ECONOMIC COMPARISON OF N, P, & K RECOMMENDATIONS FROM UNIVERSITY & PRIVATE SOIL TEST LABS

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Introduction

With the increasing cost of fertilizers (P = $0.24, K = $0.25/lb) a 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 decreases 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 with the University of Missouri in terms of input costs and yields.

Methods and Materials

This report covers the first year 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 will be 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.

The cotton variety DPL 117 was planted at each location in early May. 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 muriate 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 late 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 2007 crop White Upland Cotton warehoused in Missouri ($0.5235/lb lint) with allowances made for fiber quality. Input costs were computed at a rate of: N = $0.40/lb, P = $0.25/lb P_2O_5 and, K = $0.25/lb K_2O. Input costs were calculated and compared to net & gross returns for each recommendation.

Statistical analyses of the data were preformed with ARM.

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. The costs of these fertilizer programs ranged from $51.00 to $75.00/a. The private labs generally recommended more fertilizer and had a higher fertilizer cost per acre. Yields and gin turn out were not significantly different for any fertilizer program (Table 4). Significant differences with fertilizer program were found for the fiber properties micronaire, strength, and uniformity. These differences did not lead to significant differences in fiber value (Table 5). Gross and net returns to producers were not significantly affected by fertilizer program.

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. The costs of these fertilizer programs ranged from $36.00 to $75.50/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. Yields, gin turn out and all fiber properties were not significantly different for any fertilizer program (Table 6). Fiber values, gross and net returns to producers were not significantly affected by fertilizer program (Table 7).

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. 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 (Table 8). The fertilizer program of Private Lab A produced yields that were significantly less the University Lab 1. Gin turn out and all other fiber properties were not significantly different for any fertilizer program. Fiber values from the two University labs were significantly less than Private Lab C (Table 9). These differences did not translate into significantly greater gross or net returns to producers.

Conclusions

At only one of the locations (gumbo) significant differences in yield were produced by the soil test recommended fertilizer programs. However when translated into net returns to producers there were no significant differences between fertilizer programs. One factor that was not considered in the first year of this 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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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	$/a*
University 1	125	0	85	$71.25
Private 1	100	25	88	$68.25
Private 2	100	40	100	$75.00
Private 3	140	0	59	$70.75
University 2	90	0	60	$51.00

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

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	$/a*
University 1	130	0	50	$64.50
Private 1	120	25	85	$75.50
Private 2	110	40	80	$74.00
Private 3	120	0	25	$54.25
University 2	90	0	0	$36.00

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

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	$/a*
University 1	125	0	0	$50.00
Private 1	100	25	0	$46.25
Private 2	100	40	0	$50.00
Private 3	142	0	0	$56.80
University 2	100	0	0	$40.00

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

Table 4. Yield and fiber properties for treatments on a sand soil at Clarkton, MO 2007

Lab	yield	Turn out	mic	lgth	strgth	unfrm
University 1	705	0.37	3.87	1.125	33.7	82.48
Private 1	654	0.37	3.97	1.125	34.88	82.40
Private 2	611	0.36	3.82	1.105	32.17	81.55
Private 3	588	0.37	3.67	1.112	34.38	81.95
University 2	664	0.37	3.90	1.103	33.17	81.90
LSD 0.05	192	0.02	0.27	0.022	2.08	0.74
CV%	19.2	19.2	3.6	4.6	4.0	0.6

Table 5. Lint price net and gross returns for treatments on a sand soil at Clarkton, MO 2007

Lab	N-P-K	yield	lint price*	Gross returns	Fert costs	Net returns
University 1	125-0-85	705	0.518	363.34	71.25	292.08
Private 1	100-25-88	654	0.511	328.90	68.25	260.65
Private 2	100-40-100	611	0.530	322.95	75.00	247.95
Private 3	140-0-59	588	0.519	305.63	70.25	235.38
University 2	90-0-60	664	0.526	348.73	51.00	297.73
LSD 0.05	--------	192	0.036	90.40	--------	90.42
CV%	--------	19.2	4.5	17.4	--------	21.8

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

Table 6. Yield and fiber properties for treatments on a silt loam soil at Portageville, MO 2007

Lab	yield	Turn out	mic	lgth	strgth	unfrm
University 1	691	0.39	4.70	1.072	31.13	81.13
Private 1	700	0.40	4.70	1.060	30.60	80.65
Private 2	809	0.39	4.60	1.067	31.05	80.78
Private 3	806	0.39	4.60	1.075	30.70	81.03
University 2	761	0.39	4.40	1.092	30.65	81.00
LSD 0.05	418	0.01	0.27	0.03	1.7	1.40
CV%	13.3	2.0	3.8	2.0	3.6	1.2

Table 7. Lint price net and gross returns for treatments on a silt loam soil at Portageville, MO 2007

Lab	N-P-K	yield	lint price*	Gross returns	Fert costs	Net returns
University 1	130-0-50	691	0.466	324.711	$64.50	260.21
Private 1	120-25-85	700	0.476	332.33	$75.50	256.83
Private 2	110-40-80	809	0.474	381.04	$74.00	307.04
Private 3	120-0-25	806	0.488	387.33	$54.25	333.08
University 2	90-0-0	761	0.491	379.92	$36.00	343.92
LSD 0.05	--------	418	0.031	206.38	--------	206.38
CV%	--------	13.3	4.8	37.1	--------	44.6

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

Table 8. Yield and fiber properties for treatments on a clay soil at Portageville, MO 2007

Lab	yield	Turn out	mic	lgth	strgth	unfrm
University 1	1263	0.38	4.65	1.153	32.05	80.78
Private 1	1182	0.38	4.63	1.160	30.17	81.20
Private 2	1213	0.39	4.60	1.157	30.70	81.50
Private 3	1243	0.38	4.67	1.145	31.75	81.58
University 2	1216	0.39	4.63	1.160	31.45	81.85
LSD 0.05	81	0.01	0.10	0.02	2.21	1.10
CV%	4.3	1.8	1.4	1.2	4.6	0.9

Table 9. Lint price net and gross returns for treatments on a clay soil at Portageville, MO 2007

Lab	N-P-K	yield	lint price*	Gross returns	Fert costs	Net returns
University 1	125-0-0	1263	0.468	590.83	$50.00	540.83
Private 1	100-25-0	1182	0.489	578.15	$46.25	527.39
Private 2	100-40-0	1213	0.493	597.21	$50.00	551.59
Private 3	142-0-0	1243	0.503	626.35	$56.80	575.45
University 2	100-0-0	1216	0.467	567.13	$40.00	521.37
LSD 0.05	--------	81	0.028	57.42	--------	56.29
CV%	--------	4.3	3.7	6.3	--------	6.7

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