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In-Season Nitrogen Sensing Improves Fertilizer Efficiency

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LUBBOCK -- Farmers in the western United States can reduce in-season nitrogen use in irrigated cotton without sacrificing yield potential by using commercially available nitrogen status sensing tools, says a Texas A&M University soil fertility scientist.

Producers in the arid west currently base nitrogen fertilizer applications on the results of soil nitrate tests. But in-season monitoring of plant nitrogen status may lead to more accurate nitrogen fertilizer recommendations because these typical spring soil nitrate tests do not account for nitrate loss or gain between soil sampling and planting, noted Kevin Bronson, associate professor of soil fertility and nutrient management with the Texas Agricultural Experiment Station.

Bronson led an interdisciplinary team of scientists to test multi-spectral reflectance and chlorophyll meter measurements as in-season nitrogen decision aids at two irrigated west Texas cotton sites in 2000 and 2001.

“We made multi-spectral reflectance measurements using a CropScan MSR16R spectroradiometer at a height of 20 inches above the cotton canopy. We used a Minolta SPAD 502 chlorophyll meter to take readings on plant leaves,” Bronson said.

Based on these readings, the team applied 30 lbs. per acre of nitrogen in-season to their reflectance and chlorophyll meter plots when the sufficiency index relative to well-fertilized plants was less than 0.95 at early squaring, early bloom and peak bloom.

“In 2000, we applied 30 to 90 lbs. per acre less nitrogen than a soil-test recommendation of 120 lbs. per acre. We achieved yields similar to plants receiving 120 lbs. per acre,” Bronson said. “In 2001 in Lubbock, our cotton yields reached our goal of 2.5 bales per acre. In three of four cases, our nitrogen applications based on in-season monitoring equaled 90 lbs. per acre soil test nitrogen applications.”

Even so, in-season nitrogen sensing won't replace spring soil nitrate tests, he said.

“It can, however, reduce in-season nitrogen fertilizer rates in low-yielding seasons and it can help match soil test recommendations for yield potential in high-yielding seasons,” Bronson said. “But we still recommend pre-plant soil testing to accurately gauge early season nitrogen needs when plants are too small to use monitoring instruments, and for determining nutrient needs besides nitrogen.”

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In addition to helping producers save dollars by reducing nitrogen applications, these monitoring tools can help protect ground and surface waters from nitrate contamination by reducing the amount of residual nitrate nitrogen in the soil at harvest, Bronson added.

The results of this research were published in the September/October 2003 edition of the Soil Science Society of America Journal, published by the Soil Science Society of America. Tess Chua of Texas A&M is the senior author. Co-authors include Jon Booker, Wayne Keeling, Jim Bordovsky and Robert Lascano, all of Texas A&M University; Cary Green and Eduardo Segarra, of Texas Tech University; and Arvin Mosier, with USDA-ARS