Indian J. Agron. **41** (3) : 416–419 (September 1996)

Influence of potassium on growth and yield of pigeonpea (*Cajanus cajan*)

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Received: February 1995

ABSTRACT

An experiment was conducted during the rainy season of 1991 and 1992 to study growth and yield response of 'T21' pigeonpea [*Cajanus cajan* (L.) Millsp] to potassium application (0, 25, 50 and 75 kg/ha). Application of K significantly increased the shoot dry weight, leaf-area index (LAI), leaf-area duration and crop-growth rate. It also significantly increased the pods/plant, 1,000-seed weight, harvest index and seed yield (q/ha). Application of 50 kg K/ha proved optimum for growth and yield parameters and the seed yield.

It is well known that grain legumes in general, require high amounts of potassium for normal growth and development (Romaine, 1957). However, information on effect of K on the growth and yield of pigeonpea [*Cajanus cajan* (L.) Millsp] is limited (Mishra and Singh, 1991). Preliminary trial conducted at Aligarh revealed (data unpublished) that basal application of K increased the seed yield of pigeonpea. Encouraged by this findings, we examined the effect of different levels of K on the growth and yield of 'T 21' pigeonpea.

MATERIALS AND METHODS

An experiment was conducted during the rainy season (*kharif*) of 1991 and 1992 at the Agricultural Farm of the AMU, Aligarh. The soil of the experimental field was sandy loam and had pH 7.6 and available nitrogen 200 (1990) and 195 kg/ha (1991), available phosphorus 15 (1990) and 14 kg P/ha (1991) and available potassium 235 (1990) and 227 kg K/ha (1991). In randomized block design 4 levels of K (0,25, 50 and 75 kg K/ha) as muriate of potash were applied to the soil. A uniform dose of 20 kg N/ha as urea and 40 kg P/ha as single superphosphate was given as basal dressing. The seeds of 'T21' pigeonpea were inoculated with *Rhizobium* and were dibbled at a distance of 60 cm between the rows and 40 cm between the plants in the rows. The crop received 3 irrigations at 45, 90 and 140 days after sowing and was harvested after 180 days.

Three plants were collected randomly from each plot at 60, 90, 120 and 150 days and were dried in an oven at 80°C for 48 hr. Weight of fallen leaves was also included in shoot dry weight. Leaf-area index (LAI), leaf-area duration and crop-growth rate (CGR) were calculated according to Watson (1958), Chakrabarty *et al.* (1993) and Radford (1967) respectively.

RESULTS AND DISCUSSION

Growth parameters

Application of K influenced favourably all the growth parameters studied in both

the seasons (Tables 1, 2). The LAI and LAD significantly increased up to 75 kg K/ha but the values were found statistically equal to that recorded at 50 kg K/ha at all stages. The K increases cell expansion by regulating solute poential (Rao and Rao, 1983), which may probably increase the rate of leaf expansion and the LAI. Ravindranath *et al.*, (1985) also reported higher leaf area in K-treated plants of pigeonpea. Application of K might have reduced the premature leaf fall and thereby resulted in higher LAD.

The CGR increased significantly due to K application at all the stages (Table 2). The higher CGR in crop receiving K may be the result of increased photosynthesis (Cooper *et al.*, 1967), followed by efficient translo-cation of photosynthates (Barta, 1982). Chakrabarty *et al.* (1993) also recorded higher CGR dur to K application in sweet potato.

Like other growth parameters, shoot dry weight also significantly increased due to K application, 50 kg/ha proving best at most stages (Table 1). Mishra and Singh (1991) and Ravindranath *et al.* (1985) also reported beneficial effect of K on shoot dry weight of pigeonpea.

Yield and yield attributes

Application of K significantly increased pods/plant, 1,000-seed weight, harvest index and seed yield over the control. Application of 50 kg K/ha proved the best for these yield attributes and seed yield in both the seasons.

The higher photosynthetic surface for longer duration in crops receiving K (as indicated by higher LAI and LAD) might have resulted in enhanced photosynthetic activity and thus more metabolites are directed for the development of more pods/plant.

Potassium is also known to facilitate the partitioning of photosynthates (Barta, 1982). In the present investigation, harvest

Table 1. Effect of potassium on leaf-area indeex and shoot dry weight of pigeonopea

K (kg/ha)	Days after sowing							
	1991				1992			
	60	90	120	150	60	90	120	150
Leaf-area index								
0	0.28	0.90	1.28	0.94	0.28	0.90	1.28	0.95
25	0.37	1.17	1.65	1.16	0.37	1.17	1.65	1.16
50	0.44	1.26	1.95	1.35	0.44	1.25	1.94	1.35
70	0.45	1.27	1.95	1.3o	0.44	1.26	1.95	1.36
CD (P = 0.05)	0.05	0.07	0.28	0.18	0.05	0.07	0.27	8.18
Shoot dry weight (q/plant)								
0	8.40	44.73	89.46	126.26	8.39	46.15	90.13	128.40
25	11.65	60.99	121.92	168.41	11.75	60.15	120.46	170.52
50	13.73	71.84	143.61	197.80	13.05	70.14	140.63	198.36
75	13.80	72.03	144.04	197.52	13.10	71.02	141.41	199.15
CD (P = 0.05)	1.06	8.20	17.54	21.14	1.07	8.01	17.01	20.94

Table 2. Effect of potassium on leaf area duration and crop growth rate of pigeonpea

K (kg/ha)	Days after sowing					
	1991			1992		
	60–90	90–120	120–150	60–90	90–120	120–150
Leaf-area index						
0	16.1	32.4	33.2	16.2	32.6	37.1
25	20.9	41.9	41.9	21.0	42.0	41.8
50	23.6	47.5	49.1	23.3	47.2	49.0
75	23.7	47.7	49.2	23.6	47.5	49.2
CD (P = 0.05)	1.7	4.0	4.2	1.9	4.0	4.1
Shoot dry weight (q/plant)						
0	5.0	6.2	5.0	5.2	6.0	5.3
25	6.8	8.4	6.4	6.7	8.3	6.5
50	8.0	9.9	7.5	7.9	9.7	7.9
75	8.0	9.9	7.4	8.0	8.7	7.9
CD (P = 0.05)	1.1	1.1	1.0	1.0	1.2	1.0

Table 3. Effect of potassium on yield and yield attributes of pigeonpea

K (kg/ha)	1991				1992			
	Pods/ plant	1,000-seed weight (g)	Seed yield (q/ha)	Harvest index (%)	Pods/ plant	1,000-seed wight (g)	Seed yield (q/ha)	Harvest index (%)
0	175	42.2	14.93	15.35	180	43.9	14.01	16.49
25	209	46.7	19.40	17.08	210	47.2	18.32	17.65
50	225	51.0	22.07	14.64	230	51.4	21.15	18.70
75	227	51.1	22.13	17.59	232	51.5	21.19	18.72
CD (P = 0.05)	18.4	3.1	1.30	1.20	17.5	3.1	1.24	0.97

index which reflects the photosynthates partitioning efficiency of crop plants, increased due to K application (Table 3). Higher 1,000-seed weight may be the result of enhanced photosynthetic activity, followed by efficient transfer of metabolites and subsequent accumulation of these metabolites in the seed with the resultant increase in the size and weight of individual seed. The increased pods/plant and, 1,000-seed weight due to K application eventually contributed to higher seed yield. Ravindranath *et al.* (1985)and Yadav *et al.* (1993) reported beneficial effect of K on yield and yield attributes of pigeonpea.

The above results clearly showed that consistent response of pigeonpea to basal application of K. Application of 50 kg K/ha

proved to be optimum for growth and yield parameters and the seed yield.

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