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DIRECT AND RESIDUAL EFFECT OF DIFFERENT ZINC SOURCES ON UPTAKE OF Zn AND YIELD IN PADDY - PULSE ROTATION

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ABSTRACT

Direct and residual effect of different zinc sources (Zinc sulphate, Zincated urea and Zincated suphala) in rice-pulse-rotation was evaluated. Crop yield, concentration and uptake of zinc was high in plots where Zn was applied as zincated urea alone and in combination with zincated suphala. Residual effect on the pod yield of green gram was also found. Residual effect on the zinc uptake both by pod and haulms was not much influenced by zinc sources. None of the zinc sources could provide DTPA Zn of 2 ppm (critical limit) after greengram crop in order to raise the third crop.

Key words: Direct, residual effects, zinc sources, Paddy-Pulse.

The content of zinc in soil decreased due to increase in use of high analysis fertilizers and cropping intensity and introduction of high yielding varieties, thus causing zinc to be deficient in soil apart from N, P, K. The decline in yield due to zinc deficiency has been reported from all over India (Kanwar and Randhawa, 1974). Zinc is required in small quantities and depletion patterns vary with crop sequence and residual effect was beneficial to the succeeding crops. Gupta *et al*. (1986) found that residual effect of 2.5 ppm was sufficient to get the highest grain yield of wheat after pearl millet and cowpea crop. Sarkar and Deb (1984), maintained that 10-20 kg Zn/ha was effective even after the harvest of 4 crops. But Sarkar *et al*. (1980) found that application of 5 kg Zn/ha was not adequate for 2 years of crop.

This paper presents the results of the study on direct and residual effect of different newer zinc sources on paddy pulse rotation in low land rice soil.

MATERIALS AND METHODS

A field which is deficient in zinc was selected. The soil was deep, moderately drained, clay loam (Typic Haplustalf). The pH of the soil was 8.5. The electrical conductivity was normal (0.5 mmhos/cm). The soil recorded low available N (191 kg/ha), medium available P (12 kg/ha) and high available K (490 kg/ha) and available Zn of 1.1 ppm. Experiment consisted of 8 treatments with 4 replications in randomized block design (Table 1).

Basal dose of 100 kg P_2O_5 and 50 kg K_2O was applied to the paddy crop (variety IR 60). After the harvest of paddy crop, greengram (var. Co.3) was raised in the same plots and N and P were applied through urea and DAP and no zinc was applied. After the harvest of both the crops, the soils were analysed for available zinc with DTPA extract in an Atomic Absorption Spectrophotometer. The yield was recorded. The plant samples were digested in triple acid mixture and zinc was analysed.

RESULTS AND DISCUSSION

Direct effect on paddy (IR 60): There was significant increase in the grain yield with the application of zinc. Among the different sources zinc sulphate recorded the lowest grain yield and was on par with the application of zincated suphala (T.7) (7.51 t/ha). Highest grain yield was obtained in the combined application of zincated suphala and zincated urea (T.8) but was on par with zincated urea application (T.5). Similar trend was also reflected in the straw yield. The increase in yield was 10.5 to 25.3 per cent due to zinc application compared to NPK alone).

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Table 1.Direct effect of zinc sources on grain straw yield and zinc uptake by root, shoot, straw and grain of paddy (Mean of 4 replications)

Sl. No.	Treatments	Grain Yield (t/ha)	Straw yield t/ha)	Uptake of Zn (g/ha) Root			Shoot		Straw	Grain
				T.S	P.I.	H.S.	T.S.	P.I.		
1	Absolute control	2.57	3.43	25.27	23.71	18.49	10.10	37.92	43.10	18.07
2	Zinc sulphate only	2.91	4.07	36.85	34.61	22.65	16.94	59.24	72.68	27.38
3	NPK only	4.19	5.57	57.07	40.27	26.42	24.18	88.80	126.70	48.18
4	NPK+zinc sulphate	4.63	5.78	68.47	46.81	33.61	31.87	108.70	193.00	67.17
5	Zincated Urea (completely basal)	5.08	6.60	78.42	47.03	35.81	37.36	140.90	223.80	74.52
6	Zincated Urea (Splits)	5.01	6.60	78.92	48.07	36.26	42.32	142.70	218.50	75.12
7	Zincated suphala + ordinary urea	4.69	5.97	72.92	45.65	34.77	35.87	134.40	191.40	64.87
8	Zincated Suphala + Zincated urea	5.24	6.75	85.15	48.48	36.67	41.08	144.70	222.70	76.43
	CD (0.05)	0.16	0.27	11.50	5.07	3.34	6.75	15.31	20.60	7.51

T.S. = Tillering stage; P.I. = Panicle initiation; H.S. = Harvest Stage

Zinc uptake was influenced by different sources of zinc. At all stages of crop growth, control plot recorded the lowest uptake compared to other treatments. Zinc uptake was significantly higher in root, shoot, straw and grain due to zinc application at all stages of crop growth. Application of zinc along with NPK has increased zinc uptake over NPK alone by 22.4 to 62.9 per cent in shoot, 34.6 to 58.6 per cent in grain and 51.0 to 76.6 per cent in straw and 27.2 to 39.0 per cent in root. Jawahar (1985) observed similar results. The increase in zinc uptake over NPK alone plot was 33.4 to 67.7 per cent at tillering and 44.5 to 66.7 per cent at harvest stage.

Among the zinc sources as far as zinc uptake in root is concerned, at tillering stage all the sources were on par but combined application of zincated suphala and zincated urea was significantly superior to zinc sulphate while it was on par with other sources. At the panicle initiation and at harvest stages, irrespective of method of application, all the sources were on par. Shoot uptake of zinc also indicated almost similar trend at all the stages. Zinc uptake by grain showed that the sources of zinc were on par.

Residual effect on greengram (Co.3): In the case of grain yield, significant residual effect was found only under T.5, T.6 and T.8. (Table 2). However in other zinc treated plots, there was numerical increase in grain yield. The percentage increase in grain yield of crop was 11.2 in the case of T.8 and 10.5 in the case of T.5 and T.6 when compared with NPK alone. Sarkar *et al.* (1980,1983) found that residual effect of zincated urea gave good yield in the succeeding crop.

In the case of uptake of zinc by the green gram crop, zinc application had significant residual effect. Among the zinc sources, zincated urea had maximum residual effect on the zinc taken up by grain. While in the case of haulms it was more with zinc sulphate applied along with NPK. However the residual effect on the zinc uptake among scurces was not significant. The residual effect on the zinc uptake was more pronounced in the haulms than in grain.

DTPA Extractable zinc: There was increase in the DTPA-zinc in the soil with added zinc sources over control at all stages of crop growth (Table 3).

Table. 2 Residual effect of zinc sources on dry matter production yield and zinc uptake in greengram

Sl No	Treatments	Dry matter production (kg/ha)	Greengram yield (kg/ha)	Zinc uptake by grain (g/ha)	Zinc uptake by haulms (g/ha)
1.	Absolute control	2994	243	1.34	28.3
2.	Zinc sulphate only	3075	255	2.08	37.4
3.	NPK only	4145	459	4.55	68.8
4.	NPK + zinc sulphate	4262	483	5.61	111.3
5.	Zincated Urea (completely basal)	4571	507	5.98	106.8
6.	Zincated urea (splits)	4535	507	5.91	110.1
7.	Zincated suphala + ordinary urea	4500	502	5.83	104.6
8	Zincated suphala + Zincated urea	4239	511	5.90	105.3
	CD (0.05)	475	44.6	0.57	13.6

Comparing the different sources of zinc, soil application of zincated urea either as basal or in splits was on par with combined applications of the zincated sulphala and zincated urea but significantly superior to zinc sulphate and zincated sulphala. The zincated urea both basal and splits and combined application of zincated suphala and zincated urea raised the DTPA - Zn from deficiency level to sufficiency level.

Post harvest soil analysis after the second crop of greengram indicated that the available zinc in the soil was not more than 2 ppm due to application of any of the zinc sources, which is the critical limit for this soil. Zinc applied plots registered significantly higher available zinc after the second crop than no Zinc application. There was no difference among different zinc sources. This implies that application of 5 kg Zn/ha to rice will not be sufficient enough to raise the 3rd crop in rice pulse rotation.

Table 3.Direct and residual effect of different zinc sources on DTPA - Zn in the soil (ppm) (Mean of 4 replications)

Sl No	Treatments	Available Zinc after Paddy	Green
1.	Absolute central	0.79	0.69
2.	zinc sulphate only	1.88	1.48
3.	NPK only	0.82	0.77
4.	NPK + zinc sulphate	2.00	1.81
5.	Zincated Urea (Completely basal)	2.06	1.93
6.	Zincated Urea (splits)	2.16	1.91
7.	Zincated suphala + Ordinary urea	1.92	1.84
8.	Zincated suphala + zincated urea	2.17	1.98
	CD (0.05)	0.12	0.20

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