

Effect of phosphorus and weed management on greengram (*Phaseolus radiatus*) and its residual effect on mustard (*Brassica juncea*)

E. K. LALITHA BAI AND M. N. SINHA

Division of Agronomy, Indian Agricultural Research Institute, New Delhi 110 012

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ABSTRACT

A field experiment was conducted during 1989-90 and 1990-91 to study the influence of phosphorus and weed management on performance of greengram (*Phaseolus radiatus* L.) and its residual effect on mustard [*Brassica juncea* (L.) Czernj. & Cosson]. The phosphorus showed only marginal effect on growth and yield of greengram, but its effect on weeds was spectacular. By and large, 1 weeding resulted in significantly higher dry matter of greengram at 21 days and at maturity, whereas weed-free treatment proved significantly superior to 1 weeding in 1989 only. Weed-dry matter in favour of no-weeding treatment was about 3 times more compared with 1 weeding in 1989 and 5 times more in 1990. On an average 1 weeding gave significantly higher seed yield of greengram than no weeding each year and in 1990; weed-free treatment proved significantly superior to 1 weeding as it gave significantly higher yield of mustard over no weeding or 1 weeding in greengram. While there was no variation in available N status of soil after experimentation, a continuous increase in available P status of soil was observed with successive increase in level of P.

Being a short-stature crop, greengram (*Phaseolus radiatus* L.) is subjected to a heavy infestation of weed, particularly during the rainy seasons. This lowers the efficiency of fertilizer utilization by crop considerably, as a sizeable portion of applied fertilizer is shared by weeds. Hence an experiment was conducted to study the direct effects of phosphorus and weed management on greengram during the rainy season (*kharif*) season and the residual effects on the subsequent crop of mustard [*Brassica juncea* (L.) Czernj. & Cosson] during the winter.

MATERIALS AND METHODS

The experiment was conducted during

1989-90 and 1990-91 with 4 levels of phosphorus (0, 30, 60 and 90 kg P₂O₅/ha) and 3 levels of weed management (no weeding, 1 weeding and weed-free condition). 'PS 16' greengram was sown @ 20 kg seed/ha on 27 July and 12 July in the first and second years at 30 cm spacing. Ten days after sowing, the plants were thinned to maintain 10 cm space within the row. Three weedings were taken as enough to keep the plots weed-free. The experiment was laid out in randomized block design with 4 replications at New Delhi. The plot size was 5 m × 3 m. The soil of the experimental field was sandy loam with 179 and 5.5 kg/ha available N and P respectively, and slightly alkaline in reaction (pH 8.0). During the

Table 1. Effect of P level and weed management on plant population and dry-matter accumulation of greengram and weed at 2 stages of growth

Treatment	Plant population (No./m ²)				Dry matter (g/m ²)							
	Greengram		Weed		Greengram				Weed			
					21 days		Maturity		21 days		Maturity	
	1989	1990	1989	1990	1989	1990	1989	1990	1989	1990	1989	1990
<i>P₂O₅</i> (kg/ha)												
0	27.1	30.5	666	310	62.5	32.0	178	158	169	35.2	245	85.5
30	22.7	29.2	574	250	57.3	47.4	138	136	207	85.3	219	94.6
60	25.8	28.3	604	298	57.8	38.7	166	139	213	62.1	201	89.0
90	22.3	26.6	623	298	59.3	43.8	151	141	275	87.6	256	105.9
CD (P=0.05)	NS	NS	NS	NS	NS	6.17	NS	NS	44.3	NS	35.0	NS
<i>Weed management</i>												
No weeding	18.1	21.9	817	438	50.6	33.0	88	67			343	156
1 weeding	27.5	32.1	416	141	59.7	47.1	176	183			118	31
Weed-free	27.8	32.0			67.4	41.3	210	181				
CD (P=0.05)	3.54	2.66			3.84	5.34	31.5	24.0			24.7	28.8

crop season (July–September), 132.0 and 509.4 mm rains were received in 1989 and 1990 respectively, which showed a deficit of 408 mm rain during the first year and 31.0 mm during the second year compared with normal rainfall of 540 mm in this period. The intensity as well as frequency of rains were more from flowering to pod-filling stage in the second year, resulting in the incidence of yellow-mosaic disease which adversely affected the growth and yield of crop. Two irrigations were applied to greengram in the first year, whereas no irrigation was required in the second year. The crop was harvested 70 days after. Unfertilized mustard 'Pusa Bold' was sown @ 5 kg seed/ha on 25 and 25 October in the respective year during the winter season, in rows 40 cm apart. Intra-row space of 20 cm was maintained by thinning 20 days after sowing. Two irrigations were given in the first year, whereas no irrigation was given in the second year. Since the monsoon rain in the second year was enough and a heavy shower in November (26.6 mm) coupled with 2 showers in February (30.2 mm) and March (16.5 mm) were received, no irrigation was required. However, total rainfall was 105.2 and 73.3 mm in the first and second years respectively; the later being well-distributed whereas the former mostly at grain-filling stage. After the experimentation, soil samples were taken from each plot and composite soil samples were analysed for N and P by the method of Jackson (1967).

RESULTS AND DISCUSSION

Plant population

Plant population of either greengram or weed was not affected due to levels of P, as the differences between the treatments were not significant (Table 1). Weeding once or

thrice (weed-free) resulted in significantly higher plant population of greengram than no-weeding treatment, indicating the interference of weeds at the initial growth of crop. Overcrowding and shading also caused death of some plants at this early growth periods, as the number of greengram plants significantly reduced each year. There was hardly any difference in plant population of greengram between 1 weeding and weed-free treatments, indicating thereby that even 1 weeding helped in plant stand.

The dry-matter accumulation by weed was 2–3 times more in 1989 than that in 1990, which was due to less rainfall in the first year resulting in less accumulation of rain water for a longer period. Weed growth was therefore conducive and favourable. However, due to frequent rain in 1990, water stagnation hampered the weed growth.

Dry-matter accumulation in greengram at 21-day stage was higher with P_2O_5 levels only in 1990. At other stage, it was not influenced by P_2O_5 . The weed-dry matter was significantly higher only with 90 kg P_2O_5 at 21-day stage during 1989, while at maturity 90 kg P_2O_5 proved significantly superior to 30 or 60 kg P_2O_5 , but not over the control. In 1990, though the differences in dry matter due to various levels of P_2O_5 at 21-day stage or at maturity were not significant, there was a trend of increase in dry matter with the increase in the level of P_2O_5 .

Weeding once or thrice (weed-free) helped the growth of crop plant, as aeration and nutrient uptake by crop improved resulting in higher dry-matter production.

Yield

Response of greengram P was apparent in 1990 only and its application at any level gave significantly higher seed yield than that

Table 2. Effect of P level and weed management on yield (kg/ha) of greengram and mustard

Treatment	Greengram			Mustard		
	1989	1990	Pooled	1989-90	1990-91	Pooled
<i>P₂O₅</i> (kg/ha)						
0	345	122	234	1,012	1,572	1,290
30	280	154	217	1,046	1,483	1,260
60	309	142	226	1,092	1,401	1,250
90	329	162	246	1,054	1,578	1,320
CD (P = 0.05)	NS	19	NS	NS	NS	NS
<i>Weed management</i>						
No weeding	187	69	128	984	1,407	1,196
1 weeding	381	170	276	966	1,521	1,244
Weed-free	379	196	283	1,203	1,598	1,401
CD (P = 0.05)	73	17	30	110	NS	92

with no application of P (Table 2). There was no significant response of mustard due to residual effect of P which was available in soil in sufficient quantity (Fig. 1). Patel *et al.* (1980) also reported a lack of response to P. Singh *et al.* (1985) and Kumar *et al.* (1989) reported that deep-rooted crop with fewer side-roots could tap most of the nutrients from the deeper zones of soil and thus depend mostly on native soil P. By and large, weeding once or thrice gave significantly higher yield of greengram and mustard seed each year over no-weeding treatment in our study.

NP status of soil

Soil-available N was affected neither by levels of phosphorus nor by weed management, but there was a continuous rise in available P with the subsequent increase in the levels of P_2O_5 (Figs 1, 2). It clearly indicates that P applied to greengram was not fully used even by the second crop of mustard which is a poor feeder of P. The soil-available P decreased with the increase in frequency of weeding, indicating that weed-free treatment had relatively less unused P in soil. Normally, weed-free

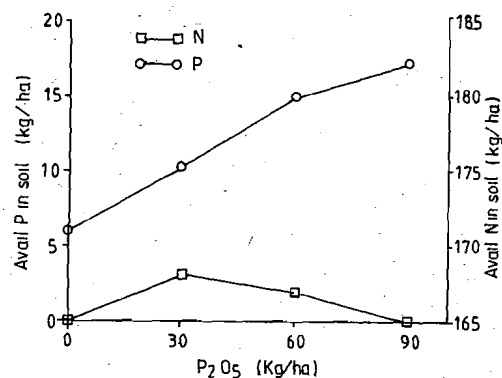


Fig. 1. Nitrogen and phosphorus status of soil after experimentation as influenced by P

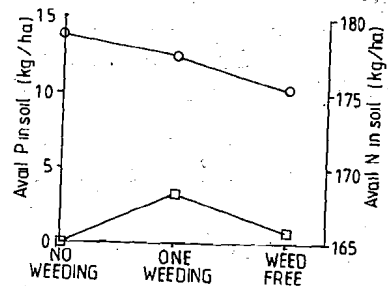


Fig. 2. Nitrogen and phosphorus status of soil after experimentation as affected by the weed management

treatment should show more left-over P due to less utilization of P by crop in absence of weed. In this experiment, both the crop and weeds were confined to few cm upper layer of soil and the soil samples were taken from 15 cm, so that the variation in soil-available P due to weed-management treatments was marginal.

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