Profitability of Enhanced Efficiency Urea Fertilizer in No-Till Corn Production

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Abstract
Nitrogen (N) is an expensive input in corn production that is difficult to manage in farm fields. Applied N can be lost to nitrification and to the air through ammonia volatilization. Efficient management of N in corn is important to reduce nutrient and sediment loading to local and regional water bodies in the Mississippi River Basin and it is also an important priority for the USDA Natural Resources Conservation Service.

For no-till (NT) corn production in Southeast and Tennessee, ammonium nitrate (AN) was the primary N source, which is a much more stable source of N and has minimal ammonia volatilization. However, due to security reasons, AN has become difficult to purchase and most producers broadcast urea on soil surface. Urea has considerably amount of N loss due to Ammonia volatilization and nitrification.

Enhanced efficiency (EE) N fertilizers have been developed to reduce N losses from fertilizer such as urea and to improve N use efficiency in crop production. These products contain additives that work either as nitrification inhibitors or urease inhibitors or to coat the fertilizer with a polymer to slow the release (controlled release) of N to the soil, which are marketed as environmentally smart N (ESN). For producers to adopt EE N fertilizers, the revenue gained from yield increases must be greater than the cost of the product. Many studies have examined the effects of these products on yield, but little research exists on the profitability of these EE N fertilizers.

This study determined the effects of EE urea fertilizers on NT corn (Zea mays L.) yields and net returns (NRs) in Tennessee.

Corn yields were from experiments conducted from 2013 through 2015 at three locations in middle and west Tennessee (Springfield, TN; Milan, TN; and Jackson, TN). Corn was grown using University of Tennessee Extension recommended NT corn production practices. The plots at each experiment site were fertilized for P and K as needed according to University of
Tennessee soil test recommendations by Mehlich I soil test prior to planting. The experimental plots for each N treatment were replicated four times in a split-plot design. Two N fertilization rates of 110 and 150 lb/acre were assigned as the main plot treatments. Each fertilizer main plot was split by randomly assigning seven sub-treatments including no N fertilizer, AN, untreated urea, urea + 30-40% MICP (Nutrisphere-N, Specialty Fertilizer Products, LLC, Leawood, KS), urea + 20% NBPT (Agrotaín, Koch Agronomic Services, LLC, Wichita, KS), urea + 26.7% NBPT (Agrotaín Ultra, Koch Agronomic Services, LLC, Wichita, KS), and PCU (Environmentally Smart Nitrogen, Agrium U.S., Inc., Loveland, CO). The no fertilizer control was used to determine yield differences for corn treated with N fertilizer. The AN control was used to compare yields with corn fertilized with untreated urea or EE urea fertilizers. Net returns (NR) by N fertilizer rate and EE urea treatment were compared to no N fertilizer and AN controls. Breakeven and sensitivity analysis was used to compare yields and identify the threshold of positive NRs for using EE urea fertilizer relative to AN (little to no N loss).

For the EE urea fertilizer treatments, yields and NRs for urea + MICP were not significantly different from untreated urea. However, three EE urea fertilizer treatments did provide significantly higher yields and NRs (urea + 20% NBPT, urea + 26.7% NBPT, and PCU) than untreated urea, but yields and NRs for these EE fertilizers were significantly below those of AN. Results also indicated that the lower NRs for urea + NBPT and PCU held for AN fertilizer price premiums relative to urea of $0/lb N and $0.17/lb N that were observed in Tennessee between 2000 and 2015. With the growing reliance on urea fertilizer in NT corn production in Tennessee because AN fertilizer has become increasingly unavailable, however, urea + NBPT and PCU offers the greatest potential to improve expected NRs relative to untreated urea. Whereas, urea + MICP was not effective at providing higher yields or NRs than untreated urea under NT growing conditions in Tennessee.