COMPARING NPK RECOMENDATIONS FROM UNIVERSITY AND PRIVATE SOIL TEST LABS UNDER CHANGING ECOMOMIC CONDITIONS

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Abstract

Soil test recommendations for university and private labs were compared for three typical Missouri cotton soils in terms of lint yields and net returns to producers. Significant differences in cotton lint yields and net returns to producers were found two of the six site years studied.

Introduction

With the increasing cost of fertilizers (P = $1.05, K = $.60/lb) cotton producers need to minimize inputs without limiting yields. Soil test fertilizer recommendations are ideally based on research data. For P & K fertilizer recommendations, a critical soil test level (above which a yield increase is not expected), crop yield goal, and fertilizer build up factors are considered. The relative weights of these factors determine the amount of fertilizer recommended. Soil labs vary greatly in their fertilizer recommendations. The University of Missouri decrease the amount recommended as the amount found rises. When a soil tests very high in P or K the recommended rate is 0. This often leads to a 0 recommendation for P & K on Missouri cotton soils. Other labs continue to recommend P & K to compensate for crop removal at all levels of nutrient found.

The objective of this evaluation is to directly compare the recommendations of several major soil test labs in terms of input costs, yields, and net returns to producers.

Materials and Methods

This report covers the first and second years of a continuing three year study. The test was conducted at three locations representing the major cotton soil types of Southeast Missouri (sand, silt loam, & gumbo). At each location a research area of approximately 200 X 200 feet was selected. The soil type at the sand area was a Bosket fine sandy loam (fine-loamy, mixed, thermic Mollic Hapludalf), at the silt loam area a Tiptonville silt loam soil (fine-loamy, mixed, thermic Typic Argiudolls), and the gumbo area Sharkey clay (very fine, montmorillonitic, thermic Vertic Haplaquept) soil. At each location a composite soil sample consisting of 50 individual 6 inch cores was collected. These samples were dried & ground, then divided into 5 sub samples. These sub samples were provided to 5 different labs (2 University, and 3 private) with a recommendation request for 2 bale cotton. If applicable a build up period for P & K of four years was requested. The resulting fertilizer recommendations were followed. The resulting N-P-K recommendations are listed in Tables 1, 2, and 3. A randomized complete block design with four replications was employed for this small plot evaluation.

Cotton was planted at each location in early May of each year. It was subsequently cultivated using the standard cultural practices for weed & insect control for producing irrigated cotton in Missouri. Specific rates of P, as triple super phosphate, and K, as murate of potash, fertilizer were applied broadcast pre-plant to each plot in late April. N fertilization was applied to all plots at a 60 lbs/N rate as ammonium nitrate at the same time. The remainder of the N rate specific to each plot was applied in mid June. The cotton plots were defoliated in mid September of and harvested in early October. The resulting seed-cotton was ginned and lint turn out percentage calculated. The resulting cotton lint was then analyzed for the fiber quality properties: micronaire, length, strength, uniformity, color grade and trash percentage. These fiber quality properties were determined at the International Textile Research Center in Lubbock Texas using high volume instrument analysis.

Gross and net returns to producers were calculated based on Commodity Credit Corporation Cotton loan base rate for respective years crop of White Upland Cotton warehoused in Missouri ($0.5235/lb lint) with allowances made for fiber quality. Input costs were computed using fertilizer prices found during each respective year (2007: N = $0.40/lb, P = $0.25/lb P_2O_5 and, K = $0.25/lb K_2O: 2008: N = $0.70/lb, P = $1.05/lb P_2O_5 and, K = $0.60/lb K_2O.

Input costs were calculated and compared to net & gross returns for each recommendation.
Statistical analyses of the data were preformed for each individual year and location with ARM.

Table 1. N-P-K recommendations and costs for a sand soil, Clarkton, MO 2007.

Lab	lb N/a	lb P_2O_5/a	lb K_2O/a		
University 1	125	0	85	$71.25	$138.50
Private 1	100	25	88	$68.25	$149.05
Private 2	100	40	100	$75.00	$172.00
Private 3	140	0	59	$70.75	$133.40
University 2	90	0	60	$51.00	$99.00

Initial soil test (MU): P = 99b/a, K = 123/a, pH = 6.0 CEC = 4.1
Recommendations for 2 bale yield goal, P & K build up 4 years
*Assumes N = $0.40/lb, P = $0.25/lb P_2O_5, K = $0.25/lb K_2O
** Assumes N = $0.70/lb, P = $1.05/lb P_2O_5 and, K = $0.60/lb K_2O

Table 2. N-P-K recommendations and costs for a silt loam soil, Portageville, MO 2007

Lab	lb N/a	lb P_2O_5/a	lb K_2O/a	2007 $/a*	2007 $/a**
University 1	130	0	50	$64.50	$121.00
Private 1	120	25	85	$75.50	$161.25
Private 2	110	40	80	$74.00	$167.00
Private 3	120	0	25	$54.25	$99.00
University 2	90	0	0	$36.00	$63.00

Initial soil test (MU): P = 96 lb/a, K = 249 lb/a, pH = 6.1, CEC = 10.1
Recommendations for 2 bale yield goal, P & K build up 4 years
*Assumes N = $0.40/lb, P = $0.25/lb P_2O_5, K = $0.25/lb K_2O
** Assumes N = $0.70/lb, P = $1.05/lb P_2O_5 and, K = $0.60/lb K_2O

Table 3. N-P-K recommendations and costs for a gumbo soil, Portageville, MO 2007

Lab	lb N/a	lb P_2O_5/a	lb K_2O/a	2007 $/a*	2007 $/a**
University 1	125	0	0	$50.00	$87.50
Private 1	100	25	0	$46.25	$96.25
Private 2	100	40	0	$50.00	$112.00
Private 3	142	0	0	$56.80	$99.40
University 2	100	0	0	$40.00	$70.00

Initial soil test (MU): P = 83 lb/a, K = 541 lb/a, pH = 6.4, CEC = 25.7
Recommendations for 2 bale yield goal, P & K build up 4 years
*Assumes N = $0.40/lb, P = $0.25/lb P_2O_5, K = $0.25/lb K_2O
** Assumes N = $0.70/lb, P = $1.05/lb P_2O_5 and, K = $0.60/lb K_2O

Results and Discussion

Sand:
At the sand location N recommendations ranged from 90 to 140 lbs N/a. P from 0 to 40 lbs P/a, and K from 59 to 100 lbs K/a. In 2007 the costs of these fertilizer programs ranged from $51.00 to $75.00/a. In 2008 the costs of these fertilizer programs was increased and had a range of $99.00 to $172.00/a. The private labs generally recommended more fertilizer with two of the labs recommending phosphate fertilizer. This lead to significantly higher fertilizer cost per acre in 2008. In 2007 there were no statistically significantly differences in yields for any fertilizer program (Table 4). However, in 2008 significant differences in yields were found. Significant differences with fertilizer program were found for the various fiber properties in both years (data not presented). These differences did not lead to significant differences in fiber value for either year. Net returns to producers were significantly affected by fertilizer program in 2007 but not in 2008.

Silt loam:
At the silt loam location N recommendations ranged from 90 to 130 lbs N/a. P from 0 to 40 lbs P/a, and K from 0 to 80 lbs K/a. In 2007 the costs of these fertilizer programs ranged from $36.00 to $75.50/a. In 2008 the costs of these

fertilizer programs was increased and had a range of $99.00 to $167.00/a. The private labs generally recommended more fertilizer and had a higher fertilizer cost per acre. The higher costs are mostly represented by greater P and K recommendations. Cotton lint yields were not significantly affected by any fertilizer program during either year of the study (Table 5). For all of the fiber properties measured only micronaire in 2008 was significantly affected by fertilizer program (data not presented). Fiber values and net returns to producers were not significantly affected by fertilizer program for either year of the study.

Gumbo:

At the gumbo location N recommendations ranged from 100 to 142 lbs N/a. P from 0 to 40 lbs P/a. Potassium was not recommended by any lab. The costs of these fertilizer programs ranged from $40.00 to $56.80/a. In 2008 the costs of these fertilizer programs was increased and had a range of $70.00 to $112.00/a. The private labs generally recommended more P fertilizer and had a higher fertilizer cost per acre. Significant differences between yields for fertilizer programs were found at the gumbo site in 2007 but not in 2008 (Table 6). For all of the fiber properties measured only micronaire in 2008 was significantly affected by fertilizer program (data not presented). Fiber value was significantly affected by fertilizer program in 2007 but not in 2008. These differences found in 2007 translated into significantly differences in net returns to producers. No significant differences were found in net returns to producers for 2008.

Table 4. Lint yields, lint value and gross returns for treatments on a sand soil at Clarkton, MO 2007 & 2008

Lab	N-P-K	Yield (lb/a)		lint price* ($/lb)		Net returns ($/a)	
		2007	2008	2007	2008	2007	2008
University 1	125-0-85	705	828	0.518	0.53	292	296
Private 1	100-25-88	654	775	0.511	0.52	261	256
Private 2	100-40-100	611	717	0.530	0.56	248	225
Private 3	140-0-59	588	700	0.519	0.51	235	223
University 2	90-0-60	664	627	0.526	0.52	298	225
LSD 0.05	--------	NS	155	NS	0.025	90.42	NS
CV%	--------	19.2	13.8	4.5	3.0	21.8	21.8

*based on Commodity Credit Corporation Cotton loan base rate for 2007 or 2008 crop White Upland Cotton warehoused in Missouri

Table 5. Lint yields, lint value and gross returns for treatments on a silt loam soil at Portageville, MO 2007 & 2008

Lab	N-P-K	Yield (lb/a)		lint price* ($/lb)		Net returns ($/a)	
		2007	2008	2007	2008	2007	2008
University 1	130-0-50	691	1085	0.47	0.47	260	386
Private 1	120-25-85	700	1023	0.48	0.45	257	303
Private 2	110-40-80	809	1157	0.47	0.47	307	380
Private 3	120-0-25	806	1129	0.49	1.46	333	426
University 2	90-0-0	761	1087	0.50	0.48	344	462
LSD 0.05	--------	NS	NS	NS	NS	NS	144
CV%	--------	13.3	15.9	4.8	3.7	44.6	23.9

*based on Commodity Credit Corporation Cotton loan base rate for 2007 or 2008 crop White Upland Cotton warehoused in Missouri

Table 6. Lint yields, lint value and gross returns for treatments on a clay soil at Portageville, MO 2007 & 2008

Lab	N-P-K	Yield (lb/a)		lint price* ($/lb)		Net returns ($/a)	
		2007	2008	2007	2008	2007	2008
University 1	130-0-50	1263	914	0.47	0.54	541	407
Private 1	120-25-85	1182	803	0.49	0.55	527	343
Private 2	110-40-80	1213	898	0.49	0.52	552	360
Private 3	120-0-25	1243	903	0.50	0.55	575	395
University 2	90-0-0	1216	917	0.47	0.53	521	414
LSD 0.05	--------	81	NS	0.028	NS	56	NS
CV%	--------	4.3.0	13.4	3.7	3.3	6.7	17.4

*based on Commodity Credit Corporation Cotton loan base rate for 2007 or 2008 crop White Upland Cotton warehoused in Missouri

Summary

For two of the site years studied significant differences in yield were produced by the soil test recommended fertilizer programs (clay soil 2007 and sand soil 2008). Significant differences in net returns to producers were produced two of the six site years (clay soil 2007 and silt loam soil 2008). No significant differences between fertilizer programs were found for the remaining four site years. In terms of numerical differences, the low input fertilizer program (University 2) had the greatest net returns to producers four of the six site years studied. One factor that was not considered in the first two years of this three-year study is the levels of available P & K remaining in the soil. Soil test programs call for retesting every third year. Fertilizer programs which recommend little or no fertilizer may eventually lead to inadequate P & K soil test levels at the next testing cycle. This could require large additions of fertilizers at that time, putting economic strains on producers. Definitive conclusions should not be based on the first year of this three year study. More study is therefore necessary.

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