Southern Cover Crops
2016 CONFERENCE FACT SHEET

Equipment Demonstration and Conservation Systems Overview

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Fig. 1. An example of a conservation system that used strip tillage and a rolled cover crop, prior to cotton planting, to enhance soil health and subsequent crop production. Photo courtesy of USDA-ARS, NSDL

Introduction

Soils in the Southeastern U.S. are very low in organic matter, which can be attributed to high temperatures, humidity, and rainfall that oxidizes organic residues very quickly. This condition is worsened by historical use of conventional tillage practices. As a result, soils in the region are susceptible to erosion, compaction, and drought, which can reduce soil productivity and profits for producers in the region.

Conservation tillage combined with high residue cover crops (Conservation Systems) can maximize residue production and minimize residue decomposition to promote the increase in organic matter across degraded soils of the Southeast, despite climatic conditions (Fig. 1). This increase in organic matter can improve soil quality and rainfall and/or irrigation infiltration to reduce short-term drought stress that can enhance productivity and profitability. The development and integration of conservation systems to ensure sustainable production, profit, and environmental stewardship is an on-going process that must keep pace with developments in crop production across multiple disciplines.

The Conservation System Research (CSR) team at the USDA-ARS, National Soil Dynamics Laboratory (NSDL) (Fig. 2) uses a multi-disciplinary approach. Our research is applicable to producers currently using conservation systems, as well as producers transitioning from conventional cropping systems to conservation systems across highly degraded soils of the Southeast. The main focus of our research is on:

(1) Developing conservation systems that integrate cover crop management and equipment for maximum soil protection and weed suppression;

(2) Developing, evaluating, and providing decision support for cropping systems that increase soil organic matter accumulation, enhance productivity, and maximize profitability of degraded southeastern soils; and

(3) Integrating existing production agricultural and conservation systems research using analysis tools and/or models to evaluate profitability and risk associated with conservation systems.

Fig. 2. The CSR team that develops sustainable cropping systems for southern cropping systems at the 2016 Southern Cover Crop Conference. Photo courtesy of USDA-ARS, NSDL

The following are examples of the types of research being conducted and evaluated:

- Cover crop termination using different types of rollers designed for walk-behind tractors;
- Managing cover crop residue using custom designed residue managers compared to commercially available row cleaners with coulters;
- Cover crop and herbicide management intensity in corn, cotton, soybean, and peanut;
- High residue cover crop mulch systems in tomato and watermelon as compared to a traditional system;
- Nitrogen fertilizer sources, rates, and time of application for a rye winter cover crop to optimize biomass production;
- Tillage and nitrogen requirements for wheat; and
- Net returns of different conservation cropping systems.

Entities, such as the USDA-NRCS and University extension services, also benefit by having access to scientifically based research results related to conservation and production agriculture practices that can be transferred to various clientele.

Conservation System Overview

Attendees were provided with a brief introduction of members of the CSR team, as well as an overview of how conservation systems are beneficial for southern producers (Fig. 3). All team members were available to interact with the attendees and answer specific questions about how conservation systems can be incorporated into existing farming operations.

Select fact sheets summarizing research findings associated with many aspects of conservation systems were provided to all interested attendees of the 2016 Southern Cover Crop Conference. In addition, attendees also received a copy of *A Simple Guide to Conservation Systems in the Southeast,* a booklet that highlights information a producer would need to transition to a conservation system (available at http://www.ars.usda.gov/SP2UserFiles/Place/60100500/SpecialPubs/ConsSysGuideComplete.pdf).

Fig. 3. Kip Balkcom provided attendees with an overview of CSR and information about the equipment included in the demonstration. Photo courtesy of USDA-ARS, NSDL

A continuous-loop video (available at http://www.ars.usda.gov/Main/docs.htm?docid=25902) was also available for attendees to observe other field operations associated with conservation systems that were not possible to demonstrate during the field day. All publications and fact sheets developed by the CSR team are available at http://www.ars.usda.gov/Main/docs.htm?docid=6502, while general information about the NSDL and the CSR team is available at http://www.ars.usda.gov/sea/nsdl.

Fig. 4. Staff from NSDL demonstrated termination of a high-residue cover crop using a four-stage roller/crimper (A) and a powered roller/crimper for walk-behind tractors (B), as well as a strip tillage implement with different strip tillage attachments (C). Photos courtesy of USDA-ARS, NSDL

Equipment Demonstration

During the 2016 Southern Cover Crop Conference field demonstration, participants were exposed to some of the equipment and management techniques associated with conservation systems. Staff from NSDL demonstrated termination of a high-residue cover crop using a four-stage roller/crimper (Fig. 4A) and a walk behind roller crimper (Fig. 4B), as well as the performance of a strip tillage implement with different strip tillage attachments (Fig. 4C).

The four-stage roller/crimper (Fig. 4A) is a patented design developed by NSDL to effectively terminate a cover crop by simulating the effects from multiple passes with a roller/crimper using a single pass. This design enables tall cover crops to be easily rolled down, crimped, and flattened to create a mat on the soil surface to enhance weed suppression and soil moisture conservation benefits (Fig. 5).

The powered roller/crimper for walk-behind tractors (Fig. 4B), another NSDL patented design, uses the same principles associated with larger field-scale roller/crimpers to accomplish mechanical cover crop termination for small-scale producers.

More detailed information regarding cover crop termination considerations are summarized in the 2016 Conference Fact Sheet *Terminating Cover Crops in a Conservation System*.

Fig. 5. Termination of cover crops using a four-stage roller/crimper. Photo courtesy of USDA-ARS, NSDL

Fig. 6. An example of two different strip tillage configurations designed to create a narrow zone of surface soil disturbance (left) compared to a wider zone of surface soil disturbance (right). Photo courtesy of USDA-ARS, NSDL

Strip tillage is a popular form of conservation tillage to alleviate sub-surface soil compaction, while maintaining aboveground surface residue across many areas of the Southern SARE region. In general, strip tillage implements consist of a coulter, to cut surface residue, mounted ahead of some type of shank designed to alleviate any soil compaction present underneath the crop row. Multiple configurations are available behind the shank to close the subsoil slit and prepare the seedbed, prior to planting.

Many of the available configurations behind the shank are designed to either minimize or maximize the tilled zone with some compromising between those levels of surface disturbance. The narrow zone of surface soil disturbance typically consists of pneumatic tires behind the shank to close the slit, while the wide zone of surface soil disturbance uses multiple sets of coulters and a rolling basket to create more surface soil disturbance (Fig. 6).

The narrow zone option leaves the maximum amount of residue on the soil surface following tillage for any given field and is popular for aboveground fruiting crops like corn (*Zea mays* L.) and cotton (*Gossypium hirsutum* L.). The wide zone option is favored by some growers producing belowground fruiting crops like peanut (*Arachis hypogaea* L.), particularly in twin-row configurations and with growers that just prefer a wider zone to plant into.

This product was developed with support from the Southern Sustainable Agriculture Research and Education (Southern SARE) program, which is funded by the U.S. Department of Agriculture—National Institute of Food and Agriculture (USDA-NIFA). Any opinions, findings, conclusions or recommendations expressed within do not necessarily reflect the view of the Southern SARE program or the U.S. Department of Agriculture. USDA is an equal opportunity provider and employer.