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Seed Bacterization for Better Quality and More Yield of Fenugreek

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ABSTRACT

The effect of combined application of *Azotobacter* with other two beneficial microbes. viz.; *Rhizobium* and *Pseudomonas striata* on fenugreek was studied. The nodular mass, shoot height and yield (1068 kg/ha) were greatly influenced by co-inoculation of *Azotobacter* and *Rhizobia*, which gave the highest net return of Rs. 3594/ha but the co-inoculation of *Azotobacter* with *P. striata* gave the highest incremental cost benefit ratio (1:55.50). The bacterization of seed could sustain the NPK content in soil.

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INTRODUCTION

In recent years due emphasis has been given to the biofertilizers use for sustainable farming. Pulse *Rhizobia* differ not only amogn themselves but their effectiveness also varies when used as co-inoculants (Bhatnagar *et al.* 1979 and Malik and Sanoria 1981). The seed inoculation of *Azotobacter* alone or in combination of compatible strains of *Rhizobium* fixes additional atmospheric nitrogen in addition to the secretion of considerable quantities of biologically active substance which ultimately help in enhancing the yield and quality of different crops (Rawat and Sanoria, 1977; Malik and Sanoria, 1981; Maurya *et al.* 1987). Hence field investigation was undertaken to assess the efficacy of *Rhizobia* alone and in combination with *Azotobacter* (with and without additional phosphate application) and phosphate solubilizer (*Pseudomonas striata)* on nodulation and yield under south Saurashtra Agroclimatic Zone of Gujarat.

MATERIALS AND METHODS

A field experiment (RBD) with 11 treatments (Table 2) replicated thrice was carried out in medium black soil having a pH 7.5 and fertility status of N 204.19, P 58.88 and K 358.81 kg/ha. The plot size was 5.0 x 2.0 m. The local fenugreek variety was broadcasted in the third week of November @30 kg seed/ha. Four treatments received the seed inoculation of *Rhizobia* and *Azotobacter* separately with zero and 10 kg of N/ha. Combined inoculation was tested with only 40 kg P/ha. Co-inoculation of *Azotobacter* and *P. striata* were evaluated with half recommended dose (RD) of fertilizers i.e. 10 kg N and 20 kg P/ha. The efficacy of *P. striata* was also tested with 20 kg N/ha alone and in combination with *Rhizobium* and *Azotobacter* without adding any fertilizers. The plots where no any treatment was given served as control. The chemical fertilizers N and P were substituted in the form of urea and single super phosphate.

The *Rhizobium*, *Azotobacter* and *P. striata* were cultured in Ashby's mannitol yeast extract mannitol and Pikovskaya's broth medium, respectively.The culture suspension (10^8 cfu/ml) of each bacterium were prepared from eight days old culture and used @ 25 ml/kg seed. After sixty days of sowing, ten plants were randomly selected and uprooted with soil from each plot for nodulation study. After thorough washing of root, nodules were separated, weighed while fresh and dried in hot-air oven at 70° C for dry weight. Ten randomly selected plants from each plot were studied for fresh and dry weight of root and shoot, height and number of pods at the time of harvesting. The final plot yield was also recorded after harvesting. The initial fertility status of the field for N, P and K were measured before the conduct of the trial. The final status of N, P and K was also measured from each plot after the harvest.

RESULTS AND DISCUSSION

It is evident from table-1 that the co-inoculation of *Azotobacter* with *Rhizobium* resulted in maximum nodulation (23.13/plant) followed by *Azotobacter* alone (21.72/plant). The fresh and dry weight of nodules were also significantly higher in comparison to control treatment. In both these treatments, number of pods, fresh and dry weight of shoot and roots were comparatively more indicating the additive effect of *Azotobacter* inoculation. Maurya *et al.* (1987) has also reported synergistic influence of co-inoculation of *Azotobacter* on *Rhizobium* in chickpea. The concomitant inoculation of *Azotobacter* and *P. striata* with half RD of fertilizers (i.e. 10 kg N and 20 kg P/ha) was also found significantly effective in increasing fresh and dry weight of nodulation. The shoot height was significantly increased in the co-inoculation of *Azotobacter* and *Rhizobium* with 40 kg P/ha followed by *Azotobacter* alone with 40 kg P/ha and *Azotobacter + P. striata* with half RD of fertilizers (i.e. 10 kg N and 20 kg P/ha) but with at par in between. The inoculation of *Rhizobium* alone was not found effective in increasing nodules numbers, fresh and dry weight, which probably might be due to the presence of native *Rhizobium* in soil.

The seed yield of fenugreek was maximum (1068 kg/ha) in concomitant seed inoculation of *Azotobacter* with *Rhizobium* followed by *Azotobacter* alone (986 kg/ha). An increase in yield due to combined culture inoculation of *Rhizobium* with *Azotobacter* in different legumes has been reported by Malik and Sonoria (1981) and Rawat and Sanoria (1977).The co-inoculation of *Azotobacter* with *P. striata* + 10 kg N and 20 kg P/ha (968 kg/ha) and *Rhizobium + P. striata* (914 kg/ha) also gave significantly more yield as compared to check corroborating with the finding of Maurya *et al.* (1987).

In terms of economic returns, the highest amount of 3594 Rs/ha was obtained in the treatment of *Azotobacter + Rhizobium* inoculation of seeds (ICBR 1:5.43) followed by half dose of chemical fertilizers i.e. N 10 kg/ha and P 20 kg/ha with seed bacterization of *Azotobacter* (500 g / 30 kg seed) + *P. striata* (500 g/30 kg seed). Though incremental cost benefit ratio of the treatment *Azotobacter + P. striata* was highest (1:55.50) but net return was less in comparison to the treatment of all the three bacteria i.e. *Rhizobium, Azotobacter* and *P. striata* which gave the 1:46.47 ICBR.

TABLE 1

Effect of seed bacterization of endo *Azotobacter, Rhizobium* and *Pseudomonas striata* on various plant character of fenugreek.

Treatment	*No. of modules/ plant	*Fresh wt. of nodules/ plant (mg)	*Dry wt. of nodules/ plant (mg)	*Pods/ plant	*Fresh wt. of shoot/ plant (g)	*Dry wt. of shoot/plant (g)	*Shoot height (cm)	*Fresh wt. of root/ plant (g)	*Dry wt. of root/plant (g)
T_1	16.53	113.33	50.33	20.73	29.53	6.62	48.56	0.94	0.41
T_2	21.72	161.66	64.88	23.91	36.25	8.76	55.31	1.39	0.66
T_3	23.13	175.55	72.55	26.82	39.84	10.46	58.35	1.30	0.69
T_4	20.56	133.88	57.33	22.82	30.20	8.14	53.57	1.13	0.60
T_5	15.76	113.33	50.00	20.32	stet 27.95	6.52	48.06	0.87	0.33
T_6	17.33	120.55	58.77	21.17	30.16	7.07	50.16	0.95	0.45
T_7	19.83	126.66	57.00	22.00	30.44	7.21	50.91	1.01	0.57
T_8	20.96	152.22	63.94	23.61	33.46	8.54	54.40	1.21	0.61
T_9	20.38	142.11	57.27	22.65	31.21	7.40	53.56	1.09	0.59
T_{10}	15.10	100.44	43.66	20.07	25.81	6.28	47.10	0.81	0.37
T_{11}	14.37	98.33	37.22	15.35	24.17	5.78	45.24	0.74	0.36
S.Em ±	2.44	12.37	6.18	2.16	3.16	0.96	1.43	0.154	0.111
C.D. at 5%	NS	36.49	18.24	NS	NS	NS	4.04	NS	NS
C. V. %	8.94	7.30	9.68	6.86	5.62	17.90	9.04	12.81	28.75

* Average of ten plants.

TABLE 2

Effect of seed bacterization of endo *Azotobacter, Rhizobium* and *Pseudomonas striata* on grain yield of fenugreek.

Sr. No.	Treatment	Yield kg / ha			Pooled yield (kg/ha)	Net return (Rs.)	I.C.B.R.	Test weight (1000 seed)
		1995-96	1996-97	1997-98				
1.	Rhizo. + 40 kg P/ha	1155	770	486	803	429	1 : 1.53	9.5
2.	Azo. + 40 kg P/ha	1438	947	573	986	2625	1 : 4.30	13.5
3.	Rhizo + Azo. + 40 kg P/ha	1641	983	580	1068	3594	1 : 5.43	13.8
4.	N-P-K (20-40-0 kg/ha)	1286	876	451	871	1086	1 : 2.14	12.0
5.	Azo. + 10 kg N + 40 kg P	1113	763	486	787	145	1 : 1.16	9.0
6.	Rhizo. + 10 kg N + 40 kg P	1228	860	528	872	1165	1 : 2.31	10.0
7.	Azo. + *P. striata*	1248	870	540	886	2180	1 : 55.50	10.5
8.	Azo. + P.S. + 10 kg N + 20 kg P	1428	910	567	968	2687	1 : 6.20	13.0
9.	Rhizo. + Azo. + *P. striata*	1311	883	548	914	2501	1 : 46.47	11.0
10.	*P. striata* + 20 kg N / ha	1065	707	468	746	33	1 : 2.88	10.0
11.	Contol	1060	633	410	701	–	–	10.0
	S. Em. ±	11.66	22.46	1.35	42.0	–	–	–
	C. D. at 5%	34.38	66.26	3.99	123.0	–	–	–
	C. V. %	11.58	14.65	14.57	12.90	–	–	–

Rhizo. : Rhizobium, Azo. : Azotobacter

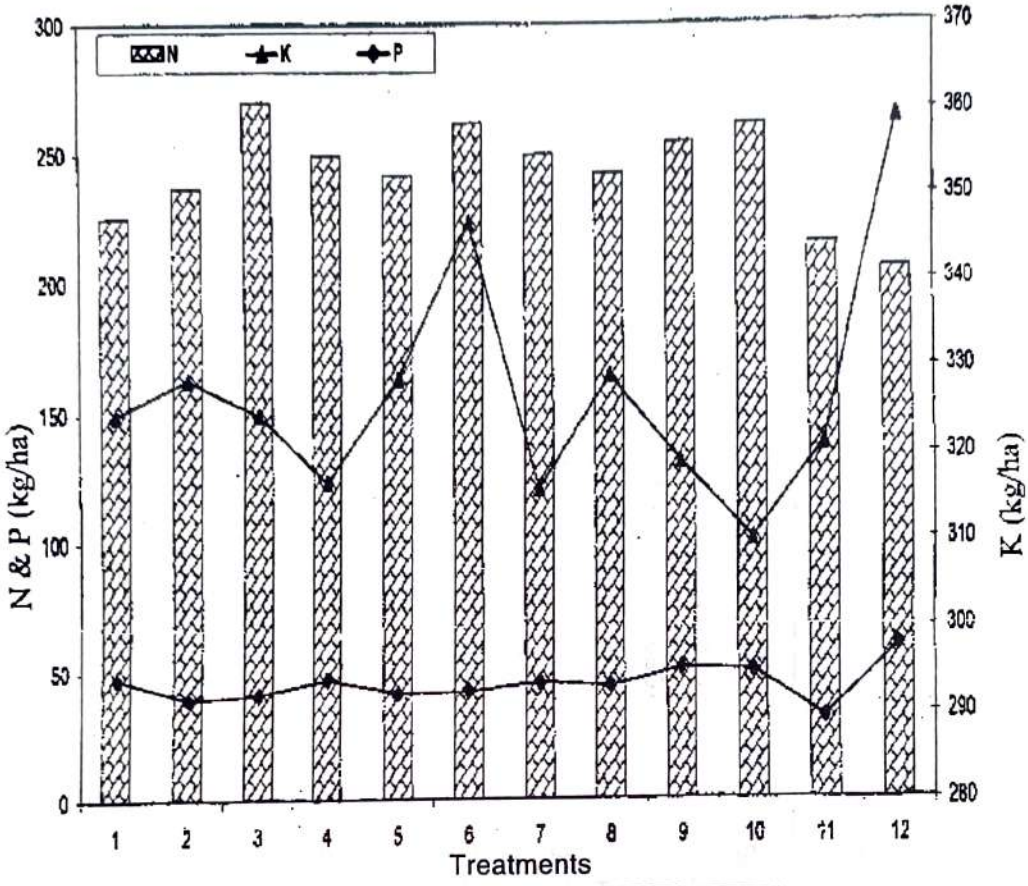

Fig. 1. N, P & K balance in soil

Bacterization could be able to fulfill the nitrogen and phosphorus requirement through efficient way from the soil as evident from the result on soil analysis before sowing and after harvesting of crop for N, P and K content. *Azotobacter* in combination with *Rhizobium* application, the nitrogen level was increased (217 kg/ha) as against initial level of nitrogen (204.19 kg/ha).

The present findings reveal that seed bacterization with *Azotobacter + Rhizobium* can contribute for better quality and more yield of fenugreek.

REFERENCES

Bhatnagar, R. S., Jauhari, K. S. and Iswaran, V. (1979). Associative effect of inoculation of *Bacillus megatherium* var. *Phosphaticum* and homologus *Rhizobium* on the yield of *Vigna radiata* and *Glycine max*. *Legume Research.* **2** : 106-8.

Malik, M. K. and Sanoria, C. L. (1981). Influence of single and combined culture of Rhizobium and Azotobacter on yield and uptake of nutrients by lentil (*Lens esculanta*). *Indian Agric.* **25** : 227-30.

Mauriya, B. R., Sonaria, C. L. and Ram, P. C. (1987). Combined culture treatment enhances nodulation, yield and quality of chickpea. *Seed and Farms*, **13** : 25-27.

Rawat, A. K. and Sonoria, C.L. (1977). Influence of seed bacterization on nodulation, yield and amino acid composition on seed protein of *Cicer arientinum* var. type-1. *Current Sci.*, 46 : 373-75.