New Sampling System Helps Growers Improve Cotton Fiber Properties

A researcher studying how cotton quality is affected by its environment has developed a new system that helps growers learn more about the fields in which their crops are grown.

The project involves a concept known as precision agriculture, which helps farmers make the best use of all parts of their fields by providing just the right amount of fertilizer, pesticide, and water. Of course, the top priority is to optimize farmers' profits.

Gretchen Sassenrath, a plant physiologist in the ARS Application and Production Technology Research Unit in Stoneville, Mississippi, worked with technician Ray Adams to design a cotton sampling system that helps determine the different fiber qualities present in a harvested field. This system complements the cotton yield monitor, which measures the quantity of cotton at any given position in the field.

Previous studies relied on hand-picking cotton at intervals throughout a field to make spatial maps of the fiber's properties. Picking cotton by hand is very labor intensive, so these studies were done on a smaller scale than is now possible. And because harvesting cotton with machines, as producers do, can alter fiber properties, the quality of hand-harvested cotton is not truly representative of the results the farmer receives from the gin.

Adams built a cotton sampler that attaches to the picker's chute. A lever switches a paddle gate in the picker chute and diverts some of the harvested cotton every 20 seconds into a sampler chute for collection and later analysis. The cotton sample, harvested from a known area of the field, is ginned in the lab and classed at the U.S. Department of Agriculture's Agricultural Marketing Service Classing Office. The fiber properties are then incorporated with the position data for entry into a database for spatial analysis.

The yield monitor, equipped with a Global Positioning System (GPS) receiver, allows a producer to collect and save information on the spatial variability of cotton yield. The GPS provides specially coded satellite signals that are processed by a receiver, which computes the position, speed, and time the sample was collected. The information about yield and fiber properties is then entered into a geographic information system (GIS) database.

The GIS software is used to translate that data into maps of different fiber characteristics—such as length, micronaire (fiber's fineness and maturity), strength, and color—as well as yield. Various colors are used to represent these different fiber properties on a map showing where in the field they were harvested.

Once the cotton fiber properties have been determined, the value of the cotton lint can be calculated from the same tables farmers use when selling their cotton. This information can also be entered into the GIS and used together with costs to determine overall profit margin.

Fiber Quality and Yield Quantity

Sassenrath is interested in improving cotton fiber quality. Developing a method of spatially sampling cotton during harvesting operations helps determine what underlying factors, such as soil moisture, may be affecting fiber properties. She says soil qualities can alter moisture and temperature in a small area of a field, changing the "microclimate" for that area. These variations can make the fiber properties of cotton plants in one area of the field better than those in another area.

The system has increased the scientists' understanding of how soil, environment, water, and nutrients contribute to

At ARS's Application and Production Technology Research Unit in Stoneville, Mississippi, (left to right) agricultural engineering professor Filip To, plant physiologist Gretchen Sassenrath, and technician Ray Adams perform final installation and testing of the automated sampling system on a cotton picker.

Ray Adams and Gretchen Sassenrath examine a map of fiber quality data created with a geographic information system.

fiber development, cotton yield, and quality. This information could lead to better management scenarios—and better cotton.

"Ideally, producers want to receive the best price for the whole harvest," Sassenrath says. "They want to optimize their profit margin by getting the highest return per acre. To do that, they have to know the yield per acre. By knowing the value of the harvested crop based on fiber properties, they can then calculate the profit margin by subtracting the production input expenses."

The GIS map shows growers which areas of their fields need more attention and which are producing cotton bolls with the best fiber properties. While yield is an important component of profitability, knowledge of fiber quality variability has contributed to the total knowledge of the production system.

Although the research team initially developed the sampling system for use in precision agriculture studies, researchers in other disciplines are also interested in it. Cotton breeders in particular have become aware of differences between hand- and machine-harvested fiber properties, and they're looking at the sampling system as a means of getting more accurate fiber-property measurements from their small test plots.

ARS isn't filing a patent on the system. Instead, it hopes to get the information out where other researchers can use it.

Sassenrath is collaborating with engineers at Mississippi State University in Starkville to automate the sampling system's trigger mechanism. Engineering professor Filip To and two graduate students are devising a mechanism for the cotton sampler paddle gate that will be triggered by the geoposition of the cotton picker. This will permit quicker sampling and greater accuracy in recording where a sample was collected.

At present, Sassenrath says, the system is a good research tool. "While the system has already contributed substantial information on fiber spatial variability and its dependence on underlying field variability, the extra work in ginning and classing the small samples limits the system's adaptability to a production setting," she says.

Sassenrath says her ultimate goal is to determine fiber quality onboard the picker and have the cotton classed right there in the field. This would give producers an instant measure of their crop's yield and quality.—By **Jim Core,** ARS.

This research is part of Integrated Agricultural Systems, an ARS National Program (#207) described on the World Wide Web at www.nps.ars.usda.gov.

Gretchen F. Sassenrath is in the USDA-ARS Application and Production Technology Research Unit, Jamie Whitten Delta States Research Center, 141 Experiment Station Road, P.O. Box 36, Stoneville, MS 38776; phone (662) 686-5289, fax (662) 686-5372, e-mail gsassenrath@ars.usda.gov. ★

Biological science aid Jason Corbit (left) records cotton sample weights while Gretchen Sassenrath (center) and biological science aid Ebony Scott gin the seed cotton samples in preparation for fiber analysis at the USDA Agricultural Marketing Service classing office.