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Nutrient Management of Conservation-Till Cotton in Terminated-Wheat

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A conservation-till cotton production system using wheat or rye winter cover, terminated with glyphosate has gained increased producer acceptance over the past 10 - 15 years. The winter cover is effective in reducing wind erosion, especially in the sandy, highly erodible topsoils of the Southern High Plains. This practice is a good way to meet conservation compliance for participation in federal programs. The small grain cover also has been shown to have the benefits of minimizing evapotranspiration and improving water use-efficiency, and of reducing wind erosion and wind-blown sand damage to seedlings (Lascano et al., 1994). Conservation-till cotton in the High Plains can be as productive as and more profitable than conventional-till cotton (Keeling et al. 1989). The added profit in conservation-till cotton is mostly due to decreased trips across the field for land preparation, sandfighting, and in-season cultivation. Herbicide costs are generally greater in conservation-till cotton.

A major benefit of conservation-till crop production is the build-up of soil organic matter. Soil organic matter is an important storehouse of nutrients such as nitrogen and sulfur. Soil structure and water relations are also improved with increased soil organic matter. Continuous cotton cropping systems return little residue to the soil such that many High Plains cotton soils are low in soil organic matter. The table below shows that on an Acuff loam at Lubbock soil organic matter shows an increasing trend after only 3 years of conservation-till terminated- wheat cotton compared to conventional-till with no winter cover. Soil organic matter build-up is more rapid in irrigated than in dryland cotton. This is probably due to higher cotton biomass production and more favorable moisture conditions for decomposition of residue.

Table 1. Soil Organic Matter Concentrations (%) in 0- to 6-inch topsoil after 3 years of conventional- and conservation-till cotton cropping.

	Dryland	75 % ET Irrigation
Conventional-till	0.86 ± 0.01	0.86 ± 0.02
Conserv.-till/Term. Wheat	0.91 ± 0.02	0.95 ± 0.03

Research at Lubbock has shown that nutrient management of conservation-till cotton does vary from conventional-till cotton (Bronson et al. 1999). The following figure shows that an additional 30 lb nitrogen/ac is required for the optimum nitrogen fertilizer rate in conservation-till cotton compared to conventional-till cotton. This modest amount of extra nitrogen is needed by the soil microorganisms involved in the decomposition of the fresh cover crop residue. Nitrogen deficiency and a subsequent yield depression is possible if this additional nitrogen is not applied. As we stated, the conservation-till/terminated wheat system will build up soil organic matter and increase the nutrient supplying capacity of the soil. However, the nitrogen dynamics are such that the 1 to 2 t/ac of fresh winter small grain residue, which is very low in nitrogen, require the extra 30 lb nitrogen/ac at time of cotton planting for the microorganisms' nitrogen needs. This modified nitrogen management of conservation-till cotton applies only to irrigated and not to dryland cotton. The amounts of phosphorus and zinc fertilizer, the other major nutrients in cotton, will not differ in conservation-till cotton.

Depth of soil sampling is a topic that deserves more attention. Our research indicates that deep-rooted plants like cotton make use of nitrate down to the 2- foot depth. Prediction, therefore, of the response of cotton to nitrogen fertilizer improves by using soil nitrate data from 0 to 2 feet. This is especially true in soils with sandy surface layers and sandy clay loam subsoils, such as the Amarillo sandy loam. In this soil, relying on soil nitrate levels in the 0- to 6-inch layer can be misleading. We have observed several cases where, due to leaching during the spring months, the Amarillo topsoil in the spring had little or no nitrate and the subsoil contained 50 to 100 lb nitrate-N/ac.

Phosphorus and zinc are not as mobile in soil as nitrate, and therefore they do not need to be analyzed in deep soil samples. In fact, in conservation-till systems (and in dryland systems) most of the phosphorus is often in the top 2 inches of 6-inch surface soil samples, which when dry is not utilized by plants (Provin and Pitt, 1999). In these cases 2- to 8-inch soil samples would be recommended for phosphorus determination. Another important phosphorus issue in the conservation-till cotton system is that the small grain cover crop is more sensitive to low to medium soil test phosphorus levels than is cotton. In other words, your phosphorus fertilizer and soil test level management should be for

the wheat, and Bray or Mehlich phosphorus test levels in soil should be maintained at 30 ppm or greater.

References

- Bronson, K.F., J. W. Keeling, A.B. Onken, D.M. Nesmith, J.L. Mabry, and J.D. Booker. 1999. Nitrogen and water response of conventional-till and conservation-till cotton in the Texas High Plains. 1999 Proceedings Beltwide Cotton Conferences vol. 2. p. 1271. National Cotton Council of America, Memphis, TN.
- Keeling, W.J., E. Segarra, and J.R. Abernathy. 1989. Evaluation of conservation tillage systems for cotton on the Texas Southern High Plains. *J. Prod. Agric.* 2:269-273.
- Lascano, R.J., R.L. Baumhardt, S.K. Hicks, and J.L. Heilman. 1994. Soil and plant evaporation from strip-tilled cotton: measurement and simulation. *Agron. J.* 86:987-994.
- Provin, T. L. and J. L. Pitt. 1999. Testing Your Soil. How to collect and send soil samples. Texas Agricultural Extension Service Publication no. L-1793.

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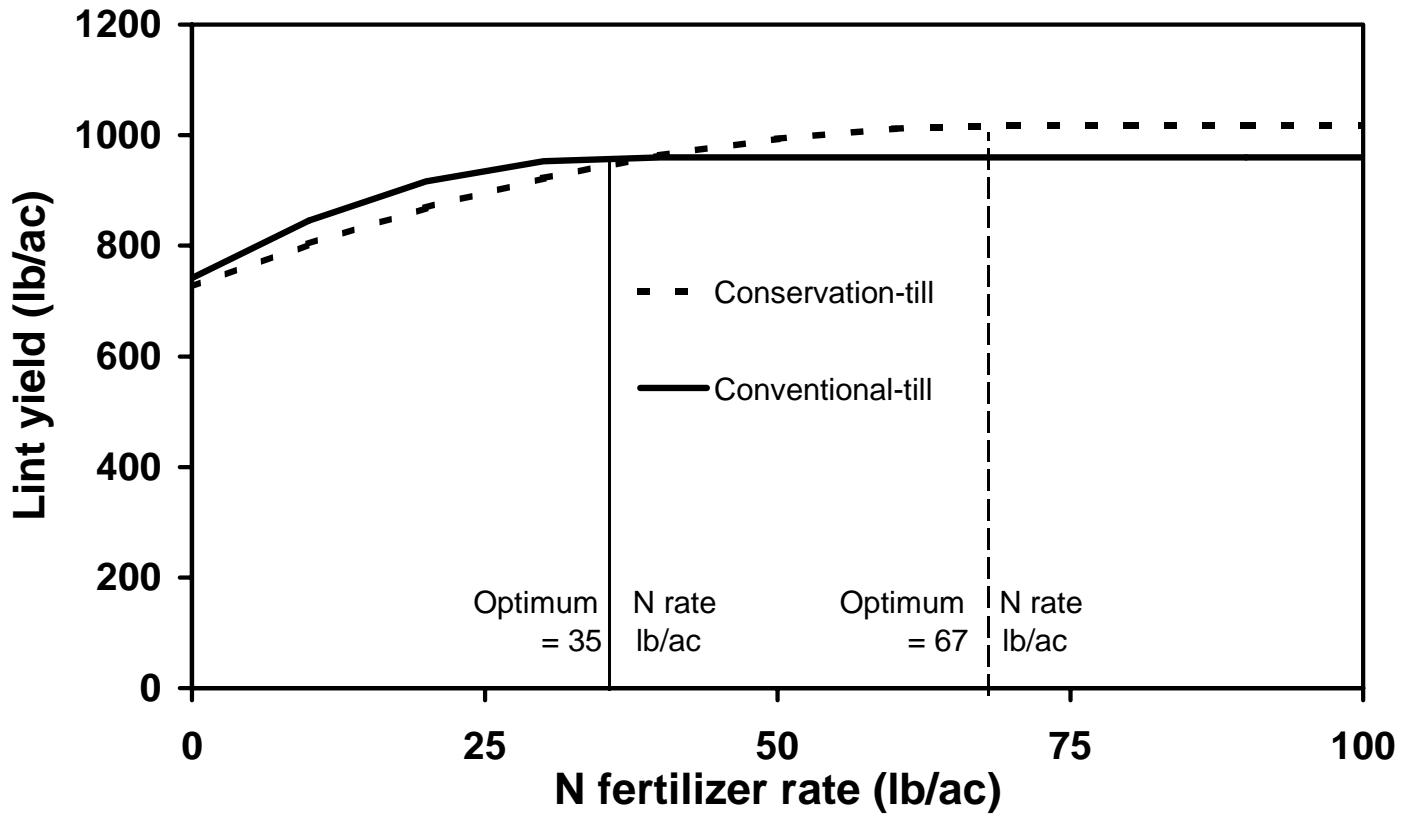


Fig. 1. Optimal N fertilizer amounts required for irrigated conservation-till terminated-wheat cotton and conventional cotton.