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Conservation Systems Research

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RESEARCH PROJECT DESCRIPTION No. 23

Nitrogen Management for High Residue Conservation Tilled Cotton in the Tennessee Valley

Cotton in high-residue system

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"The Tillage Lab" USDA ARS NSDL Conservation Systems Research Unit

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The Challenge

The Tennessee Valley is a productive physiographic region. Cotton is the major cash crop in the area. In Alabama, 60% of the area is classified *Highly Erodible Land* (HEL) and about 70% of the cotton grown in this region of Alabama is grown with conservation tillage. Most of the conservation acreage uses a rye or wheat cover crop. The rapid shift to higher residue conservation systems has resulted in problems with N deficiencies. Nitrogen recommendations based on conventional tillage continuous cotton are not applicable to the new systems. Information is needed to improve N management strategies in conservation systems using cereal cover crops.

"... 120 lb N/A may initially be needed for cotton grown in high-residue systems ... N requirements may be reduced over time ... as C and N pools reach new equilibriums."

The Experiment

Initially, coordinated replicated field experiments are restricted to the Tennessee Valley Research and Extension Center. The studies compare the old conventional tillage system to the now-recommended high-residue rye cover crop system with fall, non-inversion tillage. Interactive components researched within the system include: 1) effect of fertilization of cover crop on N availability to cotton; 2) N sources; 3) N application methods; 4) N application timing; and 5) N rates. Variables to be evaluated for potential use in revising N management recommendations for growers include: 1) soil C and C:N ratio; 2) residual fall and pre-plant soil nitrate; 3) standard petiole and leaf N analysis; 4) SPAD chlorophyll meter; 5) cover crop biomass and C:N; 6) seasonal soil nitrate; 7) ginning percentage; and 8) lint quality. In some experiments, ^{15}N will be used to partition N into availability pools. Nitrogen recommendations for the conservation system will be developed from the above data based on minimizing inputs and economics of N sources and application methods. Information, including input costs and net returns, will be transferred by field days, extension publications, producer workshops, and other means.

What We Have Learned

Lint yield and leaf N at 1st bloom data suggest that 120 lb N/A may initially be needed for cotton grown in high-residue (>4,000 lb residue/A) conservation systems in the Tennessee Valley. We speculate that N requirements may not be as high for systems with less residue and that N requirements may be reduced over time in high residue systems as soil C and N pools reach new equilibriums. Nitrogen applied at planting generally resulted in greater lint yields (803 lb lint/A in 2000; 57 lb lint/A in 2001) for both sources (UAN and AN) compared to split applications (739 lb lint/A in 2000; 962 lb lint/A in 2001). Ammonium nitrate applications resulted in greater yields when broadcast compared to banding, while efficiency of UAN application was increased when banded. Using 120 lb N/A, at a cost of $0.19/lb N for UAN ($22.80/A) and $0.28/lb N for AN ($33.60/A), producers can save $10.80/A by using UAN rather than AN. Applying all N at planting saves trips across the field, reducing operating costs and compaction. Banding all UAN at planting may help producers maximize cotton yield and profit in high-residue conservation systems in the Tennessee Valley.

Measuring leaf-N with SPAD

Related Publications

Reiter, M.S., D.W. Reeves, and C.H. Burmester. 2002. Nitrogen Management for Cotton Grown in a High-Residue Cover Crop Conservation Tillage System. pp. 136-141. In E. van Santen (ed.) Proceedings of the 25th Annual Conservation Tillage Conference for Sustainable Agriculture. Auburn, AL. 24-26 June, 2002. Alabama Agric. Expt. Sta. Spec. Report No. 1.