

MAKING UREA WORK IN NO-TILL

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Abstract

No-till and reduced tillage production systems are widely used today in the United States as well as around the world due to their capacity for reducing soil erosion and topsoil loss, reducing phosphorus movement to surface water, and reducing labor, fuel, and equipment requirements. In no-till systems, an average of 25% of the N applied as broadcast urea can be lost via ammonia volatilization. Therefore, N losses due to ammonia volatilization will decrease corn and wheat yields, independently of other restrictions that may occur. The availability of ammonium nitrate as a low-risk granular N source for use in no-till has been declining in the United States while availability of urea has been increasing since much of the nitrogen production in the rest of the world is urea. The shutting down of North American ammonium nitrate and ammonia plants is another important factor that will contribute to an increase in urea use in the near future. The objective of this project is to evaluate several strategies to reduce the risk of ammonia volatilization loss from urea applied to no-till corn and wheat. Strategies used in two corn and two wheat trials included treating urea with urease inhibitor (Agrotain), nitrification inhibitor (DCD), use of polymer coated urea, gel coated urea, and knife injection of urea. Ammonium nitrate, anhydrous ammonia, and urea-ammonium nitrate solution were also used in the trials. Reflectance values were taken during crop development to support evaluations of treatment effectiveness based on yields. In two low-yielding site-years, no treatment had better results than broadcast urea. In two high-yielding site-years (one for each crop), ammonium nitrate, urea with Agrotain, and urea with Agrotain and DCD produced higher yields than broadcast urea. Knifed ammonium nitrate or anhydrous ammonia, used only in corn, produced better yields than broadcast urea, but knifed urea did not. Urea-ammonium nitrate solution treatments had lower yields than urea in two site-years. Agrotain was effective at improving yields from broadcast urea, but yields were not improved by tillage, knifing, gel coating, or polymer coating of urea. Conclusions about treatment effectiveness at delivering N to the crop based on yield results were in most cases supported by reflectance measurements.

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Our cover: To world food security and agricultural production, the Haber-Bosch process has been the most economical means for fixation of nitrogen for fertilizer. Fritz Haber won the Nobel Prize for Chemistry in 1918 and Carl Bosch shared the prize in 1931.