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Getting Ready for Fall Fertilization

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Abstract
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Integrated Crop Management NEWS

Getting Ready for Fall Fertilization

By John Sawyer and Antonio Mallarino, Department of Agronomy

The fall season is a common time for making crop nutrient applications. Soil sampling, and applications of phosphorus and potassium, nitrogen, and manure are a few things to consider as you plan fall fertilization activities.

Soil Sampling
Soil testing is the preferred way to understand the soils ability to supply phosphorus (P) and potassium (K) for crop production, and the need, if any, for P and K fertilization. Also, testing for soil pH determines if liming is needed. While fall is the traditional time for soil sampling, it can sometimes be a challenge to collect soil samples, get them analyzed, and have results available in time for nutrient applications in the fall. Applying fertilizers in spring based on fall testing is a good practice (research has shown no obvious difference compared to fall application for P and K), but practical and logistics issues for spring fertilization can also be complicated. An alternative for fall fertilization is to collect soil samples in the spring, and then have test results available for the next fall fertilization. Keep in mind it is a good practice, if at all possible, over time to collect soil samples in the same season, especially for soil K testing.

There are several methods for determining the number of samples to collect per field. See the listed Extension publications as an aid in those decisions. It is desirable that at a minimum samples should represent no more than approximately 10 acres, unless available information suggests larger field areas have little variation, such as in soil type and yield potential. A smaller area per sample is advantageous, and grid or zone sampling methods are commonapproaches. Research has shown that for Iowa conditions each composite grid soil sample should represent areas smaller than 3 to 4 acres. Also follow minimum area size requirements for regulation required manure management plans. Having multiple test results per field aids in determining uniform application rates, and accommodates site-specific fertilizer, manure, and lime applications.

Keep in mind that Iowa State University Extension P and K fertilization recommendations are calibrated on a 0-6 inch depth sample, and that research has indicated no clear advantage with shallower or deeper sampling depths, even for no-till or pastures. Liming decisions are also made from these samples, but application rates should be adjusted for expected incorporation depth. No-till, hay, or pasture fields also should be sampled to a depth of 6 inches, but a shallower sampling depth (2 or 3 inches) often represents better the soil volume where pH can be effectively changed by liming. Therefore, testing for pH and lime requirements on these shallower samples may result in more cost-effective management in these cropping situations. Because virtually all fields have nutrient stratification (due to the reduced till systems being used), it is also important for cores to be from a consistent depth.

Collect enough cores to get a representative sample, with a suggestion for at least 10-12 cores no matter the sampling method used, and more when

fertilizers and manure have been banded. Also, if you have more soil than will fit in a sample bag, mix the cores well so the sample sent to the lab is representative of the soil sampled.

Extension resources: PM 287 - Take a good soil sample to help make good decisions.
NCM 348 - Soil sampling for variable rate fertilizer and lime application.

Phosphorus and Potassium Application
Fall is a historical time for making P and K applications. There are many reasons for this, including: time, work load, typically dry soils, available fertilizers, and application before fall tillage. Fall P and K application works well in Iowa soil conditions because the soils have little or no "fixing capacity," hence P and K applied in the fall is equally available for crops the next year as a spring application (or even for multiple years). It is quite common to apply P and K fertilizer once for two years of crop production. This is the same reason why soils that test Very High can supply nutrients for many years before fertilization is needed.

Ongoing Iowa research shows that fall application can also be advantageous for environmental issues related to P. With the historical trend for less rainfall and low probability of large rainfall events in the fall that might result in runoff, fall applied P has lower risk of loss than winter or spring applications. When small rain events occur after surface application (fertilizer or manure), the result is enhanced P interaction with the soil. If a runoff event then occurs, loss in runoff is much less. Also, with fall tillage, applied P is incorporated into the soil which significantly lowers the risk of runoff loss (although erosion or sediment loss may increase due to the tillage and reduced surface residue).

One drawback for fall P fertilizer application is that, unfortunately, the most commonly available P fertilizers in Iowa and the Midwest (DAP, diammonium phosphate; MAP, monoammonium phosphate) also contain nitrogen (N). At high P application rates, such as for low-testing soils or when applying once the maintenance rate for the corn-soybean rotation, there can be considerable N applied. The N in these products is in the ammonium form, and hence is readily available to be nitrified. When applied when soils are warm, nitrification can proceed rapidly. This means a significant portion, if not all, of the N could be converted to nitrate in the fall. Recent research at the University of Minnesota and the University of Illinois has shown that in wet springs, the N remaining from fall applied DAP/MAP is reduced. This alters the suggestion for "accounting" N from fall P applications. In reality, the N to consider as available for the following corn crop is situation dependent – application timing and climatic conditions. If conditions remain dry you could account for all the N; and if wet, reduce that 25-50 percent. The N in these products is not volatile, so no volatilization loss adjustment is needed if surface applied.

Extension resources: PM 1688 - A general guide for crop nutrient and limestone recommendations in Iowa.

Nitrogen Application
Much of the primary fertilizer N for corn is applied in the spring as preplant or sidedress, where efficiency of N use should be greatest. Fall application success can be enhanced and approach that of a spring application by following these suggestions: only use anhydrous ammonia; apply in late fall after soils cool to 50 degrees F (the colder the better) and continue to cool (most years this is sometime in November); consider a nitrification inhibitor to further slow conversion to nitrate (use with the late fall application); and avoid soils that are more prone to wetness or leaching (avoid poorly or excessively drained soils). Fall-applied ammonia can work; however, wet growing seasons will reduce the efficiency and success in achieving yield potential. Other N fertilizers, like urea and UAN (urea-ammonium nitrate solution), nitrify too quickly which increases chance for loss 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. Coated urea

products may be suitable for fall application if managed appropriately for the product and location, such as needed incorporation, application timing, etc.

Extension resources: PM 2015 - Concepts and rationale for regional nitrogen rate guidelines for corn.
IPM 69A - Don't go until it's 50 Degrees F or below
Recent Iowa 4 inch soil temperature maps

Manure Application
Manure is a good nutrient source but can be tough to manage because of handling issues and multiple N, P, and K nutrient content. It also must be analyzed and efforts made for uniform distribution at field application. The relative nutrient content ratio and differential crop nutrient availability often means that one application rate will not be optimal for one or more nutrients, and what may be good management for P or K may not be the best for N. Since N is a critical nutrient for corn, is expensive, and is subject to N loss when converted to nitrate, care should be taken to ensure greatest possible N efficiency. It is important to pay attention to the P and K amount applied when soil tests are deficient (with total needs meet with inorganic fertilizer if manure P or K is short) or monitoring the P and K amount applied if in excess of crop needs. Giving priority to manure N also means that manure sources that have high inorganic ammonium content, like liquid swine manure, should be applied in late fall after soils cool (see guidance in the N application section). Such late fall application will not affect P or K crop availability. For manure that has considerable bedding, high organic N and low inorganic N content, or composted, then fall application can give a longer time-period for microbial mineralization to inorganic N. This can enhance crop available N supply and/or avoid low crop availability with spring application and when spring temperatures are cold. Manure N can be subject to volatile loss, so injection or immediate incorporation will reduce potential losses associated with surface application.

As with P fertilizers, manure P application should be managed in a way to reduce risk of P loss with runoff. Injection or incorporation into the soil (most importantly for fields with high risk of erosion and runoff), avoiding application to soils with a very high P-Index rating, avoiding application in winter to frozen/sloping soils, and managing soil residue cover will help with reducing P loss in runoff. These practices will also reduce N loss.

Extension resources: PMR 1003 - Using manure nutrients for crop production.
Is manure the same as fertilizer as a crop nutrient resource?
PM 1558 - How to sample manure for nutrient analysis.

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