Techniques for Growing Cotton More Efficiently

Locked into each cotton plant are the keys to managing its growth. By taking certain plant measurements and relating them to production practices, growers can produce better cotton crops.

Jeff Silvertooth, University of Arizona Cooperative Extension cotton specialist, uses these tools to help Arizona farmers produce cotton more efficiently. The overall system focuses on the fruiting cycles of the plant, which eventually produce the cotton fiber.

"We're trying to help farmers get maximum potential out of the first flowering cycle," Silvertooth said. "It's critical because it indicates the bulk of the potential crop yield."

Through a series of regular meetings, "hands-on" workshops and bulletins, Silvertooth and his associates work with growers to help them understand the monitoring and management process that takes some of the guesswork out of growing cotton.

The method combines basic plant measurements and heat unit information with plant tissue testing, fertilizer management, plant growth regulator use, irrigation management and timing of irrigation termination and defoliation.

"The critical thing in Arizona and the Southwest is to achieve efficiency economically, agronomically and environmentally. They all tie together," Silvertooth said.

It sounds complicated, but certain simple, easy-to-take measurements can provide valuable information about potential yields or problems with the crop.

They include plant height, number of mainstem plant nodes, the number of nodes above the latest blooms, and the emergence, size and number of the buds and bolls (fruit load), along with their location on the plant (mapping).

"They follow a rather predictable curve," Silvertooth said. He bases his information on five seasons of measurements taken on Pima and Upland cotton stands throughout Arizona.

Measuring these physical features on selected plants during the growing season and comparing them to the standard curve enables farmers to pinpoint the maturity status and condition of the crop.

"Growers can make this method field-specific," Silvertooth said.

Silvertooth encourages farmers to determine nitrogen fertilizer applications by sampling petiole (leaf stem) tissues, taking plant height to mainstem node ratios and counting the number of plant nodes above the latest white bloom (NAWB). These measurements indicate whether the cotton has reached a stage of high fertilizer demand.

Pre-season soil tests also indicate fertilizer needs.

The University of Arizona Cooperative Extension provides weekly advisories during the cotton season to keep growers up-to-date on weather, crop development, insects and management suggestions. Ten cotton production areas in Arizona currently receive these bulletins.

Farmers can obtain the weekly advisories by mail or facsimile machine from their county extension offices, or through downloading the information directly from Arizona Meteorological Network (AZMET) weather stations to a modem-linked computer.

At the beginning of the season, the publications stress planting cotton varieties according to soil temperature and heat unit accumulation, rather than by calendar dates.

Measurements of heat accumulation during the spring help determine when conditions are warm enough for planting. They also indicate the "planting window," when to plant to avoid full-scale pink bollworm emergence during early square (bud) formation.

Later in the season, each stage of cotton growth correlates with certain heat accumulation levels. The heat unit accumulation since the date of planting (HUAP), listed in the advisories, helps predict the early stages of cotton development.

Coupled with the planting date, the irrigation termination date (IT) has a major impact on the quality and quantity of cotton harvested.
The decision depends on the type of cotton and when it was planted. Silvertooth and other cotton researchers have issued guidelines for farmers to follow in deciding when to halt irrigations and harvest the crop. Crop production costs for extra irrigations, defoliation and insect control all affect this decision.

"The bottom line is you can get more yield if you stay in the field longer, but how much will it cost?" Silvertooth said. "The trend now is to go through the fruiting cycle as quickly as possible, terminate the irrigations and get out."

Silvertooth acknowledges that it is a long, slow process to educate people in the use of these monitoring tools, but says that about 60 percent of the cotton growers in the state are now familiar with the techniques.

"I've had very positive feedback from consultants, managers, farmers and producers," Silvertooth said.

"I think right now we have the basic set of tools. It's a process of refinement and modification from here." ✴

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**An Alternative Paper Crop from the Southwest**

Not all paper comes from trees. Some desert plants also can produce fibers suitable for paper making.

Steven McLaughlin, an assistant professor in the University of Arizona Office of Arid Lands Studies, is working with private industry to domesticate two rare species of *Hesperaloe* as a source of fiber for the specialty paper market.

Native to northern Mexico, *Hesperaloe funifera* and *Hesperaloe nocturna* are related to the century plant. Both feature a rosette of strap-like leaves yielding long, thin, tough fibers suitable for filters, tea bags, currency and other specialty papers.

They differ in their leaf size: *H. funifera* produces wide, stiff leaves, but *H. nocturna*’s are narrow, pliable and more numerous.

Paper made from *Hesperaloe* fibers is strong, bright without bleaching and recyclable.

"It’s really strong, but soft, paper," McLaughlin said. "It feels like felt, but it’s nowhere near as thick." He was the first to investigate *Hesperaloe* fibers for paper.

Paper companies normally import specialty fibers, sisal in particular, at high prices and in quantities that fluctuate unpredictably from year to year. Some of the companies, and the U.S. Department of Agriculture, are funding McLaughlin's work because they're looking for a way to produce paper fibers more cheaply and consistently in the United States.

Although sisal and kenaf are fibrous plants already grown for their pulp in other parts of the country, neither does well in Arizona's climate. Sisal does not tolerate frost, and kenaf uses too much water. In contrast, *Hesperaloe* species use only two to three acre feet of water and actually prefer lower nighttime temperatures.

Tucson's full sun, cool nights and long, dry growing season ideally suit this perennial. Although requiring a lot of light, they belong to a group of plants capable of photosynthesizing at night, when evaporation is lower.

McLaughlin chose *Hesperaloe* after analyzing the fiber content of 28 plants native to the arid Southwest. Both *Hesperaloe* species had the longest and thinnest fibers, indicating fiber strength. He also included agaves, yuccas and beargrass in his research.

"The fibers of *Hesperaloe* are extraordinarily strong, so we are targeting specialty papers that have many rigid regulations for strength and fiber," McLaughlin said.

A five-year-old experimental farm at the UA Bioresources Research Facility in Tucson has two acres of *H. funifera* and *H. nocturna* cultivated in rows on drip-irrigated plots. McLaughlin and his associates are testing plant spacings, fertilizer needs, water requirements, weed problems, and growth and yield differences between the two species.

Initially slow-growing, the *H. funifera* crop was large enough after three years for the first harvest. The plants' four-foot leaves were hand-cut nearly to the ground, then chopped and processed to reduce the fibers into a pulp ready for making into paper. The fibers are pulped wet.