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ZINC AND MOLYBDENUM ON YIELD AND NUTRITION OF SOYBEAN

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ABSTRACT

Soybean Co.1. raised on Perianaickanpalayam (Typic ustivertept) and Irugur (Typic ustorthent) soil series at Tamil Nadu Agricultural University Farm, Coimbatore during *rabi* 1990-91 and *kharif* 1991-92 respectively responded significantly to Zn fertilizetion at 5.0 kg ha^{-1}. Combined application of Zn, Mo and FYM at 2.5 kg, 0.5 kg and 10 t ha^{-1} respectively produced the highest seed yield in both the years besides increasing their content and uptake by soybean seed. The highest Fe uptake by seed during rabi 1990-91 was evidenced with the application of 5.0 kg Zn ha^{-1}.

KEY WORDS : Zinc, Molybdenum, Yield, Soybean

Soybean, the most important short duration crop has a fairly high yield potential and contains nearly 40 per cent protein and 20 per cent oil. Several studies have clearly indicated the requirement of major nutrients to soybean crop. However, with regard to micronutrients the studies are limited. Among the micronutrients, Zn seems to be more important as it plays a pivotal role in protein synthesis. The next indispensable micronutrient for pulse crop is Mo as it helps in both fixation and utilization of N by plants. Keeping this in view, the present investigation was taken up.

MATERIALS AND METHODS

Two field experiments, one in Perianaickenpalayam (black calcareous) and the other in Irugur (red, non-calcareous) soil series deficient in DTPA-Zn (Lindsay and Norvell, 1978) were conducted during 1990-91 and 1991-92 at the Tamil Nadu Agricultural University Farm with soybean, Co.1. as test crop. The pH and EC of the experimental sites were 8.3 and 0.16 dsm^{-1} respectively. Both the experiments received uniform basal dosages of N, P_2O_5 and K_2O (20:80:40 kg ha^{-1}). Zinc sulphate and sodium molybdate used for supplying the required quantity of Zn and Mo were superimposed over NPK. The other details are furnished in Table 1.

RESULTS AND DISCUSSIONS

Grain yield

In the first experiment the grain yield ranged from 943 to 1411 kg ha^{-1} (Table 1.). The grain yield was significantly higher in almost all the treatments, except the treatment which received sulphur dust (T_7 and T_8) and Zn by soil and foliar spray (T_3). Zinc applied @ 2.5 and 5.0 kg ha^{-1} increased significantly the grain yield over NPK treated control and the application of Zn at 5.0 kg

Table 1. Effect of Zinc and Molybdenum on grain yield of Co 1 soybean Mean of three replications

Treatment details	Grain yield (kg/ha)			
	1990-91	Per cent over control	1991-92	Per cent over control
S.A. 2.5 kg Zn/ha as $ZnSO_4$ (T_1)	1095	+16	1459	+29
S.A. 5.0 kg Zn/ha as $ZnSO_4$ (T_2)	1232	+31	1518	+34
S.A. 5.0 kg Zn/ha + 0.5% $ZnSO_4$ F.S. 30 DAS (T_3)	1003	+6	1578	+40
S.A. 0.5 kg Mo/ha as Na_2 Moc_4 (T_4)	1299	+38	1190	+5
S.A. 1.0 kg Mo/ha (T_5)	1397	+48	1280	+13
FYM at 10 t/ha (T_6)	1085	+15	1459	+29
Application of S dust as equal to S in T_1 (T_7)	1041	+10	1399	+24
Application of S dust as equal to S in T_2 (T_8)	1053	+12	1578	+40
2.5 kg Zn + 0.5 kg Mo + 10 t FYM/ha (T_9)	1411	+50	1964	+74
NPK alone (T_{10})	943		1131	
C.D. at 5 per cent	117		295	

S.A. = Soil application : F.S. = Foliar spray DAS = Days after sowing.

Table 2. Effect of Zn and Mo on micronuirents uptake by Co 1 soybean grain (Mean of three replications).

Treatment details	Uptake (g/ha)							
	1990-91				1991-92			
	Zn	Cu	Fe	Mn	Zn	Cu	Fe	Mn
S.A. 2.5 kg Zn/ha as $ZnSO_4$ (T_1)	84	53	158	78	92	30	265	71
S.A. 5.0 kg Zn/ha as $ZnSO_4$ (T_2)	96	64	238	88	88	33	250	75
S.A. 5.0 kg Zn/ha + 0.5% $ZnSO_4$ F.S. 30 DAS (T_3)	81	51	164	70	90	35	269	80
S.A. 0.5 kg Mo/ha as Na_2Mo_4 (T_4)	90	58	167	79	64	24	208	43
S.A. 1.0 kg Mo/ha (T_5)	109	67	176	88	79	28	256	52
FYM at 10 t/ha (T_6)	98	50	174	74	69	29	265	50
Application of S dust as equal to S in T_1 (T_7)	79	46	167	67	53	24	261	49
Application of S dust as equal to S in T_2 (T_8)	67	43	109	65	67	30	267	57
2.5 kg Zn + 0.5 kg Mo + 10 t FYM/ha (T_9)	111	63	182	94	129	48	391	124
NPK alone (T_{10})	63	38	85	66	64	19	174	45
C.D. at 5 per cent	14	26	55	12	16	11	73	15

ha^{-1} produced higher grain yield than that evidenced at 2.5 kg ha^{-1}. The highest grain yield was obtained when Zn at 2.5 kg ha^{-1} as applied along with 0.5 kg Mo and 10 t FYM ha^{-1}. Chandel *et al.*, (1989) and Kalia and Sharma (1988) obtained similar results in soybean for the application of Zn at 2.0 and 5.0 kg ha^{-1} with FYM. Response was observed even for the soil application of 0.5 and 1.0 kg Mo ha^{-1} as sodium molybdate. Similar increase in grain yield of soybean due to Mo application has been reported by Gupta and Gupta (1972) and Penk (1980).

In the second year experiment, soybean responded significantly to the individual or combined application of Zn and Mo with FYM in the Zn deficient non-calcareous red loamy soil (Irugur soil series).

Uptake of Zn, Cu, Fe and Mn : Zinc uptake increased significantly due to the application of Zn and Mo and the highest uptake was observed with T_9 (Table 2). Similar trend was also evidenced in the second year experiments. The highest uptake of Zn, Cu, Fe and Mn by the seed of Co.1.soybean in both the experiments was associated with the combined application of Zn + Mo + FYM (T_9).

The results indicated the beneficial effect of application of Zn at 5.0 kg ha^{-1} in increasing significantly the seed yield of Co.1.soybean in both the experiments and was associated with the combined application of Zn + Mo + FYM (T_9).

The results though indicated the beneficial effect of application of Zn at 5.0 kg ha^{-1} in increasing significantly the seed yield of Co.1.soybean, the pronounced effect of combined application of 2.5 kg Zn + 0.5 kg Mo + 10 t FYM ha^{-1} in producing the highest yield and enhancing the uptake of Zn, Cu, Fe and Mn by Co.1 soybean seed was well brought out. Zn + Mo+ FYM is recommended to maximise the production and micronutrients (Zn, Cu, Fe and Mn) uptake by the seeds of Co.1soybean in Zn deficient black (Perianaickenpalayam series) and red (Irugur series) soils of Coimbatore district.

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