Indian Journal of Agronomy **51** (1) : 1–2 (March 2006)

Effect of sources and methods of nitrogen application on growth, yield and N uptake of transplanted lowland rice (*Oryza sativa*) and their residual effect on succeeding wheat (*Triticum aestivum*)

S.K. CHAUDHARY, S.K. THAKUR[1] AND R.B. THAKUR

Department of Agronomy, Rajendra Agricultural University, Pusa, Samastipur, Bihar 848 125

Received : September 2004

ABSTRACT

A field experiment was conducted during 1998–2000 on silty-clay soil at University research farm, Pusa (Bihar), to evaluate the relative efficiency of few slow-release N fertilizers, *viz.* prilled urea (PU), Mussoorie rock phosphate-coated urea (MRPU), nimin-coated urea (NCU) and large granulated urea (LGU) with basal and split application in transplanted lowland rice (*Oryza sativa* L.) and their effect on succeeding wheat (*Triticum aestivum* L. emend. Fiori & Paol.). Modified urea fertilizers exhibited their superiority by recording significantly higher value of all the yield-contributing characters, nitrogen uptake and significantly higher grain yield than prilled urea, irrespective of their methods of application. Maximum grain and straw yields of wheat were recorded under NCU which was significantly superior to the control and prilled urea and comparable with other sources of N.

Key words : Rice, Controlled release N materials, Residual effect, Wheat

The use of fertilizer N in lowland condition has increased rapidly in recent years but poor efficiency of applied N is one of the reason for low yield. Rice requires high quantity of N particularly up to panicle-initiation stage for high production as most of the rice-growing soils are poor in N status. The recovery of fertilizer N in rice under lowland system does not exceed 50% (Blaise and Prasad, 1996) and in many cases even less due to various losses, which in turn, contribute substantially to environmental pollution. Optimization of split application of N at critical stages of plant growth by synchronizing with the periods of efficient utilization and use of coated and controlled release N fertilizers are the approaches being suggested for improving the nitrogen-use efficiency (Reddy *et al.*, 1986).

The present study was therefore, made to evaluate some materials like Mussorie rock phosphate-coated urea (MRPU), nimin-coated urea (NCU) and large granulated urea (LGU) against prilled urea (PU) fertilizer for higher nitrogen-use efficiency in the calcareous soil of North Bihar under lowland situation.

MATERIALS AND METHODS

A field experiment was conducted at the Rajendra Agricultural University Farm, Pusa (Bihar), during 1998–2000 on silty-clay soil. The soil had 0.60% organic carbon, 34.2 kg available P_2O_5 and 124.3 kg available K_2O/ha with pH 8.4. Nine treatments consisting of 4 forms of urea, *viz.* prilled urea (PU), Mussoorie rock phosphate coated urea (MRPU), nimin-coated urea (NCU), large granulated urea (LGU), and 2 methods of application (basal and split: ½ basal + ½ at panicle initiation) including 1 control were tested in randomized block design with 3 replications. Nitrogen was applied @ 100 kg N/ha. A basal dose of 40 kg P_2O_5 and 20 kg K_2O/ha was also applied. Thirty days old seedlings of a weakly photoperiod sensitive rice variety 'Radha', was transplanted during the first week of July at 20 cm × 15 cm spacing and crop was harvested in the second week of November during both the years. The water level during the crop-growth period in the field ranged from 5 to 16 cm. The data on yield were computed on 14% moisture basis. The succeeding wheat 'UP 262' was sown in the last week of November with 50% recommended fertilizers (50 : 30 : 20 kg N : P_2O_5 : K_2O/ha).

RESULTS AND DISCUSSION

Yield and yield attributes

Application of NCU at planting or at planting and panicle initiation resulted in higher number of panicles, heavier panicles, more filled grains and bold grain, which ultimately resulted in higher grain and straw yields of rice.

Present address : [1]Department of Soil Science, SRI, Pusa, Samastipur, Bihar

Table 1. Effect of sources and time of N application on yield and yield attributes, N uptake and recovery in rice and their residual effect on succeeding wheat (pooled data of 2 years)

Treatment	Panicles/ m^2	Panicle weight (g)	Filled grains/ panicle	Test weight (g)	Rice yield (q/ha)		N uptake (kg/ha)		Nitrogen recovery	Relative efficiency	Wheat yield (q/ha)	
					Grain	Straw	Grain	Straw			Grain	Straw
Control	190	2.07	58.15	20.65	18.96	27.71	18.18	12.26			16.65	19.98
PU, basal	292	2.61	70.95	22.60	36.64	48.30	33.69	25.11	32.36		19.10	23.49
MRPU, basal	306	2.68	73.75	22.85	40.60	49.70	43.02	29.07	41.65	1.28	20.35	25.23
LGU, basal	303	2.67	73.90	23.05	40.75	59.76	43.39	33.65	46.65	1.44	21.10	25.95
NCU, basal	315	2.72	75.60	23.10	42.01	61.35	43.65	37.54	50.75	1.46	21.90	27.15
PU, split	318	2.73	79.95	23.45	41.07	63.25	44.95	40.47	55.08		20.32	25.19
MRPU, split	321	2.77	81.30	23.75	43.06	63.62	47.37	41.03	57.66	1.04	21.10	26.37
LGU, split	322	2.77	81.05	23.70	42.77	63.50	47.25	41.58	58.39	1.06	21.82	27.49
NCU, split	327	2.79	83.60	23.85	44.75	65.88	48.92	41.94	59.92	1.08	22.25	28.03
CD (P=0.05)	14	0.10	4.10	0.43	3.64	4.78	2.82	3.35			2.26	3.12

PU, Prilled urea; MRPU, Mussoorie rock phosphate-coated urea; LGU, large granulated urea; NCU, nimin-coated urea

Significantly higher grain yield was recorded when NCU was applied either at planting or at planting and panicle initiation compared to application of PU at planting. Either basal or split application of NCU exhibited non-significant increasing trend in all the yield attributes and grain yield of rice over other forms and methods of application. Better performance of NCU either at planting or planting and panicle-initiation stage might be due to delayed conversion of ammonical form to nitrite form, thereby improving and prolonging the continuous availability of N to the rice crop. These results are in conformity with the findings of Porwal *et al.* (1994).

Nitrogen uptake

The N uptake by rice grain was significantly higher due to use of slow release N fertilizers over prilled urea either basal or split (Table 1). Prilled urea recorded the lowest value irrespective of the time of N application. Similar trend was observed in straw uptake also. Between the N treatments, splitting recorded higher values than basal. Split application synchronizing to the demand at different crop stages probably helped to increase the N uptake compared to basal application. On the other hand, basal application might have been subjected to steady losses from the soil affecting crop uptake and grain yield adversely.

Nitrogen recovery

The recovery of fertilizer nitrogen was in order of NCU →LGU→MRPU→PU. Maximum recovery of applied nitrogen was with basal and split application of NCU respectively. Thus NCU applied at planting and panicle-initiation stage was the best suited in rice ecosystem which meets the N demand of the rice plant slowly over a long period of time and thereby reducing the ground water contaminations.

Residual effect on wheat

Sources of N exhibited no-significant residual effect on the yield of succeeding wheat crop. Application of NCU in rice resulted in more grain yield of succeeding wheat than PU because of greater availability of N after rice harvest. Further NCU, MRPU and LGU had similar carry-over effect on the yield of wheat. However, effect of NCU was significant over basal application of prilled urea only.

REFERENCES

Blaise, D. and Prasad, R. 1996. Relative efficiency of modified urea fertilizers in wetland rice (*Oryza sativa*). *Indian Journal of Agronomy* **41**(3) : 373–378.

Porwal, M.K., Bhatnagar, G.S. and Chaplol, P.G. 1994. Effect of nimin-coated urea and other sources at graded level of nitrogen in lowland rice (*Oryza sativa*). *Indian Journal of Agronomy* **39**(4) : 635–637.

Reddy, G.R., Reddy, G.B., Ramaiah, N.V. and Reddy, G.V. 1986. Effect of different levels of nitrogen and forms of urea on growth and yield of wetland rice. *Indian Journal of Agronomy* **31**(4) : 416–418.