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Nutrient depletion by pigeonpea (*Cajanus cajan*) and weeds as influenced by intercropping systems and weed management under rainfed conditions

K. S. RANA, MAHENDRA PAL AND D. S. RANA

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

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ABSTRACT

A field experiment was conducted during the *kharif* seasons of 1994 and 1995 at New Delhi to study the uptake of nutrients by pigeonpea [*Cajanus cajan* (L.) Millsp.] and weeds as affected by intercropping systems and weed control methods. Sole pigeonpea recorded significantly higher seed yield than its intercropped stand. The N, P and K removed by pigeonpea and weeds were higher in sole stand of pigeonpea than in its intercropped stand either with cowpea (*Vigna unguiculata*) or with mungbean (*Phaseolus radiatus*). Nutrient uptake by pigeonpea was significantly higher due to hand weeding followed by fluchloralin and unweeded check. Nutrient removal was maximum in weedy check followed by fluchloralin and hand weeding.

Key words: Pigeonpea, Cowpea, Mungbean, Intercropping system, Rainfed

Pigeonpea [*Cajanus cajan* (L.) Millsp.], being a widely spaced and slow growing crop during early stage, provides ample opportunity for weed growth, resulting in yield losses to the tune of 68% (Malik *et al.*, 1986). Weeds compete with the crops for moisture, nutrients, space and light. Hegde (1977) reported that N, P and K uptake and their distribution in various plant parts was significantly reduced by intercropping systems involving pigeonpea and various short duration legumes. Tewari *et al.* (1990) reported that the highest removal of N, P and K by weeds was noted under weedy check treatment and the minimum removal under weed free conditions in pigeonpea-blackgram intercropping system. This communication attempts to analyse the relative nutrient utilization by pigeonpea grown as sole crop as well as in intercropping combinations in relation to weed control management practices.

MATERIALS AND METHODS

The field experiment was conducted during the rainy (*kharif*) seasons of 1994 and 1995 at New Delhi, in a three times replicated split plot design. Main plot treatments consisted of 7 cropping systems viz. pigeonpea sole (50 cm), pigeonpea (75 cm) + 2 rows of mungbean, pigeonpea (100 cm) + 3 rows of mungbean pigeonpea (50 cm) +

1 row of mungbean, pigeonpea (50 cm) + 1 rows of cowpea, pigeonpea (75 cm) + 2 rows of cowpea, pigeonpea (100 cm) + 3 rows of cowpea; while sub-plot received 3 weed control methods viz. unweeded check, two hand weedings (15 and 30 days after sowing) and preplant incorporation of fluchloralin @ 1 kg a.i./ha). Variety 'Pusa 85' of pigeonpea, 'Asha' of mungbean and 'Chirori' of cowpea were used. The soil of the experimental site was sandy clay loam, having low available N and medium available P and K with pH 7.1. The crop was sown on 15 June and 18 June during 1994 and 1995 respectively and it received 15 kg N and 40 kg each of P_2O_5 and K_2O/ha as basal dose. During the experimental period from June to November a well distributed and normal rainfall of 640.8 mm and 673.6 mm was received in 1994 and 1995, respectively.

RESULTS AND DISCUSSION

Grain yield of pigeonpea

Sole pigeonpea being on par with pigeonpea (50 cm) + 1 row of cowpea and pigeonpea (50 cm) + 1 row of mungbean recorded significantly higher grain yield in comparison to pigeonpea (100 cm) + 3 rows of cowpea and pigeonpea (100 cm) + 3 rows of mungbean in both the years (Table 1). The lowest grain yield of pigeonpea was recorded in pigeonpea 100 cm + 3 rows of cowpea which was 23.1% low as compared to sole pigeonpea. Weed control methods significantly influenced the pigeonpea grain productivity over unweeded check during both the years. Hand weeding twice (15 and 30 DAS) and fluchloralin @ 1 kg a.i./ha enhanced it by 92 and 59% over weedy check respectively. Hand weeding proved significantly superior to fluchloralin in respect of grain productivity.

Nutrient uptake by pigeonpea

Cropping systems caused perceptible variations in N, P and K uptake by pigeonpea (Table 1). Pigeonpea in sole stand and pigeonpea (50 cm) + 1 row of cowpea removed similar amount of N but the uptake of N in these planting patterns was statistically superior to other systems of planting. Intercropping of pigeonpea (100 cm) either with 3 rows of cowpea or 3 rows of mungbean recorded the lowest nitrogen uptake by pigeonpea. The reduction in nitrogen uptake in aforesaid systems was 22 and 21% over the sole crop of pigeonpea. P uptake by pigeonpea was significantly higher in sole stand than its uptake by pigeonpea, in pigeonpea (100 cm) + 3 rows of mungbean or 3 rows of cowpea (Table 1). However, uptake of P in sole stand was at par with rest of the cropping systems. The reduction in phosphorus uptake in aforesaid systems was 20 and 19% over the sole crop of pigeonpea, respectively. K uptake in sole pigeonpea was statistically similar to the K uptake by pigeonpea in pigeonpea (50 cm) + 1 row of cowpea, but it recorded significantly higher uptake than other planting patterns. The highest uptake of 34.49 kg K/ha was recorded in sole pigeonpea. Pigeonpea (100 cm) + 3 rows of cowpea gave the lowest uptake of potassium by pigeonpea. The reduction in potassium uptake in aforesaid treatment was 24% over the sole crop of pigeonpea.

Hand weeding (15 and 30 DAS) was found to be most effective measure as it significantly improved the uptake of nitrogen, phosphorus and potassium by pigeonpea in comparison to fluchloralin and unweeded check. The hand weeding augmented the N, P and K uptake by 52.34, 49 and 50% over unweeded check, respectively.

Nutrient depletion by weeds

Weeds in sole pigeonpea (50 cm) re-

Table 1. Grain yield (q/ha), N, P and K uptake (kg/ha) by pigeonpea and nutrient depletion by weeds at harvest as influenced by intercropping systems and weed control methods (pooled over two years)

Treatment	Grain yield (q/ha)	Nutrient uptake by pigeonpea (kg/ha)			Nutrient depletion by weeds (kg/ha)		
		N	P	K	N	P	K
Cropping systems							
Pigeonpea sole (50 cm)	13.23	97.26	9.73	34.49	15.90	2.93	13.77
Pigeonpea (50 cm) + 1 row of mungbean	12.70	95.18	9.42	33.44	15.52	2.87	13.69
Pigeonpea (75 cm) + 2 rows of mungbean	11.80	89.87	8.88	30.75	15.42	2.81	13.61
Pigeonpea (100 cm) + 3 rows of mungbean	10.30	79.45	7.86	26.49	15.39	2.80	13.43
Pigeonpea (50 cm) + 1 row of cowpea	12.75	97.58	9.52	33.87	15.43	2.83	13.19
Pigeonpea (75 cm) + 2 rows of cowpea	12.10	92.40	9.17	31.29	15.31	2.81	13.00
Pigeonpea (100 cm) + 3 rows of cowpea	10.17	79.10	7.87	26.14	15.09	2.77	12.90
CD (P = 0.05)	0.41	1.08	0.86	1.01	0.56	NS	0.65
Weed control methods							
Unweeded check	7.89	59.10	5.88	20.13	26.89	4.11	23.94
Hand weeding (15 and 30 DAS)	15.13	116.99	11.58	41.12	4.72	1.10	5.30
Fluchloralin (PPI @ 1 kg a.i./ha)	12.49	94.93	9.12	32.56	14.70	3.73	11.55
CD (P = 0.05)	0.32	1.02	0.72	0.91	0.37	0.33	0.46

moved significantly greater amount of N and K as compared to pigeonpea (100 cm) + 2 rows of mungbean or 3 rows of cowpea. However, the aforesaid system (sole pigeonpea) failed to outdo the rest of the planting patterns with respect to N and K uptake by weeds (Table 1). Cropping systems failed to display any measurable effect so far as phosphorus depletion by weeds was concerned.

Hand weeding proved most advantageous so far as the depletion of nitrogen, phosphorus and potassium by weeds was concerned. It proved superior to pre-planting incorporation of fluchloralin @ 1 kg a.i./ha and unweeded check. The hand weeding reduced the depletion of N, P and K by weeds by 82, 69 and 79% over weedy check and 67, 70 and 52% over pre-planting incorporation of fluchloralin respectively.

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