RESPONSES TO K FERTILIZER ON HIGH TESTING SOILS

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Introduction

Soil testing is the foundation for nutrient management decisions, and is based test method research and calibration models in the Midwest has been generated in the public sector by Land Grant Universities (LGU) over the last 75 years. The successes of soil testing over the past three decades has been in large part been due to the inherent value of the testing method, monitoring over time, and adoption of precision Ag technology.

Soil testing for potassium (STK) in the Midwest, is based on the correlation and calibration work of Dr. Bray using ammonium acetate in the 1930s (Bray and DeTurk, 1939) and subsequent correlative research in the 1990s with the Mehlich 3 extraction method. The fundamental STK test, as developed by Dr. Bray and subsequent researchers, has not changed since its development 75 years ago when corn growers plowed their fields, seeded corn at 8000 plants per acre, using non-hybridized corn varieties, and produced corn yields average 25-35 bu/ac in the central corn belt. Today corn is grown with reduced or no-till cultivation systems, with plant populations of 28,000 to 36,000 plants per acre, using genetic modified hybrids, producing grain yields averaging 180-250 bushels per acre. In essence nearly all the crop production practices used today have changed from those used in when the STK test was first developed. The corn grower now uses the most genetically advanced corn varieties grown in a soil rooting volume $1/4^{th}$ the size it was 1935.

Crop K recommendations, initially developed were ranked on a low, medium, high scale, based on probability of response. This was latter expanded to five pint scale. With the exception of Iowa, Land Grant University (LGU) potassium recommendations over the last 30 years across the corn belt have remained unchanged for corn and soybeans. In the past decade there have been increasing incidences of K tissue deficiency symptoms. Although some agronomists attribute these observations have been attributed to declines in STK levels across the Midwest (International Plant Nutrition Institute (IPNI), Fixen, et al 2010), others have voiced changes in productions systems (i.e. plant populations, hybrids, tillage etc).

In 2011 a potassium research project was initiated in the Midwest covering five states. The focus of this research is two fold: (1) assess corn yield crop response to K applied in the cropping season; and (2) develop a new soil test method based on the fundamentals of nutrient uptake and modern crop production practices. This report focuses on the results of the field research.

Methods

Twenty-six sites were selected for potassium fertility research based on past yields, K fertility levels and grower participation interest by: Midwest Independent Soil Samplers, AgSource

Laboratories, Iowa; Rock River Laboratories, Wisconsin; Ward Laboratories, Nebraska and GMS Laboratories, Illinois. Sites were in Nebraska, Iowa, Wisconsin, Illinois and Indiana. Two sites were lost during the course of the study due to weather and pre-harvest. Across sites soil texture ranged from sandy loam to clay loam. Soil pH ranged from 5.67 to 7.67, with four sites having a buffer pH less than 6.7. Soil test levels indicate that fourteen of twenty-five sites were likely to have a response to applied potassium (STK levels < 175 ppm) and two sites unresponsive with STK > 300 ppm.

Potassium was applied at all sites at corn growth stage V3-V6 at rates of 0, 50 and 100 lbs/ac using a spoke wheel injector at a depth of 2.0" to plots with eight replcations of each treatment. At corn growth stage VT (location dependent) composite corn leaf samples of the leaf opposite the ear were taken at sixteen locations and submitted for laboratory nutrient analysis. At maturity plots were hand harvested using two rows from each treatment by replication.

Results

Corn grain yield for the control plots ranged from 133 to 231 bu/ac across the twenty-four harvested locations. Grain yields were lower for the Illinois sites due to moisture stress during grainfill. Across sites plant populations ranged from 21,900 to 35,300 plants per acre. Grain yield variability based on the RSD across treatments ranged from 2.7 to 15.0%. A 50 lb/ac application of K fertilizer resulted in grain yield response which ranged from –9 to 17 bu/ac over the control with significant increases noted at twelve locations. Fifteen of the sites had control plot yields in excess of 190 bu/ac of which nine showed a significant increase in in grain yield associated with a application of K fertilizer. A 100 lb/ac application resulted in grain yield response which ranged from –2 to 23 bu/ac, with significant increases noted at nine locations, three of which were not significant at the 50 lb/ac application rate.

Soil STK for the soils in this study ranged from 90 - 423 ppm, with soils having a STK < 180 ppm having the highest probability of a yield response. STK values ranging from 75-150 ppm had a 88% probability of response to a 50 lb/ac application of K; STK values ranging from 150-200 ppm had a 50% probability of response; and soil with 200 -300 ppm had a 33% probability of response. Worthy of notation was one sites with a STK level of 290 ppm, which had a 12 bu/ac yield increase on a check yield of 202 bu/ac.

These results show that corn grown under high production systems shows yield response well above current published LGU recommendations to K applied at rates of 50 and 100 lbs/ac applied in the cropping season. This research has continued in 2012 and results are pending.

Literature

Bray, R.H. and E.E. Deturk. 1939. The release of potassium from the non-replaceable forms in Illinois soils. Soil Science of America Proceedings (1938) 3:101-106.

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