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Effect of phosphorus and sulphur on growth and yield of pigeon pea (*Cajanus cajan*)

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ABSTRACT : A field experiment was conducted to study the effect of phosphorus and sulphur fertilization on growth and yield of pigeonpea during the *Kharif* season of 2005 and 2006. Eight treatments were studies in split plot design with four replications. The treatment combinations were derived from five levels of phosphorus (0, PSB, 40, 40+PSB, 80 kg P /ha) and three levels of sulphur (0,30,60 kg S /ha). Application of 80 kg P_2O_5 and 60 kg k_2O significantly increased plant height. Branches/plant, seeds/ pod and yield over the control and 40 kg P_2O_5+PSB+60kg K_2O during both the years. The result indicated a significant increase in grain yield (16.66 q/ha) and straw yield (50.16 q/ha) of pigeonpea after 80 kg P_2O_5 and 60 kg k_2O.The increase in grain and straw yield was 34 and 16 per cent as compared to higher over control. Maximum number of pods/plant, maximum number of seed/plant was also observed as compared to control.

Key Words : Pigeonpea, Phosphorus, Sulphur, PSB

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Its actual place of origin is very controversial as some people believe it to originate in India while others say that pigeonpea was found in the wild estate in Africa in regions of upper Nile and the coastal districts of Angola. From Africa it spread to other parts of the world and India. Australian people grow it for fodder and vegetable purposes. Now it is being grown in Africa, America, Australia, Hawaii, Ceylon, Netherland, Malaya, East and west Indies, India, Ando-China, Pakistan etc.

In India pigeonpea is mostly grown in the states U.P., M.P., Maharashtra, Bihar and Andhra Pradesh, Punjab, Haryana, West Bengal, Assam, Orissa, Rajasthan, H.P., Gujarat, Jammu and Kashmir, Karnataka, Tamil Nadu, Kerala etc. However, the major area is restricted to north India states. Pegionpea is grown as annual but Tur varieties grow like perennial plants. The plants are bushy, densely branched having a height of about 150cm. to 300cm. depending upon type and management practices.

Pigeonpea is an important grain legume crop of rainfed agriculture in the semi arid, tropics. Legumes are rich source of protein for common masses especially vegetarian. Both grain and stalk of legumes contain good amount of protein and minerals, which are essential for the growth, and development of human and animal body (Anonymous,2004). The crop has wide variation in their morphological character, root system and nutrient requirement therefore possess differential capability to utilized plant nutrient from different soil layers resulting in better use efficiency of the applied nutrient and residual fertility (Singh *at al.*, 2005). The adequate supply of phosphorus to legume is more important than that of nitrogen because it has beneficial effect on nodulation, growth and yield.

Presently is being required as fourth major nutrient .S, which is mostly applied to oilseed and pulses, has been found to benefit much physiological process in plant.

RESEARCH PROCEDURE

The experiment was conducted during the *Kharif* season 2005 and 2006 at the research farm of J.V. College Baraut (Baghpat), U.P. Baraut (20.6^0N, 77.17^0 E and at altitude of 226.6 m above mean sea-level). The soil was sandy clay loam with pH 7.52, organic carbon 0.55 per cent, available N 238.28 kg/ha, available P 17.21 kg /ha and available k 246.56 kg/ha. The average rainfall during crop season was 750 mm. The average sunshine hours was 6.7 and average humidity 74.35 per cent. The experiment was laid out in split plot design with 4 replications,

there were five levels of phosphorus and there levels of sulphur. The variety used was UPAS-120, this is a short duration variety. The seed were treated with thiram @ 3 g/kg seed. The seed rate was 20 kg/ha. The light hoeings with khurpi were done at 15 and 30 DAS to remove weeds along with thinning operations maintaining a plant spacing 60 cm x 20 cm. The next operation was done at 60 DAS.

RESEARCH ANALYSIS AND REASONING

Growth parameters *viz.*, plant height, dry matter accumulation and primary and secondary branches increased significantly with increasing levels of phosphorus up to 40 kg P_2O_5/ha (Table 1 and 2).

Plant height was significantly affected by phosphorus supply at all the growth stages. High dose of phosphorus 80 kg P_2O_5/ha produced taller plants which were at par with 40 kg P_2O_5/ha. The favourable effect of phosphorus application on plant height have also been reported by Prabhakar and Saraf (1991), Maruya and Rathi (2000), Baboo and Mishra (2004) and Parihar *et al* (2005). Dry matter production is resultant effect of growth parameters *viz.* plant height and number of branches/ plant. Dry matter increased with increased dose of It is evident from the result that application of 30 kg S/ha significantly increased the growth attributes *viz.*, plant height, branches/ plant, dry matter accumulation/plant over no sulphur in both the year phosphorus up to 80 kg P_2O_5 at all the growth stage.

Table 1 : Effect of phosphorus and sulphur on growth of pigeonpea

Treatments	Plant height		Dry- matter accumulation		Primary branches/plant		Secondary branches/plant	
	2005	2006	2005	2006	2005	2006	2005	2006
Phosphorus level								
No phosphorus	184.6	191.47	116.87	120.37	13.79	13.78	31.30	32.09
PSB(Phosphorus solubilizing bacteria)	187.87	195.03	127.76	131.83	13.97	14.03	32.28	32.80
40 kg Phosphorus /ha	193.70	202.57	136.67	140.40	14.20	14.26	34.59	33.48
40 kg/ Phosphorus /ha +PSB	197.23	204.87	143.41	146.40	14.61	14.71	34.88	35.09
80 kg/ha	200.63	208.97	147.95	151.00	14.81	14.94	35.76	36.47
S.E.±	2.33	2.69	0.685	0.729	0.144	0.145	0.462	0.452
C.D. (P=0.05)	6.66	7.70	1.96	2.08	0.412	0.413	1.32	1.21
Sulphur level								
No sulphur	187.74	195.04	119.49	122.72	14.37	14.42	31.82	32.09
30 kg S/ha	194.28	201.58	139.22	142.56	14.98	15.06	34.64	32.47
60 kg S/ha	196.40	205.12	144.88	148.72	15.38	15.55	34.82	34.56
S.E.±	1.81	2.09	0.531	0.564	0.143	0.120	0.357	34.93
C.D. (P=0.05)	5.16	5.96	1.52	1.62	0.410	0.342	1.21	0.350

Table 2 : Effect of phosphorus and sulphur on yield of pigeon pea

Treatments	No. of Pods/plant		No. of seed/pod		Seed yield/plant(gm)		Seed yield (q/ha)		Straw yield (q/ha)	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Phosphorus level										
No phosphorus	175.67	177.93	2.65	2.73	12.58	12.71	11.45	12.38	42.43	43.09
PSB	179.17	181.23	2.75	2.91	13.19	13.30	12.88	14.11	44.26	45.03
40 kg P/ha	183.87	184.53	3.11	3.22	13.79	13.83	14.09	15.23	46.65	47.17
40 kg P/ha +PSB	187.63	187.63	3.18	3.34	14.31	14.40	14.90	15.71	47.60	48.34
80 kg P/ha	189.93	189.73	3.31	3.43	15.13	15.32	15.84	16.66	49.31	50.16
S.E.±	1.89	1.90	0.037	0.041	0.141	0.182	0.181	0.186	0.511	0.601
C.D. (P=0.05)	5.38	5.41	0.111	0.116	0.403	0.518	0.518	0.412	1.46	1.73
Sulphur level										
No sulphur	177.24	176.34	2.68	2.80	12.40	12.49	11.46	12.21	42.80	43.37
30 kg/ha	184.00	186.18	3.08	3.23	14.25	14.39	14.51	15.55	47.37	48.30
60 kg/ha	188.52	190.12	3.23	3.35	14.75	14.85	15.53	16.69	47.98	48.60
S.E.±	1.46	1.47	0.030	0.031	0.109	0.141	0.141	0.144	0.396	0.469
C.D. (P=0.05)	4.17	4.19	0.086	0.898	0.312	0.412	0.401	0.412	1.13	1.34

It is evident from the result that application of 30 kg S/ha *viz.*, plant height, branches/plant, dry matter accumulation/plant over no sulpher in both the year. Every increase in levels of phosphorus brought about a significant increase in the number of pods/plant, seed/pod, seed and straw yield with the application of 80 kg P_2O_5/ha. The beneficial effect of phosphorus on production of grain, straw was observed in this investigation higher seed yield 15.84 and 16.66q/ha was obtained with the application of 80 kg P_2O_5. The second highest seed yield of 14.90 and 15.71 q/ha obtained with 40 kg P_2O_5+PSB inoculation Similar findings was reported was Singh *et al*.(2005), Kumar and Kushwaha (2006), Kumar *et al* (2007).

Resulted show that application of 30 kg/ha significantly increased the yield attributes *viz.* pods/plant and grain/pod and seed and straw yield of pigeon pea over no sulpher, application of sulpher was largely a junction of improved growth and consequent increase in yield attributing characters the results are in conformity with those Tewari and Pal (2005) Deshbhratar *et al.* (2010) who are also noted increased yield by application of sulphur.

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