Journal of Tropical Agriculture 33 (1995) : 171-172

# LEACHING LOSS OF NITROGEN IN WATERLOGGED RICE FERTILIZED WITH DIFFERENT FORMS OF UREA

The leaching loss of N has greater importance in waterlogged light textured soil with high percolation rate. Urea, the most common N source is prone to high leaching loss as urea N, ammoniacal N and nitrate N. Apart from the loss of added N through fertilizer, there are chances for loss of the native soil N through the percolating water. Hence an attempt was made to study the variations in N content (ammoniacal N and nitrate N) in the leachate under different sources of N application in a sandy loam laterite soil.

A field experiment was conducted at the Regional Agricultural Research Station, Pattambi during the kharif season in a sandy loam laterite (Fluventic Dystropepts) soil having pH 5.17, total N 0.13%, ammoniacal-N 5.78 ppm, organic carbon 1.13% and CEC 6.34 cmol (p') $kg^{-1}$. The N sources viz., prilled urea (PU split i.e., 50% basal, 25% at 20 days after transplanting [DAT] and 25% at 40 DAT), urea mud ball (UM), urea supergranule (USG), gypsum coated urea (GCU) and rock phosphate coated urea (RPCU) at 90 kg N $ha^{-1}$ as basal were tested along with a no N control. The experiment was laid out in randomised block design, replicated four times with Jaya as test crop. USG and UM were deep placed at 10 cm depth equidistant between four hills of transplanted rice. Phosphorus and potassium each at the rate of 45 kg $P_2O_5$ and $K_2O$ $ha^{-1}$ were uniformly applied in all treatments. The entire quantity of P as superphosphate and half the quantity of K in the form of muriate of potash were applied as basal and remaining quantity of K at 40 DAT. Porous ceramic cups in the form of piezometers were installed at 25 cm depth in each plot before fertilizer application and transplanting. Leachate was collected from the piezometers using a hand suction pump at three days interval up to 15 DAT. then at 10 days interval up to 50 per cent flowering and analysed for ammoniacal N by micro-kjeldahl distillation with MgO (Bremner and Keeney, 1966). nitrate N by chromotropic acid method (Sims and Jackson, 1971) and total N by sulphuric acid digestion and distillation (Jackson, 1958). Percentage of inorganic N, ammoniacal N and nitrate N out of the total N in the leachate was also worked out.

The data (Table 1) revealed that the different N sources had little effect on the total N content in the leachate except for UM deep placement, which recorded the lowest values at all periods of observation. This can be attributed to the thick casing of soil particles available around the urea which provide sufficient substrata for dissolved urea to form a thin film around each of the minute soil components and also better adsorption of mineralised ammoniacal N in soil particles. However, the percentage of inorganic forms of N out of total N varied widely from 19.5% in UM to 43.2% in RPCU treatments.

A significant reduction in total N content in leachate took place with crop growth up to 9 DAT which can be attributed to the leaching loss of N. On the other hand the percentage of inorganic fractions of N increased steadily from 25.9 at 3 DAT to 61.2 at 15 DAT, which is a reflection on the poor utilization of inorganic N during the early stages of plant growth owing to the low foraging capacity (Singh and Singh, 1988). The slower rate of hydrolysis of urea can be attributed to the lower content of inorganic N during the initial period at 3 DAT. Similar results have also been reported earlier (Bhagat *et al.*, 1988).

Among the N sources tried, surface applied GCU had retained more total N in the leachate at 3 DAT, decreased rapidly at 6 DAT and levelled with other N source whereas USG and UM deep placed treatments, due to lower rate of dissolution retained less content of total N in the leachate at 3 DAT. However, percentage of inorganic N at 30 DAT was almost same for all the N sources tried, indicating the chances of loss of N as urea N. PU split treatment due to application of only half of the N dose at transplanting recorded lower

Table 1. Effect of N source of total N content (ppm) in leachate at different periods

| | Days alter transplanting (DAT) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Urea forms | 3 | 6 | 9 | 12 | 15 | 25 | 35 | 45 | 55 | Mean |
| No N | 32.4 (16.4) | 15.5 (30.4) | 9.1 (39.9) | 10.4 (30.6) | 6.5 (41.7) | 7.1 (15.5) | 3.2 (25.3) | 1.6 (41.3) | 1.3 (30.0) | 9.8 (30.1) |
| PU split | 35.6 (24.0) | 35.0 (33.5) | 24.6 (56.8) | 19.4 (45.1) | 11.7 (76.7) | 7.8 (32.4) | 6.5 (16.8) | 3.2 (27.5) | 1.4 (37.1) | 16.4 (38.9) |
| UM deep placed | 33.7 (23.3) | 20.7 (14.3) | 14.2 (25.4) | 14.2 (23.2) | 10.4 (26.2) | 9.1 (18.8) | 7.1 (15.9) | 5.2 (16.2) | 5.8 (12.6) | 13.2 (19.5) |
| USG deep placed | 46.6 (29.1) | 28.5 (43.8) | 29.8 (31.9) | 18.2 (54.8) | 11.7 (76.1) | 10.4 (25.8) | 6.5 (19.4) | 4.5 (16.4) | 1.9 (21.6) | 17.6 (38.8) |
| CU basal | 77.7 (29.8) | 29.8 (52.0) | 22.0 (56.4) | 14.2 (52.0) | 10.4 (79.4) | 9.1 (21.8) | 7.8 (14.7) | 3.9 (18.5) | 1.3 (42.3) | 19.6 (40.8) |
| RPCU hasal | 72.0 (32.6) | 24.6 (56.9) | 19.4 (57.0) | 14.2 (81.7) | 10.4 (66.6) | 7.8 (23.7) | 5.8 (17.4) | 4.5 (22.4) | 1.8 (30.6) | 17.8 (43.2) |
| Mean | 50.0 (25.9) | 25.7 (38.5) | 19.9 (44.6) | 15.1 (47.9) | 10.1 (61.2) | 8.5 (23.0) | 6.0 (18.3) | 3.8 (23.8) | 2.3 (27.4) | - |

*CD* (0.05) Urea forms : 4.69, DAT : 5.74, Interaction : 14.07
Figures in the parentheses indicate percentage of inorganic forms ot ammoniacal N and nitrate N out of total N

content of total N in leachate compared to RPCU, GCU and USG treatments.

The results also indicated that among the N forms in the leachate, organic N contributes a major portion during the initial periods (3 and 6 DAT) and 25 DAT onwards. During the initial periods, urea N may he a major portion in N applied treatments and the latter being organic N ot hydrolysable and nonhydrolysable fractions. Thus from the observatioas it can be concluded that apart from the added N, native soil and organic N also contribute a major portion in the leachate especially from 25 DAT onwards in light textured waterlogged soils.

Regional Agricultural Research Station
Pattambi 679 306, India

**K. Anilakumar, K. P. Rajaram, C. Sivakumar**

## REFERENCES

Bhagat, R. M., Kanwar, B. B., Verma, T. S. and Minnas, R. S., 1988. Nitrogen economy in low land rice culture. *Oryza* 25 : 255-260

Bremner, J. M. and Keeney, D. R. 1960. Determination and isotope ratio analysis of different forms of nitrogen in soils. 3. Exchangeable ammonium, nitrate and nitrite hy extraction - distillation methods. *Soil Sci. Soc. Am. Proc.* 30 : 577

Jackson, M. L. 1958. *Soil Chemical Analysis.* Prentice Hall of India Pvt. Ltd., New Delhi

Sims, J. R. and Jackson, G. D. 1971. Rapid analysis of soil nitrate with chromotropic acid. *Soil Sci. Soc. Am. I'roc.* 35 : 603-606

Singh, G. R. and Singh, T. A. 1988. Leaching losses and use efficiency of nitrogen in rice fertilized with urea supergranules. *J. Indian Soc. Soil Sci.* 36 : 274-279