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Response of cowpea (*Vigna unguiculata*) to sources and levels of phosphorus and zinc

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ABSTRACT

An experiment was conducted for 3 consecutive years during 1988–90 to study response of 'KBC 1' cowpea [*Vigna unguiculata* (L.) Walp.] to sources and levels of P and Zn on sandy-loam soils deficient in P and Zn. The pre-ponderance effects of P up to 60 kg/ha and of Zn @ 12.5 kg/ha increased the yields from 779 to 1,105 and 810 to 1,038 kg/ha respectively.

Importance of phosphorus nutrition in pulse crops is well documented (Follet *et al.*, 1981). The decline in grain yield of cowpea [*Vigna unguiculata* (L.) Walp.] are too frequent and has been mainly attributed to deficiencies of P and Zn. Zinc plays a vital role in metabolism and is known to be involved in N-fixation through nodule formations (Shukla and Yadav, 1982). There is not much information on the role of P and Zn in improving cowpea yield. Therefore the study was initiated to assess the effect of P and Zn on growth and yields of cowpea.

Table 1. Effects of source and rate of fertilizer phosphorus and zinc application on plant height and 100-seed weight of cowpea

Treatment	Plant height (cm)				100-seed weight (g)			
	1988	1989	1990	Pooled	1988	1989	1990	Pooled
P source								
SSP	45.07	39.30	42.95	42.44	12.14	11.53	11.74	11.80
DAP	45.83	39.66	43.73	43.07	12.21	11.39	11.78	11.79
APP	46.50	39.97	43.61	43.36	12.32	11.52	11.92	11.92
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS
P (P_2O_5 *kg/ha*)								
0	38.99	33.08	36.50	36.19	11.60	11.08	11.20	11.29
30	46.39	39.52	43.24	43.05	12.23	11.53	11.94	11.90
60	52.02	46.33	50.54	49.63	12.84	11.83	12.31	12.33
CD (P = 0.05)	0.54	0.63	0.78	0.51	0.13	0.17	0.15	0.09
Zn ($ZnSO_4$ *kg/ha*)								
0	44.02	37.70	41.23	40.98	12.07	11.40	11.67	11.71
12.5	47.58	41.58	45.63	44.93	12.38	11.56	11.96	11.96
CD (P = 0.05)	0.44	0.51	0.64	0.42	0.11	0.14	0.12	0.08

SSP, Single superphosphate; DAP, diammonium phosphate; APP, ammonium polyphosphate

Table 2. Effects of source and rate of fertilizer phosphorus and zinc application on yield and yield parameters of cowpea

Treatment	Pods/plant				Seeds/pod				Seed yield (kg/ha)			
	1988	1989	1990	Pooled	1988	1989	1990	Pooled	1988	1989	1990	Pooled
P source												
SSP	7.88	8.45	7.84	8.06	10.32	9.89	10.13	10.11	1,054	911	954	973
DAP	8.92	8.36	8.77	8.68	10.65	9.84	10.14	10.21	999	843	893	912
APP	8.86	8.30	8.58	8.58	10.38	9.91	10.28	10.19	947	870	902	906
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
P (P_2O_5 *kg/ha*)												
0	6.90	6.52	6.53	6.65	7.70	7.42	7.60	7.57	838	716	783	779
30	8.25	8.28	8.02	8.18	11.28	10.50	10.88	10.89	963	865	892	907
60	10.52	10.32	10.64	10.49	12.37	11.73	12.07	12.06	1,198	1,043	1,074	1,105
CD (P = 0.05)	0.20	0.16	0.16	0.18	0.12	0.14	0.17	0.28	111.3	64.5	53.7	31.4
Zn ($ZnSO_4$ *kg/ha*)												
0	7.93	7.71	7.86	7.83	10.00	9.45	9.70	9.72	857	766	807	810
12.5	9.18	9.03	8.94	9.05	10.89	10.31	10.66	10.62	1,141	983	1,026	1,050
CD (P = 0.05)	0.16	0.13	0.13	0.15	0.10	0.11	0.14	0.23	90.9	52.7	43.8	25.6

SSP, Single superphosphate; DAP, diammonium phosphate; APP, ammonium polyphosphate

MATERIALS AND METHODS

The study was conducted at the University Farm, GKVK, Bangalore, for consecutive 3 years during rainy season of 1988–90. The soils were Alfisols and sandy loam with pH of 5.7, low in organic carbon (0.32%), available P (11.4 kg P_2O_5/ha) and adequate in potassium (208 kg K_2O/ha). The DTPA-extractable zinc content was found to be 0.58 ppm. The treatments included 3 sources of P, viz. single superphosphate (SPP), diammonium phosphate (DAP) and ammonium, poly phosphate (APP) and 3 levels of P, viz. 0, 30 and 60 kg P_2O_5/ha. Zinc was applied in the form of $ZnSO_4$ at 0 and 12.5 kg/ha. Uniform basal application of nitrogen in the form of urea was done at the time of seeding.

RESULTS AND DISCUSSION

Direct effect of phosphorus

Phosphorus application up to 60 kg/ha significantly improved the plant height, 100-seed weight, number of pods/plant and number of seed/pod of cowpea during all the years irrespective of the sources tested (Tables 1, 2). Further the seed yields of cowpea were enhanced significantly by graded levels of phosphorus up to 60 kg P_2O_5/ha irrespective of the sources tested. Since the soils were low in available phosphorus and the requirement of P for cowpea is quite large, P levels reflected in improving seed yield at each level of phosphorus applied. The results are in conformity with those of Ahlawat *et al.* (1978) and Kurdikeri *et al.* (1973).

Direct effect of zinc levels

Zinc application at 12.5 kg $ZnSO_4$/ha increased plant height, 100-seed weight, number of pods/plant and number of seeds/pod over no zinc treatment. Further, there was marked and significant improvement in seed yield. This could be attributed to its role in metabolic activity mainly in protein synthesis in plants as well as N-fixation. These results are in agreement with those of Badiger and Rosalind Michael (1981) and Puranikmath (1982). However, the interaction effects of P and Zn were synergestic but statistically non-significant.

The study indicated that cowpea crop requires high levels of phosphorus and zinc for improving grain yields.

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