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SHORT COMMUNICATION

Response of fenugreek to phosphorus, molybdenum and PSB

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Fenugreek is an annual herb, self pollinated, small seeded legume, which is grown as vegetable, fodder and seed crop. Its seeds contain protein, fatty oil, vitamins and minerals. Its seed has been found beneficial in many diseases. Disrupted free radical metabolism in diabetic may be normalized by fenugreek seed supplementation in the diet. So, the diabetic patients should be encouraged to include these medicinal plants in their daily diet to control blood sugar level (Kocchar *et al.* 2006). Fenugreek is a multipurpose crop whose every part is consumed in one or other form.

Productivity of fenugreek can be further enhanced by judicious package of fertilizers especially phosphorus, molybdenum and increasing the availability of phosphorus by seed inoculation with phosphate solubilizing bacteria. Adequate supply of phosphorus has been reported by various workers for vigorous growth, bumper yield, better quality and enormous nodule formation in legumes. Molybdenum either by soil application or through seed treatment significantly increased the grain yield of leguminous crop. Kumari *et al.* (2009) concluded that inoculation of phosphate solublising bacteria increased number of branches per plant, number of flowers per plant, number of pods per plant and dry weight/plant of urdbean.

A field experiment was conducted at College of Agriculture, Bikaner during *rabi* season, 2010-11. The soil of experiment site was loamy sand in texture containing 90.75, 21.80, and 201.15 kg ha^{-1} available nitrogen, phosphorus and potassium, respectively in 0-15 cm soil depth with pH 8.41 and organic carbon 0.09 per cent. The soil was also low in molybdenum (0.04 mg kg^{-1}). The experiment was laid out in factorial randomized block design with three replications, assigning twenty four treatments consisting four levels of phosphorus (control, 20, 40 and 60 kg P_2O_5 ha^{-1}), three levels of molybdenum (control, 0.5 and 1.0 kg Mo ha^{-1}) and two levels of PSB inoculation (with and without seed inoculation). The uniform dose of N was maintained and phosphorus and molybdenum were drilled manually through di-ammonium phosphate and ammonium molybdate as per treatment at the time of sowing. Inoculation of seeds with phosphate solubilizing bacteria was done as per treatment. The fenugreek variety 'RMt 1' was sown in the first week of November.

An increase in P level significantly improved the yield attributing characters like branches per plant, chlorophyll content at flowering stage, nodules per plant, pods per plant, seeds per pod, seed and straw yield, protein and nitrogen content in seed, molybdenum and phosphorus content in seed and straw and their uptake of fenugreek up to 40 kg P_2O_5 ha^{-1} whereas, nitrogen content in straw increased significantly only up to 20 kg P_2O_5 ha^{-1} (Table 1, 2 & 3). Significantly higher values of yield attributes and seed yield of fenugreek were reported from different locations at 40 kg P_2O_5 ha^{-1} [Dutta (2008) and Deo and Khandelwal (2009)].

Increase in Mo levels significantly improved the yield attributing characters like branches per plant, chlorophyll content at flowering stage, nodules per plant, pods per plant, seeds per pod, seed and straw yield, protein and nitrogen content in seed, molybdenum and phosphorus content in seed and straw and their uptake. Cvijanovic (2011) and Kumar and Sharma (2005) also reported similar results due to application of molybdenum in fenugreek.

The application of phosphate solubilizing bacteria recorded significantly higher branches per plant, chlorophyll content at flowering stage, nodules per plant, pods per plant, seed and straw yield, protein and nitrogen and phosphorus content in seed and straw and their uptake. These results get support from the findings of Vikram and Hamzehzarghani (2008) and Gaind and Gaur (1991). It is obvious that phosphate solubilizing bacteria produced higher quantity of organic acids which dissolved mineral phosphate and made it available to plants. These acids associate with metals and increase the concentration of soluble phosphate. They also synthesize growth promoting substances and produce vitamins which augment the plant growth (Gaind and Gaur, 1991). Thus, the beneficial effect of PSB in rendering the roots and branches helped in better nodulation and nitrogen fixation. These results are in agreement with those of Sarawagi and Rajput (2005) and Gupta and Sharma (2006).

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Table 1. Effect of phosphorus, molybdenum and PSB on Yield and yield attributes of Fenugreek

Treatments	Seed yield (q/ha)	Straw yield (q/ha)	Branches / plant	Pods / plant	Seeds / pod	Nodules /plant	Chlorophyll content (mg/g)
P(kg/ha)							
0	988	3121	7.81	29.81	12.12	4.87	1.63
20	1314	3418	9.42	34.26	13.13	5.28	2.18
40	1454	3614	10.44	37.26	13.92	5.59	2.37
60	1486	3668	10.67	37.48	14.28	5.71	2.41
C.D at 5%	71	159	0.60	1.56	0.73	0.24	0.09
Mo (kg/ha)							
0	1146	3222	32.68	12.77	12.77	5.13	2.03
0.5	1376	3561	35.72	13.44	13.44	5.40	2.20
1.0	1410	3584	35.70	13.88	13.88	5.55	2.21
C.D at 5%	61	138	1.35	0.63	0.63	0.21	0.08
PSB							
Without Inoculation	1219	3179	8.89	31.56	13.19	5.27	2.10
With inoculation	1402	3732	10.29	37.84	13.54	5.46	2.20
C.D at 5%	50	112	0.43	1.10	NS	0.17	0.07

Table 2. Effect of phosphorus, molybdenum and PSB on Nitrogen, Phosphorus, Molybdenum and protein content of fenugreek

Treatments	Nitrogen content (%)		Phosphorus content (%)		Molybdenum content (mg kg^{-1})		Protein content (%)
	Seed	Straw	Seed	Straw	Seed	Straw	Seed
P(kg/ha)							
0	2.60	0.77	0.410	0.133	4.03	1.13	16.27
20	2.85	0.81	0.434	0.153	4.23	1.24	17.81
40	2.99	0.83	0.452	0.165	4.29	1.27	18.71
60	3.06	0.84	0.461	0.168	4.31	1.28	19.14
C.D at 5%	0.13	0.04	0.015	0.008	0.12	0.06	0.83
Mo (kg/ha)							
0	2.69	0.78	0.411	0.143	3.94	1.18	16.82
0.5	2.96	0.83	0.452	0.159	4.31	1.25	18.50
1.0	2.98	0.83	0.455	0.162	4.39	1.27	18.63
C.D at 5%	0.12	0.03	0.013	0.007	0.11	0.05	0.72
PSB							
Without Inoculation	2.80	0.78	0.413	0.145	4.19	1.22	17.51
With inoculation	2.95	0.85	0.465	0.165	4.23	1.24	18.45
C.D at 5%	0.09	0.03	0.011	0.005	NS	NS	0.59

Table 3 . Effect of phosphorus, molybdenum and PSB on total nitrogen, phosphorus and molybdenum uptake and available P & Mo in soil after harvest of fenugreek

Treatments	Total nitrogen uptake (kg ha^{-1})	Total Phosphorus Uptake (kg ha^{-1})	Total Molybdenum Uptake (g ha^{-1})	Available Phosphorus in Soil after harvest (kg ha^{-1})	Available Molybdenum in soil after harvest (mg kg^{-1})
P(kg/ha)					
0	50.03	8.24	7.52	15.57	0.0489
20	65.50	11.03	9.85	17.35	0.0524
40	74.02	12.65	10.85	18.75	0.0567
60	76.70	13.13	11.14	19.98	0.0591
C.D at 5%	3.60	0.59	0.48	1.15	0.0026
Mo (kg/ha)					
0	56.24	9.40	8.33	16.92	0.0510
0.5	70.85	12.06	10.42	18.29	0.0558
1.0	72.60	12.33	10.77	18.53	0.0560
C.D at 5%	3.12	0.51	0.42	1.00	0.0023
PSB					
Without Inoculation	59.45	9.71	9.04	16.72	0.0519
With inoculation	73.68	12.81	10.64	19.10	0.0566
C.D at 5%	2.54	0.41	0.34	0.82	0.0019

References

Cvijanovic, G., Dozet G. D., Dukic V., Subic, J., Cvijanovic, D. and Dukic, V. 2011. Effects of Nitrogen fertilizing on the preceding crop and the application of Co and Mo on *Azotobacter* abundance in soya bean. *Romanian Biotechnological Letters. 16: 1.*

Deo, C. and Khandelwal, R. B. 2009. Effect of P and S nutrition on yield and quality of chickpea (*Cicer arietinum*). *Journal of Indian Society of Soil Science.* 57 (3): 352-36.

Dutta, D., Bandyopadhyay, P. and Maiti, D. 2008. Effect of P fertilization and growth regulators on yield, nutrient uptake and economics of fenugreek (*Trigonella foeum graecum*). *Research on Crops.* 9 (3): 599 601.

Gaind, S. and Gaur, A.C. 1991.Thermotolerant phosphate solubilising micro-organisms and their interaction with mungbean. *Plant and Soil.* 133: 141-149.

Gupta, A. and Sharma, V. K. 2006. Study on the effect of biofertilizer and phosphorus levels on yield and economics of urdbean (*Vigna mungo* L. Hepper). *Legume Research.* 29 (4).

Kochhar, A., Nagi, M. and Sachdeva, R. 2006. Proximate composition, available carbohydrates, dietary fibre and anti nutritional factors of selected traditional medicinal plants. *Journal of Human Ecology.* 19 (3): 195-199.

Kumar, J. and Sharma, M. 2005. Effect of phosphorus and molybdenum on yield and nutrient uptake by chickpea (*Cicer arietinum* L.) *Advances in Plant Sciences.* 18 (11): 869-873.

Kumari, M., Vasu, D., Hasan, Z. U. and Dhurwe, U. K. 2009. Effects of PSB (Phosphate Solubilizing Bacteria) on morphological characters of lentil (*Lens culinaris*). *Medicinal Biological Forum-An International Journal.* 1(2): 5-7

Sarawagi, S. K. and Rajput, R. S. 2005. Effect of phosphorus, zinc and PSB on growth and yield of soybean (*Glycine max* L. Merril) in vertisol of Chhattisgarh plains. *Annals of Agriulture Research.* 26 (2): 302 305.

Vikram, A. and Hamzehzarghani, H. 2008. Effect of PSB on nodulation and growth parameters of greengram (*Vigna radiate* L. Wilczek). *Research Journal of Microbiology.* 3 (2): 62-72.