(Preliminary Report)

Evaluation of Dry Band Application of Total Crop Phosphorous and Potassium Nutrient needs for a No-till Corn/Soybean Rotation

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Introduction:

Many Missouri farmers find their profit margins being squeezed by increasing cash rental rates and high fertilizer costs. Summarization of soil samples submitted to the University of Missouri Soil Testing Laboratory by Lincoln County farmers in 2006 document that 34% of samples had low to very low P supplying power and 28% of K samples had low to very low supplying power. With rapidly increasing cash rents and low water holding capacity of claypan soils limiting yields during dry years, farmers are looking to intensively cut input costs.

As a result, farmers are looking for methods to reduce fertilizer costs while maintaining yields. Popular press and extension research publications from northern and high plain states has shown that banding fertilizer can reduce fertilizer application rates while maintaining yields. While banding systems have research data from these production areas, there is little Missouri data on the results of such an approach. Many of the existing studies were conducted on high testing P and K soils with greater water holding capacity than the upland claypan soils in eastern and central Missouri. In addition, with current variable rate technology, it's routine for farmers to broadcast apply two years of P and K fertilizer for a corn-soybean rotation. Missouri farmers and dealers want to continue the practice of a two-year fertilizer application system.

The objectives of this study are:

1. Determine if banded phosphorus and potassium at planting can provide a yield response.
2. Determine if banding phosphorus and potassium can allow for a reduction in fertilizer rates.
3. Evaluate precision farming practices for their usefulness in this type of system.

Methods and Materials:

The 40 acre field selected for this study is typical of east central Missouri, consisting predominately of a gently rolling Mexico silt loam soil. Management of the field has been a no-till rotation of corn and soybeans and broadcast applications of P and K with liquid N applied at planting for corn. The field was grid sampled on one-acre grids in March. Composite data based on GPS reference grid points was used to calculate treatment fertilizer rates. Whole field fertility characteristics consist of soil pH_s 6.7, P1 level of 41lb/A and K level of 274 lb/A. Eighteen acres of the field were selected for replicated plot area. The soil fertility characteristics in the plot area consist of pH_s 6.7, P1 32 lb/A and K 208lb/A.

Taking into account current management techniques and the objectives of the study, four treatments were selected. They are: no application of P or K, broadcast applications of P and K based upon field composite soil test results, banded application of P and K broadcast rate, one-half rate of P and K broadcast rate.

The treatment design is a randomized complete block. Each treatment was twelve rows in size with the middle six rows harvested to insure no influence from neighboring treatments. The harvested six rows were approximately .5 acres in size.

Equipment used for planting and fertilizer application was a six row Case 950 Cyclo planter with dry fertilizer and liquid fertilizer attachments. Targeted planting rate was 26,000 seed/A, planted on May 9 using a no-till system. Dry fertilizer was metered through a standard, auger style fertilizer box and applied four inches to the side and four inches deep through a coulter and knife unit. Each fertilizer box supplied three rows with the boxes being driven through a ground driven chain and sprocket configuration. Prior to planting calibration was conducted on each fertilizer box with multiple fertilizers of different bulk densities to insure accuracy in the field. The balance of nitrogen fertilizer was applied in the row middle with UAN behind a coulter attached to the planter.

Table 1. Fertilizer amounts applied by treatment in lb/A.

Treatment	**Nitrogen Sources**			**P_20**	**K_2O_5**
	UAN	Urea	DAP		
0 P and K	70	45	0	0	0
Broadcast P and K	70	45	0	115	130
1 X Band	70	0	45	115	130
0.5 X Band	92	0	23	58	65

Broadcast fertilizer application was applied the day after planting using a conventional cart with a 40 ft. spread pattern. UAN was applied with a liquid applicator after planting for the 0.5 X band treatment to equalize N rate.

Harvesting was conducted on September 18, 2007, using a six-row combine with an Ag Leader PF 3000 yield monitor attached to a receiver for yield mapping and data collection. This allowed for the middle six rows of the twelve row plots to be harvested. Prior to harvesting of the plots a calibration load was harvested with a targeted flow rate of 1000 bu. per hour. The harvested area for the calibration load was similar in yield to the plots. The resulting calibration load had a measured weight of 4800 lbs. and an actual weighed weight of 4820 lbs. Each treatment was collected as an individual load for analysis.

Observations and Results:

The plots were scouted during the growing season for weeds, insects and diseases. No pest problems were found during the growing season.

The plots were located in an area that experienced drought and high temperature conditions during the growing season. Plots received little rainfall after early July and high daytime temperatures were experienced during August continuing into September. In spite of stress conditions, pollination was very good. Ear fill was nearly to the tip. However, the outer one-third of ears aborted due to lack of late season moisture, resulting in yield loss some 25-30 percent below long term field average. The stress conditions may have contributed to poor treatment yield separation.

The plot treatment yields ranged from 91.5 – 107.8 bu/A, with the mean being 98.5 bu/A. There was no significant difference in treatments at the 5% probability level.

Table 2. Results of Yield Analysis

	Replications				
Treatment	1	2	3	4	Trt Mean
0	*	103.2	97.2	99.8	100.1
0.5	107.8	99.4	91.5	91.7	97.6
1	99.5	105.0	93.5	97.6	98.9
Broadcast	106.5	98.0	89.7	97.0	97.8
Rep Mean	104.6	101.4	93.0	96.5	98.5
	No significant treatment differences (P=0.05)				
	* Missing data point				

One of the production concerns was the high salt loading in proximity to the seed during dry years. Population counts at V1 stage of growth (not shown) and at harvest were not significantly different and when analyzed for yield impact by treatment was not significantly different.

Table 3. Results of Yield/Population Interaction

	Replications				
Treatment	1	2	3	4	Trt Mean
0	*	103.2	97.2	100.0	100.1
0.5	107.8	99.2	91.5	92.1	97.7
1	99.5	105.2	93.3	97.8	99.0
Broadcast	106.3	97.8	89.5	97.2	97.7
Rep Mean	104.5	101.3	92.9	96.8	98.5
	No significant treatment differences (P=0.05)				
	* Missing data point				

Objectives for 2008:

Soybeans will be planted as part of the rotation, using a RTK corrected auto steer to drop seed within 4 inches of banded fertilizer. No fertilizer application is scheduled for 2008.