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INFLUENCE OF PHOSPHORUS AND MICRONUTRIENTS ON THE YIELD AND UPTAKE OF NPK IN COWPEA VAR. CO. 3

R. KRISHNASAMY[1], T. S. MANICKAM[2] and G. V. KOTHANDARAMAN[3]

Application of $ZnSO_4$ (25 kg/ha) had influenced the highest uptake of N, P and K in cowpea and soil application of 50 kg P_2O_5/ha was found to be significantly superior in increasing their uptake. The grain yield was the highest in T_3 treatment (Na_2MoO_4 at 0.25 kg/ha) while straw yield was higher in T_4 treatment ($ZnSO_4$ at 25 kg/ha). Highest grain yield (602 kg/ha) of cowpea was recorded in T_9 treatment when coupled with 2% DAP spray.

Yield of pulse crop had not been increased considerably over the last two decades. Research work done so far had given indication that pulses respond to the application of phosphorus (Deshpande and Bathkal, 1965). Foliar spray of phosphate solution (DAP) has been found comparable to soil application (Gill *et al.*, 1971). But information is laking on the interaction of P with micronutrients on the yield of pulse crops.

MATERIALS AND METHODS

A field experiment was conducted with cowpea var. CO 3 as test crop using various micronutrients viz., Na_2MoO_4 (0.25 kg/ha.), $CuSO_4$ (12.5 kg/ha), $ZnSO_4$ (25 kg/ha), $MnSO_4$ (25 kg/ha) and $FeSO_4$ (25 kg/ha) as treatments at the Tamil Nadu Agricultural University Farm. The experimental field was of deficient in available P (9.5 kg P_2O_5/ha), and sufficient in available N (207 kg/ha) and available K (240 kg/ha). As per the critical level fixed for Zn, Cu, Fe and Mn by Savithri (1978), the soil was deficient in DTPA extractable Zn, Cu and sufficient in Fe and Mn. Fifty kgP_2O_5/ha was applied through soil and two per cent solution of DAP was used as foliar spray at flowering stage. The yield was recorded. Grain sample and plant samples were collected at the time of harvest for chemical analysis. The experiment was laid out in a spilt plot design with three replications. The plant samples were analysed for NPK by following the methods as detailed by Jackson (1973). Concentrations of Zinc, Copper, Manganese and Iron were estimated in the di acid extract of plant samples using Varian Tectron AA 120 atomic absorption spectrophotometer. The data were subjected to statistical analysis (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The total uptake of N, P, K in cowpea showed (Table 1) that both 2% DAP spray and 50 kg P_2O_5/ha application had increased the uptake of N, P and K compared to water spray. Although, the uptake were higher in 50 kg P_2O_5/ha, the increase in uptake was

1-3 Department of Soil Science and Agrl. Chemistry, Tamil Nadu Agricultural University, Coimbatore-3.

slightly higher than 2% DAP sprayed plots. Substantial increase in the total uptake of NPK was observed when micronutrients were applied. It was found that all the treatments had significantly increased the NPK uptake Among the treatments, application of $ZnSO_4$ (T_4) at 25 kg/ha recorded the highest uptake in respect of all the three major nutrients followed by T_3 ($CuSO_4$-12.5 kg/ha), T_5 (Na_2MoO_4 0.25 kg/ha), T_2 ($MnSO_4$ 25 kg/ha) and T_6 ($FeSO_4$-25 kg/ha). In the case of P uptake T_4 ($ZnSO_4$) treatment has exceeded other treatments in increasing the uptake of P by cowpea. This treatment was sharply followed by T_5 (Na_2MoO_4), T_3, T_2 and T_6 in the decreasing order. Potassium uptake by cowpea also followed a similar pattern in that again the treatment T_4 ($ZnSO_4$) had influenced the highest uptake of K. These results clearly indicated that $ZnSO_4$ application had a greater impact in increasing the uptake of NPK sharply followed by T_2 and T_3 treatments. This may be due to the variation in dry matter production and concentration of N, P and K in haulm and grain. This is in agreement with Hulagur *et al.*, (1975) who stated that NPK uptake increased by Zn application. Among the methods of phosphate application, soil application (50 kg P_2O_5/ha) was found to be significantly superior in increasing the uptake of NPK.

When the yield of cowpea grains and haulm were statistically analysed (Table 2), it was observed that both micronutrient treatments and methods of P application had significant effects in increasing the yield. Contrary to the observation made in the nutrient uptake, the mean grain yield was the highest (513 kg/ha) in plots which received T_5 treatment (Na_2MoO_4) and when 2% DAP spray was done, the yield was highest (602 kg/ha) against the control yield of 408 kg/ha. The treatment T_4 ($ZnSO_4$) had emerged as the next best which was on par with the treatments T_2 and T_3. Application of $MnSO_4$ was not in any way superior to control plot. However, the yield of haulm had a different pattern, in which $ZnSO_4$ treatment had the highest mean haulm yield (3028 kg/ha). The $MnSO_4$ treatment which effected the lowest grain yield had produced a higher haulm yield (2736 kg/ha).

The total uptake of major nutrients was found to be highest in $ZnSO_4$ (T_4) treated plots. But it is interesting to note that the higher uptake had been exhibited in the form of haulm yield and not in the grain yield. However, highest grain yield was obtained only in T_5 treatment (Na_2MoO_4) plots, which recorded the NPK uptake slightly lower than that of T_4 treatment. This suggested that the nutrients (NPK) available in the T_4 treated plots were higher and the larger uptake would have been diverted to vegetative production rather than grain formation. However, in the case of T_5 treatment, though the amounts of NPK uptake were only slightly lesser, the grain production was found to be higher than vegetative production This is possibly due to some enzymes which required Mo ions for their activity. The enzyme nitrate reductase catalyses reduction of nitrate. Molybdenum is the prosthetic group of this enzyme. In T_5 treatment (Na_2MoO_4), the grain yield was higher than T_4 treatment eventhough the reverse was true in respect of the uptake of NPK. This might be due to the effective utilization of nitrogen.

Table 1 : Total uptake of N, P and K (Kg/ha) (Mean value of three replications)

Methods of application	50 kg P_2O_5/ha			2% DAP spray			Water spray			Mean		
Nutrients / Treatments	N	P	K	N	P	K	N	P	K	N	P	K
Control	43.41	13.11	41 09	39.00	12.71	39.18	30.57	9.64	33.07	37.66	11.18	37 77
Na_2MoO_4 (0.25 kg/ha)	60.42	21 81	55.42	53.35	19.96	51.60	45.13	17.16	45.90	52.96	19.60	50 97
$CuSO_4$ (12 5 kg/ha)	54.95	21.70	54.12	58.38	18.01	52 54	46.06	15 53	50.72	53.13	18.40	52 46
$ZnSO_4$ (0.5 kg/ha)	57 07	21.97	55 37	53.74	19.18	56 09	50.52	21.84	56 09	53.78	21.00	55.85
$MnSO_4$ (25 kg/ha)	52.84	18.65	44.52	46 33	18.20	50.19	54.09	15.76	53.12	51.08	17.60	49.28
$FeSO_4$ (25 kg/ha)	51.90	19.27	55,00	46.38	16.60	42,59	43.41	15.43	46.64	47.23	17.10	48 08
Mean	53.44	19.40	50,92	49,50	17.50	48,70	44.97	15 90	47.09			

	N			P		K	
	S.E	CD at 5%		S.E	CD at 5%	SE	G.D at 5%
Treatments	0.28	0.79		0.5	1.4	2.26	6.49
Methods of application	0.19	0,56		0.3	1.0	N. S	
Treatments X Methods	0,48	1.37	NS			N. S	

Table : 2. Yield of cowpea grain and Haulm (kg/ha) (Mean of three replications)

Methods of P application / Treatment	50 kg P_2O_5/ha		2% DAP spray		Water spray		Mean	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
Control	438	2200	355	2110	341	1525	378	1947
Na_2MoO_4 (0.25 kg/ha)	530	2913	602	2894	408	2138	513	2648
$CuSo_4$ (12.5 kg/ha)	480	2810	380	2919	441	2291	434	2673
$ZnSo_4$ (25 kg/ha)	494	3096	483	2994	383	2994	453	3028
$MnSo_4$ (25 kg/ha)	441	2777	385	2771	358	2732	394	2736
$ZnSO_4$(25 kg/ha)	491	2705	424	2305	399	2483	438	2497
Mean	479	2750	438	2656	358	2359		

	Grain		Haulm	
	S. E.	CD at 5%	S. E.	CD at 5%
Treatments	19.0	54	121	349
Methods of P application	13.0	41	86	246

From the results, it could be concluded that among the treatments, $ZnSO_4$ (T_5) application had influenced the highest uptake of N, P and K in cowpea and soil application of 50 kg P_2O_5/ha was found to be significantly superior in increasing their uptake. The grain yield was the highest in T_4 treatment (Na_2MoO_4) while the straw yield was higher in T_1 treatment ($ZnSO_4$). Highest grain yield (602 of kg/ha) cowpea was recorded in T_4 when coupled with 2% DAP spray.

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