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## anaging nitrogen in irrigated cotton

Guidelines focus on reduced rates

By Susan McGinley

Nitrogen fertilizer helps plants grow and produce, but too much can cause environmental problems, including leaching of nitrogen compounds into groundwater. The traditional approach to nitrogen management in irrigated cotton has been to push for maximum high yields by applying large amounts of nitrogen fertilizer. Historically, in many parts of Arizona, nitrogen application rates have exceeded 200 pounds per acre per season. Although yields may increase, there are serious drawbacks to this practice.

“Over the last ten to fifteen years the luxuriant vegetative growth resulting from these high nitrogen applications has contributed to late season problems with higher populations of damaging insects, and more diseases in Arizona’s cotton fields,” says Jeff Silvertooth, head of the Department of Soil, Water and Environmental Science at the University of Arizona. “Studies during the same period have shown that aggressive nitrogen fertilizer application can actually increase the loss of nitrogen from the soil.” In the past, nitrogen fertilizer has been relatively inexpensive for Southwest desert growers, but early in 2001 those costs rose approximately 30 percent.

To help Arizona cotton growers adjust nitrogen applications in their fields, UA researchers in the College of Agriculture and Life Sciences studied and documented nitrogen uptake patterns and requirements in the crop at the UA’s Maricopa, Marana, and Safford Agricultural Centers and many farmer cooperator fields in central and western Arizona. Their research was funded in part by the national Cooperative Extension Water Quality Program, the Arizona Cotton Growers Association, and Cotton Incorporated.

The scientists determined the period of crop growth and development where nitrogen requirements for maximum yields are greatest. Additional studies showed that pre-season and late season applications of fertilizer nitrogen are more subject to loss by leaching. Silvertooth and his team then designed nitrogen management guidelines and recommendations that pinpointed the best times to apply nitrogen in the proper amounts.

Current recommendations advocate the use of a nitrogen fertilizer window, split nitrogen applications, and plant measurements to assess crop fruit retention and vigor. Growers are encouraged to check in-season nitrogen fertilizer status through petiole (leaf) tests, and to use growth and development indices that have been developed for irrigated cotton based on heat units. Over the last 14 years this comprehensive nitrogen management strategy has been implemented in a statewide extension education plan for cotton growers that includes bulletins, reports, articles and grower meetings.

By reducing nitrogen applications, Silvertooth believes growers could maintain yields, reduce environmental impacts, and save money. The cost of cotton production has been high during the last several years, but the market price has been low. UA demonstration projects on cooperating cotton farms have realized yields equivalent to commercial yields, using less nitrogen input, and saving approximately \$30 per acre in nitrogen application costs.

“If adopted statewide, the annual savings, at February 2001 nitrogen prices (still current), would be about \$15-\$20 per acre,” Silvertooth says. “If 200,000 acres of the total cotton acreage in Arizona were affected, this would equate to \$3 to \$4 million in savings to the growers. Growers would be using an average of approximately 100 to 150 pounds per acre, compared to a more common rate of about 200 pounds per acre, a 25 to 50 percent reduction.”

One intriguing factor these experiments have revealed is the surprisingly strong nitrogen supplying power provided by the desert soils in Arizona, according to Silvertooth. He notes that soil mineralization and immobilization transformations are very dynamic and important in the process of releasing and providing plant-available forms of soil nitrogen. Future studies will focus on the residual nitrogen characteristics at each site as developed by the nitrogen fertilization regimes that have been employed at the study sites for 8 to 12 consecutive years. W

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Joanne Littlefield

Cotton bolls at Maricopa Agricultural Center

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#### CONTACT

Jeff Silvertooth  
(520) 621-7228  
silver@ag.arizona.edu