

Integrated nutrient management in fenugreek (*Trigonella foenum-graecum*)

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ABSTRACT

A field experiment was conducted on loamy sand soils of Jobner (Jaipur) during winter (*rabi*) seasons of 2000–01 to 2003–04, to study integrated nutrient management in fenugreek (*Trigonella foenum-graecum* L.). Plant height, branches/plant, pods/plant and seeds/pod were higher in the plots receiving 100% inorganic N + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha. The highest seed yield, net returns, benefit : cost ratio and N and P uptake by seed were recorded in 100% inorganic N alone, followed by 100% inorganic N + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, while the highest straw yield, N and P uptake by straw were recorded in 100% inorganic N + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha.

Key words : Inorganic N, *Rhizobium*, FYM, Yield, Nutrient uptake, Net returns, Fenugreek

Application of all the needed nutrients through chemical fertilizers had deleterious effect on soil fertility leading to unsustainable yields; while integration of chemical fertilizers with organic manures and biofertilizers would be able to maintain soil fertility and sustain crop productivity (Jeyabal *et al.*, 2000). The interactive advantage of inorganic and organic sources of nutrients generally proved superior to the use of each component applied separately. In view of this background, an experiment was conducted to study the integrated nutrient management in fenugreek.

MATERIALS AND METHODS

A field experiment was conducted during winter (*rabi*) seasons of 2000–01 to 2003–04 at Agronomy Farm, S.K.N. College of Agriculture, Jobner, situated in semi-arid eastern plain zone of Rajasthan state (IIIa). The soil was loamy sand, having pH 8.2, organic carbon 0.18%, low available nitrogen and phosphorus and medium available potassium. The experiment comprising a set of 10 treatments, viz. inorganic N (100%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, inorganic N (75%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, inorganic N (50%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, 5 tonnes FYM/ha alone, *Rhizobium* @ 1.5 kg/ha + 10 tonnes FYM/ha, 10 tonnes FYM/ha alone, inorganic N (100%) alone, *Rhizobium* @ 1.5 kg/ha alone and control, was laid out in randomized block design with 3 replications. The recommended dose

of inorganic N (100%) was 40 kg/ha, applied as per treatments at the time of sowing. Well decomposed FYM (0.5% N, 0.2% P₂O₅ and 0.5% K₂O) was applied as per treatments and incorporated into the soil 3 weeks before sowing of the crop. A uniform basal dose of 40 kg P₂O₅/ha was given at the time of sowing. The fenugreek seeds were treated with *Rhizobium* @ 1.5 kg/ha as per treatment just before sowing. The crop was sown during the first week of November during 2000–01 and 2002–03 and second week of November during 2001–02 and 2003–04. The crop was raised with recommended package of practices.

RESULTS AND DISCUSSION

Growth and yield attributes

The performance of fenugreek was better with the application of inorganic and organic manures and biofertilizer either used alone or in combination. Plant height (Table 1) was maximum in inorganic N (100%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha and was comparable with rest of the treatments except *Rhizobium* @ 1.5 kg/ha. The lowest plant height was recorded in the control. The maximum number of branches/plant, pods/plant and seeds/pod were also recorded in the plots receiving inorganic N (100%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha and was comparable to inorganic N (75%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, 100% inorganic N (except pods/plant) and *Rhizobium* @ 1.5 kg/ha + 10 tonnes FYM/ha (only branches/plant). The

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Table 1. Effect of integrated nutrient management on growth, yield attributes, yield, nutrient uptake as well as net returns of fenugreek (pooled over 4 years)

Treatment	Plant height (cm)	Branches/plant	Pods/plant	Seeds/pod	Seed yield (q/ha)	Straw yield (q/ha)	Net returns (Rs/ha)	Benefit : cost ratio	N uptake (kg/ha)		P uptake (kg/ha)	
									Seed	Straw	Seed	Straw
Inorganic N (100%) + <i>Rhizobium</i> + 5 tonnes FYM/ha	49.5	5.83	29.9	16.45	12.52	33.91	84.14	1.60	42.47	29.67	5.96	4.58
Inorganic N (75%) + <i>Rhizobium</i> + 5 tonnes FYM/ha	49.1	5.61	28.6	16.14	11.76	31.74	7,146	1.51	38.51	27.26	5.40	3.94
Inorganic N (50%) + <i>Rhizobium</i> + 5 tonnes FYM/ha	47.8	5.50	26.4	15.31	11.77	29.14	7,264	1.52	37.78	23.63	5.46	3.47
<i>Rhizobium</i> + 5 tonnes FYM/ha	48.2	5.16	24.1	15.00	11.01	25.89	6,096	1.44	34.04	20.84	4.94	2.85
5 tonnes FYM/ha alone	48.0	5.02	22.2	14.76	10.59	24.54	5,365	1.39	31.60	19.51	4.64	2.55
<i>Rhizobium</i> + 10 tonnes FYM/ha	48.9	5.61	27.1	15.21	11.78	29.64	6,232	1.29	38.89	24.36	5.48	3.59
10 tonnes FYM/ha	48.9	5.14	24.4	15.31	11.05	27.06	4,943	1.33	34.42	21.81	5.03	3.19
Inorganic N (100%)	48.7	5.64	26.1	15.62	12.56	30.99	9,761	1.76	42.93	25.97	6.02	4.03
<i>Rhizobium</i> @ 1.5 kg/ha	45.3	5.19	20.7	14.38	10.27	23.66	6,014	1.48	30.33	18.72	4.47	2.72
Control	43.2	4.77	20.3	13.74	9.64	21.38	4,905	1.39	27.97	16.74	4.15	2.35
CD (P=0.5)	2.5	0.32	2.4	1.03	0.94	3.46			2.07	1.35	0.30	0.20

control plot recorded the lowest values of all the growth and yield attributes. The overall improvement in crop growth under inorganic N (100%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha could be attributed to better development of roots and increased microbial activities because of balanced nutritional environment probably both in soil rhizosphere and plant system which consequently enhanced value of yield attributes. The results of Prabhu *et al.* (2002) confirm these findings.

Yield

All the treatments were found to influence the seed and straw yields of fenugreek appreciably (Table 1). The highest seed yield was recorded with the application of 100% inorganic N alone, followed by 100% inorganic N + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, *Rhizobium* @ 1.5 kg/ha + 10 tonnes FYM/ha, inorganic N (50%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha and inorganic N (75%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha and these treatments were statistically at par. This could be owing to beneficial effect on yield attributes of fenugreek which in turn resulted in higher seed yield. The lowest seed yield was recorded in the control. The results are in close conformity with the findings of Choudhary and Jat (2004). The highest straw yield was recorded in inorganic N (100%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha, followed by inorganic N (75%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha and 100% inorganic N alone. The lowest straw yield was recorded in the control.

Nutrient uptake

All the treatments recorded significantly higher uptake of N and P by fenugreek seed and straw over the control (Table 1). Application of 100% inorganic N alone, being at par with 100% inorganic N + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha recorded significantly higher uptake of N and P by fenugreek seed. However, the significantly higher uptake of N and P by fenugreek straw was recorded with the application of 100% inorganic N + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha over all the other treatments except 100% inorganic N alone by 77.2 and 94.9% over the control respectively. Dwivedi and Dikshit (2002) also reported beneficial effect of organic and inorganic sources of nutrient on nutrient uptake.

Economic viability

Maximum net returns and benefit : cost ratio were recorded under the application of 100% inorganic N

alone, followed by inorganic N (100%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha. The lowest net returns were recorded in the control, while the benefit: cost ratio of 1.29 : 1 in treatment *Rhizobium* @ 1.5 kg/ha + 10 tonnes FYM/ha.

Thus, it can be concluded that application of 100% inorganic N alone (40 kg/ha) could be recommended for obtaining higher seed yield and net returns from fenugreek. However, by considering the residual effect of FYM on the succeeding crop as well as soil health, application of inorganic N (100%) + *Rhizobium* @ 1.5 kg/ha + 5 tonnes FYM/ha could be second best alternative.

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