Effect of different modes and forms of nitrogen application on productivity and nitrogen use efficiency of rice in the North-Eastern coastal plain zone of Orissa

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ABSTRACT
A field experiment was conducted during 2005 and 2006 in the Research Farm of the Regional Research Station, Motto of North Eastern Coastal plain zone of Orissa to study the performance of different forms of urea *viz*., Prilled Urea (PU), Nimin Coated Prilled Urea (NCPU), Urea Super Granule (USG) and combination of both USG and PU on yield and nitrogen use efficiency of rice. Results revealed that application of 57 kg N ha^{-1} as USG at 7 Days after transplanting (DAT) and 19 kg N ha^{-1} as PU at PI stage resulted in maximum grain and straw yields, maximum N uptake and agronomic N use efficiency. Application of USG 57 and 76 kg N ha^{-1} registered significantly higher grain yield over PU by 26% and 18%, respectively. Application of NCPU and USG improved the N uptake, agronomic N use efficiency and apparent N recovery over PU application.

Key words : Urea super granule, Nimin coated prilled urea, Prilled urea, Nitrogen use efficiency.

Rice is the dominant crop of Orissa grown under submergence condition and requires standing water through out its growing period. Due to heavy precipitation during *kharif* season, most of the low land rice fields in Orissa remain under submergence (10 to 30 cm standing water). Nitrogen use efficiency (NUE) of rice is very low because of this submergence environment (Goswami *et al.,* 1988) as it facilitates losses of N through ammonia volatilization, leaching and denitrification (Jena *et al.*, 1990). There is a need to improve the nitrogen use efficiency to minimize the economic loss and to reduce the environmental pollution. Different approaches like use of modified form of Urea N, method and time of application are used by different workers to reduce the losses of N and increase the NUE in *kharif* rice. Kumar *et al.* (1996) examined the various methods of urea application and reported that placement of urea super granule (USG) resulted in 60% more grain yield. Similarly Mishra *et al.* (1999) reported that placement of USG significantly increased both the grain and straw yield of rice in comparison to PU or USG broadcast at Bhubneshwar sandy clay loam soil. The present investigation was undertaken to study the effect of USG, NCPU and combination of USG and PU on the grain yield and nitrogen use efficiency of *kharif* rice grown under coastal saline soils of Orissa.

MATERIALS AND METHODS

A field experiment was conducted during 2005 and 2006 *kharif* season at the research farm of the Regional Research Station (RRS), Motto of Balasore district in the North Eastern coastal plain zone of Orissa in order to study the efficiency of USG, PU, NCPU or combination of both USG and PU on *kharif* rice. The physico-chemical properties of the experimental site were presented in Table 1. The data indicate that the soil of the experimental site was clay in texture, slightly alkaline in reaction (pH = 7.01), saline (EC = 13.5 dSm^{-1}) with medium soil organic carbon content (7.6 g kg^{-1} soil). The CEC and the base saturation percentage value for surface soil were 15.5 C mol (p$^+$) kg^{-1} and 88.1%, respectively.

The experiment was laid out in a randomized block design with 7 treatments replicated thrice. The treatments consisted of T$_1$: Control (No Nitrogen); T$_2$: 57 kg N ha^{-1} as PU (3 splits); T$_3$: 57 kg N ha^{-1} as NCPU applied as basal; T$_4$: 76 kg N ha^{-1} as PU (3 splits); T$_5$: 57 kg N ha^{-1} as USG at 7 DAT; T$_6$: 76 kg N ha^{-1} USG at 7 DAT; T$_7$: 57

Table 1 : Physico - chemical properties of the soil of the experimental site

Properties	Soil depths (cm)		
	0-20	20-65	65-95
Sand (%)	13.5	12.0	17.0
Silt (%)	40.0	36.5	46.5
Clay (%)	46.5	51.5	36.5
Texture	C	C	C
pH (1:2.5)	7.1	7.8	8.0
EC (dS m^{-1})	13.5	8.4	7.1
OC (g kg^{-1})	7.6	6.2	2.9
ESP	27.0	24.5	17.9
CEC Cmol (p$^+$) kg^{-1}	15.5	18.4	14.0
Base saturation	88.1	90.0	85.4