

# INTEGRATED CROP MANAGEMENT

## Use new potassium soil test and fertilizer recommendations

Iowa State University (ISU) potassium (K) soil-test interpretations and fertilizer recommendations were updated in November 2002. These recommendations are contained in publication A General Guide for Crop Nutrient and Limestone Recommendations in Iowa [1] (PM 1688), which is available at through any Iowa State University Extension office or at <http://www.extension.iastate.edu/pubs> [2]. Major changes included new soil-test K interpretations for all crops and K fertilizer placement recommendations for corn and soybeans grown with no-till and ridge-till systems.

A need to update soil test interpretations for K was first suggested during the middle 1990s from observation of an increasing frequency of K deficiency symptoms in corn and soybeans, even in some soils that tested in the Optimum category according to interpretations at the time. In addition, field experiments designed to evaluate K placement methods often showed larger than expected yield responses in soils testing Optimum, and sometimes High. During the 1970s and 1980s deficiency symptoms and large yield responses were rare for the Optimum category, and only maintenance K fertilization based on crop removal was recommended. Recent field response experiments have confirmed interpretations in use until November 2002 sometimes recommended too little or no K fertilizer for soils with a high probability of yield response.

Several reasons could explain the increased soil test K requirement for many soils. Ongoing research is addressing these issues and no firm conclusions are possible at this time. These reasons may include increasing yield levels, increasing K removal with harvest, and the introduction to the market of new hybrids and varieties. However, a more likely reason relates to better knowledge about soil testing for K based on dried soil samples. Until 1989, Iowa State University interpretations for K tests were based on analysis of field-moist soil samples. Research during the 1980s had shown that drying the soil sample to about 35 to 40 degrees C increased measured K by approximately 25%. However, recent research suggests that the difference between K extracted from field-moist and dried soil samples is variable, and large for some soils and conditions. Research continues on this question.

Table 1 showed how the new soil test interpretation classes are now defined for soil series with low subsoil K. The table is a simplified version of tables given in publication PM 1688. The range defined as Very Low for soils with low subsoil K was extended upward to 90 ppm. What was previously classified as Low, Optimum, and High are now classified as Very Low, Low, and Optimum, respectively. The lower limit of the Very High class was shifted upward to 201 ppm. Fertilizer K rates recommended have also been increased for some classes by recognizing higher removal levels, not only for corn and soybeans (as shown in the table) but also for other crops.

Results of more than 200 harvested field experiments that evaluated fertilizer placement for corn and soybeans since the middle 1990s indicated the need to provide discussion of K fertilizer placement method in conservation tillage systems. With reduced tillage, broadcast fertilizers are not incorporated (such as in no-till) 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. Increased residue cover improves water availability and root efficiency in shallow soil layers during dry periods, but may result in cooler and wetter soils in early spring, which may reduce early crop growth and nutrient uptake.

Data in Figure 1 show average research results for no-till and ridge-till corn across several fields in which there was yield response to K fertilization. The treatments were various rates of granulated fertilizer broadcast or deep banded in the fall, and banded with the planter approximately 2 inches besides and below the seed. The deep bands were applied about 5 to 7 inches deep, and crops were planted on top of the knife tracks. In ridge-till fields, the fertilizer was banded through the top or shoulder of the ridges. The planter-band placement was not evaluated.

The results for no-till and ridge-till crops indicated that deep-band K applications often were more efficient than either broadcast or planter-band K. The differences were more consistent and larger for ridge-till than for no-till. Responses of soybean to deep K placement were smaller and less consistent than for corn. Results of the K placement studies for chisel-plow/disk tillage showed much smaller differences for both crops. The results showed little or no difference between placement methods for phosphorous fertilizer for any crop or tillage system, which confirmed results of research conducted decades ago.

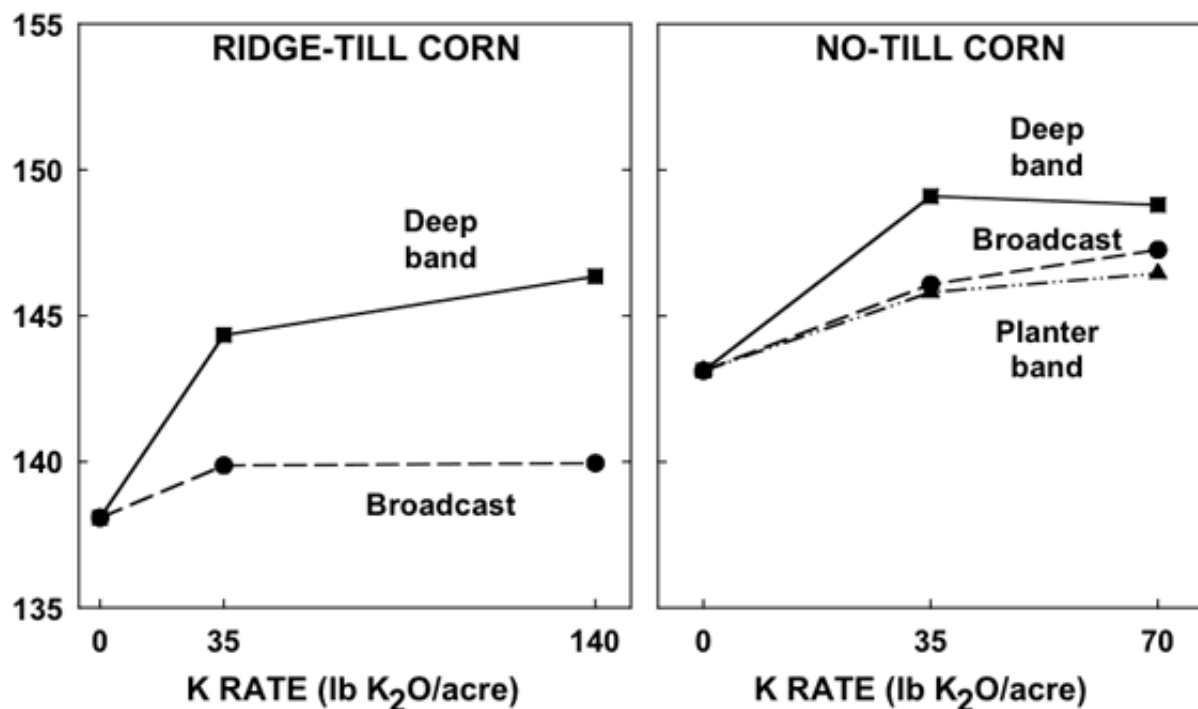
Based on these results, deep-band K fertilization now is suggested as an improved placement for no-till and ridge-till management. However, the yield increase of no-till crops from deep-banding K often is not large and may not always offset increased application costs. Large variation in the no-till response to deep-band K seemed more related to soil moisture in late spring and early summer than to soil-test K stratification, and responses tended to be larger when rainfall was deficient. Recommended potassium fertilization rates are the same for both broadcast and deep banding, as research indicates no differential rate response between placement methods.

**Table 1. Previous and current soil-test K interpretation classes (for soil series with low subsoil K) and K fertilizer recommendations for corn and soybeans.**

	Previous recommendations			New recommendations		
Soil test category	Soil test K	K fertilizer rate		Soil test K	K fertilizer rate	
	Soil test K	Corn	Soybeans	Soil test K	Corn	Soybeans
	-- ppm --	-- lb K <sub>2</sub> O/acre --		-- ppm --	-- lb K <sub>2</sub> O/acre --	
Very low	0-60	120	90	0-90	130	120
Low	61-90	90	75	91-130	90	90
Optimum	91-130	40	65	131-170	45	75

High	131-170	0	0	171-200	0	0
Very high	171+	0	0	201+	0	0

\*Notes: Previous recommendations are before November 2002. The fertilizer amounts recommended for the Optimum category assume corn and soybean yields of 150 and 55 bu/acre, respectively. Simplified data from more complete tables that are available in publication (PM1688).



**Figure 1. Yield response of ridge-till and no-till corn to K fertilizer applied with various placement methods.**

The November issue of this newsletter will feature an article explaining how to interpret phosphorus soil test results.

This article originally appeared on pages 172-173 of the IC-490(23) -- October 20, 2003 issue.

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<http://www.ipm.iastate.edu/ipm/icm//ipm/icm/2003/10-20-2003/fertrecom.html>

**Links:**

- [1] <http://www.extension.iastate.edu/Publications/PM1688.pdf>
- [2] <http://www.extension.iastate.edu/pubs>

