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Plan carefully for potassium fertilization this fall

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Plan carefully for potassium fertilization this fall

Abstract
The prices of potassium (K) fertilizer and other fertilizers have increased significantly during the last two years. Profitable crop production requires appropriate soil K levels so careful fertilization planning is required. Iowa State University soil-test interpretations and fertilizer recommendations were updated in November 2002. Two important changes were to recommend higher soil-test K (STK) levels for optimum yield of Iowa crops and to suggest efficient K fertilizer application methods for some conservation tillage systems.

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Plan carefully for potassium fertilization this fall

The prices of potassium (K) fertilizer and other fertilizers have increased significantly during the last two years. Profitable crop production requires appropriate soil K levels so careful fertilization planning is required.

Iowa State University soil-test interpretations and fertilizer recommendations were updated in November 2002. Two important changes were to recommend higher soil-test K (STK) levels for optimum yield of Iowa crops and to suggest efficient K fertilizer application methods for some conservation tillage systems. These recommendations are explained in Iowa State University Extension publication PM 1688, A General Guide for Crop Nutrient and Limestone Recommendations in Iowa [1], which is available onlne or at your county extension office.

A need to update the soil-test interpretations for K was first identified during the mid- to late 1990s because of increasing frequency of K deficiency symptoms in corn and sometimes soybeans in some soils that tested in the older High soil-test category. Recent field response experiments have confirmed that the interpretations in use until 2002 often recommended too little or no K fertilizer for fields with a high probability of yield response and that the current higher STK recommendations are appropriate for most Iowa fields. Dense soil sampling and spotty deficiencies in many fields during the last few years have indicated that the most common reason for deficiency symptoms is low STK levels. However, K deficiency is sometimes observed on soils with apparently adequate K levels because it is induced by other factors. See issue 15 (6/20/2005) of the ICM Newsletter, Potassium deficiency symptoms in corn and soybean: What can we do about them? [2]; for a more detailed discussion of reasons for K deficiency, go to www.ipm.iastate.edu/ipm/icm/.

As an example of recommendations found in publication PM 1688, Table 1 shows the current STK interpretation classes defined for soil series with fine texture and low subsoil K. For these soils (the majority in Iowa) the recommendation is to maintain STK within a range of 131 to 170 ppm K for both corn and soybean. The maintenance fertilization for this class should be based on estimates of nutrient removal with harvest for each field. Information for average K concentration in harvested plant parts is provided in PM 1688. Research has shown that fertilization before one crop to supply the needs of a 2-year sequence of the corn--soybean rotation has similar efficiency as fertilization before each crop. Suggested K rates for this fertilization strategy are included in Table 1.

The results of numerous Iowa field experiments that evaluated fertilizer placement methods since the mid-1990s indicated a benefit of deep K placement for corn and soybean managed with no-till and ridge-till systems.

With these tillage systems, broadcast fertilizers are not incorporated or are incorporated in a

way that may not optimize early nutrient uptake (such as in ridge-till). Continued broadcast or planter-band fertilization and nutrient recycling with crop residues results in large K accumulation near the soil surface. The benefit of deep-band K applications (5 to 7 inches deep) was larger and more consistent for ridge-till than for no-till and was not significant on fields managed with chisel-plow tillage. Large variation in the no-till response to deep-band K appears more related to soil moisture than to STK stratification, and responses tend to be larger when rainfall is deficient in late spring or summer. Annual deep applications are not essential, and soybean benefits from one deep application before corn as long as the needs of the two crops are supplied.

Based on these results, deep-band K fertilization is suggested as an improved placement method for no-till and ridge-till management. The recommended fertilization rates are the same for both broadcast and deep banding, as research indicates no differential rate response between placement methods. It is important to note that the yield increase of no-till crops from deep K banding is not always large (even when done in combination with strip tillage for corn), and often may not offset increased application costs due to currently high fuel and fertilizer prices.

Producers and crop consultants need to understand that we always have to deal with probabilities concerning crop yield response to fertilizer application. Research indicates a very high probability of crop response to K in low-testing soils, on average a 25 percent probability of response in soils testing Optimum, and a much smaller probability (less than 5%) in high-testing soils. However, the probability of crop response to K in the Optimum category is higher for poorly drained and finer-textured soils in low landscape positions than for better-drained soils.

Producers can save money by withholding K fertilization in high-testing soils. Use of variable-rate K fertilization is a very good option in fields that have variable STK levels and have shown spotty K deficiency symptoms. This technology can be used to target applications to the most deficient field areas to get the highest possible return when the grain/fertilizer price ratio is unfavorable. Research also shows that when STK is in the Optimum category, the corn yield response achieved with a starter application (10 to 14 lb K_2O) or a larger maintenance K application often are similar. Obviously, applying only starter K fertilization for corn will not supply enough K for the following soybean crop and maintain soil tests over time. The strength of the research results does not allow for specific recommendations concerning use of one or the other option but shows that a rate lower than the maintenance rate could be considered as a short-term measure in well-drained soils testing within this category when fertilizer prices are high in a particular season.

Because the probability of response in the Optimum category is lower than in low-testing soils, issues such as land tenure, the producer's financial condition, and the producer's attitude about risk play a significant role when making a decision for fertilizing soils when prices are unfavorable.

Table 1. Soil-test K interpretation categories (ammonium-acetate or Mehlich-3 tests) and K fertilizer recommendations for corn and soybean. These are for soil series with low subsoil K and fine texture, which predominate in Iowa.

		K Fertilizer Rate		
Soil-test K	Soil-test K	Corn	Soybean	Corn--Soybean

Category	ppm	ppm lb K_2O/acre		
Very low	0--90	130	120	220
Low	91--130	90	90	165
Optimum	131--170	45*	75*	120*
High	171--200	0	0	#
Very high	201+	0	0	

* The fertilizer amounts for the Optimum category assume corn and soybean yields of 150 and 55 bu/acre, respectively.

A partial crop removal rate may be applied when the soil test is in the lower part of the High category. See publication PM 1688 for more detailed information.

[3]
Avoid potassium deficiency and increase profits by using soil testing and careful fertilizer application. (Antonio P. Mallarino)


[4]
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Links:
[1] http://www.extension.iastate.edu/Publications/PM1688.pdf
[2] http://www.ipm.iastate.edu/ipm/icm/2005/6-20/potassium.html
[3] http://www.ipm.iastate.edu/ipm/icm/node/191
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