

Effect of phosphorus and farmyard manure on yield, yield attributes and nitrogen, phosphorus and potassium uptake of fenugreek (*Trigonella foenum-graecum*)

K.D. KHIRIYA¹ AND B.P. SINGH

Department of Agronomy, Choudhary Charan Singh Haryana Agricultural University, Hisar 125 004

Received : January 2002

ABSTRACT

A field experiment was conducted during the winter (*rabi*) season of 1996–97 and 1997–98 at CCS Haryana Agricultural University, Hisar, to study the effect of farmyard manure (0, 5, 10 and 15 tonnes/ha) and phosphorus (0, 20, 40 and 60 kg/ha) on 2 fenugreek (*Trigonella foenum-graecum* L.) genotypes ('HM 65' and 'NLM'). Genotype 'NLM' was significantly superior to 'HM 65' in terms of more number of branches/plant, pods/plant and seeds/pod. These yield attributes resulted in higher seed and straw yields of 'NLM'. However, non-significant differences were observed for nutrient uptake between both the genotypes. Each successive dose of FYM up to 15 tonnes/ha significantly increased the number of branches, pods/plant, seeds/pod, seed straw, and biological yields and nutrient uptake over their lower doses. Increasing levels of phosphorus up to 40 kg P_2O_5 /ha significantly increased the yield-attributing characters, seed yield and quality parameters of fenugreek.

Key words : Fenugreek, *Trigonella foenum-graecum*, Farmyard manure, Phosphorus, Harvest index, Attraction index

Fenugreek is a multipurpose crop and its every plant part is utilized in one or other form as leafy vegetable, fodder and condiment. The productivity of a crop is controlled by many factors, of which the mineral nutrition, especially nitrogen and phosphorus, is by and large the most important factor, though the chemical fertilizer alone cannot sustain the productivity of land since these chemical fertilizers do not add all nutrients in a balanced manner. On the other hand, nutrient supply through organic manure can hardly fulfil the need of existing crop with regard to major nutrients. Therefore, to sustain the productivity of land and sustainability in the productivity of crop, judicious use of fertilizers and integration of organic manure and their scientific management is important. Therefore the present investigation was carried out to study the effect of farmyard and phosphorus fertilization on yield attributes and yield of fenugreek genotypes.

MATERIALS AND METHODS

A field experiment was carried out during the winter season of 1996–97 and 1997–98 at Research Farm of CCS Haryana Agricultural University, Hisar, with 4 levels of

farmyard manure (0, 5, 10 and 15 tonnes/ha) and 4 of phosphorus (0, 20, 40 and 60 kg P_2O_5 /ha) on 2 fenugreek genotypes ('HM 65' and 'NLM'). Thirty-two treatments combinations were used, keeping genotypes and farmyard manure in main plots and levels of phosphorus in subplots, replicated thrice in split-plot design on sandy-loam soil, low in organic carbon (0.35%), available N (116.2 kg/ha) and phosphorus (21.45 kg/ha), high in potash (522.7 kg/ha) and slightly alkaline in reaction (pH 7.8). The crop was sown in lines, 30 cm apart, using a uniform seed rate of 20 kg/ha for both the genotypes. Full dose of farmyard manure was incorporated into the soil as per treatments, 21 days before sowing. Full dose of phosphorus through single superphosphate was drilled as per the treatments before sowing. All the recommended packages of practices were followed during the crop period. The treatments were evaluated in terms of yield attributes, seed, straw and biological yields, harvest index and attraction index (seed yield/(biological yield–seed yield)).

The total N, P and K uptake in grain and straw in above-ground portion was calculated by multiplying the per cent content of these nutrients with their respective yield.

Table 1. Effect of farmyard manure and phosphorus levels on yield-attributing characters, yield, harvest index and attraction index of genotypes of fenugreek

Treatment	Branches/ plant		Pods/ plant		Seeds/ pod		Test weight (g)		Seed yield (kg/ha)		Straw yield (kg/ha)		Biological yield (kg/ha)		Harvest index (%)		Attraction index (%)	
	A	B	A	B	A	B												
							A	B	A	B	A	B	A	B	A	B	A	B
<i>Genotype</i>																		
‘HM 65’	5.6	5.0	49.3	39.7	10.8	9.6	12.5	11.6	2,022	1,755	4,220	3,920	6,238	5,617	32.7	31.5	48.2	44.9
‘NLM’	6.1	5.4	53.0	44.0	11.9	10.7	12.9	12.2	2,254	2,093	4,400	4,300	6,650	6,290	33.7	32.3	52.0	49.2
CD (P=0.05)	0.2	0.2	0.9	0.5	0.2	0.3	0.4	0.4	99	101	NS	181	284	213	NS	NS	2.3	1.4
<i>Farmyard manure (tonnes/ha)</i>																		
F ₀	4.9	4.2	48.3	36.3	10.2	8.9	12.5	11.6	1,752	1,519	3,576	3,370	5,320	4,884	32.3	31.7	49.4	45.0
F ₅	5.7	5.0	50.7	39.3	10.3	9.3	12.7	11.8	2,093	1,854	4,130	3,940	6,321	5,752	33.2	31.7	49.7	46.0
F ₁₀	6.3	5.5	52.5	43.7	12.4	11.1	12.8	12.0	2,257	2,073	4,585	4,400	6,842	6,473	33.6	32.1	51.4	48.8
F ₁₅	6.7	6.0	54.0	48.1	12.4	11.2	13.0	12.1	2,450	2,249	4,950	4,722	7,400	6,971	33.7	32.1	50.0	48.4
CD (P=0.05)	0.3	0.3	1.3	0.8	0.3	0.4	NS	NS	140	144	313	264	401	300	NS	NS	NS	2.0
<i>Phosphorus (P₂O₅ kg/ha)</i>																		
P ₀	4.8	4.2	46.8	37.0	10.9	9.7	12.4	11.7	1,755	1,496	3,440	3,600	5,200	5,040	32.7	31.5	48.3	42.0
P ₂₀	6.0	5.2	49.8	40.2	11.4	10.1	12.8	11.8	2,120	1,929	4,300	4,005	6,420	5,917	33.0	31.8	50.2	48.1
P ₄₀	6.3	5.6	53.2	44.8	11.6	10.4	12.8	12.0	2,329	2,130	4,633	4,310	7,000	6,477	33.4	32.0	50.7	48.7
P ₆₀	6.5	5.7	55.7	45.4	11.4	10.4	12.9	12.0	2,348	2,140	4,862	4,530	7,202	6,500	33.8	32.2	51.2	49.4
CD (P=0.05)	0.3	0.4	0.9	0.8	NS	NS	NS	NS	110	105	236	186	320	238	NS	NS	1.8	1.9

NS, Non-significant; A, 1996–97; B, 1997–98

RESULTS AND DISCUSSION

Varietal performance

All the yield-attributing traits, viz. branches/plant, pods/plant, seeds/pod and test weight, were significantly higher in genotype 'NLM' than 'HM 65' during both the years (Table 1). The corresponding increase in these parameters of genotype 'NLM' was 8.5, 9.4, 10.4, and 2.0%, respectively, over genotype 'HM 65' on mean basis. This improvement in yield-attributing characters of 'NLM' resulted in significantly higher seed yield than 'HM 65' (Table 1). It also proved significantly better than 'HM 65' for straw yield, biological yield and attraction index. It recorded 15.1, 6.9 and 8.6% higher seed, straw and biological yield than 'HM 65' on mean basis respectively. However, both the genotypes did not differ significantly for harvest index.

Both the genotypes also did not differ significantly for N, P and K uptake (Table 2).

Effect of farmyard manure

Each successive dose of FYM up to 15 tonnes/ha significantly improved branches/plant and pods/plant over the preceding doses (Table 1). The similar increase in seeds/pod was observed up to 10 tonnes/ha only. However, test weight remained unaffected due to the application of FYM. Likewise, the increasing levels of FYM up to 15 tonnes/ha significantly increased the seed, straw and biological yields over their lower levels (Table 1). However, FYM did not significant affect harvest index and attraction index during both the years except during

1997–98, where attraction index was found to increase significantly up to 10 tonnes FYM/ha. The improvement in yield-attributing characters might be due to the proper mixing of FYM in soil which had supplied available nutrients to the plants and brought about a favourable soil environment, which ultimately increased the nutrient and water-holding capacity of soil for longer time which resulted in better growth and yield attributes. This integrated effect of all these yield-attributing characters resulted in the higher yield of fenugreek with the increasing levels of FYM. These results corroborate the findings of Pareek (1983). Application of graded doses of FYM up to 15 tonnes/ha increased the N, P and K uptake significantly over their preceding doses (Table 2). The increase in N, P and K uptake with the graded dose of FYM might be due to the balanced supply of these nutrients through FYM and increased availability of these nutrient to the plants. Application of FYM also improved the soil environment which enhanced proliferous root-system resulting better absorption of moisture and nutrients and thereby resulting in higher biomass production (Table 1). Similar results were reported by Pareek (1983).

Effect of phosphorus

The phosphorus application had tremendous effect on yield of fenugreek. Every increase in the levels of phosphorus up to 40 kg/ha resulted in a significant increase in seed, straw and biological yields over their lower doses (Table 1). Phosphorus fertilization in

Table 2. Effect of farmyard manure and phosphorus levels on total nutrient uptake (kg/ha) of fenugreek genotypes at harvest

Treatment	N uptake		P uptake		K uptake	
	1996–97	1997–98	1996–97	1997–98	1996–97	1997–98
<i>Genotype</i>						
'HM 65'	97.71	98.60	14.99	14.48	47.41	47.73
'NLM'	98.92	99.15	13.43	14.37	48.75	49.96
CD (P=0.05)	NS	NS	NS	NS	NS	NS
<i>Farmyard manure (tonnes/ha)</i>						
F ₀	70.48	69.93	8.84	9.03	31.88	32.52
F ₅	91.15	91.83	13.13	12.79	42.60	44.06
F ₁₀	108.63	111.50	16.34	16.66	54.17	56.66
F ₁₅	127.05	129.45	20.67	20.04	64.30	66.67
CD (P=0.05)	5.60	5.89	2.44	3.21	2.31	4.02
<i>Phosphorus (P₂O₅ kg/ha)</i>						
P ₀	67.98	71.60	8.74	8.34	31.28	32.64
P ₂₀	93.70	97.64	13.43	13.29	43.98	45.36
P ₄₀	113.72	114.63	16.97	17.68	52.25	57.48
P ₆₀	123.64	120.80	19.05	19.07	59.56	64.00
CD (P=0.05)	4.77	5.54	2.14	2.22	2.70	3.44

NS, Non-significant

fenugreek had no significant effect on harvest index. However, attraction index increased significantly up to 20 kg P_2O_5 /ha only. An increase in seed yield to the tune of 24.5 and 37.% was recorded with the application of 20 and 40 kg P_2O_5 /ha over the control respectively. Almost similar increase in biomass and straw yields was also observed. The increase in seed yield is reflected clearly with increase in yield-attributing traits like branches/plant, pods/plant and seeds/pod (Table 1). The better development of yield attributes with phosphorus fertilization might be due to its key role in root development, energy translocation and metabolic processes of plant through which increased translocation of photosynthates towards the sink development might have occurred. Significant increase in yield and yield attributes up to 40 kg P_2O_5 /ha was also reported by Maliwal and Gupta (1989), Bhati (1993), Dayanand (1996) and Jat and Sharma (1999).

Increasing levels of phosphorus from 0 to 60 kg/ha brought significant increase in N, P and K uptake over the lower doses (Table 2). The increased uptake of nutrient with the increasing levels of phosphorus could be attributed to the fact that added phosphorus increased the content by balanced nutritional environment inside the plant favouring better crop yield (Table 1) which ultimately led to more uptake of these elements. Rathore and Manohar (1990) and Sheoran (1999) obtained the

similar results in fenugreek crop.

REFERENCES

- Bhati, D.S. 1993. Effect of irrigation and phosphorus on seed yield and its attributes of fenugreek (*Trigonella foenum-graecum* L.). *Indian Journal of Agronomy* **38** : 449–452.
- Dayanand. 1996. 'Effect of phosphorus and sulphur on growth, yield and quality of fenugreek (*Trigonella foenum-graecum* L.)'. M.Sc. (Agricultural) thesis, Rajasthan Agriculture University, Bikaner.
- Jat, Ram Sukh and Sharma, O.P. 1999. Effect of fertility levels and biofertilizers on growth, yield and quality of fenugreek. (In) *Fourth Agricultural Science Congress*, held at Jaipur, 21–24 February, pp. 172.
- Maliwal, P.L. and Gupta, O.P. 1989. Study on the effect of four herbicides with and without phosphorus on weed control and seed yield of fenugreek. *Tropical Pest Management* **35** : 307–310.
- Pareek, R.G. 1983. 'Effect of fertility levels and irrigation on growth and yield of fenugreek (*Trigonella foenum-graecum* L.)'. M.Sc. (Agric.) Thesis, Sukhadia University, Udaipur (Rajasthan).
- Rathore, P.S. and Manohar, S.S. 1990. Effect of dates of sowing, nitrogen and phosphorus on quality and nodulation of fenugreek. *Indian Cocoa, Arecanut and Spices Journal* **13** : 148.
- Sheoran, R.S., Pannu, R.K. and Sharma, H.C. 1999. Influence of sowing time and phosphorus fertilization on yield attributes and yield of fenugreek (*Trigonella foenum-graecum* L.) genotypes. *Indian Journal of Arecanut, Spices and Medicinal Plants* **1** : 15–18.