MISSISSIPPI STATE UNIVERSITY
EXTENSION SERVICE

Grain Crops Update

April 9, 2010 Erick Larson and Larry Oldham

Corn Nitrogen Suggestions

Mississippi's warm, wet climate can pose considerable issues for nitrogen fertilization, particularly for crops which demand high amounts for optimal productivity, such as corn. Nitrogen, unlike some other nutrients, is very subject to change forms in the soil, which can substantially affect its availability to plants. The South's warm, high rainfall climate greatly increases potential nitrogen loss through denitrification and leaching, compared to drier and colder climates. Therefore, optimizing your fertilizer dollars can involve considerable more planning than simply applying a given fertilizer rate. This newsletter will discuss various nitrogen sources, suitable application methods and placement, appropriate timing, and proper rates for corn fertilization. The primary methods we suggest to improve corn nitrogen utilization are:

1) Split fertilizer application to limit exposure and losses when crop demand is low.
2) Minimize volatility potential of urea-based nitrogen sources.
   - Inject liquid UAN-solution in the soil.
   - Apply urea during the "first split," rather than later when temperatures are higher.
   - Limit the amount of urea-based fertilizers you broadcast of your total N program.
   - Apply urease inhibitors to urea-based sources when you broadcast them on corn.

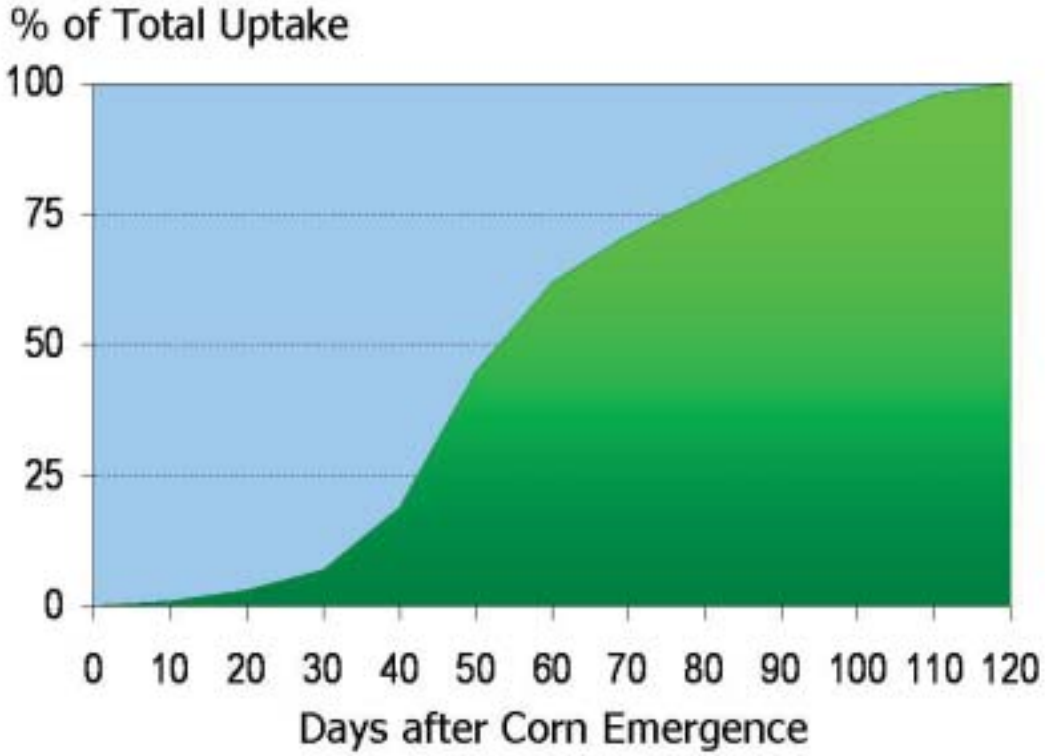
Figure 1. Mississippi's warm, wet climate dictates we use nitrogen management strategies to minimize potential nutrient loss which can be substantial during the early spring.

Nitrogen sources and application - Using the right nitrogen source and application method may be more important to corn grain yield, than how much you apply. Many growers had to aerially apply supplemental urea to fields last spring due to losses or delays associated with prolonged soil saturation. While this broadcast method is somewhat convenient compared to injecting liquid nitrogen, there is risk associated with its use on corn. Urea (46-0-0 or 41-0-0-5) or urea-containing nitrogen sources, including UAN-solution (N-sol, 32%, or 28-0-0-5), are subject to volatilization loss when applied to the soil surface (either broadcast or dribbled in a band). This risk may offset convenience or other savings. In fact, no-tillage research studies in Missouri and Tennessee show UAN-solution and urea broadcast on the soil surface reduced corn yield potential 9 to 23 percent compared to ammonium nitrate broadcast, N-sol injected, or anhydrous ammonia injected. Thus, we strongly suggest using methods to minimize urea volatility potential. Of course, injecting UAN-solution in the soil solves this issue, and is why this practice is standard. If you do chose to broadcast urea-containing sources, apply it during the "first" split application period, because temperatures are generally cooler and likelihood of rainfall capable of incorporating nitrogen is greater. These environmental conditions reduce the potential for volatility losses. On the other hand, hotter temperatures and more infrequent showers during the "second" split application period, promote high potential nitrogen loss. Broadcast no more than 1/3 of the seasonal nitrogen, to reduce risk of loss. You can reduce volatility by adding urease inhibitors, such as Agrotain, to granular urea or UAN-solution. Urease inhibitors temporarily slow the activity of the urease enzyme. But you'll still need timely rainfall or overhead irrigation to get urea-based N into the soil to reduce loss and make it available so the plants can use it. Tillage can also incorporate urea, but may not be practical, and should be assessed relative to savings. Sole reliance on granular urea to supply nitrogen for corn not only increases volatility risk, but either requires forgoing a split application strategy, or jeopardizing plants to considerable fertilizer burn from heavy postemergence application. Thus, we do not generally advocate this strategy for use on corn.

Figure 2. Crop utilization and performance of nitrogen fertilizer depends on using application methods and timing suited for the various nitrogen sources available.

Nitrogen application – Abundant spring rainfall which saturates soils for extended periods greatly increases potential nitrogen loss through denitrification and leaching, limiting nitrogen available for crop use later in the season. Denitrification happens when microorganisms in saturated soils turn nitrate nitrogen into nitrogen gases that escape into the air. Warm soil temperatures speed up this process. Research indicates denitrification rates range from 2 to 3 percent per day at soil temperatures from 55 to 65 ˚F. Denitrification rates increase to about 5 percent per day when soil temperatures are warmer. Nitrogen application timing can have considerable effect on potential nitrogen loss. Since corn nitrogen requirement is high, and it is the first crop planted in the spring (when losses can be high), application timing can have tremendous impact on corn productivity and your profitability. Therefore, we strongly encourage you apply nitrogen fertilizer at specific times according to corn need -- in other words "spoon feed" your crop using a split application strategy. This split application method reduces the likelihood of considerable nitrogen loss due to wet weather before crop uptake, and generally increases crop response to nitrogen fertilizer. Corn uses less than 10 percent of its nitrogen before rapid vegetative growth begins. This growth spurt usually begins in late April through mid-May in Mississippi, depending on seasonal temperatures and planting date. Thus, there is no good reason to apply considerable nitrogen in March, when it is not needed until May. You can use nitrogen more efficiently if you apply only a small portion of nitrogen just after plants emerge. This reduces the amount of nitrogen exposed to potential early season loss. Apply the bulk of your nitrogen fertilizer just before the growth spurt, when the plants need it most. Our standard nitrogen recommendation is to apply no more than one-third of the total nitrogen near planting/crop emergence. Apply the remaining nitrogen about 30 days later. Corn should be higher than 12 inches or at V6 growth stage by the second application.

Figure 3. Corn seasonal nitrogen uptake. Split application is encouraged because corn nitrogen uptake is very low during the early season, when often wet conditions encourage substantial loss. Although it is more difficult to implement split application, you are going to benefit substantially more by doing so during a wet year.



Nitrogen placement – Close nitrogen sidedress placement in relationship to the crop row is certainly not necessary, or even preferred for corn production. This is largely because nitrogen is relatively mobile in the soil-water solution, compared to some nutrients. Furthermore, more than 90% of nitrogen uptake will occur after corn is more than knee-high. Thus, corn very rarely has difficulty obtaining nitrogen during early growth stages, when its root system is small. Corn also has a fibrous root system, which develops substantially more lateral growth than tap-rooted crops, such as cotton or soybeans. In fact, corn roots will likely extend to the row middles before plants are knee-high. If you side-dress the second split-application when corn is about 12 inches tall or at the V6 growth stage as is preferred to optimize fertilizer efficiency, close knife placement may prune and/or burn lateral roots. For these reasons, we suggest corn growers place side-dress knives in the row middles or near the extreme edge of raised beds. This applies to all normal (single) row widths and twin-row patterns (based upon wide rows). If knives are positioned in row-middles, the outside knife on each side of the applicator should be modified to apply one-half of the intended nitrogen rate, since it will run between the same rows twice.

Figure 4. Close nitrogen fertilizer placement is not generally needed for corn, and may cause unwanted lateral root pruning from side-dress application.

Figure 5. We suggest we you place side-dress knives in the row middles or near the extreme edge of raised beds to avoid corn root pruning.

Nitrogen rate recommendations – The MSU Extension Service recommends using 1.3 pounds of actual nitrogen for each bushel of corn yield goal. For example, the nitrogen recommendation for a goal of 160 bushels per acre is: (1.3 lb N × 160 bu/A) = 208 lb N/A. However, research shows you can use 10 to 15 percent less nitrogen than the standard recommendation if you are growing corn on lighter, sandier soil. These recommendations were developed and based upon using split application strategy. Therefore, applying nitrogen in a single application, especially a preplant or early-timed application, may require a higher rate. How much more would be needed depends upon how wet spring conditions are, which determine potential nitrogen loss. The split application strategy is preferred to minimize this guesswork and considerable risk. This should improve nitrogen-use efficiency and reduce expense. Nitrogen recommendations for corn in the south are based totally on corn yield goal because our warm, wet winters keep nitrogen from carrying over from year to year. This is different from the Midwest, where consistently cold, dry conditions effectively stop nitrogen loss during the winter, allowing them to forgo yield goals in their rate determinations.

For more information regarding all aspects of corn fertilization, refer to:
"Corn Fertilization," Mississippi State University Extension Service - IS 864
http://msucares.com/pubs/infosheets/is0864.pdf

To add your address to the Corn and/or Wheat email list, please send a request to: **elarson@pss.msstate.edu**