2005 Annual Report
C.I. Project # 03-166AL

TITLE: "Fertilization of Cotton on Black Belt Soils"

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OBJECTIVES:

(1) Determine the need for additional N, P, and K fertilization for high-yielding cotton on Black Belt soils;
(2) Determine if cotton will respond to other fertility treatments on Black Belt soils;
(3) Evaluate existing soil test methodologies for evaluating K for cotton on Black Belts soils.

JUSTIFICATION:

The "Rates of N-P-K" experiment has existed at 7 locations around Alabama since 1954. These experiments have been important in developing soil test calibration for the southeastern U.S. However, for some reason, this test was never established on the Black Belt Station. Soil test calibration and fertilizer recommendations for Black Belt soils are very poorly supported by research. On-farm research has not improved the situation because sites on farmers' fields are usually heavily fertilized and will not respond to direct applications of P and/or K.

PROCEDURES:

An experiment similar to the "Rates of N-P-K" test at other locations was established on a Vaiden clay (very fine, montmorillonitic, thermic Vertic Hapludalfs) at the Black Belt R&E Center in 2004. It will contain the same 17 treatments as found at other locations where cotton is grown on this test e.g. 6 N rates, 5 P rates, 6 K rates and a “no lime” and “no amendment” control. The experimental design, a randomized block, was updated to allow for better statistical analysis. Plot size was 15 feet wide (5, 36” rows) by 25 feet long.

Sorghum-sudangrass was planted on the site in 2004 in an attempt to remove residual N and some K. Cereal rye was planted on the site as a winter cover crop in the fall, 2004, and killed with glyphosate in mid-April, 2005. In anticipation of an early May planting, all fertilizer treatments and ½ of the annual N rate was applied to plots on 10 May. It was too dry to plant cotton at this time and project leaders agreed to wait until a good rain to plant. Less than 0.3 inch fell until 29 May. Over the next 5 days, a total of 4.33 inches fell making it impossible to plant in these fine-textured, clayey soils until 8 June. In spite of a very late planted crop, a good stand emerged with the prospects of a reasonable crop. However, excessive rainfall in June and July caused some loss of stand, severe denitrification losses and a severely stunted crop. Sidedress N was applied on 21 July to a very late crop. Good weather in late August and September, in spite of wind damage from Hurricane Katrina, offered better prospects for a crop. However, an extremely dry fall and an early frost in late October, further reduced yield prospects. The crop was hand harvested on 16 November.

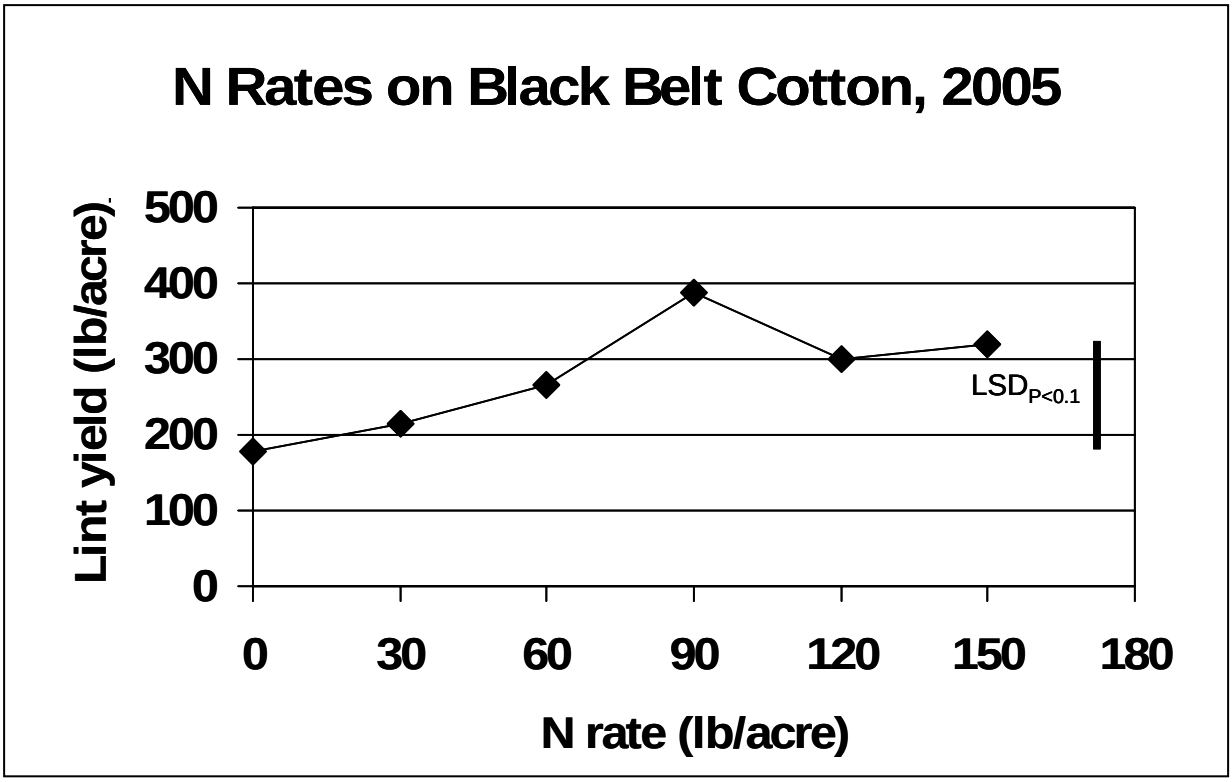
2005 RESULTS

Very low yields were produced in 2005. However, some surprisingly interesting information was gleaned from the statistical analyses. There was a quadratic response to N rates with the standard recommended rate of 90 pound total N as the optimum rate (see figure). This produced the highest yield which was only 388 pounds lint per acre. Only at the highest P rates was there an apparent response to added P although the soil test was “low” in P (see figure).

Potassium fertilization is of particular concern on these soils. This site tested "very high" in K which is typical of most Black Belt soils. Nevertheless, there was a nice, linear response to applied K by cotton lint yield even though the yields were very low (see figure). This trend may suggest that stressed cotton with a limited root system is more responsive to K fertilization than a healthy, high-yielding crop in these soils.

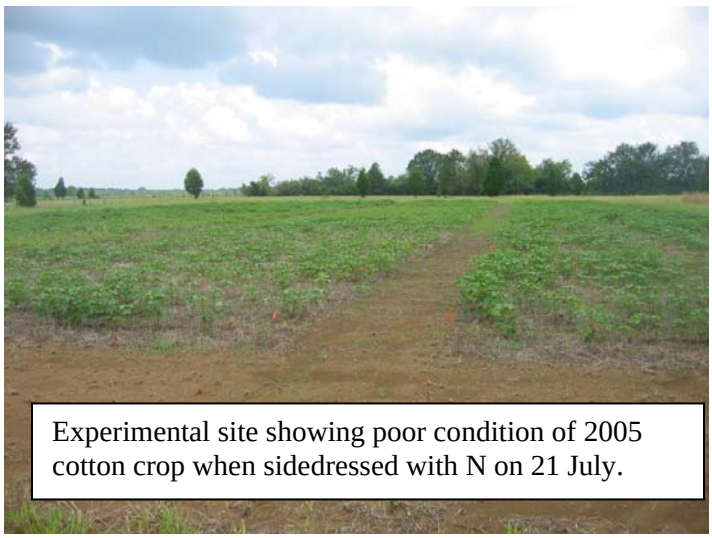
Fertilizer treatments and cotton lint yields on a Vaiden clay in 2005

Treatment number	Description	Rate of Nutrients applied			Mean lint yield
		N	P_2O_5	K_2O	
		----------pounds per acre----------			
N rates					
1	No N	0	100	100	177
2	Low N	30	100	100	214
3	Intermediate N	60	100	100	265
5	Control	90	100	100	388
4	High N	120	100	100	237
6	No S/VH N	150	100	100	320
P rates					
7	No P	90	0	100	280
8	Very low P	90	20	100	205
9	Low soil P	90	40	100	274
10	Intermediate P	90	60	100	233
5	Control	90	100	100	388
K rates					
11	No K	90	100	0	157
12	Very low K	90	100	20	170
13	Low K	90	100	40	253
14	Intermediate K	90	100	60	341
15	High K	90	100	80	319
5	Control	90	100	100	388
Other treatments					
16	No lime	90	100	100	196
17	Nothing	0	0	0	160
	L.S.D $_{P<0.1}$				135

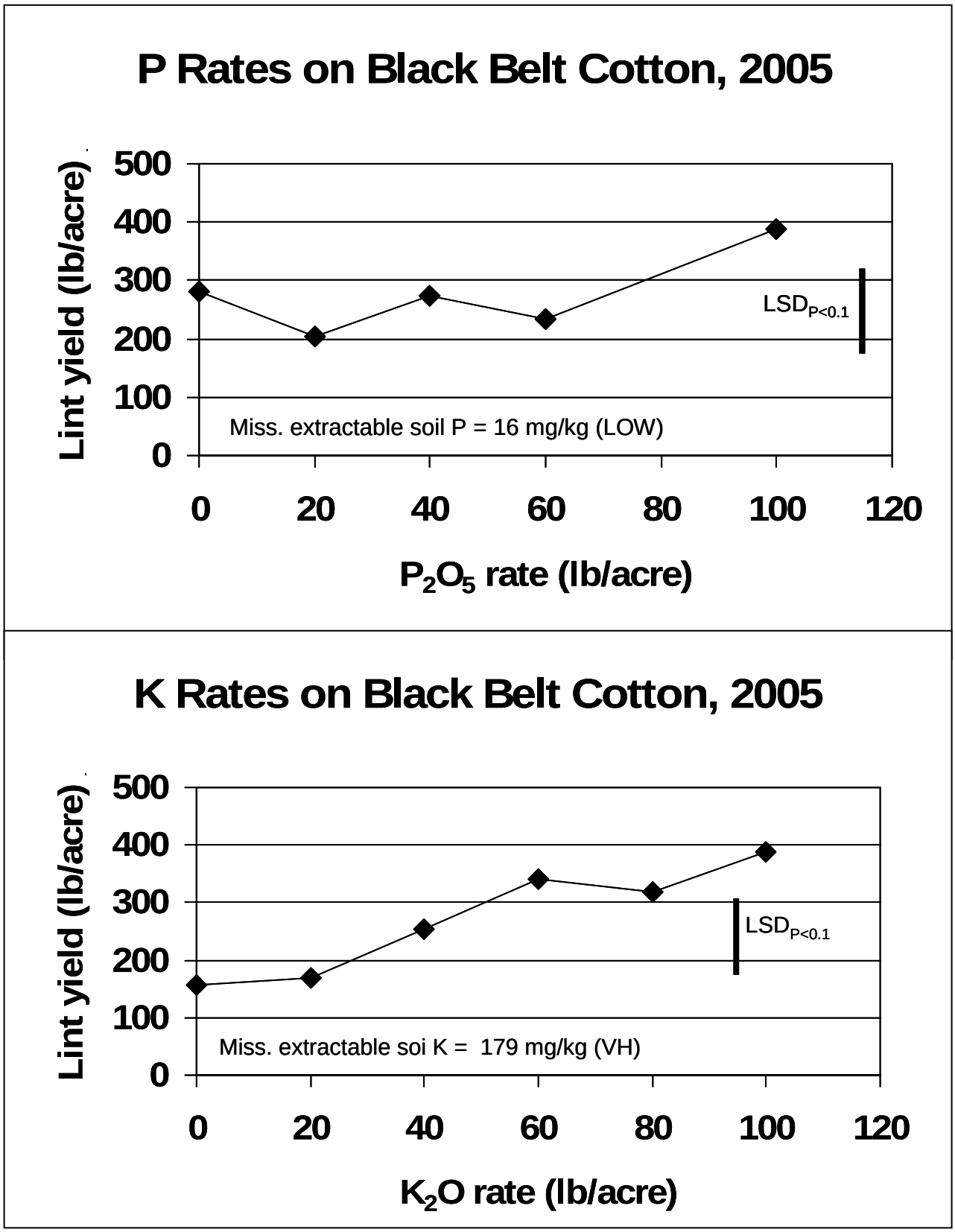


SUMMARY:

In spite of a disappointing year and very poor cotton yields on a Vaiden clay in Alabama, a good, long-term (hopefully) soil fertility experiment has been established on this soils for the first time in more than 35 years. Cotton lint yields in 2005, although very low, confirmed existing N rate recommendations and raised new concerns about K calibration on these montmorillonitic soils. There was a linear yield increase to increasing K rates although soil test K is considered very high. Phosphorus tested low in these soils yet there was only a weak response to added P. In 2005, cotton was planted using conservation tillage and high residue management which probably aggravated problems in a very wet year. In 2006, plans are to plant on raised beds with no winter cover crop.



Experimental site showing poor condition of 2005 cotton crop when sidedressed with N on 21 July.


P Rates on Black Belt Cotton, 2005
Lint yield (lb/acre)
500
400
300
200
100
0
LSD P<0.1
Miss. extractable soil P = 16 mg/kg (LOW)
0
20
40
60
80
100
120
P2O5 rate (lb/acre)
K Rates on Black Belt Cotton, 2005
Lint yield (lb/acre)
500
400
300
200
100
0
LSD P<0.1
Miss. extractable soi K = 179 mg/kg (VH)
0
20
40
60
80
100
120
K2O rate (lb/acre)