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EFFECT OF FORMS OF UREA ON THE YIELD OF RICE

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Abstract: Field trials conducted in the farmers' fields at eight different farming situations for four seasons proved that large granule urea (LGU) is an economic and efficient source of N for low land rice, especially in areas with heavy monsoonic rains . LGU having no extra cost either in production or application over the ordinary prilled urea (PU) offers greater potential for efficient N nutrition in rice. The results also reveal that the entire quantity of LGU can be broadcast as a single basal dose.

INTRODUCTION

In India urea is the most important source of nitrogen, accounting for approximately 85 per cent of the total nitrogen applied for wet land rice. The small size (2-3 mm diameter) and high water solubility of the ordinary prilled urea (PU), the form of urea now used, reduce its utilisation efficiency as it is lost from the soil by volatilisation, denitrification, leaching etc. The nitrogen use efficiency in wet land rice is as low as 20 to maximum 50 per cent (Koole, 1987).

The improvement in the management practices and modification of prilled urea into coated materials and large sized granules so far made could not be adopted by the farmers because of various constraints like difficulty in field practice, high production cost, application cost etc. The high production cost of coated urea materials such as rock phosphate coated urea, gypsum coated urea, sulphurcoated urea, plastic coated urea, lac coated urea, neem coated urea etc. escalates the cost per unit of nutrient. One of the large sized urea materials tested widely and found efficient for N utilization is urea supergranule (USG) of 1 g size. But its field application is limited by the high application cost. For ensuring uniform distribution of the fertilizer, regular stand of the crop and the desired fertilizer use efficiency, USG has to be point-placed at 5 to 10 cm depth in the root zone. It is in this context that investigations have been taken up to study the efficacy of large granule urea (LGU), in the high rainfall situation of Kerala, for which the manufacturers (Nedelandse Stickst of Maatschappiji B.V. Belgium) claim no extra cost in production over PU. The size of the granules (6-8 mm diameter, i.e., intermediary between USG and PU) would make it ideal for application in low land rice by broadcast at no extra cost.

MATERIALS AND METHODS

Experiments were conducted in farmers' fields at eight locations namely Koratty, Kodakara, Parappukkara, Thrikkur, Vallachira, Panancherry, Chembuthara and Annamanada in Thrissur district of Kerala State during the kharif and rabi seasons of 1988 and 1989. The soils were of medium organic carbon status (0.8 - 1.35%) and contained 3.0 - 7.4 P kg/ha (Brays No.I) and 64.0 - 131.6 K kg/ha (neutral NH_4Ac). The pH ranged from 5.1 to 5.36 and the texture from clayey loam to loam.

All plots received uniform dose of

45 kg P_2O_5 (completely basal) and 45 kg K_2O (half as basal and half at tillering) per hectare. In each season the experiments were laid out at all the eight locations in randomised block design. Four farmers were selected from each site so that individual farmers could represent a replication. The mean grain yields of 32 replications (32 farm sites) were taken for statistical analysis.

RESULTS AND DISCUSSION

All the modified urea materials gave grain yield (Table 2) than PU at the same level of N. The effect of LGU at 84 kg N was same as that of PU at 112 kg N. Among the modified urea materials, LGU ranked higher. LGU @ 84 kg N whether completely basal or in two splits were on par. The pooled yield data show that LGU outperformed PU only at 84 kg N/ha in the kharif season. This may possibly be due to the high rainfall received during the kharif season and hence higher losses of PU unlike in the rabi season when amount of rainfall was less. The lack of significant difference between PU and LGU at 112 kg N/ha may be due to the non-response of the variety Jyothi above 84 kg N/ha.

Since the effects of modified materials (LGU, USG, RPCU) were statistically on par, the selection of the best source depends on the economic considerations. A higher cost of production involved in the case of RPCU eliminates the same from the list. In the case of USG the additional cost of production combined with a sharp increase in the cost of cultivation due to higher application cost makes it inferior on an economic point of view. The point placement of USG requires about 25 labourers per hectare which increases the cost of production by about Rs 750.

In the case of LGU, the manufacturers claim no extra cost in production. Further, no additional cost is involved in its field application as it can be applied broadcast like PU. All these advantages along with its effect on grain yield make it a more efficient and economic source of nitrogen. The results also reveal that the entire dose of LGU can be applied as a single basal dose. The superiority of LGU over PU has been reported by several research workers (AICARP, 1988; Prasad rf *al.*, 1988 and Sahu and Mitra, 1989). Urea application in wet land rice often results in high concentration of NH_4^+ ions in flood water leading to ammonia volatilisation and run-off. This possibility is more in the agro-climatic situations with high temperature and heavy rains. Basal broadcast application of LGU enables its penetration into the soft mud and the granules go into the reduced zone which minimises the denitirification losses. Thus the application of LGU increases the N use efficiency than the ordinary PU. Similar effects of LGU over PU have also been reported by Koole (1987). The results clearly reveal that LGU is an efficient and economic source of nitrogen for wet land rice in Kerala.

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Table 1. Details of the treatments

Treatment notation	N level (kg/ha)	Source	Time of application			Method of application
			Basal	Tillering	PI	
T1	0	--	--	--	--	--
T2	84	PU	1/3	1/3	1/3	Broadcast
T3	84	USG	Full	--	--	Point placement at 5 cm depth
T4	84	LGU	Full	--	--	Broadcast
T5	84	RPCU	Full	--	--	Broadcast
T6	84	LGU	1/2	1/2	--	Broadcast
T7	112	PU	1/3	1/3	1/3	Broadcast
T8	112	LGU	1/2	1/2	--	Broadcast

(PU = Prilled urea, USG = Urea supergranule, LGU = Large granule urea, RPCU = Rock phosphate coated urea, PI = Panicle initiation)

Table 2. Effect of treatments on grain yield of rice

Treatments	Grain yield, kg/ha					
	Kharif 1988	Kharif 1989	Kharif pooled	Rabi 1988	Rabi 1989	Rabi pooled
T1	2798	2930	2864	2928	3067	2998
T2	3404	3594	3499	3617	3181	3399
T3	3579	3830	3704	3888	3431	3659
T4	3903	3791	3850	4037	3400	3619
T5	3599	3753	3676	3771	3730	3750
T6	3917	3876	3897	3911	3548	3729
T7	3855	3764	3810	3744	3327	3535
T8	4086	3762	3924	4135	3491	3813
CD (0,05)	134	182	269	118	296	344

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