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Effect of biofertilizer and phosphorus levels on yield attributes, yield and quality of urdbean *(Vigna mungo)*

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ABSTRACT

A field investigation was conducted at farmer's field during the rainy seasons of 2000 and 2001 to study the effect of bio-fertilizer inoculation and phosphorus fertilization on yield and quality of the cultivars of urdbean *(Vigna mungo* (L.) Hepper] 'UG 218' urdbean produced significantly higher pods/plants, 1,000-seed weight, seed yield as well as straw yield over other 2 varieties. However, the protein content was higher in the seeds of 'Type 9'. The practice of seed inoculation with phosphorus-solubilising bacteria showed a significant increase in seed yield and its attributes as well as protein content and N and P uptake over uninoculated treatment. Response of crop to phosphorus fertilization was significant up to 60 kg P_2O_5/ha for seed and straw yields. Phosphorus application also resulted in significant increase in seed protein content and N and P uptake in seed and straw.

Key words : Crude protein, N and P uptake, Phosphorus-solubilizing bacteria, Urdbean varieties

Urdbean is one of the major rainy-season pluse crops of India and Himachal Pradesh. The yield and nutritional quality of pulses is greatly influenced by application of nutrient elements and biofertilizers. The crop responds favourably to application of fertilizer phosphorus (Shah *et al.,* 1994). However, the majority of applied phosphorus is rendered unavailable due to its fixation by Fe and Al cations that pre-dominate under acidic conditions of Himachal Pradesh. The role of phosphorus-solubilizing bacteria in increasing crop yields and nutrient availability has been demonstrated under some soils of India, but such information on this aspect in urdbean has not been investigated under Himachal conditions. Therefore, an experiment was conducted to study response of urdbean to different phosphorus and seed inoculation levels.

MATERIALS AND METHODS

The study was conducted on farmer's field at Kangra, Himachal Pradesh, during the rainy seasons *(kharif)* of 2000 and 2001. The soil was acidic in reaction (pH. 5.7) and clay loam, having 0.8% organic carbon. Soil was low in available nitrogen (237.4 kg/ha) and medium in available phosphorus (112.76 kg P_2O_5/ha) and potassium (224 kg K_2O/ha). The experiment was laid out in split-plot design with 3 replications. Combinations of 3 varieties ('Pant U 19', 'UG 218' and 'Type 9') and 2 levels of seed inoculation (without inoculation and with inoculation with phosphorus-solubilizing bacteria) were assigned to the main plots. Four levels of phosphorus (0, 30, 60 and 90 kg P_2O_5/ha) were kept in sub-plot. A basal dose of 20 kg N/ha through urea (46% N) and phosphorus as per treatment through single superphosphate (16% P_2O_5) was applied to each plot at the time of sowing. The crop was sown on 22 and 17 June during 2001 and 2002, respectively, by drilling behind the plough in rows 30 cm apart with 20 kg seed/ha. The healthy seeds were inoculated with liquid culture of phosphorus-solubilising bacteria *(Bacillus polymyxa)* 2 hr before sowing using 10% *gur* solution.

RESULTS AND DISCUSSION

Effect of varieties

Yield attributes and yield: The varieties showed significant difference for pods/plant, seeds/pod and 1,000-grain weight. Variety 'UG 218' produced the highest number of pods/plant, which was significantly superior to 'Pant U 19' and 'Type 9' during 2001 and in pooled data, but at par with 'Pant-U 19' during 2000. Varieties 'UG 218' and 'Pant U 19' recorded higher seeds/pod than 'Type 9', but the differences were significant only during 2000. 'UG 218' urdbean recorded the maximum 1,000-grain weight, being significantly superior to 'Pant U 19' and 'Type 9' during both the years and in pooled data. The higher number of pods in 'UG 218' showed significant superiority of

this variety with respect to the growth characters like primary branches/plant. The higher 1,000-grain weight in 'UG 218' was probably owing to more production and translocation of synthesized carbohydrates into grains, which is the resultant of more branches or leaves/plant in 'UG 218'. Sudhakar *et al.* (1989) also reported similar findings.

Urdbean 'UG 218' gave significantly higher seed and straw yields than 'Pant U 19', 'Type 9' during both the years. The increase in seed yield of variety 'UG 218' was 17.7 and 19.3% over 'Pant U 19' and 33.3 and 23.7% over 'Type 9' during 2000 and 2001 respectively. 'Pant U 19' recorded significantly higher seed yield than 'Type 9'only during the first year (Table 1). In pooled data, the increase in seed yield with 'UG 218' over 'Pant U 19' and 'Type 9' was 18.5 and 28.1% respectively.

Nutrient uptake : Variety 'UG 218' showed the highest uptake of nitrogen and phosphorus in seed and straw during both years and pooled basis because of its higher seed yield and dry-matter content at harvest. Significant differences in N uptake in seed were observed among varieties on pooled mean bases, whereas non-significant differences were obtained for P uptake in straw.

Effect of seed inoculation

Yield attributes and yield: Phosphorus-solubilizing bacteria (PSB) inoculation influenced 1,000-seed weight, while its influence on pods/plant and seeds/pod was significant only during 2001 and 2000 respectively. Pooled data of 2 years revealed that the plants inoculated with PSB showed an increase of 5.5% in seed yield over uninoculated treatment. Straw yield was also influenced significantly during both years by the inoculation treatment. The enhanced seed and straw yields on seed inoculation with PSB was mainly owing to increased yield attributes. Prabhakaran *et al.* (1999) also reported similar results with seed inoculation on grain yield.

Nutrient uptake: The N and P uptake in seed and straw was significantly influenced by seed inoculation with PSB during both the years. Data of individual years (data not shown) and pooled analysis showed a considerable increase in N and P uptake that was significant. Total N uptake increased by 13.6%, whereas total P uptake increased by 16.3% for 2 years. The improvement in nodulation with inoculation using phosphorus-solubilising organisms may have resulted in higher nitrogen fixation and hence higher nitrogen availability to plants, whereas solubilisation of fixed phosphorus by PSB probably resulted in increased content and uptake of phosphorus by plants. Dubey and Agarwal (1999) also made similar observations.

Effect of phosphorus

Yield attributes and yield: All the yield attributes, viz. pods/plant, seeds/pod and 1,000-seed weight, increased significantly with phosphorus application to 60 kg P_2O_5/ha. However, seeds/pod during 2001 and 1,000-seed weight during 2 years (pooled) and 2001 showed significant response up to 90 kg P_2O_5/ha. This may be owing to availability of water-soluble phosphorus from applied

Table 1. Yield attributes and yield of urdbean as influenced by varieties, seed inoculation and phosphorus levels

Treatments	Yield attributes						Seed yield (q/ha)		Straw yield (q/ha)	
	Poods/plant		Seeds/pod		1,000-seed weight		2000	2001	2000	2001
	2000	2001	2000	2001	2000	2001				
Variety										
'Pant-U 19'	17.4	18.5	4.7	4.4	40.3	36.0	8.5	9.0	17.6	22.4
'UG 218'	18.0	20.8	5.2	4.5	43.0	39.8	10.0	10.8	19.2	24.9
'Type 9'	15.0	17.4	4.3	4.4	39.3	35.7	7.5	8.7	16.2	22.0
CD (P=0.05)	2.1	0.9	0.3	NS	1.8	0.9	0.6	0.7	1.6	1.2
Seed inoculation (PSB level)										
Without inoculation	16.0	18.3	4.6	4.4	40.1	36.4	8.2	9.1	16.4	22.6
With inoculation	17.7	19.5	4.9	4.5	41.7	38.8	9.2	10.0	18.9	23.6
CD (P=0.05)	NS	0.8	0.3	NS	1.5	0.7	0.5	0.6	1.3	0.9
Phosphorus (kg P_2O_5/ha)										
0	15.0	16.1	4.4	4.1	38.7	33.8	7.4	8.6	15.9	20.1
30	16.0	18.3	4.7	4.3	40.0	36.4	8.7	9.1	17.4	22.2
60	18.1	20.3	5.0	4.5	42.0	38.1	9.3	10.1	18.6	24.5
90	18.2	20.9	5.0	4.9	42.7	40.4	9.7	10.3	18.8	25.5
CD (P=0.05)	1.9	1.0	0.3	0.3	1.9	1.4	0.6	0.6	1.1	1.6

PSB, Phosphorus-solubilising bacteria

Table 2. Nutrient uptake of urdbean as influenced by varieties, seed inoculation and phosphorus levels

Treatment	N uptake* (kg/ha)*		P uptake* (kg/ha)*	
	Grain	Total (G+S)	Grain	Straw (G+S)
Variety				
'Pant-U 19'	32.2	66.0	4.8	9.1
'UG 218'	37.8	73.4	5.4	10.1
'Type 9'	30.4	64.3	4.7	9.2
CD (P=0.05)	2.76	4.13	0.41	0.55
Seed inoculation (PSB level)				
Without inoculation	31.5	63.6	4.6	8.8
With inoculation	35.4	72.2	5.4	10.2
CD (P=0.05)	2.4	4.0	0.3	0.7
Phosphorus (kg P_2O_5/ha)				
0	26.8	54.7	3.9	7.4
30	32.2	65.5	4.7	8.9
60	36.8	73.8	5.4	10.4
90	37.9	77.7	5.9	11.2
CD (P=0.05)	2.2	4.1	0.3	0.6

*Pooled data of 2000 and 2001
PSB, Phosphorus-solubilizing bacteria

single superphosphate causing vigorous growth, initiating more number of flower buds in the plant thereby increasing pods/plant and seed yield (Reddy and Swamy, 2000).

Phosphorus fertilization @ 30, 60 and 90 kg P_2O_5/ha recorded an increase of 22.1, 31.9 and 37.9% and 5.7, 17.5 and 19.4% in seed yield over no-phosphorus application, respectively, during 2000 and 2001. Pooling of seed yield over 2 years recorded an increase of 10.3, 22.0 and 24.2% over the control with 30, 60 and 90 kg P_2O_5/ha. This may perhaps be due to reason that phosphorus helped in proliferation of root-system and thus resulted in increasing the nutrient absorption by increasing the absorbing surface. Thus the higher absorption of nutrients by the crop favourably influenced the yield attributes and finally the yield. Similar results were also obtained by Shah *et al.* (1994).

Nutrient uptake: The N uptake in seed and straw and total N uptake of 2 years increased significantly up to 60 kg P_2O_5/ha, whereas P uptake in seed and straw and total P uptake for 2 years showed significant increase up to 90 kg P_2O_5/ha, which may be due to increased availability of available P to crop.

REFERENCES

Dubey, S.K. and Agarwal, S. 1999. Effect of phosphate-solubilizing microorganisms as single and composite inoculants on rainfed soybean *(Glycine max)* in vertisol. *Indian Journal of Agricultural Sciences* **69**(8) : 611–613.

Prabhakaran, J., Balachandar, D., Nagarajan, P. and Dhanakodi, C.V. 1999. Effect of dual inoculation of rhizobium and phosphobacteria at different levels of phosphorus in horsegram. *Legume Research* **22**(2) : 137–138.

Reddy, R.E. and Swamy, S.N. 2000.Effect of farmyard manure, phosphorus solubilising bacteria and phosphorus on yield and economics of blackgram *(Phaseolus mungo). Indian Journal of Agricultural Sciences* **70** (10) : 694–696.

Shah, S.K., Sharma, G.L. and Vyas, A.K. 1994. Growth parameters, biomass production and nutrient uptake by blackgram *(Phaseolus mungo)* as influenced by phosphorus, potassium and plant growth regulators. *Indian Journal of Agronomy* **39**(3) : 481–483.

Sudhakars, P., Singh, B.G. and Rao, L.M. 1989. Effect of rhizobium and phosphorus on growth parameters and yield of *(Phaseolus mungo). Indian Journal of Agricultural Sciences* **59**(6) : 402–406.