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Effect of Neem Coated Urea on Nitrogen Uptake, Nitrogen Use Efficiency and Yield of Rice under Low Land Ecosystem of Godavari Delta of Andhra Pradesh, India

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A B S T R A C T

A field experiment was carried out during the *Kharif*, 2016 at Regional Agricultural Research Station, Maruteru to study the Response of applied neem coated urea (NCU) on nutrient uptake and nitrogen use efficiency of rice (*Oryza sativa L*) in low land rice ecosystem of Godavari delta, West Godavari district of Andhra Pradesh. The experiment was laid out in a Randomized block design with three replications and eight treatments namely i.e. 100 % PU (3 equal splits as basal, tillering and PI stage), 75 % NCU (3 equal splits splits as basal, tillering and PI stage), 100 % NCU (3 equal splits as basal, tillering and PI stage), 125 % NCU (3 equal splits splits as basal, tillering and PI stage), 100 % NCU (as basal), 100 % NCU (2 splits as 50 % basal and 50% max. tillering stage) 100 % NCU (2 splits 75% as basal and 25% at maximum tillering stage) and Control (No P60 K40).

Introduction

Rice (*Oryza sativa* L.) remains the most important staple food on the planet since it feeds about half the population on a daily basis. Fertilizer nitrogen (N) has contributed an estimated 40% to the increase in per capita food production over the past 50 years (Brown, 1999; Smile, 2002).As nitrogen (N) is major most limiting plant nutrient directly influences the growth, development, yield and quality of crops in different cropping systems. The efficiency of urea is a serious problem both in direct seeded rice in rainfed system as well as recovery of applied fertilizer N in flooded rice soils. N is conventionally applied to the soil at various stages in splits before transplanting to panicle initiation stage. Nitrogen use efficiency in rice rarely exceeds 30- 40 per cent. The improvement in the N efficiency is, therefore, of prime importance, not only for achieving and sustaining high crop grain yield but also to protect the natural resources from degradation.

Neem has nitrification inhibiting properties (Deva Kumar and Mukherjee, 1985; Santhi *et al.,* 1986) and neemcake-coated urea shows more effectiveness than prilled urea for rice and other crops. With the current thrust on sustainable agriculture and organic farming, the use of natural products like neem has achieved a great practical significance, especially in augmenting the N-use efficiency which abysmally low, around 20-40% under our predominantly sub-tropical agriculture. Therefore a field study was undertaken to study the effect of nitrogen levels and the modified urea materials on productivity and nitrogen-use efficiency of lowland transplanted rice.

Materials and Methods

A field experiment was carried out during the *Kharif*, 2016 at the Regional Agricultural Research Station, Maruteru to study the Response of applied neem coated urea (NCU) on nutrient uptake and nitrogen use efficiency of rice (*Oryza sativa L*) in low land rice ecosystem of Godavari delta. The soil of experimental site is represented as a clay loam texture. Initial soil characteristics of top-soil (0–15 cm layer) was neutral in reaction (pH 7.19), electrical conductivity 0.57 dSm^{-1}, soil organic carbon 1.15 %, available N 149 kg/ha (Subbiah and Asija 1956), available P2O5 66.30 kg/ha (Olsen *et al.,* 1954) and available K2O 364 kg/ha(N-N NH4OAc-extractable K). The experiment was laid out in a Randomized block design with three replications and eight treatments 100 % PU (3 equal splits as basal, tillering and PI stage), 75 % NCU (3 equal splits as basal, tillering and PI stage), 100 % NCU (3 equal splits as basal, tillering and PI stage), 125 % NCU (3 equal splits splits as basal, tillering and PI stage), 100 % NCU (as basal), 100 % NCU (2 splits as 50 % basal and 50% max. tillering stage) 100 % NCU (2 splits 75% as basal and 25% at maximum tillering stage) and Control (No P60 K40). The variety used in this experiment was MTU-1061 (Amara). Recommended dose of fertilizer for rice in Godavari zone of Andhra Pradesh was 90-60-40 kg NPK per Ha.

Results and Discussion

Effect of neem coated urea on grain and straw yield of rice

There was a significant increase in the grain and straw yields of rice with an increase in level of nitrogen. There was significant highest grain yield of rice 5733 kg/ha was recorded with 125 % neem coated urea which was on par with 100% and 75% neem coated urea applied in three equal splits as basal, at maximum tillering stage and Panicle initiation stage (5550 and 5133 kg/ha as respectively). Application of coated urea materials, e.g. neemcake-coated urea and neem oil emulsion-coated urea, irrespective of the concentrations, had beneficial effects on grain and straw yields of rice. Singh and & Singh (1991) and Panigrahi and Dixit (1991) also reported superiority of neem-coated urea materials to the prilled urea (Table 1).

Effect of neem coated urea on nutrient content and uptake of rice

There was not much variation in nutrient content of rice grain and straw, however, the total N, P and K uptake was significantly higher in 125 % NCU (3 splits). In case of nitrogen, maximum uptake was found in 125 % NCU (3 splits) 101.38 kg ha^{-1} followed by 100% NCU (3 split) 100.53 kg ha^{-1}, 75% NCU (3 splits) 95.17 kg ha^{-1} and lowest from control (No nitrogen) 35.36 kg ha^{-1}. Phosphorus and Potassium uptake also followed the same trend. With regard to different N source, neem cake blended urea recorded the highest uptake and prilled urea recorded the lowest uptake. Upadhyay and

Tripathi (2000), Shivay *et al.*, (2000) and Thind *et al.*, (2010) also found superiority of NCU over ordinary urea in N uptake and nitrogen use efficiencies (Table 2-4).

Effect of neem coated urea on nitrogen use efficiency

Nitrogen use efficiency (NUE) followed the similar trend (Table 5) as that of grain yield and recorded higher NUE in 125% NCU (3split) 33.01 % followed by 100 % NCU (3split) 32.59 %, 75% NCU (3 split) 29.41% and 100% prilled urea 20.68 %. With regard to NUE, Khanna *et al.*, (2000) found that neem based product coated urea on rice produced the maximum grain yield and N use efficiency (30.21 kg grain/kg N), which was significantly superior to prilled urea (PU), and higher N use efficiency. Similarly Singh and Shivay (2003) reported that coated urea with neem formulations not only increased the grain yield, but also increased NUE and apparent N recovery. Kumar *et al.*, (2011) and Pushpanathan *et al.*, (2005) also reported similar finding.

Effect of neem coated urea on soil nutrient status

Post harvest soil analysis data revealed that, soil nitrogen status was high with the treatment receiving 125% Nitrogen applied as neem coated urea followed by 100 % NCU. Control plot recorded the lowest soil nitrogen status. Raj *et al.*, (2014) found that neem cake blended urea maintained high available N status in the soil compared to other slow release forms of urea. Prilled urea maintained lower N status.

Table.1 Effect of application of neem coated urea on grain and straw yield (kg/ha) during *kharif*-2016

Treatments		Grain yield Kg/ha	Straw yield Kg/ha	Panicles/m2
T1	100% Prilled Urea (PU) - 3Splits(Basal, max. tillering and PI)	4850	6069	217
T2	75% Neem coated urea (NCU) - 3 Splits (Basal, max. tillering and PI)	5133	6811	226
T3	100% NCU (3 Splits - Basal, max. tillering and PI)	5550	7190	242
T4	125% NCU(3 Splits - Basal, max. tillering and PI)	5733	7393	249
T5	100% NCU (Full Basal)	3767	5460	182
T6	100% NCU (2 Splits - 50%- Basal + 50%- max. tillering)	3833	5542	207
T7	100% NCU (2 Splits -75% Basal+25% max. tillering)	4367	6199	215
T8	Control (No nitrogen fertilizer application (only P and K)	2400	3074	151
	Mean	3959	5304	187
	C.V (%)	14.3	11.0	16.6
	C.D (0.05)	588	719	21.6

Table.2 Effect of application of neem coated urea on N, P and K content in grain and straw during *kharif*-2016

Treatments		Content (%)					
		Grain			Straw		
		N	P	K	N	P	K
T1	100% Prilled Urea (PU) - 3Splits(Basal, max. tillering and PI)	0.95	0.28	0.24	0.40	0.14	1.23
T2	75% Neem coated urea (NCU) - 3 Splits (Basal, max. tillering and PI)	0.96	0.28	0.23	0.43	0.14	1.20
T3	100% NCU (3 Splits - Basal, max. tillering and PI)	1.09	0.30	0.24	0.45	0.16	1.21
T4	125% NCU(3 Splits - Basal, max. tillering and PI)	1.03	0.29	0.24	0.48	0.16	1.22
T5	100% NCU (Full Basal)	0.87	0.28	0.23	0.41	0.14	1.17
T6	100% NCU (2 Splits - 50%- Basal + 50%- max. tillering)	0.83	0.28	0.24	0.32	0.14	1.20
T7	100% NCU (2 Splits -75% Basal+25% max. tillering)	0.99	0.28	0.21	0.41	0.16	1.18
T8	Control (No nitrogen fertilizer application (only P and K)	0.60	0.30	0.24	0.35	0.14	1.19
	Mean	0.81	0.25	0.21	0.36	0.13	1.07
	C.V (%)	6.74	14.34	16.10	13.85	18.27	6.34
	C.D (0.05)	0.10	0.06	0.06	0.09	0.04	0.12

Table.3 Effect of application of neem coated urea on N, P and K uptake by grain and straw during *kharif*-2016

Treatments		Nutrient Uptake (kg/ha)					
		Grain			Straw		
		N	P	K	N	P	K
T1	100% Prilled Urea (PU) - 3Splits(Basal, max. tillering and PI)	50.88	15.00	12.66	25.83	9.03	78.66
T2	75% Neem coated urea (NCU) - 3 Splits (Basal, max. tillering and PI)	55.79	16.18	13.47	29.38	9.35	81.40
T3	100% NCU (3 Splits - Basal, max. tillering and PI)	67.98	18.56	15.24	32.55	11.82	87.46
T4	125% NCU(3 Splits - Basal, max. tillering and PI)	66.19	18.60	14.97	35.19	11.89	90.53
T5	100% NCU (Full Basal)	38.57	12.52	10.23	22.40	7.66	64.24
T6	100% NCU (2 Splits - 50%- Basal + 50%- max. tillering)	37.59	12.78	10.67	17.77	7.76	66.39
T7	100% NCU (2 Splits -75% Basal+25% max. tillering)	49.73	14.24	10.69	25.25	9.89	73.11
T8	Control (No nitrogen fertilizer application (only P and K)	20.80	10.29	8.13	14.56	5.67	49.31
	Mean	43.06	13.13	10.67	22.55	8.12	65.68
	C.V (%)	16.32	19.17	20.94	16.27	21.97	12.29
	C.D (0.05)	12.27	4.40	3.91	6.41	3.12	14.10

Table.4 Effect of application of neem coated urea on soil nutrient status during *kharif*-2016

Treatments		pH	E.C (dS/m)	OC (%)	Available nutrients (kg/ha)		
					N	P_2O_5	K_2O
T1	100% Prilled Urea (PU) - 3Splits(Basal, max. tillering and PI)	6.24	0.50	1.23	195	57.4	305
T2	75% Neem coated urea (NCU) - 3 Splits (Basal, max. tillering and PI)	6.19	0.49	1.26	204	57.5	326
T3	100% NCU (3 Splits - Basal, max. tillering and PI)	6.46	0.46	1.18	213	57.3	325
T4	125% NCU(3 Splits - Basal, max. tillering and PI)	6.35	0.51	1.27	217	58.2	317
T5	100% NCU (Full Basal)	6.46	0.54	1.21	200	57.5	315
T6	100% NCU (2 Splits - 50%- Basal + 50%- max. tillering)	6.37	0.48	1.20	208	57.6	304
T7	100% NCU (2 Splits -75% Basal+25% max. tillering)	6.27	0.50	1.23	204	54.7	308
T8	Control (No nitrogen fertilizer application (only P and K)	6.16	0.48	1.15	175	52.4	304
	Mean	6.31	0.50	1.08	180	50.3	278
	C.V (%)	2.39	13.28	5.75	7.43	6.10	8.0
	C.D (0.05)	0.26	0.11	0.11	23.5	5.36	38.8

Table.5 Effect of application of neem coated urea on total nitrogen uptake (kg/ha) and nitrogen use efficiency (%) in rice during *kharif*-2016

S.No	Treatments	Total Nitrogen Uptake (kg/ha)	Nitrogen Use Efficiency (%)
T1	100% Prilled Urea (PU) - 3Splits(Basal, max. tillering and PI)	76.71	20.68
T2	75% Neem coated urea (NCU) - 3 Splits (Basal, max. tillering and PI)	95.17	29.41
T3	100% NCU (3 Splits - Basal, max. tillering and PI)	100.53	32.59
T4	125% NCU(3 Splits - Basal, max. tillering and PI)	101.38	33.01
T5	100% NCU (Full Basal)	60.97	12.81
T6	100% NCU (2 Splits - 50%- Basal + 50%- max. tillering)	55.36	10.00
T7	100% NCU (2 Splits -75% Basal+25% max. tillering)	74.98	19.81
T8	Control (No nitrogen fertilizer application (only P and K)	35.36	--
	Mean	73.81	19.22
	C.V (%)	10.71	9.54
	C.D (0.05)	11.26	3.11

In conclusion, the application of neem coated urea significantly increased the grain yield of rice as compared to control (no nitrogen) and prilled urea. Total uptake of Nitrogen, Phosphorus and Potassium by plant was maximum in 125 % NCU (3split), followed by 100 % NCU (3 splits) and minimum was noticed under control. Nitrogen use efficiency was found to be high under the treatments received neem coated urea.

References

Brown, L. R. 1999. A world watches Institute Report on Progress toward a sustainable society, eds. L. R. Brown, C. Flavin, and H. Hench, 115–132.

Devakumar, C. and Mukcrjce, S.K. 1985. Nitrification retardation by neem-products. Neem newsletter. 2: 11 - 14.

Khanna P, Pandey N, Tripathi RS. Relative performance of soil FYM conditioned and neem based product coated urea on grain yield and NUE of transplanted rice in *Vertisol*s. Agricultural Sc. Digest. 2000; 20(4):259-260.

Kumar Dinesh, Kumar Deva C, Kumar Rajesh, Das Aurovinda, Panneer Selvam P, Shivay YS. Relative efficiency of prilled urea coated with major neem (*Azadirachta indica* A. Juss) oil components in lowland irrigated rice of the Indo-Gangetic plains. Archives of Agronomy and Soil Science. 2011; 57:61-74.

Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soil by extraction with sodium bicarbonate. USDA, Circ. 1954, 939.

Panigrahi R.K. and Dixit. L. 199 1. Relative efficiency of slow-release nitrogenous fertilizers in rainfed rice (*Oryza sativa*). Indian journal of Agronomy 36: 401 403.

Prasad, R.. Devakumar. C. and Shivay. Y.S. 1993.Neem Research and Development. Randhawa, N.S. and Parmar B.S. Santhi. S.R.. Palaniappan, Sp. and (Eds). Society of Pesticide Science, India.

Pushpanathan KR, Vijayakumar M, Siddeswaran K. Effect of forms of fertilizer nitrogen and timing of application on growth and yield of rice (*Oryza sativa l.*) Agriculture Review. 2005; 2:153-156.

Santhi. S.R.. Palaniappan, Sp. and Purushottaman, D. 1986. Influence of neern leaf on nitrification in a lowland rice inhibitors for agriculture, health and the environ- soil. Plalzt and Soil 93 : 133-135

Shivay YS, Prasad R, Singh S. Effect of nitrogen levels and neem-oil emulsions coated urea on growth, yield attributes and yield of wetland rice. In: Extended Summary of International Conference on Managing Natural Resources New Delhi ICAR. 2000; 3:1340-1342.

Singh. G. and Singh, O.P. 199 1. Effect of coated urea materials on rainfed low land transplanted rice (*Oryza sativa*) and their residual effect on wheat. Indian journal of Agronomy (suppl.): 22 1-223.

Smil, V. 2002. Nitrogen and food production proteins for human diets. Ambio 31: 126–131

Subbiah BV, Asija GL. A rapid procedure for determination of available nitrogen status in soil. Current Science. 1956; 25:259-260.

Thind HS, Singh Bijay Pannu, Singh RPS, Yadvinder Singh, Varinderpal Gupta, Vashistha RK. Relative performance of neem (*Azadirachta indica*) coated urea vis-à-vis ordinary urea applied to rice on the basis of soil test or following need based nitrogen management using leaf colour chart. Nutrient Cycling in Agro ecosystems. 2010; 87:1-8.

Upadhyay SK, Tripathi KS. Response of

prilled and neem extract coated urea application timings to rice (*Oryza sativa*), Agric. Sci. Digest. 2000; 20(2):84-86.

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