Indian J. Agron. 38 (1) : 124–126 (March 1993)

Effect of cropping system, residual nitrogen and phosphorus on yield and nutrient uptake by summer greengram (*Phaseolus radiatus*)

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Received: January 1992

A field experiment was conducted to study the effect of cropping system, residual nitrogen and phosphorus on yield and yield attributes and nutrient uptake by summer greengram (*Phaseolus radiatus* L.) at New Delhi, during summer season of 1989. The soil of experimental field was a loam of pH 7.8 (1 : 2.5 soil : water ratio). The experiment was laid out in split-plot design with 4 croppping systems, viz. potato (*Solanum tuberosum* L.) sole, wheat (*Triticum aestivum* L. emend. Fiori & Paol.) sole, potato–wheat sequential and potato + wheat relay, in main plots; 3 levels of nitrogen (0, 60 and 120 kg N/ha) to wheat in subplots; and 2 levels of phosphorus (0 and 17.5 kg P/ha) to greengram in sub-subplots. There were 3 replications. However, in the case of sole cropping of potato where 3 levels of N to wheat were not applied there were 9 replications.

In potato and wheat sole and potato--wheat sequential cropping, greengram cultivar 'PS 16' was sown at 30 cm-row spacing after the harvest of potato and or wheat, whereas in potato + wheat relay cropping, 2 rows of greengram were sown in between 2 rows of wheat spaced at 50 cm. The sowing of greengram was done on 30 March 1989 in sole cropping of potato, on April 1989 in potato + wheat relay cropping in standing wheat and on 27 April 1989 in wheat sole and potato--wheat sequential cropping after the harvest of wheat crop. The mature pods of greengram were picked up in 2 flashes on 15 June 1989 and 30 June 1989 in potato sole and potato + wheat relay cropping and on 30 June 1989 and 15 July 1989 in wheat sole and potato–wheat sequential cropping.

The crop sown after potato-sole cropping produced significantly taller plants, more number of branches and pods/plant and higher number of seeds/pod than that sown after wheat sole, potato–wheat sequential or after potato + wheat relay cropping system (Table 1), which led to more seed and straw yields and higher N and P uptake by greengram soon after potato sole cropping compared with that sown after other cropping systems (Table 1). Also, the crop sown after potato + wheat relay cropping had significantly higher number of branches and pods/plant, seeds/pod and more seed and straw yields and N and P uptake than that sown after wheat sole and potato–wheat sequential cropping, which did not differ significantly in respect of above-mentioned characters of greengram. The crop sown after potato sole and potato + wheat relay cropping gave 124 and 26% respectively more seed yield than the crop

Table 1. Effect of cropping system, N applied to preceding wheat and P applied to greengram on growth and yield-attributing characters, grain and straw yields, and N and P uptake in greengram

Treatment	Plant height (cm)	Branches/ plant	Pods/ plant	Grains/ pod	1,000-grain weight	Yield (q/ha)		N uptake (kg/ha)			P uptake (kg/ha)		
						Grain	Straw	Grain	Straw	Total	Grain	Straw	Total
Cropping system													
Potato sole	46.5	3.6	23.6	10.5	33.8	15.5	60.0	46.5	78.0	124.5	4.80	11.40	16.20
Wheat sole	41.0	2.5	16.9	8.1	33.5	6.9	40.0	22.0	48.0	70.0	2.25	7.60	9.85
Potato–wheat sequential	44.1	2.6	18.1	8.1	33.8	6.9	41.6	22.0	49.9	71.9	2.14	7.91	10.05
Potato+wheat relay	44.1	2.9	18.0	8.6	33.7	8.7	45.0	26.9	54.0	80.9	2.90	8.50	11.40
CD (P=0.05)	1.81	0.24	2.2	0.47	NS	0.75	5.83	0.85	3.81	4.79	0.25	0.68	0.71
N (kg/ha) applied to wheat													
0	41.4	2.5	16.1	7.5	32.6	6.9	42.0	20.7	46.2	66.9	2.10	7.52	9.62
60	43.9	2.8	18.6	8.4	33.8	7.6	43.3	23.5	51.9	75.4	2.41	8.20	10.61
120	45.3	3.1	18.5	9.1	34.5	9.3	48.3	31.6	62.7	94.3	3.02	9.62	12.64
CD (P=0.05)	1.03	0.16	1.94	0.44	0.63	0.84	3.34	1.29	3.21	3.77	0.21	0.40	0.45
P (kg P_2O_5/ha) applied to greengram													
0	42.4	2.7	16.9	8.2	32.9	8.9	44.0	25.8	48.4	74.2	2.71	7.90	10.61
40	44.7	3.2	20.5	9.2	34.5	9.6	46.0	31.6	55.2	86.8	3.10	9.20	12.30
CD (P=0.05)	0.76	0.09	0.95	0.17	9.37	0.20	1.99	0.55	1.50	1.51	0.07	0.23	0.24

Table 2. Effect of phosphorus on grain yield, and nitrogen and phosphorus uptake by greengram as influenced by residual nitrogen applied to preceding wheat

P (kg/ha) applied to greengram	N (kg/ha) applied to wheat		
	0	60	120
	Grain yield (q/ha)		
0	6.6	7.4	8.7
1.75	7.0	8.0	10.0
CD (P=0.05)		0.46	
	N uptake (kg/ha)		
0	64.4	71.8	77.3
17.5	72.5	78.6	90.8
CD (P=0.05)		0.97	
	P uptake (kg/ha)		
0	7.4	9.1	9.7
17.5	9.2	10.5	12.5
CD (P=0.05)		0.63	

sown after either wheat sole or potato–wheat sequential cropping.

Application of N to preceding wheat had a significant residual effect on all the growth, yield and yield-attributing characters, and N and P uptake by greengram. The increase in grain yield due to 120 kg N/ha was 35% compared with the control.

Phosphorus application to greengram also significantly gave taller plants, more number of branches and pods/plant and seeds/pod, 1,000-seed weight, seed and straw yields and N and P uptake by greengram. The increase in seed yield due to 17.5 kg P/ha over the control was 11%.

The interaction between N applied to preceding wheat and P applied to greengram indicated that the response of greengram to P in respect of seed yield and N and P uptake was higher when preceding wheat received higher dose (120 kg N/ha) of N (Table 2).

Indian J. Agron. **38** (1) : 126–128 (March 1993)

Water relations and moisture-use efficiency of summer greengram (*Phaseolus radiatus*) as influenced by irrigation and cycocel application

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Received: January 1992

A field study including foliar application of cycocel with soil-moisture regimes was conducted during summer 1990 at Ludhiana, to study effect of irrigation and cycocel on water relationship and moisture-use efficiency of summer greengram (*Phaseolus radiatus* L.). The experimental soil was loamy sand, having available water capacity of 7.1 and 10.9 cm in 60 and 90 cm profile respectively. It was low in organic carbon