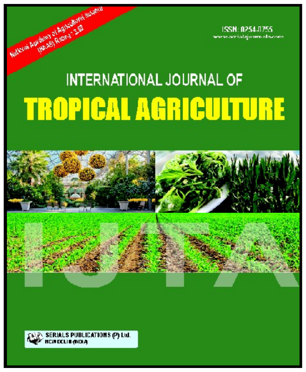

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Nutrient Up-take of Rice as Effected by Different Levels and Sources of Zinc under Temperate Conditions

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INTRODUCTION

Zinc deficiency is prevalent worldwide both in temperate and tropical climate (Fageria *et al.,* 2003). Soil low in CEC (Rengel and Graham, 1995) does not bind Zn well, leaving a relatively greater proportion of fertilizer Zn in the plant available form, thus allowing for a considerable increase in grain Zn concentration with an increase in Zn fertilization to 3.2 mg Zn kg^{-1} soil (up to 145 mg Zn kg^{-1} grain). Zinc can be directly applied to soil as both organic and inorganic compounds. Zinc sulfate ($ZnSO_4$) is the most widely applied inorganic source of Zn due to its high solubility and low cost. Keeping in view the importance of zinc fertilization, a field experiment was conducted to study the nutrient up-take of rice as effected by different levels and sources of zinc under temperate Kashmir conditions.

MATERIALS AND METHODS

A field experiment was conducted at Mountain Research Centre for Field Crops, Khudwani of Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir during kharief 2011 and 2012. The experimental site is situated in temperate zone of Jammu and Kashmir State between 34° N latitude and 74° E longitude at an altitude of 1560 m above mean sea level. The experiment comprised of two factors viz. 3 levels of zinc(3,6 and 9kg Zn ha^{-1}) and 5 sources of zinc (Zinc sulphate ,Zinc oxide, Zinc enriched urea, Zinc FYM incubated and Zn-EDTA and one absolute control (*i.e.* no zinc) laid out in a Randomized Complete Block Design with three replications. Recommended packages of practices were fallowed. As per the treatments wherever zinc was to supplied through Zn enriched urea, the entire dose of N and Zn was supplied through the same. In the rest of the plots the N was supplied through urea. In the plots wherever the Zn was supplied through Zn incubated FYM, the recommended dose of FYM and Zn as per the treatments was applied through Zn incubated FYM. Recommended dose of FYM was applied in rest of the plots. After recording the dry weight of pant samples (qha^{-1}) collected from each plot, oven dried samples were grounded in Wileys mill and passed through 32 mesh sieve, both of grain and straw were grounded and subsequently used for chemical analysis. The data were statistically analysed for critical difference as per method described by Cochran and Cox (1963).

RESULTS AND DISCUSSION

The pooled data (Table) on N and K up-take of grain and straw revealed that Zn levels significantly increased N and K uptake in grain and straw over control. 6kg Zn ha^{-1} increased N and k uptake over 3kg Zn ha^{-1} and control though at par with 9kg Zn ha^{-1}. Zinc sources recorded a significant difference with respect to N and K uptake in grain as well as straw. Zn-EDTA recorded highest N uptake though it was at par with zinc enriched urea and Zn-FYM incubated but significantly higher than ZnO and $ZnSO_4$. The results are in line with Swami and Shekhawat (2009). A positive impact on Zn application on K uptake has been reported by many researchers (Fageria *et al*., 2011). In spite of the fact that P content in grain and straw got decreased due to the increasing Zn levels but P uptake increased over control due to overwhelming effect of increase in grain and straw yield. These findings confirm the findings of Shivay *et al*. (2008b). Zn-EDTA recorded highest P uptake though it was at par with zinc enriched urea and Zn-FYM incubated but significantly higher than ZnO and $ZnSO_4$.

Zn-EDTA, Zn enriched urea and Zn-FYM incubated were more efficient in increasing the K uptake than the ZnO and $ZnSO_4$. Zn-EDTA has been reported to posses highest "zinc-mobilization efficiency" compared to the other zinc sources Srivastava *et al.* (1999).

CONCLUSION

From this study it is concluded that 6 kg Zn ha^{-1} significantly increase N and k up-take in grain and straw over 3kg Zn ha^{-1} and control and highest uptake was recorded with 9 kg Zn ha^{-1}. However, P up-take was significant only upto 3kg Zn ha^{-1} beyond which it started decreasing significantly upto 9 kg Zn ha^{-1}. Among different zinc sources Zn-EDTA recorded the highest macronutrient uptake in grain as well as straw though at par with Zn enriched urea and Zn-incubated FYM.

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Table 1
Nutrient up- take of rice as affected by different levels and sources of zinc (pooled data)

Treatment	*NPK uptake (kg ha⁻¹)*					
	Grain			*Straw*		
	N	*P*	*K*	*N*	*P*	*K*
Zinc levels (kg ha^{-1})						
3	78.20	14.72	13.76	46.62	11.47	117.5
6	86.20	14.88	16.40	55.51	11.73	128.7
9	87.00	14.21	16.75	57.28	11.87	129.2
SEm±	1.66	0.62	0.63	2.14	0.49	3.55
C.D (pd"0.05)	3.35	1.21	1.28	4.38	NS	7.24
Zinc sources						
Zinc sulphate	81.05	13.87	14.61	48.33	11.23	119.9
Zinc oxide	79.95	13.25	14.18	50.85	10.95	120.2
Zinc enriched urea	86.11	14.54	15.92	53.67	11.99	127.8
Zinc-FYM incubated	85.81	14.26	16.32	55.75	12.13	126.9
Zn-EDTA	86.83	14.62	16.69	53.27	12.81	130.0
SEm±	2.14	0.8	0.80	2.77	0.63	4.58
C.D (pd"0.05)	4.37	1.33	1.65	5.65	NS	9.36
Control	62.54	13.52	10.65	36.65	11.25	99.17
SEm±	2.87	1.07	1.08	3.71	0.15	6.14
C.D (Control vs Zn)	5.87	1.36	2.22	7.59	NS	12.55