

Response of chickpea (*Cicer arietinum*) to levels of phosphorus in rainfed upland of Chotanagpur plateau

R. K. SARKAR¹, D. SHIT² AND A. CHAKRABORTY³

Deochanda Experiment Station, Damodar Valley Corporation, Hazaribag, Bihar 828 001

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The average yield of chickpea (*Cicer arietinum* L.) under rainfed conditions in Chotanagpur plateau is very low. Suitable variety and efficient use of phosphatic fertilizer play an important role in enhancing production and productivity of the crop. Even in soil with medium to high P status response is often obscured due to aberrant soil and climatic conditions. Response further varies with genotypes. Moreover, the efficiency of applied P seldom exceeds 15% (Roy *et al.*, 1978). A field experiment was therefore conducted to find out the suitable variety of chickpea to levels of phosphorus under rainfed conditions.

The experiment was conducted during the winter seasons of 1987–88 and 1988–89 at Deochanda Experiment Station, Hazaribag. The soil was low in organic carbon (0.34%), medium in available P (28.4 kg/ha) and K (259.1 kg/ha), with pH 5.9. The treatments comprising 7 varieties and 4 levels of P (Table 1) were tested in factorial design with 3 replications. A uniform dose of 20 kg N/ha and 40 kg P₂O₅/ha along with P as per treatment was applied basal. The P was given through single superphosphate. The crop was sown at 30 cm x 10 cm spacing in the third week of October during both the years. The available soil moisture in 100

cm soil profile at the time of sowing was 22.7 and 22.5 cm during 1987–88 and 1988–89 respectively. Rainfall received during the crop season was 196.5 and 83.6 mm during 1987–88 and 1988–89 respectively.

The varieties of chickpea differed significantly for yield-contributing characters and yield (Table 1). The yield-contributing characters and yield were higher in the first year than in the second year, due to low temperature and atmospheric humidity coupled with intermittent rains in first year during October–December.

Variety 'Radhey' recorded significantly highest grain yield, followed by 'ICCV 5' and 'ICCV 40' during the first year. In the second year, however, 'Radhey' outyielded and 'ICCV 5' remaining at par with each other all the other varieties. 'BR 77' chickpea recorded the highest number of pods/plant, number of grains/pod and grain weight/plant but lesser 1,000-seed weight. 'C 235' and 'ICCV 41' recorded lower yield mainly due to lesser grain weight/plant and 1,000-seed weight during both the years. The higher grain yield in 'Radhey' and 'ICCV 5' was mainly the resultant effect of increased 1,000-seed weight. In these 2 varieties, the effect of lower number of pods/

Present address: ¹Department of Agronomy, University College of Agriculture, Calcutta University, Calcutta, West Bengal 700 019; ²Soil Conservation-cum-Training Centre, Hazaribag, Bihar 825 301; ³Department of Agronomy, BCKV, Kalyani, West Bengal 741 252

Table 1. Yield attributes and yield of chickpea as influenced by cultivars and phosphate fertilizer

Treatment	Pods/ plant		Seeds/ pod		Seed/ plant (g)		1,000-seed weight (g)		Seed yield (q/ha)	
	1987-88	1988-89	1987-88	1988-89	1987-88	1988-89	1987-88	1988-89	1987-88	1988-89
<i>Variety</i>										
'ICCC 4'	92.7	53.5	1.25	1.24	73.4	42.2	127.4	122.6	12.85	6.35
'ICCC 40'	96.8	54.5	1.25	1.23	82.5	48.2	142.3	132.9	14.02	7.55
'ICCC 41'	91.7	55.8	1.23	1.17	77.0	46.8	136.9	129.3	12.87	6.27
'ICCV 5'	103.0	51.0	1.16	1.14	88.0	44.8	208.2	188.5	14.63	8.27
'Radhey'	78.6	47.2	1.14	1.12	76.8	42.1	214.1	194.6	15.63	8.28
'BR 77'	143.2	76.8	1.42	1.33	99.5	59.1	110.9	104.6	13.44	7.22
'C 235'	120.4	73.2	1.43	1.32	82.4	54.9	104.1	95.3	12.25	6.64
CD (P = 0.05)	2.16	3.40	0.06	0.04	1.82	2.61	2.86	1.92	0.58	0.59
<i>P₂O₅ (kg/ha)</i>										
0	78.9	44.9	1.15	1.13	67.3	39.3	142.7	135.4	9.61	5.20
20	106.6	54.3	1.29	1.21	85.4	45.3	150.0	137.9	13.99	7.12
40	120.3	69.9	1.35	1.29	91.9	55.9	151.2	139.7	15.39	8.30
60	109.3	66.4	1.29	1.25	86.5	52.7	152.6	139.8	15.69	8.28
CD (P = 0.05)	1.63	2.57	0.04	0.03	1.38	1.97	2.16	1.45	0.44	0.44
CD (P = 0.05) for interaction	4.32	6.81	NS	NS	3.65	5.22	5.73	3.85	NS	NS

plant and grains/pod on yield was counter-balanced largely by higher 1,000-seed weight. The differences in grain yield between the varieties were due to genetic potentialities maintained by the different varieties and also due to the combined effect of different polygenic traits.

The increase in dose of P up to 40 kg P_2O_5 /ha significantly increased the yield attributes over the control. Application of P increased the 1,000-seed weight considerably, but there was no significant difference between 60 and 40 kg P_2O_5 /ha during the second year. Considerable improvement in yield-attributing characters in chickpea owing to P fertilization may be accounted for favourable influence of P nutrition on promotion of source capacity in legumes.

The grain yield increased appreciably with P application. However, response to P beyond 40 kg P_2O_5 /ha did not show significant difference. A very little improvement in grain yield and even-depressing effect on the yield during the second year may be explained in view of the fact that the low rainfall during 1988–89 was probably responsible for the absence of response to high rate

of P application, while ample soil moisture owing to high rainfall in 1987–88 favoured the response of higher rate of P application. The results confirm the findings of Khandekar *et al.* (1986). The favourable response of seed yield to P fertilization might be attributed to the potent role of this element in improving nodulation and mobilization of nutrients and protein synthesis (Prihar and Tripathi, 1989). The results on seed yield due to P application indicate that the response followed the law of diminishing return. Thus the optimum P_2O_5 level lies within 60 kg/ha for chickpea under rainfed land of Chhotanagpur plateau.

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