FALL NITROGEN CONSIDERATIONS - 2020

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Fall nitrogen (N) application for corn continues to be popular for several reasons, including lower product cost, time for application, equipment availability, suitable soil conditions, and competing springtime field activities. Success, relative to spring or sidedress timing, can be enhanced by following several long-standing suggestions: for N fertilizer, only use anhydrous ammonia; apply in late fall after soils cool to 50 degrees F and are trending cooler (the colder the better); consider an effective nitrification inhibitor to further slow nitrification to nitrate; and avoid fall application to soils that are more prone to wetness or leaching (poorly or excessively drained soils). Most years in Iowa soils cool below 50 degrees F in late October and early November. The risk with early application is that temperatures can rebound and nitrification continue for an extended period. On the other hand, a risk is inability to get the fall application completed if waiting too long. This fall, with possible early harvest and on fields destroyed due to the derecho, there might be a temptation to apply ammonia or manure early. Best is to wait until soils cool.

Nitrification inhibitors

Nitrification inhibitors should be considered a component of fall anhydrous ammonia and liquid manure management. Nitrification inhibitors work by slowing, not stopping, activity of nitrifying bacteria and hence slow nitrification of ammonium to nitrate. Nitrification inhibitors are more effective with cold temperatures, and thus delay nitrification longer when soils are cold. With warm temperatures, the inhibitors are also "degraded" quickly and hence loose effectiveness. Nitrification inhibitors can "pay" but not always – results depend on ammonium conversion rate to nitrate, when converted to nitrate, how effective the inhibitor, and if any major wet/loss conditions are "missed" because applied N is still in the ammonium form which is not subject to leaching or denitrification. Most nitrate loss occurs in the springtime months, so having ammonium present during those months is important. Fall applied fertilizer and manure, to be more like a spring application, needs to keep applied N in the ammonium form – hence late fall application, cold soils, and a nitrification inhibitor consideration.

Other nitrogen fertilizers

Other common N fertilizers, like UAN (urea-ammonium nitrate solution) and granular urea, do not have the initial inhibitory effect on nitrifying bacteria like anhydrous ammonia, and therefore should not be fall applied. For example, research across many years at the ISU Northern Research Farm at Kanawha has documented lower corn yield with fall incorporated urea compared to spring incorporated urea. The co-nitrogen application in DAP and MAP (N in DAP and MAP is in the ammonium form) can be at risk with fall application due to rapid nitrification, along with the often early fall phosphorus fertilizer application. Triple superphosphate is becoming more available in the Midwest, and is a phosphorus fertilizer option that does not contain N.

What about drought affected corn fields or fields destroyed due to high winds?

For drought affected fields with severely reduced yield, there will likely be more than normal residual nitrate in the soil profile. This was observed in the fall 2012. However, that nitrate may or may not remain in the soil profile by the time a next-year corn crop takes up N. This was observed in the spring 2013 where well above normal rainfall in May resulted in nitrate loss and little of the carryover nitrate remaining in the soil profile. Of course at this time it is unknown the long-term fate of residual nitrate. If they can be successfully established this fall, cover crops can accumulate and help retain residual nitrate.

For wind damaged corn, N remaining in any non-harvested material will cycle through the soil system. If fields are rotated to soybean next year, any change in N recycling will not affect the soybean crop. What is different from normal harvest is the lower C:N ratio of vegetation/cobs and amount of grain in addition to vegetation/cobs. The C:N ratio of corn grain varies, but is approximately 27:1 to 37:1 depending on the reproductive stage when killed (range for R3-R6). Those C:N ratios mean that microbial degradation of corn grain will likely not provide a net amount of mineralized N, instead would be in an approximate balance with soil microbial demand as the corn grain is used as an energy (carbon) source. In conjunction with vegetation/cob degradation there may not be an overall net release of plant available N to a corn crop. With many fields damaged (killed) at the R4-dough stage, with lower vegetative plant C:N ratio than at R5 or maturity, there would be less need for microbes to access N from soil. Any estimation of available N should not be made until the spring of 2021 as there needs to be time for microbial degradation (affected by temperature and soil moisture) and there can be rapid change in inorganic-N (specifically nitrate) with wet conditions from fall through the next spring. Profile nitrate sampling next spring can help to understand inorganic-N levels and possible N rate adjustments. Also, due to volunteer corn concerns, wind damaged fields may be planted to soybean instead of corn in 2021 and thus no N adjustment needed. For more information about wind damaged corn and nutrient considerations, see these ICM News and Blog articles: Wind Damaged Corn – Nutrient Content? and Biological Breakdown of Wind Destroyed Corn.

Where to find soil temperature information

Soil temperatures can be found at several web sites. One site gives the 3-day, 4-inch depth soil temperature estimates for each county, and the 6-10 day weather forecast. That site can also be accessed through the Agronomy Extension and Outreach Soil Fertility web site, either from the weather page or Nitrogen - Nutrient Topic page. The 4-inch soil temperatures are estimated for each county based on interpolation of observed soil temperatures at multiple locations. The estimates are for soil temperatures on level, bare soil. Maximum/minimum soil temperatures from ISU research farms are available from the same sources, and are useful for watching the impact of warm air on soil temperatures. If you are curious about older 4-inch soil temperatures (longer than 3 days ago), check this "IEM Time Machine" site.