Spatial and Temporal Distribution of Nitrogen from Controlled-Release Fertilizers Applied in a Sandy Soil

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INTRODUCTION and OBJECTIVE

Nitrogen (N) fertilizers play one of the critical roles in production programs of Florida (FL) agriculture. In tomato (*Lycopersicon esculentum* Mill.) production, most fertilizers are applied preplant in raised and polyethylene-mulched beds using seepage irrigation. Best Management Practices (BMP) for vegetable crops emphasize the need for reduced N losses to the environment hence increased fertilizer efficiency. Various commercial controlled-release fertilizers (CRF) have shown reduced leaching N losses, as compared to readily soluble N fertilizers. However, degree of the effect depends on various experimental and environmental factors including type of CRF. This study was conducted to determine spatial distribution and temporal transformation of N (NH_4-N and NO_3-N) from CRF applied under growing conditions in southwest FL for 2006- and 2007-spring seasons (2006 data only presented).

MATERIALS and METHODS

- ✓ Experiment at the Southwest Florida Research and Education Center in Immokalee, FL
- ✓ Fertilizers applied:

Soluble fertilizer	NH_4NO_3	Local supplier
Sulfur-coated urea	Urea	Local supplier
Nitamin®	23-0-0	Georgia-Pacific Resins, Inc.
Multicote®	40-0-0	Haifa Chemicals Ltd.
Agrocote®	38-0-0	The Scotts Company

- ✓ Immokalee sand (sandy, siliceous, hyperthermic Arenic Haplaquods): pH 4.9, 98% sand, 0.97% total C, 0.1% total N
- ✓ Soil sampling for 2006 season on weeks after application (WAA) 2, 3, 4, 6, 8, and 11 from band (fertilizer band) and center of bed at 3 different depths (0-10, 10-20, and 20-30 cm; Fig. 1)
- ✓ 2 M KCl-extracted soil NH_4-N and NO_3-N analyzed

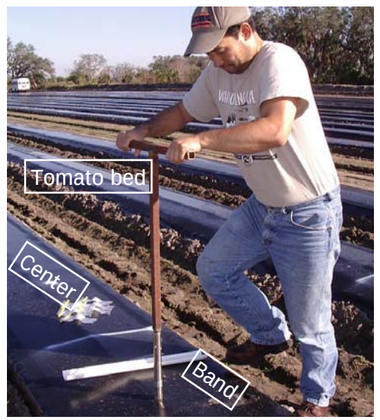

Figure 1. Soil sampling from band and center of tomato bed

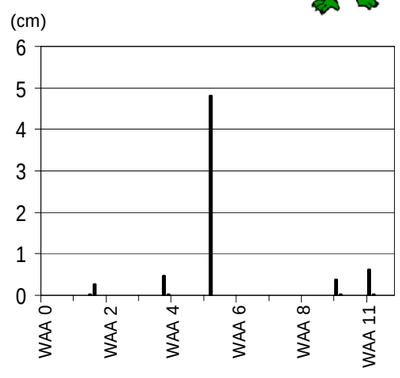

Figure 2. Rainfall during the 2006-growing season

RESULTS

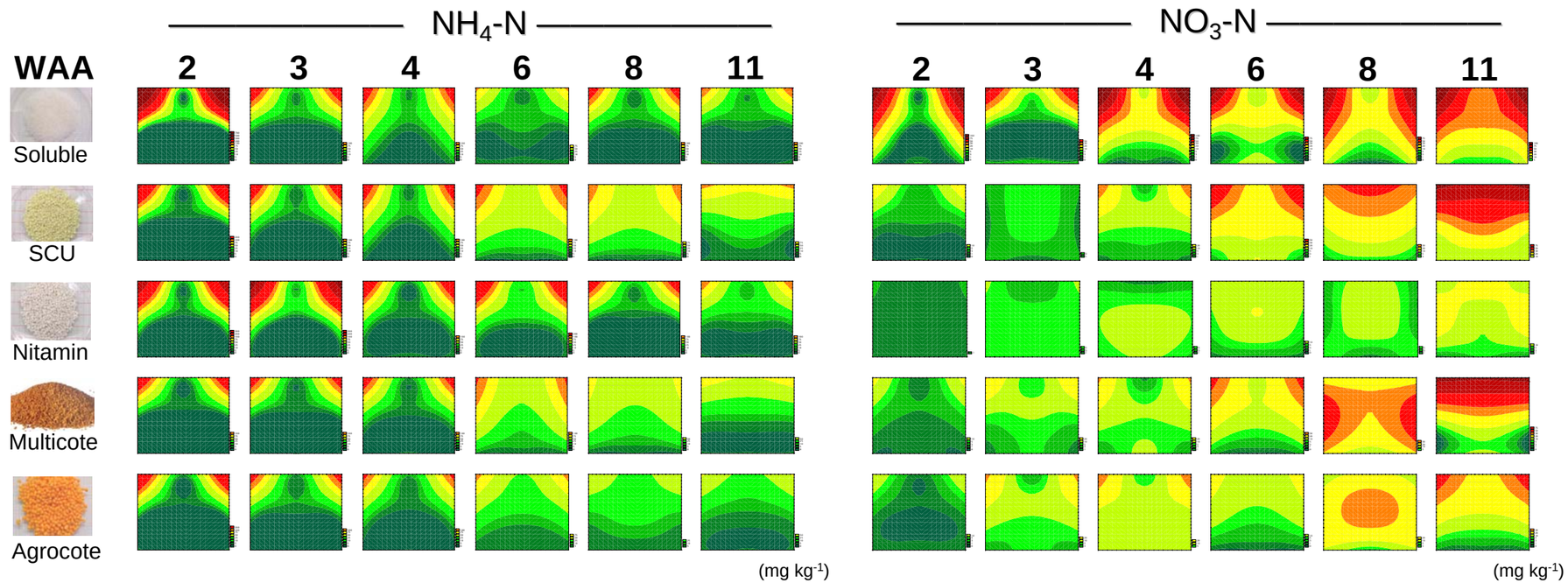

Figure 3. NH_4-N and NO_3-N concentration contours around bed in cross section with different fertilizers applied during the 2006-spring season. Band concentrations are replicated in the other side of bed to produce contour images. Actual bed is 20-cm depth and 90-cm wide, and the contour image is 30-cm depth and 70-cm wide.

SUMMARY

- ➢ A few light rainfall events occurred during the growing season except for 4.8 cm on WAA 5 (Fig. 2).
- ⚐ Soluble fertilizer had the highest NH_4-N on WAA 2 and dropped considerably at fertilizer band (3 times less) on WAA 3, while all CRF decreased in the band gradually throughout the season (Fig. 3).
- ⚐ NH_4-N from soluble fertilizer in top-center location remained low throughout the season, while that from CRF in top-center location gradually increased over time.
- ⚐ NH_4-N from all fertilizers redistributed to bottom of bed (20 cm) at some point of the season. It appeared that CRF distributed more NH_4-N than soluble fertilizer did to bottom of bed, especially on and after WAA 6.
- ⚐ It appeared that NH_4-N did not leach to below the bed (30 cm) throughout the season from any fertilizers (constantly < 6 mg NH_4-N kg^{-1}).
- ❋ In general, soluble fertilizer had greater NO_3-N at the band and lower NO_3-N at center during the season.
- ❋ In general, NO_3-N from CRF increased at the surface in both band and center over time, particularly on and after WAA 6.
- ❋ NO_3-N from all fertilizers tended to increase at bottom of bed over time, especially on and after WAA 6.
- ❋ It seemed some NO_3-N from soluble fertilizer leached below the bed after WAA 8, while all CRF had lower NO_3-N leached below the bed than soluble fertilizer throughout the season except for Multicote on WAA 8.
- ☺ NH_4-N from soluble fertilizer drastically dropped on WAA 3, but unexpectedly remained in high concentrations throughout the season. It appeared that NH_4-N from CRF slowly moved from band to center of bed over time.
- ☺ While soluble fertilizer made both NH_4-N and NO_3-N available throughout the season, CRF showed lack of NO_3-N in the beginning of the season. Particularly, Nitamin showed reduced NO_3-N throughout the season.