

Comparative Efficiency of Coated Urea Materials in Saline-alkali Soil of Agra Region

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The recovery of applied N through its various forms, even under best possible management, does not exceed 60% (Sarkar *et al.* 1985). Under salt affected condition, the efficiency and recovery of applied N (5-20%) is extremely low (Chandra & Abrol 1972). Recent advances in urea technology have offered various excellent urea materials which need to be examined for efficiency under salty conditions. The present investigation was, therefore, undertaken to find out the efficiency of coated N under saline alkali conditions for rice and wheat crops.

Ten kg clay loam soil (pH 10.2, O.C.0.15%, ECe 7.5 dSm⁻¹, CEC 13.8 C mol (p+) kg⁻¹, Exchangeable Na 11.4 C mol (p+) kg⁻¹ and ESP 82.6) was treated with gypsum (50% of GR) in pots and leached with 60 cm canal water. After leaching, soil analysis showed pH 9.2, O.C.0.13%, ECe 3.2 dSm⁻¹, exchangeable Na 4.5 C mol (p+) kg⁻¹ and ESP 33. Soil was removed from each pot, crushed, sieved and refilled in the same pot.

Before transplanting paddy CV IR 8, to each pot, p (60 kg P₂O₅ ha⁻¹) through SSP, K (60 Kg K₂O ha⁻¹) through muriate of potash and Zn (25 Kg ZnSO₄ ha⁻¹) were applied. Five sources of coated materials, viz. prilled urea (PU), sulphur coated urea (SCU), neem cake coated urea (NCU), gypsum coated urea (GCU) and rock phosphate coated urea (RCU), were applied at uniform rate (100 ppm N). To study the carry over effect after rice harvest, wheat variety HD 2009 was sown without N application. Grain and straw yields were recorded. Soil samples collected at initial and harvest stages after processing were analysed for N

(Jackson 1973), NH₄⁺ - N and NO₃ - N (Bremner & Keeney 1966). Total N uptake (mg pot⁻¹) by plant was calculated by

$$\frac{\text{Total dry matter yield} \times \% \text{ N content}}{100}, \text{ and}$$

per cent N recovery of applied N by

$$\frac{\text{N uptake in treated pot} - \text{N uptake in control pot}}{\text{Amount of N applied}} \times 100$$

The coated materials of urea were processed in the laboratory to have fine coatings of coaltar. One Kg of coaltar was dissolved in 2L of kerosene oil and mixed thoroughly by shaking. About 2 mL of coaltar solution was added to 100 g of urea. Kept the materials in a polythene bag and contents were thoroughly mixed with the help of a small size rotating drum fitted with high speed motor. Sulphur, neem, gypsum and rockphosphate were added (about 20 g 100⁻¹ g of urea) and rotated separately to have different coatings.

The grain yield of paddy increased by 40.3, 27.0, 24.0 and 17.5% with application of NCU, RCU, GCU and SSU, respectively over PU (Table 1). An increase of 5.5, 7.1, -1.0 and 2.4% in straw yield was also observed. All the modified materials produced higher grain yield over PU but NCU proved superior to other coated materials.

Among all the coated materials, maximum uptake of N was observed with NCU, followed by RCU (Table 1). NCU, RCU, GCU and SCU showed an increased N-uptake by paddy than from prilled urea. The increase was 102, 87, 61 and 24%, respectively. Coated materials also differed sig

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Table 1 Effect of coated N materials on N-uptake, % N-recovery and dry matter yield of rice and wheat

Treatment (100 ppm N)	N uptake (mg pot ⁻¹)		N recovery %		Dry matter yield (g pot ⁻¹)			
	Rice		Wheat		Rice		Wheat	
	Rice	Wheat	Rice	Wheat	Grain	Straw	Grain	Straw
Control	110	25	—	—	6.8	10.8	5.2	9.4
PU	273	75	16.3	5.1	11.0	17.6	7.1	11.1
SCU	388	81	27.8	5.5	13.0	18.8	7.6	11.2
NCU	524	95	41.8	6.9	15.5	18.5	8.3	12.1
GCU	422	83	31.2	5.8	13.7	17.4	7.9	11.0
RCU	461	89	35.1	6.4	14.1	18.8	8.0	11.8
CD 5%	60.63	5.53	10.33	0.50	1.10	0.61	0.41	0.44

Table 2 Effect of coated N materials on NH₄⁺ - N and NO₃ - N content in saline-alkali soil

Treatment	NH ₄ ⁺ NO ₃ - N content (ppm)				NO ₃ -N content (ppm)			
	Initial stage		Harvest stage		Initial stage		Harvest stage	
	Rice	Wheat	Rice	Wheat	Rice	Wheat	Rice	Wheat
Control	22.9	14.5	13.0	12.1	17.2	12.6	13.7	11.8
PU	34.8	20.6	23.9	16.2	20.5	14.2	31.2	17.1
SSU	37.6	24.0	25.9	17.6	22.7	16.2	32.1	20.1
NCU	44.2	30.0	30.2	23.0	26.1	19.1	35.2	23.7
GCU	40.1	26.7	28.2	19.8	33.5	17.4	34.4	22.6
RCU	41.5	29.1	29.2	22.0	25.9	18.2	35.0	22.4
CD (5%)	9.44	3.64	0.92	1.36	2.45	2.72	0.72	2.19

nificantly in respect of N-uptake by the subsequent wheat crop. On the basis of N-uptake, superiority of urea materials follows : NCU > RCU > GCU > SCU > PU. Uptake with NCU was 25% higher over PU. N recovery was found highest with NCU (41.8%), followed by RCU. However, per cent N-recovery by wheat was significant in case of NCU only.

Contents of $\text{NH}_4^+ - \text{N}$ and $\text{NO}_3^- - \text{N}$ were higher in rice treated with coated materials, than the PU (Table 2). The decrease in content of $\text{NH}_4^+ - \text{N}$ at 30 days and at harvest was nearly same in all the cases except NCU. Increase in ammonification over PU followed the order : NCU > RCU > GCU > SCU. Nitrification rate was found to be highest under NCU, followed by RCU, GCU and PU. Similar trend in nitrification and ammonification rate was reported by Singh and Singh (1984).

Results showed the superiority of coated N materials over urea under normal as well as saline-alkali conditions. This could be due to the regulated release rate of N synchronizing with the requirement of growing plants and efficient assimilation. Superiority of neem cake coated urea than others may

be due to the nitrification inhibition characteristics of neem cake (Bains *et al.* 1971).

The coated N materials were very much effective in bringing about the mineralization of both native and immobilised N which resulted in increased N uptake and grain yield of both rice and wheat crops.

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