Yield, and Nutrient and Soil Loss Comparisons of Long Term Tillage and Management System Trials: North Carolina

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Introduction

The ever-growing global population combined with decreasing producible land, forces producers to improve productivity on fewer acres. Nutrient losses from agricultural systems not only gives rise to environmental and health concerns but causes direct losses to producers. The sustainability of agriculture systems is imperative in today's economy and little research exists that directly compares conventional and organic systems and their tillage types effects on water quality and yield.

The objective of this study was to measure non-point source pollution and collect agronomic data associated with organic and conventional agriculture systems under different conservation and conventional tillage.

Methods-Materials

Location and Plot Design

- Located at the Mountain Horticultural Crops Research Station, NC
- **Unique due to its long term organic management & tillage history of 20 years**
- 20 plots (4 replications of 5 treatments)
  - Conventional production with conservation tillage (no-till) - NT/Conven.
  - Conventional production with standard tillage - CT/Conven.
  - Organic production with conservation tillage (no-till) - NT/Org
  - Organic production with standard tillage - CT/Org
  - Fertilizer rates (except nitrogen) are based on yearly soil sample analysis
- Nitrogen rate = 202 kg/ha
  - Conventional plots = commercial fertilizer (33-0-0)
  - Organic plots = pelletized poultry litter (4-2-3) + leguminous cover crop residue

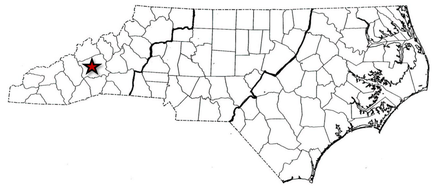

Figure 1 – Mountain Horticulture Crops Research Station

Runoff

- Runoff monitored & samples collected with ISCO samplers
- Analyzed for:
  - Nitrate nitrogen
  - Ammonia nitrogen
  - Total dissolved nitrogen
  - Total Kjeldahl nitrogen
  - Total organic carbon
  - Total phosphorus
  - Dissolved phosphorus
  - Total suspended solids

Sweet Corn Yield and Nutrient Content

- Yield measurements made from the two center rows of each plot
- Ears measured and weighed
- Stalks dried and weighed
- Tissue analyzed for N and P

Results and Discussion

Sweet Corn Yield

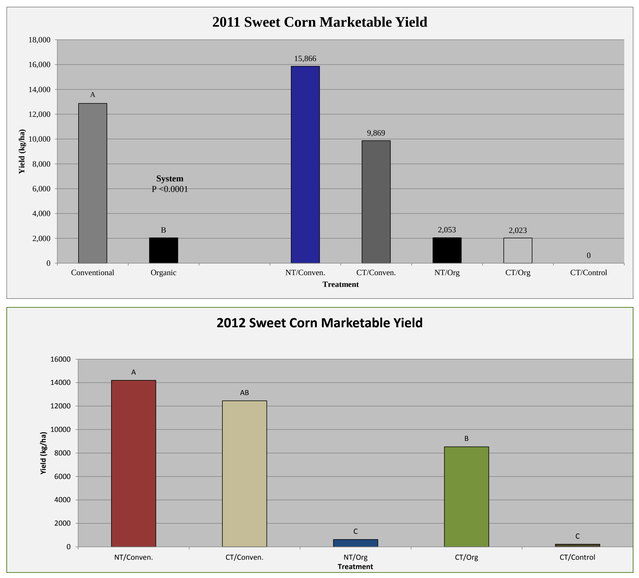

Figure 2 – Sweet corn marketable yield 2011 and 2012.

Yields were highest in the conventional systems. In 2011, yields were 5 to 8 times greater with conventional management. In 2012, yields were 1.5 to 14 times greater with conventional management. Lower yields associated with organic management were a result of higher weed pressure and lower plant available nitrogen supplied by the cover crop and pelletized poultry litter.

Water Quality

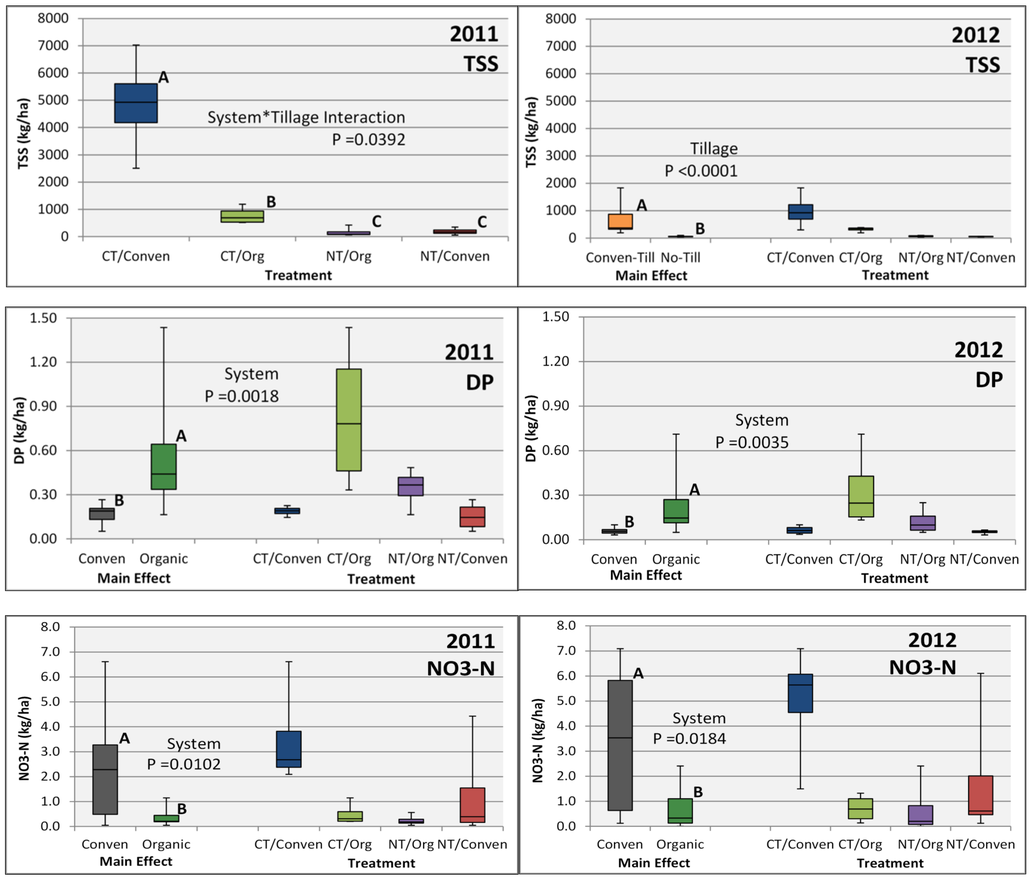

Figure 3 – Edge-of-field storm event sediment, dissolved phosphorus and nitrate load losses in 2011 and 2012.

Sediment (total suspended solids or TSS), total phosphorus (TP),and total Kjeldahl nitrogen (TKN) losses demonstrated an interaction between system and tillage in 2011 but were only affected by tillage in 2012, with plowed plots eroding more than no-till plots.

Soluble or dissolved P (DP) losses are driven by cropping system, with organic systems losing more than the conventional systems, regardless of tillage practice. This is likely due to the high P content of the organic pelletized poultry manure and in the case of the no-till organic system the fact that it remains on the soil surface rather than being incorporated.

Nitrate-nitrogen (NO_3-N) losses demonstrated a system effect; conventional treatments lost more than organic treatments. Fertilizer nitrogen is more soluble than the nitrogen sources used in the organic plots: poultry pellets and legumes.

Conclusions

- The data strongly suggest that in these long-term plots, tillage was more important relative to losses of sediment and sediment-attached nutrients than the agricultural production system.
- Conversely, the data also indicate that soluble nutrient losses are a function of agricultural production system rather than tillage.
- Conventional management, conservation tillage plots had the greatest yield and generally lowest sediment and nutrient pollutant losses making this system the most sustainable.
- **Due to the longevity of these plots, we are confident that the system has reached equilibrium, making the results more extractable to management systems.**

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