

Conservation Tillage in Arizona Cotton

*Method preserves
the environment,
reduces costs
and
preserves yields*

By Joanne Littlefield



Cotton in dead barley cover crop

Bill McCloskey

Agricultural producers today face the dilemma of rising production costs but stagnant prices for their crops. Add to that increased government regulation of dust emissions throughout Arizona and you have a group of farmers interested in learning about new information the university may have to enhance their bottom line.

Researchers at the University of Arizona are looking at ways to eliminate the number of times a farmer has to pass through the field with a tractor, saving money on fuel and labor without a loss in crop yield.

Cotton growers typically prepare and maintain fields by performing tillage (soil-disturbing) operations that include landplaning, leveling, several disking operations, chisel plowing, and cultivation for weed control and maintenance of irrigation furrows. Historically cotton growers had to follow Arizona statutes related to pink bollworm (*Pectinophora gossypiella*, Sanders) control which required some tillage following cotton harvest. Recent regulatory changes have allowed for a reduction in tillage when the cotton crop is followed with a small grain planting and irrigation.

Conservation tillage is defined as a production system that eliminates or reduces tillage operations to the minimum required to produce a crop, and in which 30 percent of the previous crop residue remains on the surface after planting. Advantages in other parts of the country have included an increase in the overall productivity of the soil by increasing the soil's organic material and moisture-holding capacity, and reducing erosion. While it has been adopted in other parts of the United States, conservation tillage hasn't caught on with Arizona growers until recently, in part because of recent rises in diesel costs. The Arizona research is looking at whether these advantages will hold true in desert soils.

For years Arizona farmers have been paying close attention to practices that reduce the use of pesticides while controlling insect and weed pests. They have also looked at improving irrigation efficiency and are now seeking additional areas where they can reduce costs. Tillage is one of them. Field crops extension agent Steve Husman is one of nine College of Agriculture and

Life Sciences (CALs) researchers investigating conservation tillage and the entire system of crop production: yields, economic input, weed and insect control, and irrigation efficiency.

"Part of this research involves collecting the data and identifying physical changes in soil structure, water infiltration rate, water-holding capacity, organic matter, weed control systems," Husman says. "These are all secondary possible benefits that will go along with the system. The short-term objective is to reduce costs through reducing the number of equipment passes across the field."

Field experiments were conducted at two CALs agricultural centers (Marana and Maricopa) and also with a commercial farmer in central Arizona. These trials included double cropping by planting oats or barley, without tillage, following a cotton harvest; 2004 was the third year of the study. What the researchers have discovered is a bit different than in other parts of the country where rainfall provides even irrigation to the crop in a field.

"One of our biggest problems is moving water down furrows," Husman says. "In a high-residue system you have a lot of vegetative trash that actually impedes the flow of water down the fur-



WeedSeeker® hooded sprayer in cotton

row. It's actually taking more water." Because this means more water is needed to sufficiently irrigate a crop, the scientists are looking at ways to alleviate that in the future.

"We're very sensitive to the cost and the volume of water because allocations are shrinking and we're in a drought," Husman says.

Weed control in conservation tillage systems must be addressed. Leaving crop residue—with more potential weed seed—in the fields and making fewer trips with the tractor to chop young weeds out naturally can lead to an increase in weed populations. UA weeds specialist Bill McCloskey has been evaluating herbicide weed control programs.

In all conservation tillage treatments for the study, weed control was obtained using only postemergent herbicides. Pre-emergent herbicides, it was discovered, would be used up by crop residue and grain crop stubble and not be available to knock out emerging weeds. In addition, McCloskey is also evaluating new herbicides applied with an automatic weed-sensing spot sprayer. The weed-sensing unit is used with herbicide applicators that have a plastic "hood" to prevent herbicide drift. The herbicide is concentrated only where it is needed, rather than broadcast over the entire field. Results have been dramatic.

"Using the weed-sensing automatic spot-spray technology reduced herbicide spray volumes between 47 and 99 percent," McCloskey reports.

Other objectives of the study include evaluating the direct planting of cotton into cover crop residues or grain stubble and small grain planting into cotton stalks; and analyzing changes in soil properties at the three sites.

"We're heading into the second phase," Husman says, "working collaboratively with commercial farmers to let them become partners in the continuing development and refinement of processes that will work on their farm. Each farmer's objectives are different; each farmer's soils are different; each farmer's slopes are different."

That input is essential to tailoring conservation tillage practices to specific locales, according to Husman. Growers are offered the loan of equipment specifically acquired for the project in exchange for feedback.

Equipment needs vary, and the researchers have already found that some adaptation was required.

"We're working with an equipment manufacturer that produces a one-pass tillage implement," Husman says. "It has ripper shanks down the center of the beds to allow free root development and water penetration."

Reducing production costs through conservation tillage is possible, according to data generated by the economist on the research team, Trent Teegerstrom. Although some cases of yield reduction and higher seed costs were noted, lower labor and machinery costs offset those. He also found that increased grain yield could

make up for the reduced cotton yields in a late plant system.

Teegerstrom's research determined that the inclusion of additional grain varieties possibly better suited to the conservation tillage system in Arizona could lead to increased yields and resulting higher income potential.

"In all, we've had a few successes and we definitely have identified some problems," Husman says. "Yet we still feel that there's essentially reason to continue in addressing some of the issues."

Working with commercial growers has a side benefit—or drawback—of informing the farming community in general about what is going on.

"If it doesn't work as well as what we suggested, the whole world will know about it, all their neighboring farmers," Husman admits. Yet if it does work well, that will also spread to surrounding farmers.

"I've learned in the 15 years of doing this that farmers tend to put more confidence or credence in what one of their peers or neighbors tells them than in what I might send them in the research report alone." 🌱

Conservation Tillage Project Research Team

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