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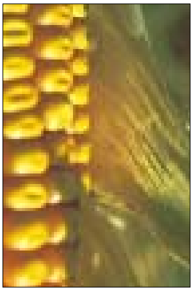
New Soil Test Interpretation Classes for Potassium

By A.P. Mallarino, D.J. Wittry, and P.A. Barbagelata



A need to update Iowa soil test K interpretations was first suggested during the middle 1990s by an increasing frequency of K deficiency symptoms in corn and soybeans, even in some soils that tested Optimum according to the current soil test K interpretations at that time.

The Optimum category included a range of 90 to 130 parts per million (ppm) K measured with the ammonium acetate test on 0 to 6 in. samples dried at 95 to 104°F. In addition, field experiments designed to evaluate K placement methods often showed larger than expected yield responses in soils testing Optimum, and small responses in soils testing within the High category. In the past, deficiency symptoms and large yield responses were rare for the Optimum category, for which only maintenance K fertilization based on crop removal is recommended.

> Iowa soil test potassium (K) interpretation classes have been reclassified to reflect crop responses to K fertilization at higher soil test levels.

Soil test calibration experiments have confirmed that soil test K interpretations in use sometimes recommended too little or no K fertilizer for soils with a high probability of yield response.

Figure 1 shows the relationship between relative corn yield and ammonium acetate extractable K. Data for soybeans and for the Mehlich-3 soil test extractant were

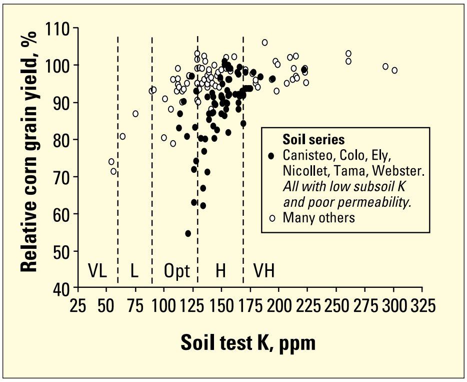


Figure 1. Relationship between relative corn yield and ammonium acetate soil test K values for various Iowa soils. VL, L, Opt, H, VH are abbreviations for the Very Low, Low, Optimum, High, and Very High soil test interpretation classes. Interpretation classes were used until October 2002.

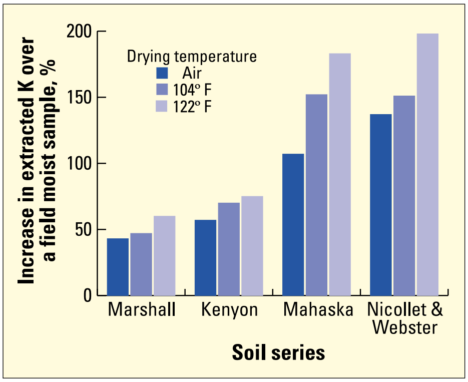


Figure 2. Example of the effect of sample drying temperature on K extracted from dried samples using the ammonium acetate procedure. All results are compared to those attained from the same procedure conducted on field-moist samples.

TABLE 1. Previous and current soil test interpretation classes for K (for Iowa soil series with low subsoil K).

	Previous recommendations			New recommendations		
Soil test category	Soil test K, ppm	Corn	Soybean	Soil test K, ppm	Corn	Soybean
		K_2O rate, lb/A			K_2O, lb/A	
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: The fertilizer amounts recommended for the Optimum category assume corn yields of 150 bu/A and soybean yields of 55 bu/A. More complete tables are available at the Iowa State University Extension Publication PM-1688. Website: >www.extension.iastate.edu/Publications/PM1688.pdf<

similar (not shown). The black points in the figure denote data for Iowa soil series in which the response to K was much larger than current interpretations would predict. The white points are those behaving according to expectations. All series represented by black points have low subsoil K. The white points include soil series with either low or high subsoil K in approximately similar proportions (not shown). Thus, dividing soils into those with either high or low subsoil K concentrations only partially explained crop response differences.

Several reasons could explain both the increased soil test K requirement for many soils and the large response variation across soils with similar soil test K levels. Ongoing research is addressing these issues and no firm conclusions are possible at this time. However, one likely reason relates to a change made in 1989 from interpretations based on analyses of field-moist samples to dried samples. When that transition was made, the relationship of soil test K results from both sample preparation techniques was established (soil test correlation). This relationship was used to adjust soil test K results of dried samples to the calibration data established with field-moist samples.

Ongoing investigations into this area are revealing that this relationship was not a good approximation under all conditions. Variation in soil properties likely changes the ratio of extracted K of field-moist and dried samples. As an example, the data in **Figure 2** show the difference in extracted K for samples dried at different temperatures relative to field-moist samples. Differences in amounts of K extracted from dried or field-moist samples varied with drying temperature, soil series, and soil moisture content. While this likely explains some of the differences found between K tests of dried and moist samples, there are other important factors to consider as well. Moisture relations during the growing season partly associated with internal soil drainage and landscape position may also be important.

Soil test calibration data in **Figure 1** and data in **Figure 2** suggest at least two contrasting groups of soil series for which soil test K interpretations should be different. However, there is substantial variability below soil test K levels of approximately 170 ppm and our research needs to be extended to many other soils and environmental conditions. **Given the current lack of resolution in classifying soils and/or environmental conditions according to differences in probabilities of crop response, our immediate solution was to reclassify soil test K interpretation classes for all soils.**

Table 1 shows how the new soil test interpretation classes are now defined. The range defined as Very Low 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. Rates of recommended K have also been increased for some classes, not only for corn and soybeans (as shown in the table), but also for other crops. However, field calibration data for other crops are less complete. These changes reflect crop responses to K observed at higher soil test K levels.

We hope to refine these recommendations further as more calibration experiments are conducted and results analyzed. The complete new Iowa K recommendations are available in the Iowa State University Extension Publication PM-1688, available at this website: >**www.extension.iastate.edu/Publications/PM1688.pdf**<

Summary

Unpredicted yield responses to K fertilization at higher soil test K levels have led to redefinitions of soil test K interpretation classes based on recent calibration research.

Crop responses are now considered more likely up to higher soil test K levels. Recommended rates of K have also increased for some classes to recognize larger K needs to optimize yield or better reflect K removal with harvest. BC

Dr. Mallarino (e-mail: apmallar@iastate.edu) is Professor, Soil Fertility; Dr. Wittry is Assistant Scientist; and Mr. Barbagelata is Graduate Research Assistant, all with the Department of Agronomy, Iowa State University.

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