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EFFECT OF NEWER SOURCES OF ZINC APPLICATION ON Zn, Mn, Cu, Fe UPTAKE BY RICE (VAR IR.60) IN LOWLAND

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ABSTRACT

Zincated urea and zincated suphala were evaluated along with the zinc sulphate for the uptake of micronutrients such as Zn, Mn, Cu and Fe by rice (Var IR.60) in a deficient (DTPA extractable Zn 1.1 ppm) clay loam soil (Typic Haplustalf) at Tamil Nadu Agricultural University, Coimbatore, India. The data revealed that zinc fertilization increased Fe, Mn, Cu and Zn uptake with other nutrients indicating synergistic effect. Among the sources of zinc, zincated urea applied alone provided higher value for copper uptake but in combination with zincated suphala provided the highest value for Zn, Fe and Mn uptake.

Key words: Zinc sources uptake by rice.

The use of fertilizers has become very common for correcting zinc deficiency in crops and soils. Literature evidences are plenty to show that zinc application increased the content and uptake of zinc by rice crop (Gangwar, 1976; Ahmed *et al.*, 1981).

Nagarajan (1983) recorded increase in the uptake of copper due to addition of zinc while Chatterjee and Mandal (1983) reported that zinc application decreased the content and uptake of copper.

Gangwar and Mann (1972) showed that zinc application tends to increase Mn under flooding. Sakar *et al.* (1981) reported antagonistic effect of Zn on Mn. Chatterjee and Mandal (1985) found that zinc fertilization increased the concentration of Mn by suppressing tha availability of Fe. Iron content and uptake was reduced by zinc application (Verma and Tripathi, 1983). Chavan and Banerjee (1980) found that uptake of Fe increased significantly with higher levels of zinc.

The use of zinc incorporated macronutrient fertilizers is very ideal since it reduces the cost of transport and application. Fertilizer industries are therefore incorporating zinc with various macronutrients and two such materials are zincated urea and zincated suphala. Field trials were conducted to find out the use of these in improving the zinc content, uptake of Fe, Mn and Cu by lowland rice crop.

MATERIALS AND METHODS

A field trial was conducted in wetlands of Tamil Nadu Agricultural University, Coimbatore, India during the period from November 1986 to March 1987. The soil was deep, moderately drained, clay loam with pH value of 8.5. The soil selected was deficient in available zinc (DTPA Zn 1.1 ppm). The soil belongs to sub group-Typic Haplustalf. The experiment was laid out in RBD with four replications with the eight treatments (Table 1). The plot size of the experiment is 5 x 4 m^2. The zincated urea contained 2% zinc and 43% N and zincated suphala contained 2% zinc, 15% N, 15% P_2O_5 and 15% K_2O. Rice variety, IR.60 maturing in 105-110 days was the test crop. Fertilizer dose was 100:50:50 kg/ha of N, P_2O_5 and K_2O respectively. P and K were applied as per treatmental schedule.

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The plant samples were taken at harvest stage and analysed for Zn, Mn, Cu, Fe contents in the triple acid extract using Atomic Absorption Spectro Photometer. The uptake of nutrients was also calculated.

RESULTS AND DISCUSSION

Zinc uptake: Zinc uptake was influenced by different zinc sources (Table 1). Control plot recorded the lowest zinc uptake as compared to other treatments. Application of zinc with NPK increased zinc uptake over NPK alone by 34.6 to 58.6 per cent in grain, 51.0 to 76.6 per cent in straw and 27.2 to 39.0 per cent in root. Jawahar (1985) observed that applied zinc increased the zinc uptake in rice crop. Zinc uptake by grain showed that the sources of zinc compared were equal in their influence.

Table 1. Effect of zinc sources on Zn and Mn uptake by rice (Var. IR.60).

S.No.	Treatments	Zn uptake (g/ha)			Mn uptake (g/ha)			Grain yield (t/ha)	Straw yield (t/ha)
		Root	Straw	Grain	Root	Straw	Grain		
1.	Absolute control	18.5	43.1	18.1	111.5	636.3	28.6	2.57	3.43
2.	Zinc sulphate (25 kg/ha)	22.7	72.7	27.4	129.5	805.2	62.1	2.91	4.07
3.	NPK only	26.4	126.7	48.2	163.8	1344.4	111.8	4.19	5.51
4.	NPK + Zinc sulphate (25 kg/ha)	33.6	193.0	67.2	222.6	1479.1	147.7	4.69	5.78
5.	Zinc blended urea (basal)	35.8	223.8	74.5	238.9	1700.9	158.3	5.08	6.60
6.	Zinc blended urea (splits)	36.3	218.5	75.1	238.7	1583.0	157.2	5.01	6.60
7.	Zinc blended suphala + top dressing with urea	34.8	191.4	64.9	231.7	1454.3	148.6	4.63	5.97
8.	Zinc blended suphala + top dressing with zincated urea	36.2	232.7	76.4	236.1	1675.3	157.6	5.24	6.75
	CD (0.05)	3.3	20.6	7.5	151.0	11.2	0.16	0.27	

Manganese uptake: In general, fertilization with zinc was found to increase the uptake of manganese also by root, shoot and grain. There was no significant difference among the zinc sources on the manganese uptake. The highest manganese uptake by the whole crop was seen in T_5 and was comparable with other zinc treatments, but there was a significant increase over NPK alone plots. Total zinc uptake had ($r = 0.962^{**}$) a positive correlation with total managanese uptake. The manganese uptake was found to be more in straw and root than in grain.

Copper uptake: When zinc was applied along with NPK, the copper uptake in the root was significantly higher than NPK alone plots at harvest stage. All the zinc sources were on par. But copper uptake by straw showed that zinc sulphate was on par with NPK alone but other sources of zinc were significantly superior to NPK alone. Copper uptake by grain was positively influenced by zinc application, but among the sources, there was no variation. Total copper uptake was the highest with T_5 and was found to be on par with other zinc treatments. Total zinc uptake showed very high positive correlation with total copper uptake ($r = 0.974^{**}$). Higher quantity of copper was taken by the roots as compared straw and grain.

Iron uptake: Application of zinc did not influence the uptake of iron by roots of paddy. Sources of zinc also did not influence the uptake of iron. Zinc application increased the iron uptake by shoots but among the sources there was no variation. The uptake pattern of Fe by grain showed that it did not increase the uptake significantly. Total zinc uptake had a positive correlation with total iron uptake ($r = 0.980^{**}$). The

Table 2. Effect of zinc sources on Cu and Fe uptake by rice (Var. IR.60) (g/ha).

S.No.	Treatments	Cu uptake			Fe uptake		
		Root	Straw	Grain	Root	Straw	Grain
1.	Absolute control	25.3	6.4	3.8	688	361	318
2.	Zinc sulphate (25 kg/ha)	36.0	10.6	4.8	937	642	342
3.	NPK only	39.6	28.2	16.3	1989	1063	888
4.	NPK + Zinc sulphate (25 kg/ha)	58.5	31.4	22.3	2178	1181	914
5.	Zinc blended urea (basal)	58.8	34.5	24.2	2092	1379	975
6.	Zinc blended urea (splits)	57.2	32.9	22.6	2044	1320	960
7.	Zinc blended suphala + top dressing with urea	58.1	34.4	23.0	2138	1363	948
	CD (0.05)	5.2	3.3	2.3	160	115	72

quantity of Fe taken up by the roots was comparatively more than by straw or grains.

Dry matter production: Application of zinc had increased the grain and straw yield over no zinc application which could be due to the favourable effect on yield components and perhaps zinc influenced the uptake of plant nutrients by rice through enzymatic effect in the metabolic process which ultimately account for the higher grain yield. Application of zincated suphala gave higher yield over the other source.

Regarding the straw yield, application of zincated urea alone or in combination with zincated suphala provided significant increase in yield over other sources. The positive correlation between zinc uptake at harvest and straw yield ($r = 0.925^{**}$), soil availability zinc and straw yield ($r = 0.791^{**}$) and total zinc uptake and straw yield ($r = 888^{**}$) confirmed the strong and significant influence of zinc on the straw yield.

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