2005 Wheat & Feed Grain Report
Continued Support of Long-term, Field Research

C. C. Mitchell, D.P. Delaney, K.S. Balkcom

The Old Rotation - 2005

The Old Rotation (circa 1896) is the oldest, continuous cotton experiment in the world. Its 13 plots on 1 acre of land on the campus of Auburn University continue to document the long-term effects of crop rotations with and without winter legumes (crimson clover) as a source of nitrogen for cotton, corn, soybean, and wheat.

The 110th year of The Old Rotation experiment continues the trend that began in 1996 when the experiment changed from conventional tillage to conservation tillage and GMO crops. Impressive yields of most crops were produced in 2005 with cotton lint yields on plot 9 producing an all-time record of 1660 lb. lint/acre (Table 1). The Old Rotation averaged over 2.1 tons of legume dry matter on those plots that were planted to 'AU Robin' crimson clover in the fall of 2004. Based upon an average N concentration of 1.77%, the winter legume contributed 75 lb. N/acre in the herbage.

This is the third year that irrigation on the Old Rotation could be compared with non-irrigated plots. A very wet growing season resulted in no apparent yield increase due to irrigation for corn and cotton. A very dry fall did result in a soybean yield response to irrigation. Comparing the 3-year mean yields of corn and cotton with and without irrigation suggests that corn yields can be increased with irrigation whereas cotton yields have not indicated a dramatic yield response to irrigation at this central Alabama location (Table 2). Soybean on the 3-yr rotation averaged 51 bu/acre with irrigation and 43 bu/acre without irrigation since irrigation was established in 2003.

Table 1. Crop yields on the Old Rotation in 2005.

Plot	Description	Clover dry matter	Wheat	Corn		Cotton		Soybean	
				Irrigated	Non-irrigated	Irrigated	Non-irrgated	Irrigated	Non-irrigated
		lb/acre	bu/acre	---------bu/acre---------		-------lint/acre-------		--------bu/acre--------	
1	no N/no legume	0				520	550		
2	winter legume	4480				650	750		
3	winter legume	1700				690	1010		
4	cotton-corn	4840		62	34				
5	cotton-corn + N	5170		133	141				
6	no N/no legume	0				390	390		
7	cotton-corn	3400				770	1020		
8	winter legume	2950				740	790		
9	cotton-corn + N	4570				1210	1660		
10	3-year rotation	0				1060	850		
11	3-year rotation	6790		52	48				
12	3-year rotation	0	31.8					48.3	26.9
13	Cont. cotton/no legume +N	0				720	1040		

Table 2. Effect of irrigation on Old Rotation mean crop yields, 2003-2005.

Treatment (plots)	Corn grain		Cotton lint	
	Irrigated	Non-irrigated	Irrigated	Non-irrigated
	----------bu/acre----------		------pounds lint/acre------	
No N/no legume (plots 1 & 6)	--	--	440	380
Legume N only (plot 8)	--	--	1020	1040
120 lb. N/acre (plot 13)	--	--	1150	1190
2-yr rotation, legume N only (plots 4&7)	67	56	1070	1080
2-yr rotation, +legume, + 120 lb N/acre (plots 5&9)	168	139	1340	1480
3-yr rotation, legume N only (plots 10, 11 , 12)	103	78	1180	870

The Cullars Rotation (circa 1911) - 2005

The Cullars Rotation is the oldest, continuous soil fertility experiment in the southern U.S. and the second oldest experiment in the world that includes cotton. It was placed on the National Register of Historical Places in 2003. It continues to document the long-term yield trends of 5 crops in a 3-year rotation with 14 soil fertility variables. Each fertility treatment is replicated 3 times.

The 2005 growing season was characterized by a wet summer and very dry fall. On the Marvyn loamy sand where the Cullars Rotation is located, the wet season resulted in very good yields of corn and cotton (Table 3). All corn and cotton plots received 120 pounds total N per acre in split applications

except on plots A, B, and C. The complete fertilizer plus micronutrient treatment produced almost the equivalent of 3 bales of cotton per acre. In spite of the dry fall, soybean yields were generally higher than the irrigated soybean yields on the nearby Old Rotation experiment. The 2005 yields continue a trend of high yields that seem to have begun about the time we converted this experiment from conventional tillage to conservation tillage in 1997. Conservation tillage includes either in-row subsoiling or paratilling prior to planting cotton and corn.

While long-term trends seem to indicate higher yields on the well fertilized plots, the plots with low levels of one or more nutrient or factor e.g., plot C (nothing), plot 2 (no P), plot 6 (no K), and plot 8 (no lime), continue a trend toward lower and lower yields. For example, plot C (nothing) would produce very low yields of most crops until recently when we get nothing from this treatment. Yields on the no P, no K, and no lime plots are also decreasing.

New signs were placed on the Cullars Rotation in 2005 because of this site's visibility and exposure adjacent to the Jules Smith Museum of Fine Art in Auburn.

Table 3. Cullars Rotation yields in 2005

Plot	Description	CLOVER Clover dry matter	WHEAT Wheat	CORN Non-irrigated	COTTON Non-irrgated	SOYBEAN Non-irrigated
		lb/acre	bu/acre	bu/acre	lint/acre	bu/acre
A	no N/+legume	2540	9.9	28	920	49.0
B	no N/no legume	--	10.9	27	750	52.0
C	nothing	0	0	0	0	0
1	no legume	--	33.4	109	1310	56.1
2	no P	1230	14.4	26	1290	0
3	complete	3990	40.8	151	1440	55.7
4	4/3 K	4210	26.7	148	1190	53.7
5	rock P	5710	41.1	144	1090	58.8
6	no K	2370	31.7	33	0	12.6
7	2/3 K	5640	45.8	172	1040	51.3
8	no lime	3560	7.5	26	70	0
9	no S	5620	39.1	144	1170	52.5
10	complete+ micros	4870	40.6	154	1490	53.8
11	1/3 K	4270	37.0	128	380	47.0

ACKNOWLEDGEMENT

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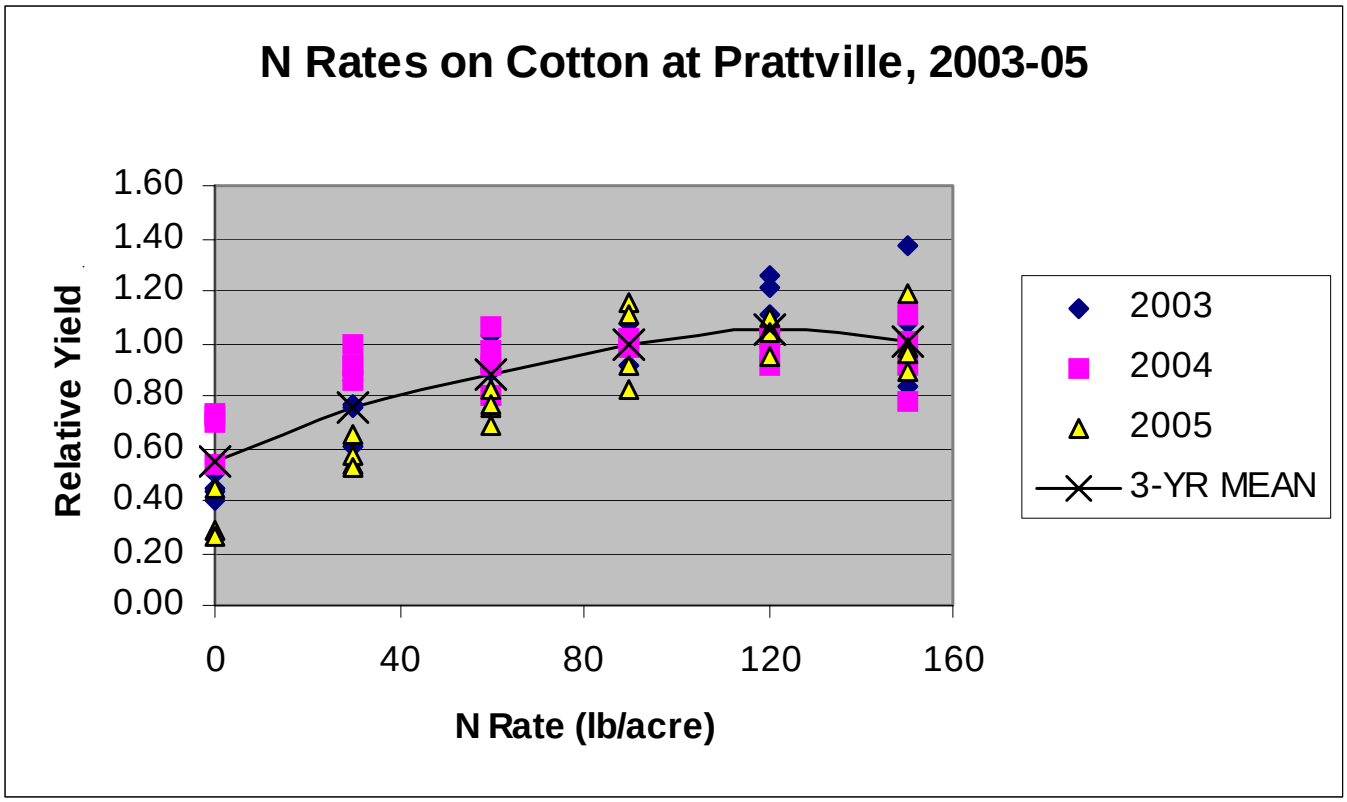
The "Two Year Rotation" (circa 1929)

The "Two-Year Rotation Experiment" (17 fertility treatments replicated 4 times) was planted to cotton and soybean at the Tennessee Valley Research & Extension Center and cotton and peanuts at the Prattville Research Unit (Table 4). Both sites were planted no-till into a small grain residue. This was the first year that peanuts have been planted on the Prattville Research Unit. Cotton and peanuts were due to be planted at the Wiregrass R&E Center but because of management and weather problems, this test was not harvested in 2005. The Two-year Rotation at Brewton has been fallow since 2000. At Sand Mountain, this experiment is planted to *Sericea lespedeza.*

Table 4. Yields on the Two-Year Rotation Experiment at Tennessee Valley and Prattville in 2005.						
		Tennessee Valley		Prattville		
Treatment	N-P_2O_5-K_2O	Cotton lint	Soybean	Conv. Cotton	No-till Cotton	Peanuts
		---Lb/acre---	---bu/acre---	----------lb/acre----------		
1. Untreated	0-0-0	630	28.8	467	311	1525
2. No sulfur	150-60-60	1168	36.9	1006	913	3691
3. Moderate P	90-30-60	1235	35.7	1089	980	3551
4. No lime, low pH	90-60-60	1309	32.5	938	897	2656
5. Low Mg	90-60-60	1177	34.7	591	607	3521
6. No K	90-60-0	533	30.7	150	104	3376
7. Low K	90-60-30	1061	29.0	368	379	3757
8. + micros	90-60-60	1261	28.8	778	944	4205
9. No NPK, + lime	0-0-0	613	24.7	254	119	3406
10. High N	120-60-60	1225	32.4	809	1037	4283
11. Low N	30-60-60	902	31.8	824	684	4066
12. No P	90-0-60	1091	31.6	809	788	3793
13. Moderate N	60-60-60	1121	36.1	798	633	3660
14. NPK+lime	90-60-60	1286	38.7	1187	1016	3612
15. High K	90-60-120	1314	39.1	1193	1333	3993
16. No N	0-60-60	603	35.3	767	653	3116
17. Fertilized 1978-82 only	0-0-0	501	30.6	544	316	2644
				Mean=740	Mean=689	

The Rates of N-P-K Experiment (circa 1954)

The “Rates of N-P-K Experiment” at Tennessee Valley, Prattville, and Wiregrass were planted to cotton in 2005. This experiment contains 16 soil fertility treatments replicated 4 times. It is planted in Serecia lespedeza at Sand Mountain and Upper Coastal Plains. This experiment has been fallow at Brewton since 2000. The Wiregrass location was not harvested in 2005. Cotton lint yields in 2005 at Tennessee Valley and Prattville are presented in Table 5. Figure 1 illustrates how some of these long-term data are used. Growers demand assurances that current N recommendations are sufficient for high yields of modern cultivars. These on-going experiments allow continual monitoring of N rate response. The three years, 2003-2005, represent some of the highest cotton yields ever produced on this experiment at Prattville. Because actual yields vary from year to year, Fig. 1 is presented in “relative yield”. A relative yield of 1.0 is assigned to the standard, recommended N rate of 90 lb. N per acre and all other rates are compared to this. Lint yields on the standard N recommendation (90 lb. N/acre) were 1560 pounds in 2003, 1110 in 2004, and 1470 in 2005. In 2003, responses to rates as high as 150 lb. N per acre were recorded.



The Rates of NPK Experiment at the Tennessee Valley R&E Center near Belle Mina.

Table 5. Cotton lint yields on the "Rates of NPK Experiment" at Tennessee Valley and Prattville in 2005.

Variable	Tennessee Valley R&E Center		Prattville Research Unit	
	Soil test	Lint yields	Soil test	Lint yields
N rates (lb/acre)		---lb/acre---		--lb/acre--
0	--	900	--	780
30	--	1210	--	840
60	--	1300	--	1110
90	--	1250	--	1470
120	--	1370	--	1520
150	--	1310	--	1480
P_2O_5 rates (lb./acre)	Soil test P (lb/a)/rating		Soil test P (lb/a)/rating	
0	38 High	1460	83 High	1460
20	31 High	1330	83 High	1340
40	55 High	1430	105 VH	1390
60	65 VH	1360	116 VH	1360
100	113 VH	1250	188 VH	1470
K_20 rates (lb/acre)	Soil test K (lb/a)/rating		Soil test K (lb/a)/rating	
0	166 Med.	1220	128 Medium	860
20	184 Med.	`1270	151 Medium	1050
40	276 High	1310	194 High	1260
60	239 High	1450	223 High	1200
80	237 High	1300	244 High	1400
100	358 High	1250	375 VH	1470
No lime	pH=5.7	1500	pH=4.8	1290
L.S.D $_{P<0.05}$		*205*		*310*