dried ground with wooden hammer, sieved through 2 mm sieve and used.

This work was conducted in Saifia Science College, Bhopal during (2007-2008 and 2008 -2009). In these studies, the effect of some[6] biofertillizers Azatobacter chrococcum, phosphate solubilizing bacteria (PSB) and their combination on germination and survival of *Brassica campestris.*

Brassica campestris seeds of known varieties YS-66 and K-88 of central India produced from Seed Corporation of India, new market Bhopal 500g dry healthy seeds with average moisture content of each variety selected from *Brassica*.

Two biofertillizers Azatobacter, PSB and their combination were used. Biofertillizers were taken from Agra industries in Inderpuri, Bhopal (M.P.) about 15,15g of biofertillizers mixed with 2 kg of soil were used in these nine treatments and control one was used for the study of germination and survival.

Soil was treated with two biofertillizers and their combination in two years. First treatment was done with Azatobacter biofertillizers. Second treatment was done with PSB biofertillizers[10 & 11] and third treatment with the mixture of two i.e. azatobacter and PSB 1:1 ratio. Now the 100 seeds were sown in the treated soil with 15g and 15g of the biofertillizers. Same procedure was followed with second biofertillizers. The soil was treated with 15g +15g, 15g + 15g of biofertillizers and 100 seeds were sown on it.

Seeds were sown in pots with treated soil to study the germination and survival in October 2007 and seeds obtained from treated germination were sown in the next year October 2008, and observe the germination and survival of these plant seeds collected.

RESULTS AND DISCUSSION

Table 1 and Table 2 show the germination and survival of the *Brassica campestris L.* treated with different biofertillizers and their combination.

The effect of biofertillizers Azatobacter, PSB[15, 16] and their combination on the germination percentage of *Brassica campestris*. the results indicate that the germination percentage in YS-66 and K-88 varieties with the treatment of 15g Azatobacter $97 \pm 1.1\%$ and 97 ± 1.2 % germination, the treatment in both varieties 15g PSB showed 98 ± 1.2 %and $99 \pm 1.1\%$ germination, the treatment with 15g +15g of Azatobacter + PSB to both the varieties of the germination percentage was 98 ± 1.2 % and $99 \pm 1.2\%$ respectively.

In varities YS-66 and K-88 treated with 15g Azatobacter survival observed was $99 \pm 1.2\%$ and $98 \pm 1.2\%$ respectively. The treatment with 15g PSB survival observed was $96 \pm 1.1\%$ and 97 ± 1.2 % survival respectively and and treatment with 15g +15g Azatobacter +PSB showed 98 ± 1.1 %and $98 \pm 1.1\%$ survival was recorded.

Control of two varieties K-88, YS-66 showed 96 ± 1.2 % germination and $94 \pm 1.2\%$survival respectively.

Table 1: Effect of different doses of Biofertillizers Azatobacter, PSB and their combination on the germination percentage of two cultivars YS-66 and K-88 of *Brassica campestris* L.

S. No.	Biofertillizers	Treatments	Germination %			
			Cultivar YS-66		Cultivar K-88	
			2007-08	2008-09	2007-08	2008-09
1	Azatobacter	5 gm.	96±1.1	95±1.2	97±1.2	96±1.3
2	Azatobacter	10 gm.	96±1.2	96±1.1	97±1.1	96±1.2
3	Azatobacter	15 gm.	97±1.1	97±1.2	97±1.1	97±1.2
4	PSB	5 gm.	96±1.2	96±1.1	96±1.2	95±1.3
5	PSB	10 gm.	97±1.3	97±1.2	97±1.3	98±1.1
6	PSB	15 gm.	98±1.2	97±1.1	98±1.2	99±1.1
7	Azatobacter+PSB	5 gm. + 5 gm.	97±1.3	97±1.3	96±1.2	97±1.2
8	Azatobacter+PSB	10 gm. + 10 gm.	98±1.1	98±1.2	98±1.1	97±1.1
9	Azatobacter+PSB	15 gm. + 15 gm.	98±1.2	99±1.3	98±1.1	99±1.2
10	Untreated	Control	96±1.2	95±1.1	97±1.2	96±1.2

LSD 0.05 = 1.21
CV = 3.26

Table 2: Effect of different doses of Biofertillizers Azatobacter, PSB and their combination on the survival percentage of two cultivars YS-66 ad K-88 of *Brassica campestris* L.

S. No.	Biofertillizers	Treatments	Survival %			
			Cultivar YS-66		Cultivar K-88	
			2007-08	2008-09	2007-08	2008-09
1	Azatobacter	5 gm.	94±1.2	95±1.1	95±1.2	94±1.3
2	Azatobacter	10 gm.	96±1.1	95±1.2	95±1.3	96±1.2

3	Azatobacter	15 gm.	99±1.2	98±1.3	97±1.1	98±1.2
4	PSB	5 gm.	94±1.1	94±1.2	93±1.1	94±1.2
5	PSB	10 gm.	96±1.2	95±1.1	96±1.2	96±1.3
6	PSB	15 gm.	96±1.1	97±1.2	98±1.1	97±1.2
7	Azatobacter+PSB	5 gm. + 5 gm.	96±1.2	96±1.1	97±1.1	97±1.3
8	Azatobacter+PSB	10 gm. + 10 gm.	97±1.2	97±1.1	98±1.2	97±1.3
9	Azatobacter+PSB	15 gm. + 15 gm.	98±1.1	99±1.2	98±1.3	98±1.1
10	Untreated	Control	94±1.2	93±1.1	95±1.2	94±1.2

LSD 0.05 = 1.10
CV = 3.13

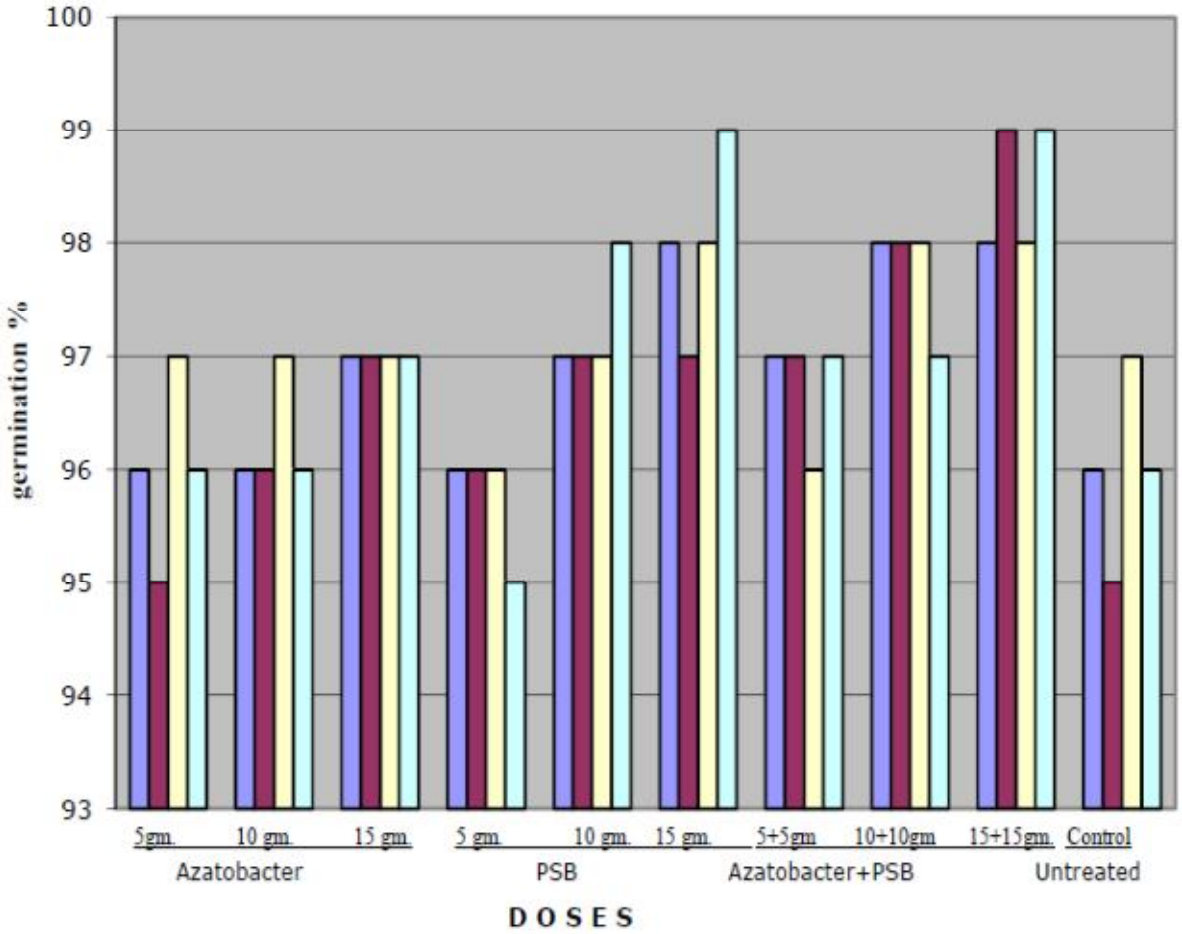

Figure 1: Effect of different doses of Biofertillizers Azatobacter, PSB and their combination on the germination percentage of two cultivars YS-66 and K-88 of *Brassica campestris* L.

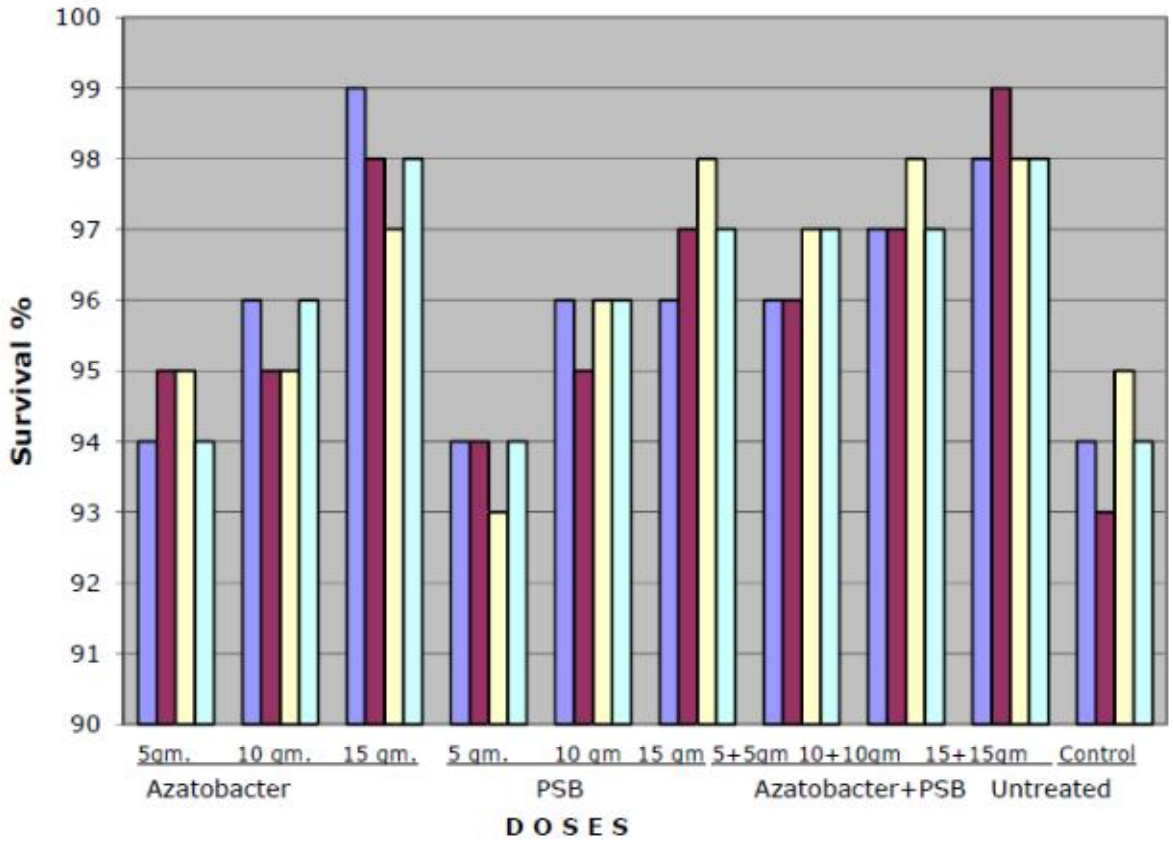

Figure 2: Effect of different doses of Biofertilizers Azatobacter, PSB and their combination on the survival percentage of two cultivars YS-66 ad K-88 of *Brassica campestris* L.

CONCLUSION

The germination percentage in two years 2007-08, 2008-09 in two cultivars of *Brassica campestris* L. YS-66 and K-88. Statistical analysis showed a non -significant increase in germination percentage in both cultivars with respect to their un-inoculated control. In respect to treatment *Azatobacter* and PSB higher treatment with slight high germination percentage in both cultivars in both years. Highest germination percentage 2007-08 and 2008-09 in both cultivar were 98$\pm$1.2, 99$\pm$1.3 in YS-66 and 98$\pm$1.2, 99$\pm$1.2 in K-88 cultivar in the combined treatment of *Azatobacter* + PSB against their control 96$\pm$1.2, 95$\pm$1.1 and 97$\pm$1.2 and 96$\pm$1.2 respectively. Table-1 and Figure-1Observations on germination of bio-fertilizers treated seeds and their controls were recorded when radical of germinated seeds were come out. Final seed germination percentage were calculated and statistically analysed 10 days after sowing..Plant population was counted 20 days after germination and mean was worked out and statistically analysed. Inoculation with *Azatobacter,* PSB and their combination resulted an increase in survival of seedlings in comparison of their controls in both years, but in second year this increase was slight more in comparison of first year *Azatobacter* 5 gm, treatment PSB 5 gm, *and Azatobacter*+PSB 10 gm +10 gm and 15gm+15gm treatment in both cultivars a significant increase in survival percentage in both years as compared to their respective controls. YS-66 gave best response in comparison of other cultivar K-88.

REFERENCES

1. Anonymous (2001) In: Bio-fertilizers (A Training Manual). Regional Bio-fertilizer Development Centre, Imphal.

2. Apte, R. and Shende, S. T. (1981) Effect of *Azatobacter Chroococcum* on germination of Maize seeds (Zea mays L.) Zentbl. Bakd. Paarasitkde Abt.I 136:555-559.
3. Badway, F. H. and Amer, S. B. (1974) The effect of inoculation with *Azatobacter* on growth of wheat and tomato plant, *Libyan J. Agric* 3:141-143.
4. Biswas, B. C.; Das and Kalwe, P. S. (2001) Crop response to bio-fertilizers. *Fert. News,* 46(2):15-18.
5. Chinnusamy, Muthukumaravel, Kaushik, Dutta, B. and Radha, P. (2006) Growth, Nutritional and yield parameters of wetland rice as influenced by microbial consortia under controlled conditions. *Journal of Plant Nutrition* 29(5): 857-871.
6. Dhumal, K. N. (1992) Effect of Azatobacter on germination, growth and yield of some vegetables. *J. Maharashtra Agri. Univ.* 17(3): 500.
7. Dubey, S. K. (1997) Co-inoculation of *Phosphorus solubilizing bacteria* with *Bradyrhizobium japonicum* to increase phosphate availability to rainfed soybean on vertisol *Journal of Indian Society of Soil Science,* 45(3): 506-509.
8. Gupta, A.; Sharma, V. K.; Sharma, G. D. and Chopra, P. (2006) Effect of bio-fertilizer and phosphorus levels on yield attributes, yield and quality of urdbean *(Vigna mungo) Indian Journal of Agronomy,* 51(2): 142-144.
9. Jakhar, P.; Singh, J. and Nanwal, R. K. (2005) Effect of planting methods, bio-fertilizers and nitrogen levels on growth, yield and economics of wheat (*Triticum aestivum L.) Indian Journal of Agronomy,*43(1): 294-298.
10. Kumar, S.; Reager, M. L. and Pareek, B. L. (2006) Yield components of moathben (*Vigna Aconitifolia* (JACQ.) Marechal) as influenced by phosphorus and bio-fertilizers. *Ann. Agrie. Res. New Series Vol.,* 27(3) : 227-229.
11. Mane, S. S.; Hadgaonakar, A. K.; Suryawanshi, A. P. and Salunke, S. D. (2002) Response of pearl millet to inoculation *Phosphorus solubilising bacteria* and *Azospirillum "Journal of Indian Society of Soil Science.* 48(3): 617-619.
12. Okon, Y. (1985) The Physiology of *Azospirillum* in relation to its utilization as inoculum for promoting growth of plants. In : Nitrogen Fixation and CO_2 Metabolism (eds. PW Ludden and JE Burns). Elsevier New York, USA, pp. 165-174.
13. Purbey, S. K. and Sen, N. L. (2007) Effect of bio-inoculator and bio-regulators on yield and nutrient uptake by Fenugreek *(Trigonella Foenum* Graecum L.) Indian *J. Agric. Res.,* 41(2): 154-156.
14. Pushplata, N. J. (2010) Efficacy of *Azatobactor chroococcum* on nitrogen fixation in Tomato Life Science Bulletin Vol. 7(1) 51-52.
15. Singh, M.S. and Singh, D. P. (2006) Studies on influence of bio-fertilizers and bioregulators on flowering, yield and fruit quality of strawberry cv. Sweet Charlie. *Ann. Agric. Res.* New Series Vol. 27(3): 261-264.
16. Singh, M. S. (2006) Cereal crops response to *Azatobacter* - A review. *Agric. Rev.* 27(3): 229-231.