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Relative performance of neem coated urea (NCU) on Nutrient uptake and Nitrogen use efficiency of rice (*Oryza sativa* L) in *Vertisol*

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Abstract
A field experiment was carried out during the Kharif season (June–October) of 2016 at the Research Farm of the Indira Gandhi Agricultural University, Raipur (C.G.), India to study the Response of applied neem coated urea (NCU) on nutrient uptake and nitrogen use efficiency of rice (*Oryza sativa L*) in Vertisol. The experiment was laid out in a Randomized block design with three replications and eight treatments namely i.e. 100 % PU (3 splits), 75 % NCU (3 splits), 100 % NCU (3 splits), 125 % NCU (3 splits), 100 % NCU (full basal), 100 % NCU (2 splits 50%+50%), 100 % NCU (2 splits 75%+25%) and Control (No P60 K40). The results obtained in this study showed that the T_4-125% Neem coated urea performed significantly better than the other treatments in nutrient uptake (103kg ha^{-1}N, 18.8 kg ha^{-1} P, 190 kg ha^{-1}K) and nutrient use efficiency 35.88% of rice.

Keywords: Rice, Nitrogen, Neem Coated Urea, Nutrient uptake, Nitrogen Use Efficiency.

Introduction
Fertilizer nitrogen plays a vital role in rice production but its management in crop field is very important for its utilization. Utilization of applied nitrogen by rice has been estimated to be about 25 to 31 per cent (Singh, 1995) [12]. The nitrogen applied to transplanted rice under anaerobic conditions, often is subjected to losses by leaching, run-off and denitrification etc. (Reddy and Reddy, 1986) [8]. Use of slow release sources of nitrogen and/or coinciding the supplies of N at critical stages of crop growth through split application reduce these losses to some extent. The indigenous materials like neem reported to reduce the losses of nitrogen from the soil and increase its efficiency (Sagar and Reddy, 1992) [9]. But the extent of losses and efficiency of applied N varied under different soil systems. Singh *et al.* (2003) [11] reported that basal application of whole amotmt of neem extract coated urea was beneficial for growth and yield of rice. On the other hand, Singh *et al.* (2003) [11] observed that neem extract coated urea applied in split produced significantly higher grain yield than its whole amount was given as basal. Therefore, present study intended to find out the relative performance of neem coated urea (NCU) on Nutrient uptake and Nitrogen use efficiency of rice (*Oryza sativa L*) in Vertisol.

Methods and Materials
A field experiment was carried out during the Kharif season (June–October) of 2016 at the Research Farm of the Indira Gandhi Agricultural University, Raipur (C.G.), India to study the Response of applied neem coated urea (NCU) on nutrient uptake and nitrogen use efficieny of rice (Oryza sativa L) in Vertisol. The experimental site is situated in plains of Chhattisgarh at Eastern part of Raipur and it is located at 2004' North latitude and 81039' East longitudes and 293 m above mean sea level. The soil of experimental site is represented as a Typic chromesterts (Vertisols) (Arang-I series). It is locally called Kanhar. The soil is characterized by silty clay texture and moderate to slow internal drainage, medium to deep depth, and brownish gray in surface color, sub angular to angular, blocky structure and neutral in reaction. The decennial monthly minimum temperature fluctuates from 6.6 to 26.8 0C and maximum temperature from 28.5 to 44.8 0C in this region. The average annual rainfall is 1150 mm, and over 80% of this is received through northwest monsoon during July to September. The characteristics of top-soil (0–15 cm layer) at the start of experiment was neutral in reaction

(pH 7.3), electrical conductivity 0.27 dSm-1, soil organic carbon 0.53 %, available N 169 kg/ha (Subbiah and Asija 1956) [24], available P 12.97 kg/ha (Olsen et al. 1954) [14] and available K 368 kg/ha(1 N NH_4OAc-extractable K). The experiment was laid out in a Randomized block design with three replications and eight treatments namely i.e. 100 % PU (3 splits), 75 % NCU (3 splits), 100 % NCU (3 splits), 125 % NCU (3 splits), 100 %NCU (full basal), 100 % NCU (2 splits 50%+50%), 100 % NCU (2 splits 75%+25%) and Control (No P60 K40). The treatment means were compared using least significant differences at 5% level of significance (Gomez and Gomez 1984) [1].

Results and Discussion

Effect of neem coated urea on nutrient uptake of rice

The total N, P and K uptake (table 1) was significantly higher in T_4-125 % NCU (3 splits). In case of nitrogen, maximum uptake was found in T_4-125 % NCU (3 splits) 103kg ha^{-1} followed by T_3 100%NCU (3 split) 85.4kg ha^{-1},T_6 -100% NCU (2 splits 50%+50%) 83 kg ha^{-1} and T_5-100% NCU (full basal) 78.2 kg ha^{-1} recorded higher total nitrogen uptake and lowest from T_8-control (N_o P_{60},K_{40}) 49.2 kg ha^{-1}. Phosphorus uptake was recorded significantly higher in T_4-125 %NCU (3 splits) 18.8 kg ha^{-1} followed by T_6-100% NCU (2 splits 50%+50%) 14.8 kg ha^{-1} which was statistically at par with T_7-100% NCU (2 splits 75%+25%) 14.5 kg ha^{-1}, T_3-100% NCU (3split) 13.6 kg ha^{-1}, T_6 100% NCU (2splits 50%+50%) 13.5 kg ha^{-1} and T_1 100% PU (3split) 13.2 kg ha^{-1}. The lowest phosphorus uptake was recorded from T_8-control (N_o P_{60}, K_{40}) 10 kg ha^{-1}. The range of total K uptake was from 111.7 kg ha^{-1} to 190 kg ha^{-1}. The total uptake of potassium was seen more in the sites which is significantly higher in the order of T_4 (190 kg ha^{-1}) > T_2 (151.3 kg ha^{-1}) > T_7 (148 kg ha^{-1}) > T_3 (147.2 kg ha^{-1}) > T_6 (139.2 kg ha^{-1}) and the lowest K uptake was found in T_8-control (N_o P_{60} K_{40}) 111.7 kg ha^{-1}. The balanced nutrition led to better uptake of all the nutrients. 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. 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) [17], Shivay *et al*. (2000) [10] and Thind *et al*. (2010) [16] also found superiority of NCU over ordinary urea in N uptake and nitrogen use efficiencies.

Effect of neem coated urea on nutrient use efficiency of rice

Nitrogen use efficiency (NUE) followed the similar trend (table 3) as that of grain yield and recorded higher NUE in T_4-125% NCU (3split) 35.88% followed by T_2-75% NCU (3split) 31.47%, T_3-100% NCU (3 split) 30.15% and T_6-100% NCU (2 split 50%+50%) 28.14%. With regard to NUE, Khanna *et al.* (2000) [2] 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) [11] reported that coated urea with neem formulations not only increased the grain yield, but also increased NUE and apparent N recovery. Dinesh *et al*. (2010) [3], Kumar *et al*. (2011) [3] and Pushpanathan *et al.* (2005) [7] also reported similar finding. Agronomic use efficiency (5.56-9.57 kg/kg) of rice was found higher in T_2-75% PU (3split) 9.57 kg/kg followed by T_4-125 % NCU (3 splits Basal, Max. tiller and PI) 9.03 kg/kg and lower AUE was found under T_8-control (N_o P_{60} K_{40}) 10 kg ha^{-1}.

Table 1: Effect of Neem coated urea on Total nutrient uptake in rice

Treatment	Total nutrient uptake (kg h^{-1})		
	N	P	K
T_1 100 % PU (3 splits)	77.5	13.2	136.5
T_2 75 % NCU (3 splits)	74.3	12.6	151.3
T_3 100 %NCU(3 splits)	85.4	13.6	147.2
T_4 125 % NCU(3 splits)	103.0	18.8	190.0
T_5 100 % NCU (full basal)	78.2	14.8	139.2
T_6.100%NCU (2split 50%+50%)	83.0	13.5	143.2
T_7 100%NCU (2split 75%+25%)	75.4	14.5	148.1
T_8. Control (N_o P_{60} K_{40})	49.2	10.0	111.7
CD (P=0.05%)	**7.07**	**2.46**	**11.15**

Table 2: Effect of neem coated urea (NCU) on nutrient uptake in rice grain and straw

Treatment	N uptake (kg ha^{-1})		P uptake (kg ha^{-1})		K uptake (kg ha^{-1})	
	Grain	Straw	Grain	Straw	Grain	Straw
T_1 100 % PU (3 splits)	42.9	34.8	9.1	4.4	12.8	123.4
T_2 75 % NCU (3 splits)	40.0	33.7	8.4	4.2	12.3	138.2
T_3 100 %NCU(3 splits)	44.0	39.0	8.6	4.7	13.7	132.2
T_4 125 % NCU(3 splits)	52.8	50.4	12.0	6.7	19.7	170.2
T_5 100 %NCU (full basal)	43.5	36.0	10.1	4.4	12.3	127.0
T_6.100 %NCU (2 splits 50%+50%)	44.5	38.2	9.2	4.5	14.7	127.5
T_7 100 % NCU (2 splits 75%+25%)	40.7	34.9	9.9	4.7	14.2	130.7
T_8. Control (N_o P_{60},K_{40})	27.6	22.3	6.8	3.3	6.9	104.9
CD (P=0.05%)	**3.05**	**NS**	**2.08**	**1.09**	**2.41**	**10.22**

Table 3: Effect of neem coated urea and pilled urea on nitrogen use efficiency (%) and agronomic use efficiency (kg/kg)

Treatment	Nitrogen use efficiency (%)	Agronomic use efficiency (kg/kg)
T_1 100 % PU (3 splits)	23.60	6.33
T_2 75 % NCU (3 splits)	31.47	9.57
T_3 100 %NCU(3 splits)	30.15	8.02
T_4 125 % NCU(3 splits)	35.88	9.03
T_5 100 % NCU (full basal)	24.19	6.79
T_6.100%NCU (2split 50%+50%)	28.14	7.18
T_7 100%NCU (2split 75%+25%)	21.88	5.56
T_8. Control (N_o P_{60},K_{40})	-	-

Conclusion

The application of neem cated urea significantly increased the grain yield of rice as compared to control (no nitrogen).Total uptake of Nitrogen, Phosphorus and Potassium by plant was maximum in T_4-125 %NCU (3split), followed by T_3 100 % NCU (3 splits) and minimum was noticed under T_8 control. Similarly recorded in Nitrogen efficiency and agronomic efficiency was found higher under T_4-Neem coated urea 125 % and T_2 75 %NCU (3 splits), respectively. Nitrogen use efficiency was found maximum in treatment T_4-125% NCU (3split) 35.88% followed by T_2-75% NCU (3split) 31.47%.

References

1. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research, 2nd Ed. John Wiley and Sons. New York, 1984, 639.
2. 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.
3. 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.
4. Kumar N, Prasad R, Fuzaman. Relative response of high yielding variety and a hybrid of rice to levels and sources of nitrogen. Indian nation of science academy. 2007; 73:1-6.
5. Kumar Sunil, Shivay YS, Kumar Dinesh. Effect of levels and sources of nitrogen on N, P and K concentrations and uptake, and N use indices by a high-yielding variety and a hybrid of rice Indian Journal of Fertilizer. 2007; 2:53-56.
6. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soil by extraction with sodium bicarbonate. USDA, Circ. 1954, 939.
7. 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.
8. Reddy GRS, Reddy KA. Indian J Agric. Sci. 1986; 6:775-780.
9. Sagar GK, Reddy GRS. OtyZa 29: 376-378, 1992.
10. 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.
11. Singh S, Shivay YS. Coating of prilled urea with ecofriendly neem (Azadirachta indica a juss.) formulations for efficient nitrogen use in hybrid rice. Acta Agronomica Hungarica. 2003; 51:53-59.
12. Singh TA. In: Soil Fertility and Fertilizer Use. Indian Farmer Fertilizer Cooperative Limited, New Delhi. 1995, 1-11.
13. Subbiah BV, Asija GL. A rapid procedure for determination of available nitrogen status in soil. Current Science. 1956; 25:259-260.
14. Suganya S, Appavu K, Vadivel A. Nitrogen release pattern of neem coated urea products in flood water. An Agriculture Journal of Soil Science. 2007; 2:128-133.
15. Suganya S, Appavu K, Vadivel A. Relative efficiency of neem coated urea products for rice grown in different soils. An Agriculture Journal of Soil Science. 2007; 2:29-34.
16. 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.
17. 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.