 Oryza Vol. 43. No.4, 2006 (326-328)

Effect of zinc management practices on growth yield and economics in transplanted rice (*Oryza sativa* L)

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ABSTRACT

A field experiment was conducted during wet season 1998 at Agricultural College Farm, Bapatla on a clay loam soil to find out a better zinc practices for transplanted rice using the test variety MTU2067. The results revealed that soil application of 50 kg $ZnSo_4$ ha^{-1} followed by foliar spray of Zn-EDTA (equivalent to 0.2% $ZnSO_4$) and seedling root dip with ZnO (equivalent to 10 kg $ZnSO_4$ ha^{-1}) significantly increased the growth characters, yield attributes, grain and straw yield. Soil application of $ZnSO_4$ @ 50 kg ha^{-1} recorded 25 per cent increase in grain yield over control. Though highest Benefit Cost Ratio (BCR) 1.30 was recorded by seedling root dip with ZnO (equivalent to 10 kg $ZnSO_4$ ha^{-1}), soil application of 50 kg $ZnSO_4$ ha^{-1} was found o be the best which recorded the highest net monetary returns (Rs.12,340 ha^{-1}) with BCR of 1.25.

Key words: *Zinc, management practices, rice, growth, yield and economics*

In rice cultivation, zinc is one of the most essential micronutrients, since it plays a vital role in translocation of nitrogen and protein synthesis. An estimated area of nearly 54,000 ha of rice land is known to be affected by zinc deficiency in A.P. State (Deb,1989). Zinc management region, wherein zinc deficiency in rice fields is quiet often noticed. Therefore, the present investigation was undertaken to evaluate the efficacy of various zinc management practices in a zinc deficient soil of Bapatla region.

A field experiment was conducted during wet season 1998 at Agricultural College Farm, Bapatla campus of Acharya N.G. Ranga Agricultural University using the test variety MTU 2067 (150 days duration) on a clay loam soil having pH 8.4, EC 0.94 ds/m, organic carbon 0.5 per cent, available nitrogen 223 kg^{-1} and DTPA-Zn 0.7 mg kg^{-1}. the experiment was laid out in a randomized block design with four replications. The treatments consisted of a control, soil application and seedling root dip with two zinc sources (Zinc sulphate and Zinc oxide) and foliar application twice with three Zinc sources (Zince sulphate, Zince oxide and Zn – EDTA), thus making sources (Zn SO_4 or ZnO) were broadcast into puddle soil as per the treatment schedule (Table 1) three days after the application of phosphatic fertilizer. In respect of seedling dip treatments, slurry was prepared by mixing zinc sources (Zn SO_4 or ZnO) as per the treatment with soil and water in 1:2:3 ratio and seedling roots were dipped in the slurry for 30 minutes in sunlight and later they were transplanted. With regard to foliar application, the required quantities of sources (Zn SO_4/ ZnO/Zn-EDTA) were dissolved in water in order to obtain 0.2% Zn SO_4 equivalent solutions and foliar sprayings were given at 30 and 40 Days after transplanting (DAT). A common dose of 80-60-40 kg NPK ha^{-1} was applied. Nitrogen was applied in three equal splits *i.e.* at planting, 30 and 60 DAT. Entire doses of P and K were applied at planting. Suitable provisions were made in the sources *viz.*, zinc oxide, Zn EDTA treatments by supplementing equivalent to Zn SO_4 available.

Biometric data were collected on five randomly selected plants and subjected to statistical analysis (Panse and Sukhatme, 1978). At harvest, the grain and straw yields were recorded besides calculating harvest index and economics.

Drymatter production at 60 DAT showed that soil application of 50 kg Zn SO_4 ha^{-1} (T_2) recorded significantly higher drymatter over control followed by foliar application twice with Zn-EDTA (T8) and seedling root dip in ZnO (Table 1). However, the rest of

Table 1. Effect of zine management practices on growth and yield of transplanted rice

Treatment	Plant height (cm)	Draymater production (g m^{-2}) at		EBT	Panicles m^{-2}	Filled grain	Test weight g(1000gr)	Grain yield t ha^{-1}	Straw yield t ha^{-1}	Harvest Index (%)
		30 DAT	60 DAT							
T_1 control (No. zinc application)	90.5	150	486	281	182	98	20.4	3.340	5.48	37.8
T_2 soil application of 50 kg $ZnSO_4$ ha^{-1}	95.7	180	604	318	223	122	21.4	4.17	6.32	39.7
T_3 soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1}	93.0	157	516	288	189	103	20.7	3.63	5.84	38.3
T_4 Seedling dip in 10 kg $ZnSO_4$ slurry ha^{-1}	93.5	163	535	288	187	101	20.9	3.62	5.80	38.4
T_5 Seedling dip in ZnO slurry equivalent to 10 kg ZnSO4 ha^{-1}	93.8	167	549	308	203	113	20.7	3.79	5.95	38.9
T_6 Foliar application twice with 0.2% $ZnSO_4$	93.6	163	536	306	193	107	20.7	3.75	5.90	38.8
T_7 Foliar application twice with ZnO equivalent to 0.2% ZnSO4	91.0	160	522	293	185	100	20.5	3.53	5.77	37.9
T_8 Foliar application twice with Zn-EDTA equivalent to 0.2% $ZnSO_4$	95.6	174	583	313	207	115	21.0	3.95	6.01	39.6
SEm±	1.1	12.7	21.9	12	8.5	4.5	0.2	0.142	0.227	0.4
CD (P=0.05)	3.1	NS	65	35	25	13	0.6	0.42	0.67	1.2
CV %	7.0	6.7	8.4	7.4	5.0	6.5	7.2	7.3	8.3	6.4

N.S = non significant 3.1

treatments remained at par. Similar trend was also recorded in respect of earbearing tillers (EBT) and plant height at harvest. Dry matter accumulation was higher in soil application of 50 kg $ZnSO_4$ ha^{-1} over other treatments that might be due to more availability of zinc near rhizosphere (Uddin *et al.*, 1981, Varshney, 1988, Mali and Shaik 1994).

Soil application of 50 kg $ZnSO_4$ ha^{-1} recorded more number of panicles followed by foliar application twice with Zn-EDTA and seedling root dip in ZnO compared to the remaining treatments. The treatment T_2 significantly increased the number of filled grains $panicle^{-1}$ compared to rest of the treatments except T8 and T5 at par (Table 1). The results were in conformity with the findings of Sriramachandrasekharan and Mathan (1998). The treatment T2 recorded the highest test weight of 21.4g as against 20.4g recorded in the control. This might be due to increased transportation of photosynthates from source to sink due to zinc application as reported by Varshney (1988).

Superiority of T_2 treatment over other treatments might be attributed to higher zinc concentration maintained by soil application of zinc in the rhizosphere with constant supply. More number of productivity tillers, filled grains $panicle^{-1}$ and higher test weight with zinc application might have contributed to increased grain yield with T_2 treatment followed by T_8 and T_5 (Table 1). The results corroborate with the findings of Singh and Sharma (1994).

Straw yield was also significantly higher with soil application of 50 kg $ZnSO_4$ ha^{-1} (T_2) over control (T_1) only. Higher growth characters and tillers m^{-2} might have contributed to increased straw yield. (Singh and Sarma, 1994).

Soil application of 50 kg $ZnSO_4$ ha^{-1} (T_2) significantly enhanced the harvest index (39.7%) which however, did not differ with foliar spray of $ZnSO_4$ and Zn-EDTA and seedling root dip with ZnO treatments.

Critical perusal of the data (Table 2) revealed that soil application of 50 kg $ZnSO_4$ ha^{-1} (T_2) recorded at higher extra net return of Rs.2924 and Rs.2725 ha^{-1} (T_1) and soil application of ZnO (T_3) respectively.

Table 2. Economics of different zinc management practices in transplanted rice

Treatment	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net returns (Rs./ha)	Benefit cost ratio
T_1 control (No. zinc application)	17,926	8,510	9,416	1.10
T_2 soil application of 50 kg $ZnSO_4$ ha^{-1}	22,150	9,180	12,340	1.25
T_3 soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1}	19,415	9,800	9,615	0.98
T_4 Seedling dip in 10 kg $ZnSO_4$ slurry ha^{-1}	19,364	8,770	10,594	1.20
T_5 Seedling dip in ZnO slurry equivalent to 10 kg ZnSO4 ha^{-1}	20,201	8,768	11,433	1.30
T_6 Foliar application twice with 0.2% $ZnSO_4$	20,018	8,787	11,231	1.27
T_7 Foliar application twice with ZnO equivalent to 0.2% ZnSO4	18,938	8,787	10,151	1.15
T_8 Foliar application twice with Zn-EDTA equivalent to 0.2% $ZnSO_4$	20,960	9,145	11,815	1.29

Cost of Rs. 26 kg^{-1} Cost of rice grain Rs. 4.55 kg^{-1} $ZnSO_4$
Cost of ZnO Rs. 86 ke^{-1} Cost of rice straw Rs. 0.50 kg^{-1}
Cost of ZnEDTA Rs.1000 kg^{-1} cost of rice cultivation (without out Zn application) Rs. 8510 ha^{-1}

Highest net returns was obtained with T_2 (Rs. 12,340/-) with moderate benefit cost ratio (BCR) of 1.25 whereas the highest BCR (1.30) was recorded with T_5 (seedling root dip in ZnO slurry).

Thus, it is concluded that soil application of 50 kg $ZnSO_4$ ha^{-1} may be adopted for obtaining maximum grain and straw yield and higher monetary return.

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