Leaching of nitrogen from polymer coated and stabilized, controlled-release nitrogen fertilizers.

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OVERVIEW

- Extensive use of nitrogen fertilizer, coupled with their low nitrogen use efficiencies, cause significant amount of environmental and socio-economic problems worldwide.
- Use of stabilized and controlled-release nitrogen fertilizers, is a common method adopted to address these issues.

OBJECTIVES

I. To asses the nitrogen release patterns of 4 polymer coated and stabilized urea based nitrogen fertilizers.

II. To assess the effect of polymer loading percentage and urea stabilizers on nitrogen release patterns.

METHODOLOGY

- Polyvinylchloride columns, measuring 30 cm in height and 5 cm in diameter were mounted vertically.
- Columns were filled to a depth of 28 cm with sieved soil (RBE).
- 5g of each of the 5 treatments were placed 5 cm below the surface of soil.
- Columns were irrigated with 80 ml of distilled water three times per week and leachates were collected.

Measurements

1. Leachate volume
2. Total Dissolved Solids (TDS)
3. pH
4. Electrical Conductivity (EC)
5. Total nitrogen

- TDS, pH and EC were measured using the EC meter (model: senSION + MM 150).
- Total nitrogen was determined using the Kjeldahal procedure.

Plate 1. Leaching column setup

Treatments

- T0 – No fertilizers.
- T1 – Uncoated mix of Urea, TSP, MOP and Zinc Sulphate
- T2 – Double polymer coated mix of Urea, TSP, MOP and Zinc Sulphate (1% polymer loading)
- T3 - Double polymer coated mix of Urea, TSP, MOP and Zinc Sulphate (3% polymer loading)
- T4 - Double polymer coated mix of Urea, TSP, MOP and Zinc Sulphate (1% polymer loading) + DCD + NBPT
- T5 - Double polymer coated mix of Urea, TSP, MOP and Zinc Sulphate (3% polymer loading)+ DCD + NBPT

RESULTS AND DISCUSSION

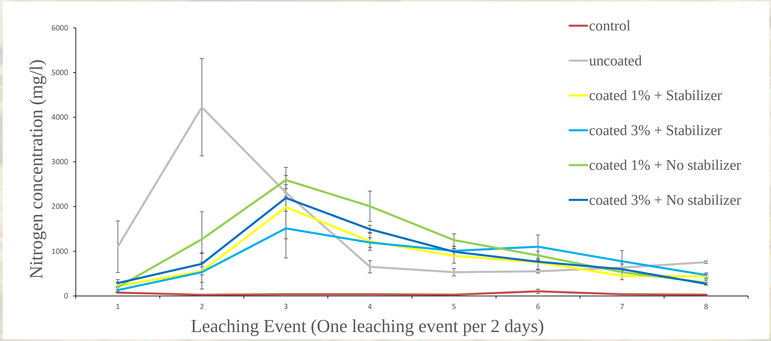

Figure 1: Relationships between the N concentrations of leachates and leaching events with respect to different treatments.

- Uncoated fertilizer showed a significantly higher rate of nitrogen leaching compared to all the coated fertilizers during the initial 2 leaching events at *P=0.05*.
- Coated fertilizer did not show any significant difference in leachate nitrogen concentrations throughout the 8 leaching events at *P=0.05*.

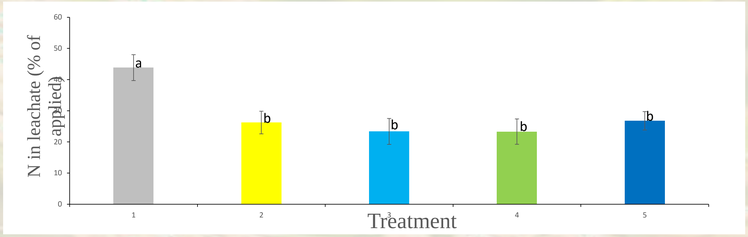

Figure 2: Cumulative leaching of N (as a % of applied N) from 5 treatments, after 8 leaching events.

- After 8 leaching events, uncoated fertilizer had significantly higher cumulative leaching of applied nitrogen at *P=0.05*.
- Coated fertilizer did not show any significant difference in cumulative leaching of applied nitrogen at the end of the 8 leaching events at *P=0.05*.

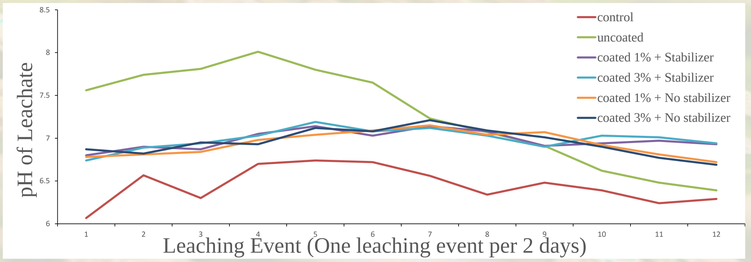

Figure 3: Variation of the pH of 6 treatment leachates during 12 leaching events.

CONCLUSIONS

- Coated fertilizer can delay and extend the release of nitrogen compared to uncoated fertilizer.
- Polymer loading percentages at 1% and 3% (weight basis) has no significant difference regarding the nitrogen release of polymer coated fertilizers.
- Urea stabilizers (DCD and NBPT) has no significant effect on the nitrogen release patterns of stabilized fertilizers.

References

- Paramasivam, S. and Alva, A.K. (1997). Leaching of Nitrogen Forms from Controlled-Release Nitrogen Fertilizers. Commun. Soil sci. Plant anal., 28(17&18), 1663-1674.