Agroecology News

Working to enhance the sustainability of South Carolina's cropping systems Fall, 1999

FIELD TOUR HELD ON JULY 15

Approximately 75 people attended the Agroecology program's 2nd Annual Summer Field Tour on July 15. The objective of the tour was to show South Carolina's agricultural leadership the latest agroecology research being conducted at the Pee Dee REC. In attendance were farmer leaders and representatives of farm organizations, agencies, and agribusinesses. The group was given a detailed look at the split-landscape field, in which narrow-row no-till corn was compared to conventionally tilled wide-row corn. In addition, conservation tillage tobacco was discussed along with various conservation tillage treatments for soybeans and cotton.

After touring Agroecology field sites at Pee Dee REC, the group went to the nearby Edwin Dargan farm where conservation tillage cotton grown with and without irrigation was observed. It was encouraging to see an outstanding farmer like Mr. Dargan utilizing many of the innovative concepts and ideas being researched by Agroecology scientists. After the Dargan farm tour, the group participated in a social hour and barbecue supper at the Pee Dee REC.

Figure 1. Participants registering for the field tour at Pee Dee REC

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SPLIT-LANDSCAPE STUDY UPDATE - CROP YIELDS

The split-landscape study is a long-term experiment conducted on a 14-acre site at the Pee Dee Research and Education Center at Florence, SC. The objective of the study is to compare traditional row-crop practices with innovative cropping systems for enhanced profitability and environmental protection. Table 1 describes the components of the two cropping systems compared in the study.

The innovative cropping practices used in the study include narrow row widths, conservation tillage, "total-loosening" deep tillage, transgenic technologies, and precision farming. Innovative practices were chosen for their potential to build up soil organic matter and maximize the benefits of crop residues, thereby alleviating the effects of drought stress, improving soil health, and reducing erosion and runoff. In contrast, the traditional practices center on disking and cultivating the soil, which are considered detrimental to soil quality.

Since 1998, Agroecology researchers have compiled extensive data sets from the split landscape field. This information includes crop yield; soil chemical and physical characteristics; pest populations; runoff of sediment, water and agrichemicals; economic data; and potential socioeconomic impacts from farmer adoption of new cropping systems.

This article summarizes the crop yield trends obtained since the cropping system comparison was initiated in 1997-98. Grain was harvested with a combine equipped with a yield monitor and GPS technology. Yield maps were generated with GIS software and are presented in Figure 2. Color yield

*See **Split-Landscape** on page 2*

PARTICIPANTS

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- Bill Patterson
- Virgil Quisenberry
- Emerson Shipe
- Horace Skipper
- Susan Wallace

USDA-ARS
- Phil Bauer
- Warren Busscher
- Jeffrey Novak

The Agroecology team is a multi-disciplinary group working together to identify innovative combinations of ecologically friendly production practices for increasing farmer profits. We are also developing Extension and classroom teaching programs related to agroecology projects and issues. This is the fourth in a series of newsletters about our activities. For an on-line copy of our previous newsletters plus additional information about agroecology program activities, visit our website at http://agroecology.clemson.edu.

Split-Landscape
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maps giving more detail can be found on the Agroecology website (http://agroecology.clemson.edu).

A wheat/soybean doublecrop was grown in 1997-1998. Wheat yields averaged 38 bu/ac for the Innovative cropping system and 33 bu/ac for the Traditional system (Figure 2). In the Traditional system, differences in wheat yield generally followed differences in soil type (Figure 3).

In contrast, wheat yields in the Innovative system were more uniform across the field, and most of the yield improvement (relative to the Traditional system) occurred on the sloping, lower-yielding areas. While yield improvement across all soil types is desirable, increased yields in areas which are generally low yielding provides more uniformity and allows farmers to more accurately match fertilizer and seed inputs to crop needs. This can lower farmer input costs and reduce the potential for environmental harm from excessive chemical application.

Table 1. Summary of treatments for the two cropping systems.

	Traditional System	Innovative System
1997-1998 Wheat		
land preparation	disked, chisel-plowed, smoothed	deep tillage with Paratill*; no disking
soil sampling / P application	bulk sampling / no P needed	grid sampling / P_2O_5 rates varied from 0 to 100 lb/ac
wheat variety / planting	Pioneer 2684 / conventional planting	Pioneer 2684 / no-till planting
1998 Soybeans		
land preparation after wheat	wheat straw burned; soil disked	straw not burned; no disking; Paratill
soybean variety / planting	NK S75-55 (not Roundup resistant) / in 30” rows with in-row subsoiling	NK S73-Z5 (Roundup Ready®) / planted no-till in 7.5” rows
herbicides / cultivation	conventional herbicides / 2 cultivations	Roundup applied pre-plant & 3 WAP / no cultivation
1999 Corn		
land preparation	disking	Roundup; no disking; Paratill
soil sampling / P application	bulk sampling / no P needed	grid sampling / 0 to 50 lb/ac P_2O_5

*Names are necessary to report factually on available data; however, Clemson University and the USDA neither guarantee nor warrant the standard of the product, and the use of the name by Clemson University and the USDA implies no approval of the product to the exclusion of others that may also be suitable.

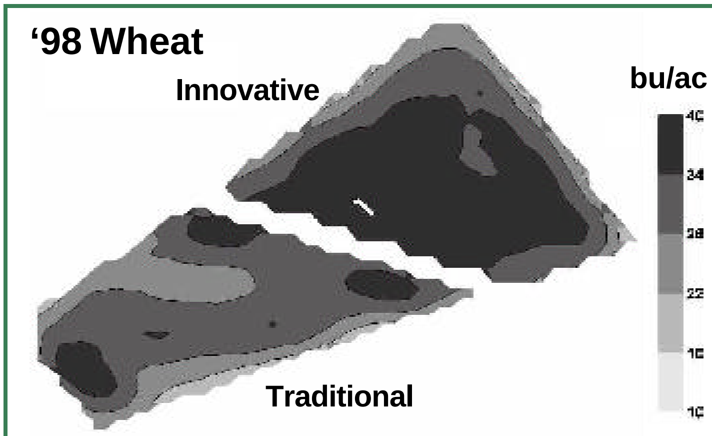
1998 soybean yields (Figure 2) generally followed differences in soil type in both cropping systems. Soybean yield averaged 26 bu/ac in the Traditional system and 21 bu/ac in the Innovative system. This is the first time in five years of research and on-farm testing of components of the Innovative system that we have seen a yield loss. Our previous work has shown average yield increases of 15 to 20% for soybeans grown in narrow rows with conservation tillage and total-loosening deep tillage.

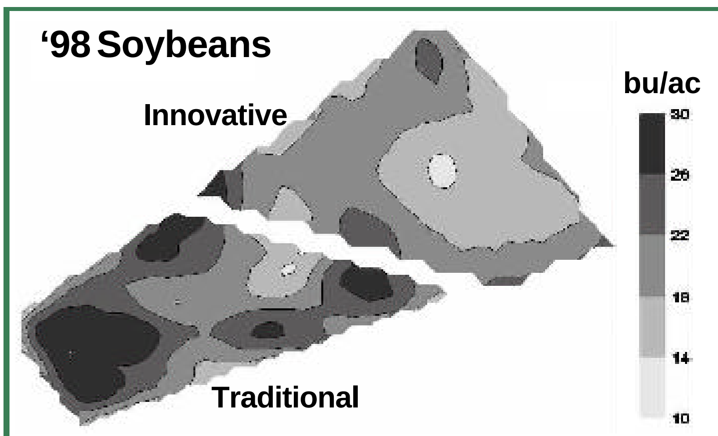
Although the exact cause of the yield reduction in the Innovative system will be difficult to pinpoint, the soybean variety used may have played a part. The varieties planted in the two cropping systems are said to be genetically similar, but the Roundup Ready® variety used in the Innovative system was recently reported to have less tolerance to rootknot nematode than the variety used in the Traditional system.

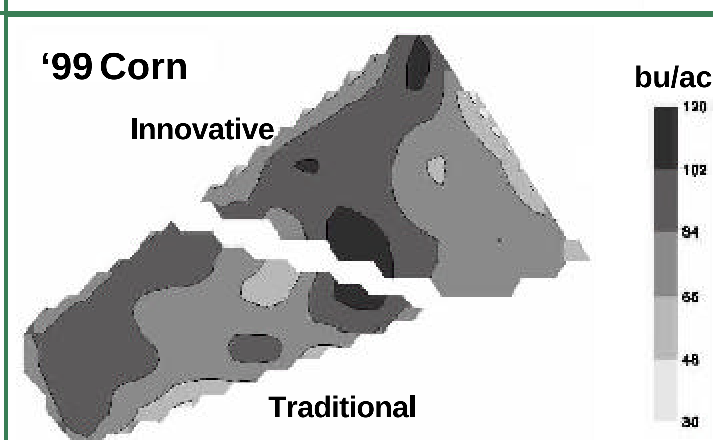
Figure 4 shows the results of rootknot nematode counts made on samples taken at the end of the soybean growing season. Rootknot nematode populations were higher in the Innovative system than in the Traditional system, and this likely influenced yields. These results demonstrate how one “weak link” in a cropping system can substantially change the outcome of a comparison.

An important observation made from this study is that obtaining a good stand is often a problem with wheat and

Figure 2. Yield maps for the split-landscape study







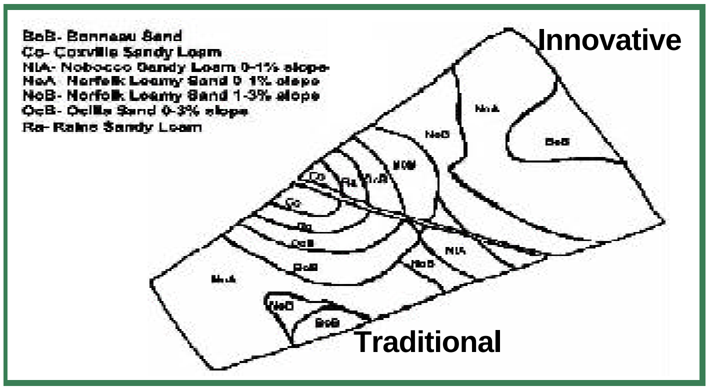


Figure 3. Soil types in the split-landscape study

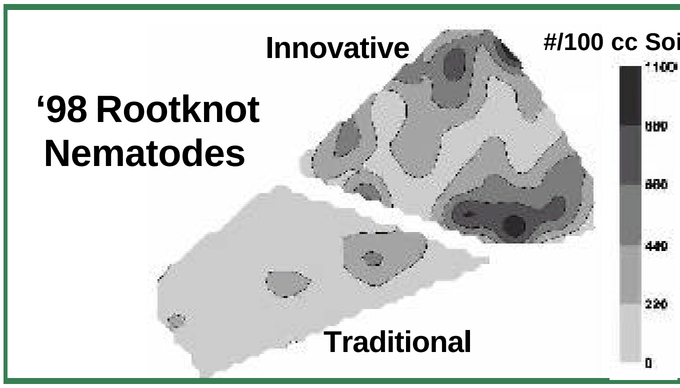


Figure 4. Rootknot nematode counts in the split-landscape study

soybean cropping systems involving conservation tillage. These problems are usually worse when no rainfall occurs for some time after planting. The reduction in seedling emergence with these innovative systems appears to be due in part to reduced seed-to-soil contact caused by residues being pushed into the furrow by seed planters. When a sandy soil is soft due to total-loosening with a winged deep tillage device, even the best precision no-till planters have a hard time cutting through plant residues. This fall, Agroecology scientists will begin collaboration with University of Georgia researchers to find solutions to this problem.

Corn was planted in the split-landscape study in 1999. Yields averaged 91 bu/ac for the Innovative system and 85 bu/ac for the Traditional system (Figure 2). The yield benefit of the Innovative system appeared to occur over most soil types in the field.

Sulfur deficiency and low soil moisture in the seed zone were two problems encountered this year, especially for the Innovative system in which 15" row widths, conservation tillage, and total-loosening deep tillage were used. "When using a winged deep tillage device for total loosening," explains Agroecology soil scientist Warren Busscher, "the roots usually explore more total soil volume early in the growing season, but they probably do not move to the clay subsoil as fast as with in-row subsoiling, and the subsoil is where most of the soil sulfur is found. Therefore, adding sulfur to the fertilizer may be more important with innovative systems than with traditional systems."

"Planting at the right soil depth is also important," notes Agroecology researcher Jim Frederick. "At planting, the soil may be dry in the top inch or so even when there appears to be plenty of water down deeper. Both disking and in-row cultivating tend to bring moisture up to where the seed is planted. This does not happen with innovative systems centering on conservation tillage, so it is very important that the farmer makes sure the corn seed is planted to a depth where there is sufficient soil water."

The split-landscape study compares cropping systems on a larger scale than in conventional plots. This allows Agroecology scientists to observe the benefits, as well as potential problems, associated with the new cropping systems that they are developing. Yield and environmental data collected thus far indicate that the new systems under development will be a plus for both the farmers of South Carolina and the environment. Environmental aspects of the study will be discussed in a future newsletter.

The cropping system comparison will continue with cotton grown on the split-landscape site in 2000, and the study is scheduled to continue with the wheat/soybean, corn, and cotton rotation in future years.

SUMMER INTERN "CROP" PRODUCED GOOD YIELDS

The Agroecology program was fortunate to have six outstanding undergraduate interns working at the Pee Dee REC this summer. They were Chuck Bonnett and Bhavini Patel from Francis Marion University, Daryl Curry and Shirelda Bell from South Carolina State University, Richard Pitts from Clemson University, and Marcus Washington, a South Carolina resident who attends Georgia Tech University.

According to Agroecology scientist Jim Frederick, "the internship program is held each year to give South Carolina undergraduate students working experience in the biological, agricultural, and environmental sciences and to foster greater cooperation among South Carolina universities". Partial funding for intern wages was obtained from SC Alliance 2020 and Sustainable Universities Initiative competitive grant programs.

The interns worked under the direction of Sue Robinson and Jim Frederick and assisted Agroecology scientists in research and Extension activities. Their research work included such responsibilities as data collection and maintenance of runoff plots, calibrating research equipment and assisting in preparing experimental plots, sampling for fire ants and thrips, taking photosynthesis measurements, soil sampling, and using GPS/GIS technologies.

The interns also assisted with planning and implementing the Agroecology arrangements for a field tour at the Pee Dee REC on July 15. This event also featured a tour of the farm of Edwin Dargan, a project cooperator and Agroecology program advisory panel member.

Figure 5. Interns (from left to right); Shirelda Bell, Chuck Bonnett, Marcus Washington, Darryl Curry, Bhavini Patel and Richard Pitts

Other educational activities included attending a crop scouting school at Pee Dee REC and a workshop on precision agriculture at Clemson University. The interns visited Agroecology team member Gloria McCutcheon in Charleston where they learned about biological control of pests, and they made a four-day trip to Clemson University to visit Agroecology team members and other scientists on campus.

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DEEP TILLAGE EQUIPMENT SALES TAKE OFF

Growers have taken to heart the deep tillage results from research studies conducted by South Carolina scientists. "Sales of deep tillage equipment that cause almost total loosening of the topsoil have risen dramatically," says Clark Rast, former sales representative with Implement Sales and now with Powell Manufacturing. Deep tillage is a necessary practice for crop production on sandy Coastal Plain soils because of the frequent presence of compacted layers.

"Over the past two years, we have sold close to $1,000,000 worth of deep tillage equipment in South Carolina, with the ParaTill being the most popular piece of equipment," reports Clark. "Even though the farm economy is down right now, we expect to sell another 25 to 30 Paratills in South Carolina this coming year," he says.

When comparing these numbers to an average of about one per year just five years ago, Clark credits much of the sales increase to the recent research conducted by Clemson University and the USDA-ARS unit in Florence. "ParaTills have been around for quite awhile. It's just that the research scientists are discovering new ways to use them," states Clark.

These numbers do not reflect sales of other popular "total-loosening" deep tillage equipment in the Southeast, such as the DMI Ecolo-Till and the Worksaver Terra-Max II. "Most of these total loosening devices are well-suited for the conservation tillage/narrow-row-width systems we are developing," states Jim Frederick, Agroecology research scientist. According to Frederick, the economic and environmental advantages that researchers are seeing with these new cropping systems will almost guarantee that these types of deep tillage devices will be popular with farmers for some time to come.