Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(5): 638-640
Received: 03-07-2017
Accepted: 04-08-2017

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Effect of different zinc management practices on growth, yield, protein content, nutrient uptake and economics on rice under partially reclaimed salt-affected soil

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Abstract
A field experiment was conducted during *Kharif* season of 2013 at students instructional farm, Narendra Deva university of Agriculture & Technology Narendra Nagar Faizabad (Uttar Pradesh) to study the effect of zinc management practices on rice with variety Arize-6444. The results revealed that the treatment T_2: soil application of 50kg $ZnSO_4$ ha^{-1} recorded maximum protein content (8.45%), grain yield (7.11 t ha^{-1}) and straw yield (8.45 t ha^{-1}) followed by T_3 and T_5. The treatment T_2:soil application of 50kg $ZnSO_4$ ha^{-1} also recorded maximum nutrient uptake and economics, resulting maximum total N uptake, Zn uptake by grain (146.34 and 1.06 kg ha^{-1}) and net return (Rs.82607) and benefit cost ratio (2.34) followed by T_6 and T_4.

Key words: Zinc management practices, rice, protein content, yield and nutrient uptake.

Introduction

Rice is one of the most important cereal crops of *kharif* season. It is the principal food of the global population inhabiting in the humid tropics and subtropics. It is one of the excellent sources of carbohydrate and to a certain extent it provides protein to regular human diet and consumed by about half of the world's population. Zinc is essential in formation of a large number of enzymes and plays an essential role in DNA transcription. It plays a vital role especially translocation of nitrogen and synthesis of protein.

Zinc deficiency has received great attention in India, because nearly half of the Indian soils are poor in availability of Zn. The essentiality of Zn was first shown by Maze (1915) in maize, where it is known as 'white bud'. Its deficiency in rice was first reported by Nene (1966) at the Govind Ballabh Pant University and Technology, Pant Nagar. Rice is the bulk of food security of the global population. Rice is most susceptible to zinc deficiency. In rice cultivation, the application of micronutrient such different zinc management practices. The great sources of Zn such as zinc sulphate and zinc oxide ($ZnSO_4$ or ZnO).

Materials and Methods

The field experiment was conducted during *Kharif* season in 2013 at Instructional Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) to study the effect of different management practices on paddy crop. The soil of experimental field was silty loam in texture, having pH 8.15, electrical conductivity (EC) 0.34 dSm^{-1}, organic carbon (OC) 0.31%, Available N 170.50 kg ha^{-1}, P_2O_5 16.20 kg ha^{-1}, K_2O 230.10 kg ha^{-1} and Zn 0.85 ppm. The experiment was laid out in a randomized block design with 8 treatments comprising different combinations of Zn management practices, replicated three times. The treatment were; T_1:control,T_2:soil application of 50kg $ZnSO_4$ ha^{-1},T_3:soil application of ZnO equivalent to 50kg $ZnSO_4$ ha^{-1}, T_4: seedling dip in 10kg $ZnSO_4$ slurry ha-1, T_5 : seedling dip in ZnO slurry equivalent to 10kg $ZnSO_4$, T_6 : foliar application twice with 0.2% $ZnSO_4$, T_7 : foliar application twice with ZnO equivalent to 0.2% $ZnSO_4$, T_8 : foliar application twice with Zn-EDTA equivalent to 0.2% $ZnSO_4$. All the treatments in the plots allotted randomly. Zinc treatments were applied as per treatment as basal, slurry and foliar application. Application of zinc sulphate and zinc oxide ($ZnSO_4$ or ZnO) were broadcast into puddled soil as per the treatment schedule three days after the application. For the seedling dip treatments, slurry was prepared by mixing zinc sources ($ZnSO_4$ 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 the sunlight and later they were transplanted.

With regard to foliar application, the required quantities of zinc sources ($ZnSO_4$/ ZnO/ Zn-EDTA) were dissolved in water in order to obtained 0.2 % $ZnSO_4$ equivalent solutions and foliar sprayings were done at 30 and 40 days after transplanting (DAT). A common dose N, P and K at the rate 150, 75, 75 kg ha^{-1} were applied, respectively. Nitrogen was applied in three equal splits *i.e.* at planting, 30 and 60 DAT. Entire dose of P and K were applied just before the planting. Suitable provisions were made in the sources viz., Zinc oxide, Zn-EDTA treatment by supplementing equivalent to $ZnSO_4$ available.

Results and Discussion

Plant height

The treatment T_2 (Soil application of the 50 kg $ZnSO_4$ ha^{-1}) recorded significantly higher plant height (107.70 cm) significantly superior treatment T_1 and T_7 remaining treatments statistically at par. Similar kind of result has been reported by Rahman *et al.* (2007).

Number of tiller

The data with respect to number of tiller m^{-2} as influenced by various treatments have been portrayed in Table 4.1. It clearly indicates that the maximum number of tiller (447.50 m^{-2}) recorded with T_2 (Soil application of the 50 kg $ZnSO_4$ ha^{-1}) which was statistically at par T_3 (Soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1}) and T_5 (Seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1})and significantly superior over the rest treatments. Similar kind of result has been reported by Rahman *et al.* (2007).

Number of panicle

The data with respect to number of panicle m^{-2} as influenced by various treatments have been presented in Table 4.1. It clearly indicates that the maximum number of panicle (301.30 m^{-2}) recorded with T_2 (Soil application of the 50 kg $ZnSO_4$ ha^{-1}) which was statistically at par T_3 (Soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1}) and T_5 (Seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1}) and significantly superior over the rest treatments. Similar kind of result has been reported by Rahman *et al.* (2007).

Number of grain panicle^{-1}

The data with respect to number of panicle m^{-2} as influenced by various treatments have been presented in Table 4.1. It clearly indicates that the maximum number of grain panicle^{-1} (74.40) recorded with T_2 (Soil application of the 50 kg $ZnSO_4$ ha^{-1}) which was significantly superior treatments T_1 (No zinc application) and T_7 (Foliar application twice with ZnO equivalent to 0.2% $ZnSO_4$) and statistically at par over rest of the treatments.

Test weight (g)

Critical examination of data showed in (Table 3) revealed that that maximum test weight (23.80 gm) was recorded under treatment T_2 (soil application of the 50 kg $ZnSO_4$ ha^{-1}) which was statistically at par with soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1} (T_3) and seedling dip in 10 kg $ZnSO_4$ slurry ha^{-1} (T_4) and were significantly superior over all other treatment combinations. The minimum test weight was obtained in control plot (22.65g). This might be became of the fact that zinc is also help in better uptake of nitrogen along with other nutrient uptake which has consequently increase these sources. The increase in growth and yield attributes of rice with application of zinc was also reported by Singh (1980), Takker *et al*. (1989).

Table 1: Effect of different sources of Zinc on plant height, number of panicle m^{-2}, No. of grain per panicle and test weight of transplanted rice

Treatments	Plant height (cm)	Number of panicle m^{-2}	No. of grain panicle^{-1}	Test weight (g)
T_1 : No zinc application	101.80	245.90	62.80	22.65
T_2 : Soil application of the 50 kg $ZnSO_4$ ha^{-1}	107.70	301.30	74.40	23.80
T_3 : Soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1}	107.50	279.70	74.30	23.35
T_4 : Seedling dip in 10 kg $ZnSO_4$ slurry ha^{-1}	105.20	252.70	68.05	23.25
T_5 : Seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1}	105.60	274.30	71.30	23.00
T_6 : Foliar application twice with 0.2% $ZnSO_4$	105.30	260.75	70.50	23.00
T_7 : Foliar application twice with ZnO equivalent to 0.2% $ZnSO_4$	102.40	250.00	66.40	22.80
T_8 : Foliar application twice with Zn- EDTA equivalent to 0.2% $ZnSO_4$	104.60	255.30	68.30	23.00
SEm±	1.11	9.12	2.15	0.25
C.D. (P=0.05)	3.37	27.66	6.54	0.78

Grain and straw yield (t ha^{-1})

There was the progressive increase the grain and straw yield of transplanted rice (Table 2) which increased significantly with different sources of zinc over control. However, maximum grain yield (7.11 t ha^{-1}) and straw yield (8.45 t ha^{-1}) were recorded with @ soil application of 50 kg $ZnSO_4$ ha^{-1} (T_2) which was statistically at par with soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1} (T_3) and Seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1} (T_5). This might be due to increased transplantation of photosynthate from source to sink due to zinc application as reported by Varsheny (1988). Superiority of soil application of 50 kg $ZnSO_4$ ha-^{1} (T_2) treatment over other treatments might be attributed due to higher zinc concentration alone with availability of sulphure which resulted more number of productive tillers, filled grains panicle^{-1} and higher test weight which ultimately increased grain and straw yield in soil application of 50 kg $ZnSO_4$ ha-^{1} (T_2) treatment followed by soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1} (T_3), seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1} (T_5). The results corroborate with the findings of Singh and Sharma (1994) [3].

Protein content in grain

Data regarding protein percentage in grain have been presented in Table 4.6 indicated that protein content in grain was significantly influenced by various treatment combinations. The maximum protein content (7.43%) in grain was recorded with treatment having Soil application of the 50 kg $ZnSO_4$ ha^{-1} (T_2) and statistically at par treatment soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1} (T_3) and seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1} (T_5) and significantly superior over rest of the treatments.

Total nitrogen uptake by rice crop (kg ha^{-1})

Data assembled on account of total nitrogen uptake by grain have been presented in Table 4.7 indicated that nitrogen uptake by grain was influenced by various treatment combinations. The maximum nitrogen uptake (146.34 kg ha^{-1}) by grain was recorded under the treatment soil application of the 50 kg $ZnSO_4$ ha^{-1} (T_2) which was statistically at par with Foliar application twice with Zn- EDTA equivalent to 0.2% $ZnSO_4$ (T_8) and were significantly superior over rest of the treatment combinations.

Table 2: Effect of different sources of Zinc on protein content, yield and nutrient uptake of rice crop.

Treatments	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Total N uptake (kg ha^{-1})	Zn Uptake by grain (kg ha^{-1})	Protein content (%)
T_1 : No zinc application	5.70	7.00	107.50	0.79	6.87
T_2 : Soil application of the 50 kg $ZnSO_4$ ha^{-1}	7.11	8.45	146.34	1.06	7.43
T_3 : Soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1}	6.74	7.82	120.35	0.89	7.31
T_4 : Seedling dip in 10 kg $ZnSO_4$ slurry ha^{-1}	6.17	7.20	115.81	0.9	7.12
T_5 : Seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1}	6.47	7.40	123.39	0.93	7.25
T_6 : Foliar application twice with 0.2% $ZnSO_4$	6.39	7.33	122.68	0.92	7.12
T_7 : Foliar application twice with ZnO equivalent to 0.2% $ZnSO_4$	6.02	7.17	116.89	0.85	7.00
T_8 : Foliar application twice with Zn- EDTA equivalent to 0.2% $ZnSO_4$	6.19	7.25	134.60	0.99	7.13
SEm±	0.22	0.21	4.38	0.04	0.81
C.D. (P=0.05)	0.69	0.66	12.72	0.12	0.25

Zinc uptake by grain (kg ha^{-1})

A perusal of data presented in Table 4.9 obviously showed that the zinc uptake by rice grain was affected by various treatment combinations. The maximum zinc uptake by grain (1.06 kg ha^{-1}) was computed with treatment soil application of the 50 kg $ZnSO_4$ ha^{-1} (T_2) which was statistically at par with foliar application twice with Zn- EDTA equivalent to 0.2% $ZnSO_4$ (T_8) and significantly superior over rest of the treatment. The minimum zinc uptake was recorded in control plots.

Economics analysis

The economics of different treatment combinations have been presented in Table 3. It worked out on the basis of input and output analysis The soil application of 50 $ZnSO_4$ ha^{-1} (T_2) recorded to highest net return of Rs. 82607 followed by foliar application twice with 0.2% $ZnSO_4$ (T_6) Rs. 72627 and seedling dip in ZnO slurry equivalent to 10 kg $ZnSO_4$ ha^{-1}(T_5) Rs.71577. These results are in conformity with the finding of Ray and Pradhan (1994). Highest benefit cost ratio (BCR) of 2.34 were recorded treatment (T_2) soil application of the 50 kg $ZnSO_4$ ha^{-1} followed by (T_6) foliar application twice with 0.2% $ZnSO_4$ and (T_4) seedling dip in 10 kg $ZnSO_4$ slurry ha^{-1} recording to 2.23 and 2.10 (BCR) respectively. These result could corroborated with findings of Varsheney *et al.* (2008).

Table 3: Economics of the various treatment combinations.

Treatments		Net return (Rs. ha^{-1})	Benefit cost ratio
T_1	No zinc application	62927	1.95
T_2	Soil application of the 50 kg $ZnSO_4$ ha^{-1}	82607	2.34
T_3	Soil application of ZnO equivalent to 50 kg $ZnSO_4$ ha^{-1}	64897	1.43
T_4	Seedling dip in 10 kg $ZnSO_4$ slurry ha^{-1}	69037	2.10
T_5	Seedling dip in ZnO Slurry equivalent to 10 kg $ZnSO_4$ ha^{-1}	71577	2.06
T_6	Foliar application twice with 0.2% $ZnSO_4$	72627	2.23
T_7	Foliar application twice with ZnO equivalent to 0.2% $ZnSO_4$	66197	1.97
T_8	Foliar application twice with Zn- EDTA equivalent to 0.2% $ZnSO_4$	68297	2.01

Bibliography

1. Naik SK, Das DK. Effect of split application of zinc on yield of rice (*Oryza sativa* L.) in an inceptisol. Arch. Agron. Soil Sci. 2007; 53:305–313.
2. Panse VG, Sukhatme PV. Statistical methods for agricultural works. ICAR, New Delhi, 1967.
3. Singh R, Sharma MP. Response of rice to different zinc carriers and their method of applications in partially reclaimed salt affected soil. Fertilizer News, 1994; 39:51-52.
4. Uddin MJ, Bhuiya ZH, Hoque MS, Rahuman L. Effect of rates and methods of zinc application of rice. Madras Agric. J. 1981; 68:211-216.
5. Varsheny JG. Effect of different micronutrients on the flooded rice in hilly tract of Meghalaya. Oryza. 1988; 25:23-26.
6. Rahman MT, Jahiruddind M, Humauan MR, Alamand MJ, Khan AA. Effect of Sulphure in Zinc on growth and yield and nutrient uptake of boro rice (cv. BRRI Dhan-29). J. Soil Nature. 2008; 2(3):10-15.