MICHIGAN STATE UNIVERSITY | Extension
Courtesy of MSU Extension.
For additional information, visit news.msue.msu.edu.

FACTSHEET ON SOIL FERTILITY AND NUTRIENT MANAGEMENT

Use of Controlled Release Nitrogen Fertilizer on Corn and Wheat

George Silva

Efficient nitrogen (N) fertilizer use is increasingly important with rising costs and potential environmental concerns. Important N management decisions are choosing the right rate, source, timing and placement. Common N fertilizers such as anhydrous ammonia (82% N), urea (46% N) and urea ammonium nitrate (UAN) (28% N) are susceptible to losses from leaching, denitrification, and volatilization, particularly when large doses are applied before or at planting. Under normal growing conditions, peak N uptake in corn occurs about six weeks after planting when plants are 12-15 inches tall. During this period unpredictable spring rainfall and temperature conditions would predispose soil N to environmental losses. With the high N prices, this would mean a substantial economic loss as well.

Michigan State University currently recommends about 20-40 lb. N/A as a starter and the balance of corn N needs to be sidedressed in June. This is a rational approach, but some corn producers have reservations because of the narrow application window, unpredictable rain, added fuel costs, and time demands on pre-sidedress soil nitrate testing. Low-cost anhydrous ammonia is still widely used for corn, but it is losing favor because of liability, theft, freight issues and increasing application costs.

New controlled-release fertilizer technology gives farmers the convenience of applying N ahead of planting while potentially achieving high N efficiencies and minimizing environmental risks. Environmentally Smart Nitrogen (ESN®) is a product where urea is coated with a semi-permeable polymer, resulting in a temperature-controlled N release in synchronization with corn growth and N uptake. Its controlled-release qualities lower nitrogen losses from volatilization and leaching.

ESN ON CORN PRODUCTION

Michigan State University Extension conducted on-farm trials in 2004, 2005 and 2006 to determine if ESN, particularly the pre-plant incorporated treatments, were as effective as side-dressed anhydrous ammonia, urea and UAN. Normal growing conditions prevailed in 2005 and 2006. In 2005, ESN and anhydrous ammonia were applied at the rate of 120 lb. N /A. The corn yields were identical (Figure 1). The 2006 trial compared N fertilizer sources, rates and application treatments listed in Table 1. The corn yield from ESN was not significantly different from urea and UAN (Figure 2). The drawbacks of ESN appear to be that it is more expensive than urea and it needs to be incorporated after application.

The 2004 was a very unusual year in terms of May rainfall. The ESN was applied on April 28 at the rate of 120 lb. N/A. Corn was planted on April 29. This field received an unprecedented 12.2 inches of rainfall in May. The anhydrous ammonia treatment was sidedressed on June 19 after the flooding. The corn yield with ESN treatment turned out to be significantly lower than anhydrous ammonia (Figure 3). It is conceivable that ESN lost most of its N under these conditions just like any other soluble N source. In contrast, the anhydrous treatment reached the yield goal during the season. **A word of caution on ESN!** Under prolonged flooded conditions in the spring, even ESN was susceptible to N losses.

Figure 1. Corn yield— ESN versus anhydrous ammonia 2005

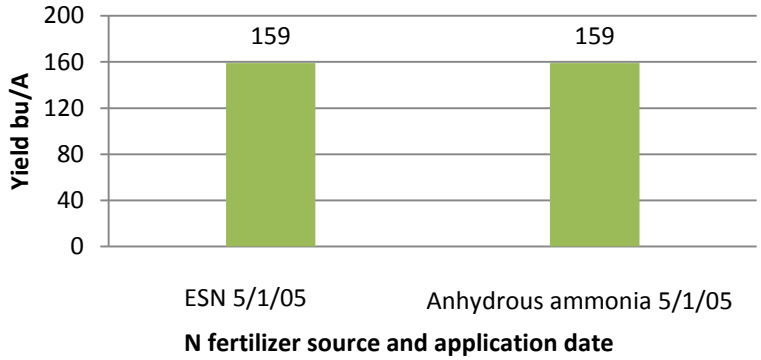
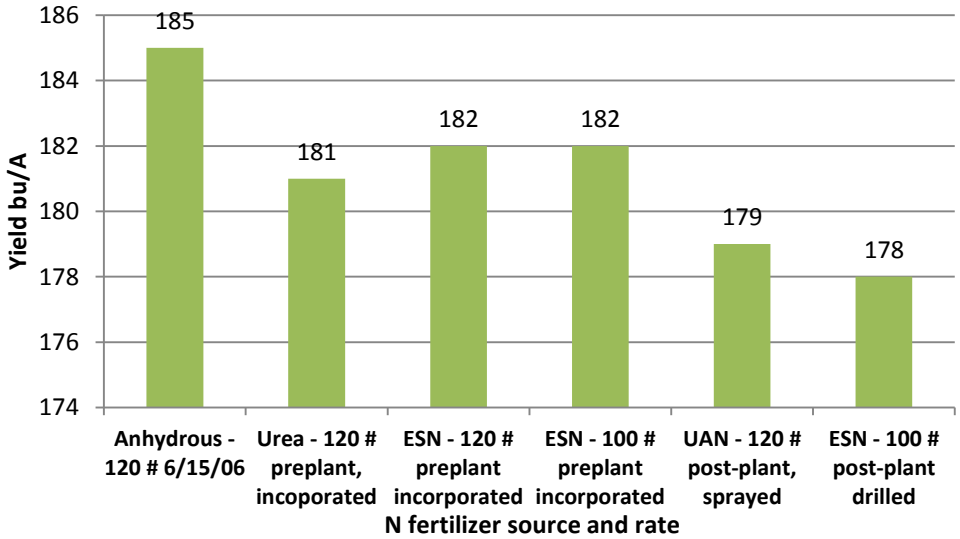


Table 1. Nitrogen sources, rates and application dates in 2006

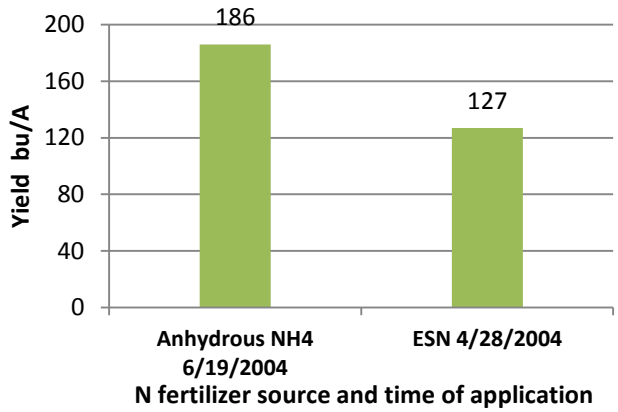
Treatment	N Fertilizer Source	Application Date
1	Anhydrous - N 120 # sidedress after planting	6/15/2006
2	Urea – 120 # N pre-plant and tilled	4/26/2006
3	ESN – 120 # N pre-plant and tilled	4/26/2006
4	ESN – 100 # N pre-plant and tilled	4/26/2006
5	UAN- 120 # N after planting, surface sprayed	5/6/2006
6	ESN – 100 # N after planting, drilled	5/5/2006

Figure 2. Corn yield from ESN compared to three other N sources - 2006



[1] corn yields were not significantly different among treatments

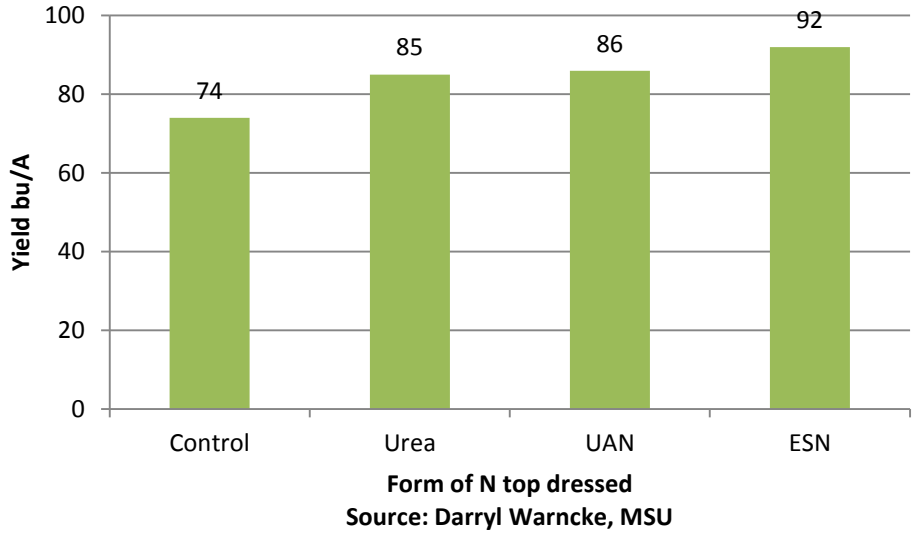
Figure 3. Corn yield— ESN versus anhydrous ammonia 2004



ESN ON WHEAT PRODUCTION

In a four-year (2004-07) Michigan study with soft red winter wheat, Dr. Darryl Warncke, Soil Fertility Specialist at Michigan State University compared urea, UAN and ESN for top dressing 90 lb. N /A in early spring (late March just prior to spring green-up). The ESN treatments produced a significantly higher average wheat yield compared to the other two sources (Figure 4). This average yield increase ranged from 5 to 8 bu/A for harvests in 2005, 2006 and 2007. The 2004 had a dry spring and ESN produced yields slightly lower than urea and UAN. Warncke estimated that the additional yield from early spring-applied ESN would easily cover the extra cost of the N.

Figure 4 . Average wheat yield from urea, UAN and ESN 2004-07
90 lb N/A spring applied



Source: Darryl Warncke, MSU

Summary

ESN has the potential to be used as an alternative N source on corn and wheat. The higher cost of ESN compared to urea (about $0.25/lb N) and the need for incorporation after application appear to be the main drawbacks. Recently, however, the high commodity prices have provided farmers with incentives to opt for more convenient and environmentally friendly N sources such as ESN. Higher efficiencies and ease of use with potential to eliminate multiple field passes may offset the higher cost of ESN compared to urea. Moreover, social, economic, and sustainability issues have generated a compelling need to find alternatives to cheaper anhydrous ammonia use on corn. The ESN also may fit special needs or situations on a farm, such as fields that are course textured or those adjacent to surface water.

MICHIGAN STATE UNIVERSITY | Extension