Effect of Long-Term Cropping System Management on Crop Yield and Soybean Cyst Nematode

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INTRODUCTION

- Cover crops (CC) have been utilized to reduce erosion, weed densities, and soil compaction as well as increase soil organic matter (SOM) and yields of rotational crops over time (Meyers et al. 2015, Nascente et al. 2015, Teasdale et al. 1991).
- Soil organic matter improves soil water holding capacity and infiltration, CEC, buffering capacity, diversity of microbial communities, and plant nutrient availability (Fenton et al. 2008,).
- Soybean cyst nematode (SCN) is the most destructive pest to soybean in Missouri causing estimated annual losses of $1.5 billion in the US (Wrather and Mitchum 2006, United Soybean Board 2016). Short-term CC experiments in upstate Missouri reported limited effects on SCN egg counts (Nelson et al. 2006).

OBJECTIVE

- Evaluate the effect of long-term cropping systems on crop yields and SCN egg population densities.

MATERIALS AND METHODS

- Long-term cropping systems site was established in 1994 at the University of Missouri Greenley Research Center near Novelty.
- The experiment has a corn-soybean-wheat rotation and includes three tillage/cropping systems [1) no-till corn-soybean-wheat with double-crop soybean (NT DCS), 2) no-till corn-soybean-wheat with frost-seeded red clover (NT FSC) and 3) reduced-till corn-soybean-wheat (RT)].
- RT includes fall chisel plowing before corn or soybean followed by a field cultivator, disk, or finishing tool in the spring. A field cultivator, disk, or finishing tool is utilized prior to planting wheat.
- Arranged in a split-plot design with four replications. Main plots are 27 by 91 meters.
- Soil samples were collected from individual plots in the spring to a 15 cm depth to evaluate cropping system effects on SCN egg population densities (2002-2016) and soil properties (1994, 2002-2016).
- Data were subjected to ANOVA and means separated using Fisher's Protected LSD.

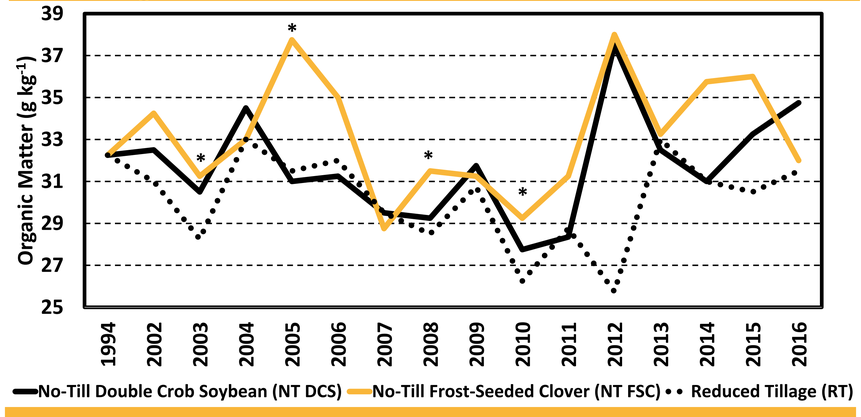

Figure 1. Differences in soil organic matter (SOM) measured prior to corn (1994, 2002-2016) for NT DCS, NT FSC, and RT cropping systems. Asterisks represent significant differences in SOM levels among cropping systems (*P*=0.05).

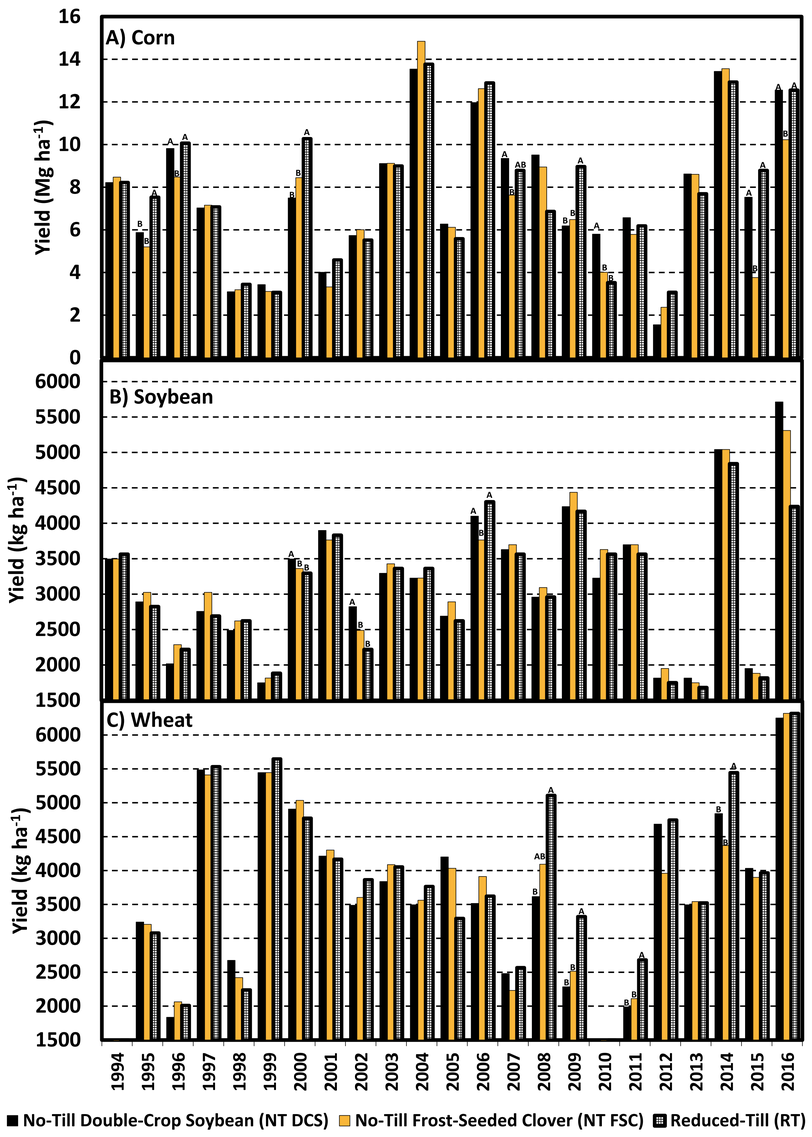

Figure 2. Corn (A), soybean (B), and wheat (C) yields from 1994 to 2016 for NT DCS, NT FSC and RT cropping systems. Lettered bars represent significant differences among cropping systems within a year (*P*=0.05).

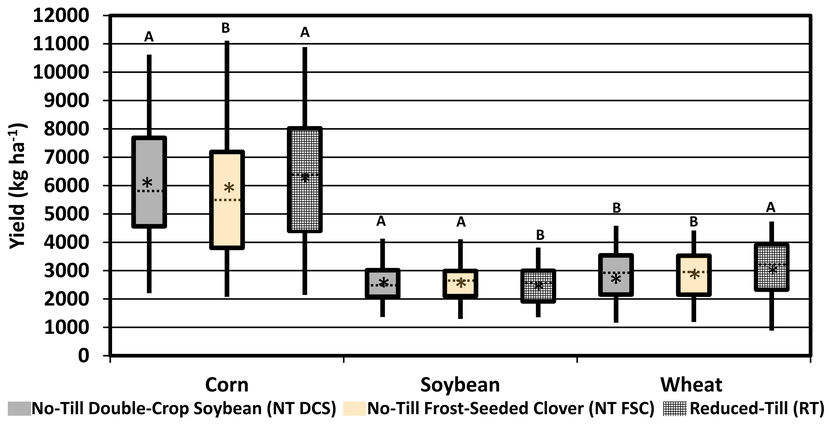

Figure 3. Box plots of the grain yield response to cropping systems (NT DCS, NT FSC, and RT) combined over years from 1994-2016. Letters above boxes indicate significant differences in yield between cropping system means (asterisk) (*P*=0.05).

REFERENCES

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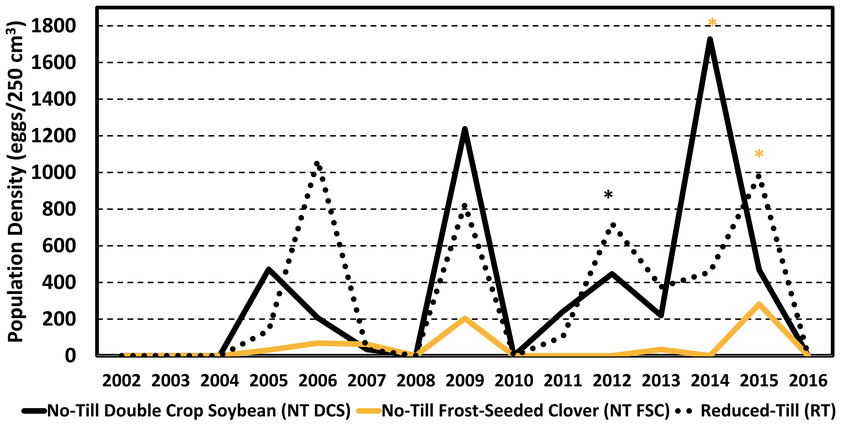

Figure 4. SCN egg population densities following corn for NT DCS, NT FSC, and RT cropping systems. Black (*P*=0.1) and gold (*P=0.*17) asterisks represent significant differences among cropping systems.

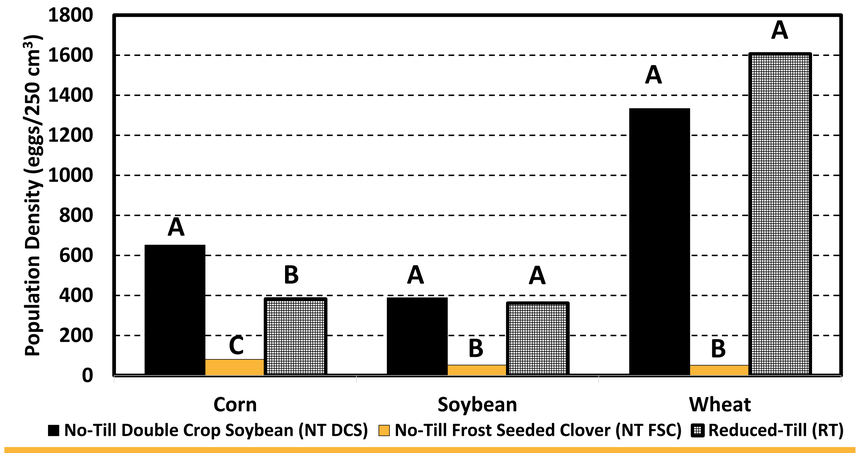

Figure 5. SCN egg population densities following corn, soybean, or wheat for NT DCS, NT FSC and RT cropping systems. Data were combined over years (2002-2016) in the absence of a significant interaction within years. Lettered bars represent significant differences among cropping systems (*P*=0.1). Comparisons within a crop are valid.

RESULTS

- The highest levels of SOM occurred 4 years with the NT FSC cover crop system (Figure 1).
- For corn, there were 5 years RT was the highest yielding cropping system while NT DCS had the highest yield 3 of the years (Figure 2A).
- The highest yielding soybean cropping system for 2 years was NT DCS and 1 year for RT (Figure 2B).
- Reduced-till was the highest yielding cropping system for wheat for 4 years (Figure 2C).
- Combined over all years, yields were ranked for corn RT=NT DCS>NT FSC, soybean NT FSC=NT DCS>RT, and wheat RT> NT FSC=NT DCS (Figure 3).
- SCN population densities were lowest using the NT FSC cropping system (Figures 4 & 5).

CONCLUSIONS

- Long-term cropping systems are important to understand the impacts of cover crops and tillage systems on yield, pests, and soil properties.
- No single cropping system had the highest yields for all rotational crops (Figure 3).
- Producers should match cropping systems with individual management goals specific to each rotational crop.