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FIFTY YEARS OF SOIL TESTING FOR COTTON IN ALABAMA

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Abstract

A summary of fifty years of public soil testing by Auburn University indicates that Alabama cotton producers are, in general, doing a very good job of maintaining a desirable soil pH and "high" soil test values for P, K, and Mg for optimum production. Whereas cotton fields accounted for almost all of the soil samples tested in the 1950s, cotton accounts for only 13 percent of the samples tested today. The A.U. laboratory tests about 1 sample each year for every 100 acres of cotton grown in the State.

Introduction

The Auburn University soil testing program celebrated 50 years of service to Alabama farmers by moving into a new facility in 2004. The new ALFA Agricultural Services Building on the Auburn University campus houses soil testing, plant analyses, feed and forage analysis, manure analysis, environmental testing, nematode assay, and plant diagnostic services. In 1953 when soil testing began, it was mostly a service for cotton and corn producers. Soon afterwards, other crop recommendations were added. By 2004, over 50 crop recommendations are included, and cotton samples accounted for 13 percent of total recommendations. The purpose of this paper is to summarize 50 years of routine soil testing for cotton production and observe the trends in soil fertility for Alabama cotton producers who use the services of the Auburn University Soil Testing Laboratory.

Methods

Soil testing records or summaries of records have been kept since the laboratory began operation in 1954. Some of these records have been lost and some old computer records are difficult to recover. However, enough old summaries and data were recovered to make some general statements regarding the trends in soil fertility for cotton in Alabama. We estimate that about one-third to one-half of all commercial agricultural samples in Alabama is being tested by private laboratories.

Sample Numbers

Decreasing numbers of soil samples since the early 1980s reflect decreasing row crop acreage in Alabama (Fig. 1 and 2). However, acreages of cotton, peanuts, and hay have remained fairly constant during this time period. When grouped, leading crops recommendations in 2004 were:

All forage crops	38%
Home gardens, lawns, shrubs	23%
Cotton	13%
Corn	7%
Peanut	5%
Soybean	3%
Commercial vegetables & fruits	3%
All other crops and non-crop areas	8%

Soil pH and Magnesium

Acid soil infertility has always been a concern of Alabama cotton producers, and regular ground limestone applications are part of their routine production inputs. Extremely acid soils (<pH 5.0) are generally less than 1% of total soils tested but they do occur in problem situations (Fig. 3). In the mid-1960s, almost 70% of samples needed lime (pH<6.0). Today, around 30% need lime each year. If we assume that a good cotton farmer may need to apply some limestone every 3 to 5 years in order to maintain a soil pH above 5.8, Alabama cotton producers are doing

about as good a job of managing soil pH as could be expected. Soils with a pH above 7.0 are usually calcareous soils from the central Alabama Black Belt prairie region.

Cotton samples consistently test higher in Mg than other crops (Fig. 4). This is probably due to the fact that cotton farmers generally do a better job of liming their fields, and most use dolomitic limestone or calcitic limestone that is high in Mg. Less than 4% of all cotton samples need Mg, and these are usually the same samples with a low pH.

Phosphorus

Farmers have become aware that putting out too much P is expensive and could degrade surface water quality. Cotton soils testing very high (VH) and high (H) have been trending downward (Fig. 5). At the same time the number of samples testing medium (M) in P have been increasing. The low (L) and very low (VL) values have continued to stay approximately the same over the past fifty years. The slight increase in the number of "high" samples in 2004 may reflect a change in trends due to an increase in conservation tillage practices and P stratification in the soil surface.

Potassium

Potassium nutrition of cotton has been a concern throughout the cotton belt for several years. Alabama has extensive research relating plow layer soil test K to cotton yields, and these trends indicate that soil test K levels have not changed very much since the 1980s (Fig. 6). There is a slight trend toward fewer medium (M) and more high (H) testing soils.

Soil Groups and Cation Exchange Capacity

Since the early 1960's, the A.U. Soil Testing Laboratory has categorized samples based upon their soil texture and/or estimated cation exchange capacity (CEC). Separate calibrations are used for each soil group. Samples from each soil group have remained fairly constant over the 50 years.

Sandy soils with CEC< 4.6 cmol/kg	26%
Loamy soils with CEC 4.7-9.0 cmol/kg	39%
Silt loams & clay loams from the Limestone Valley region & soils high in organic matter (CEC 9.0+)	31%
Clays from the Black Belt Prairie region (CEC 9.0+ cmol/kg)	4%

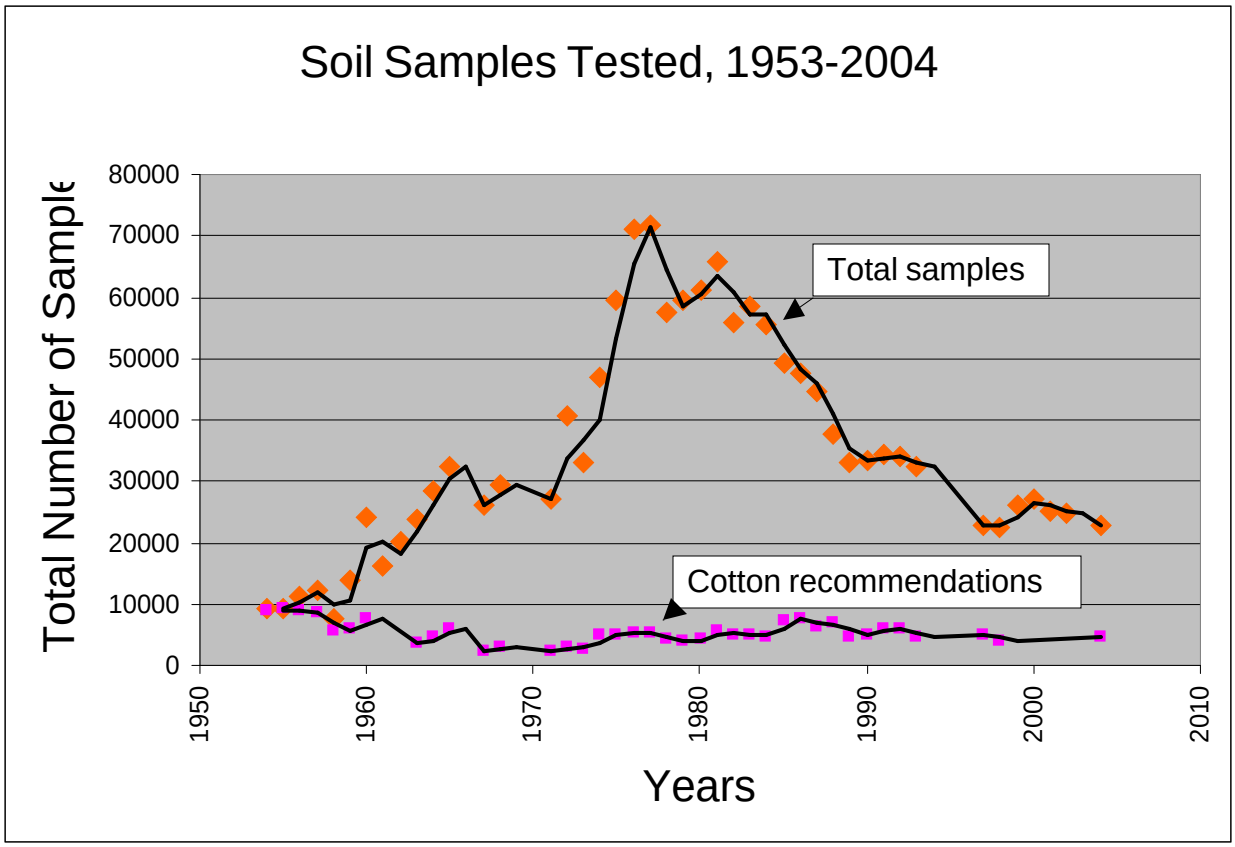

Figure 1. Total soil samples tested since 1954 and the number of cotton recommendations reported.

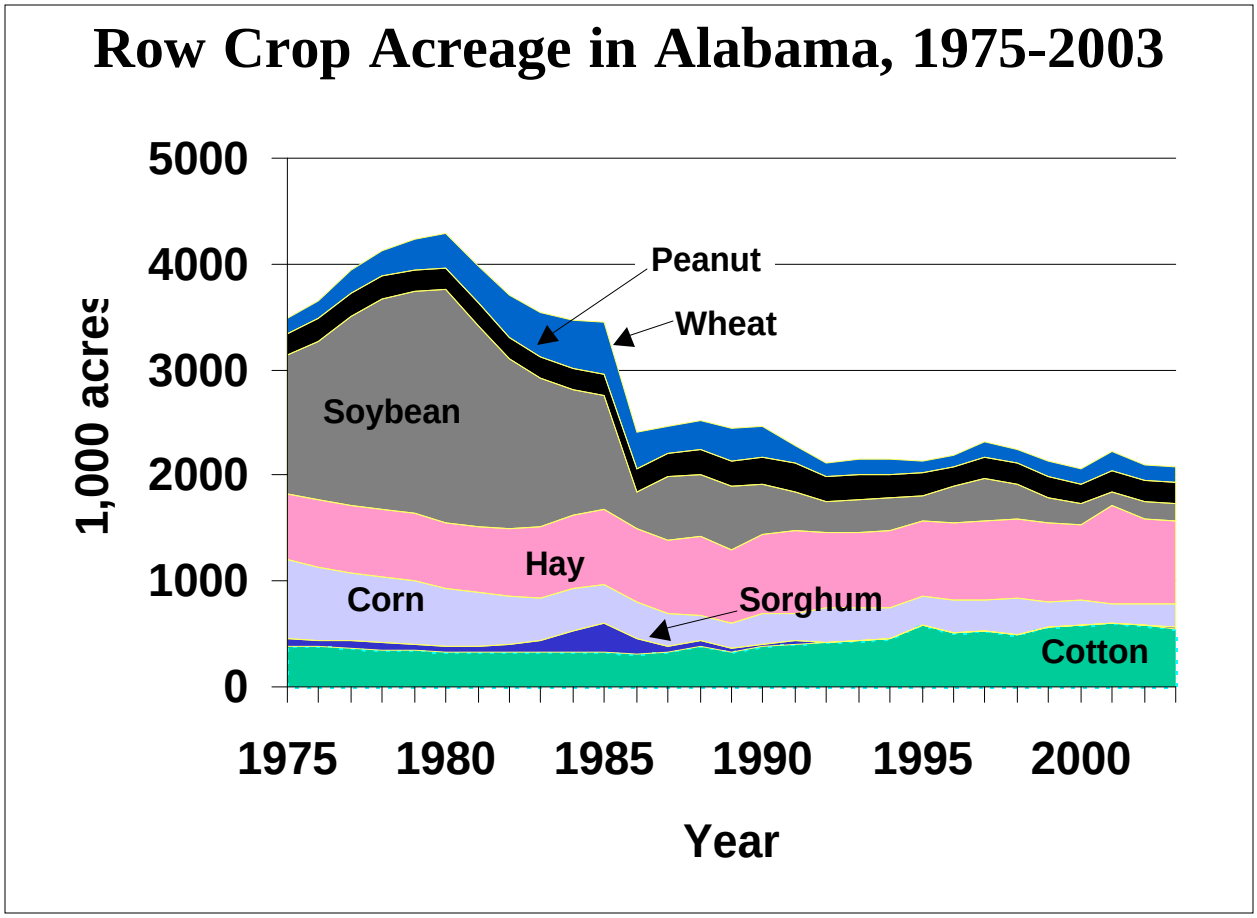

Figure 2. Alabama row crop acreage since 1975.

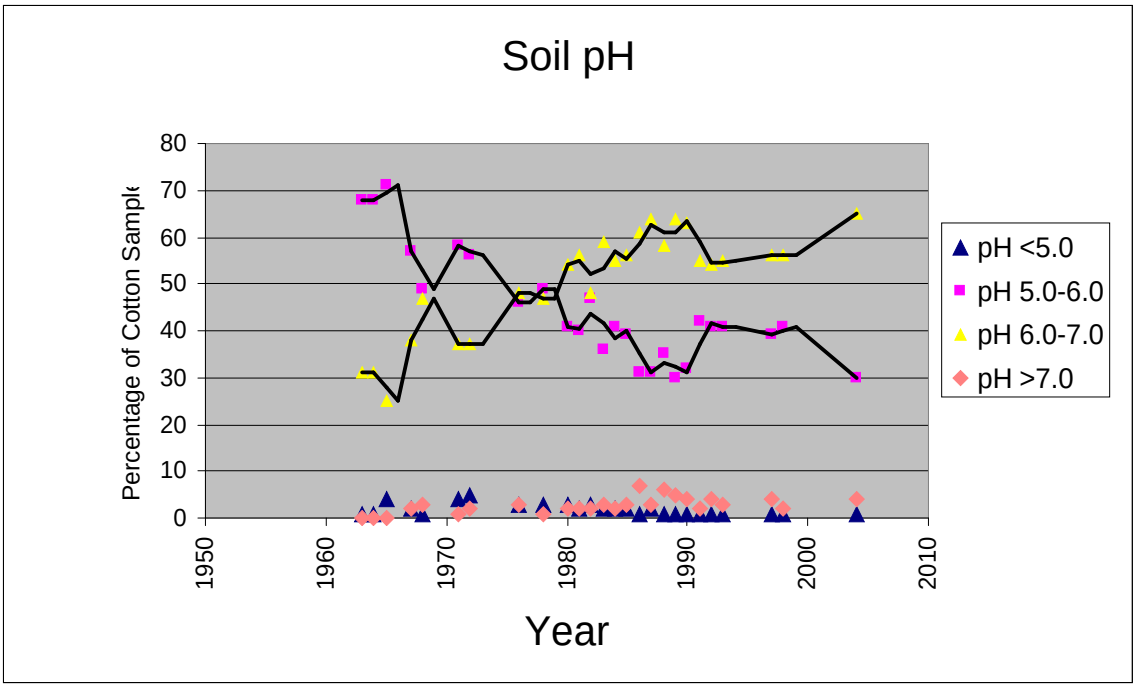

Figure 3. Trends in soil pH for Alabama cotton samples tested.

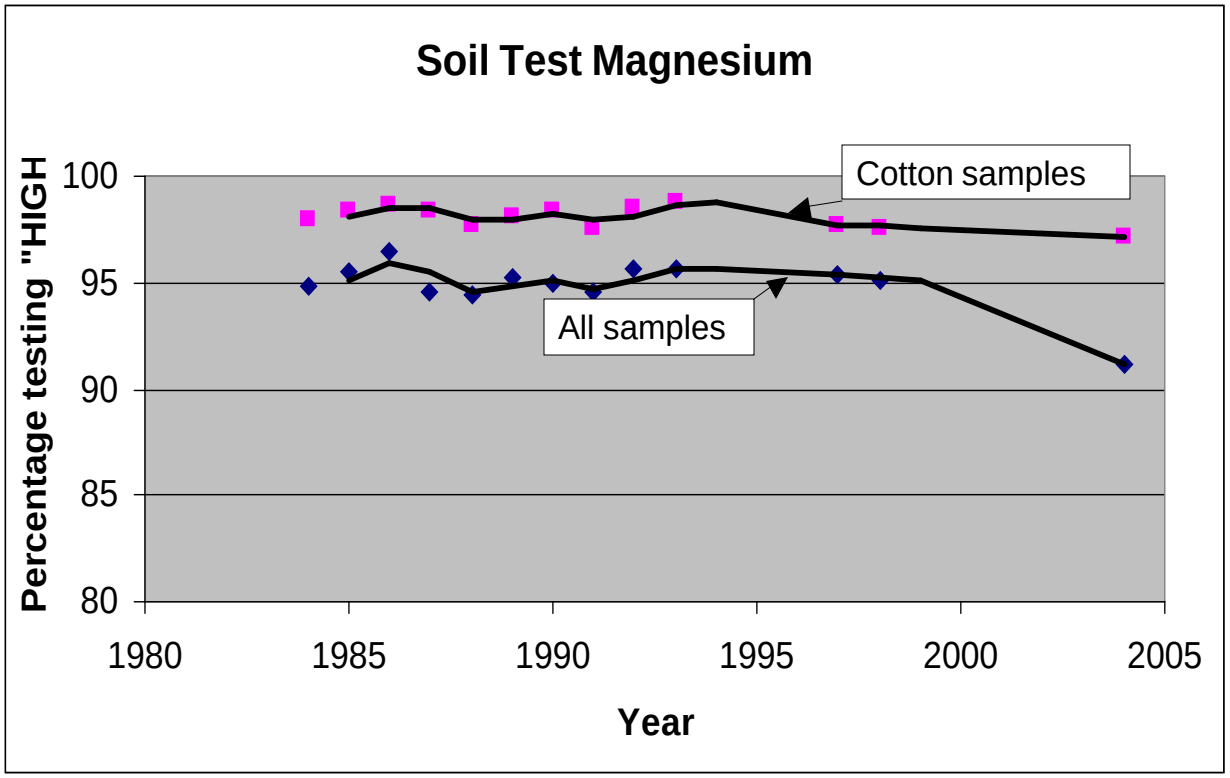

Figure 4. Trends in soil samples testing “HIGH” in magnesium. High is defined as Mehlich-1 extractable Mg > 25 mg/kg for soils with a CEC > 4.6 cmol/kg or Mehlich-1 extractable Mg > 12.5 mg/kg for soils with a CEC< 4.6 cmol/kg.

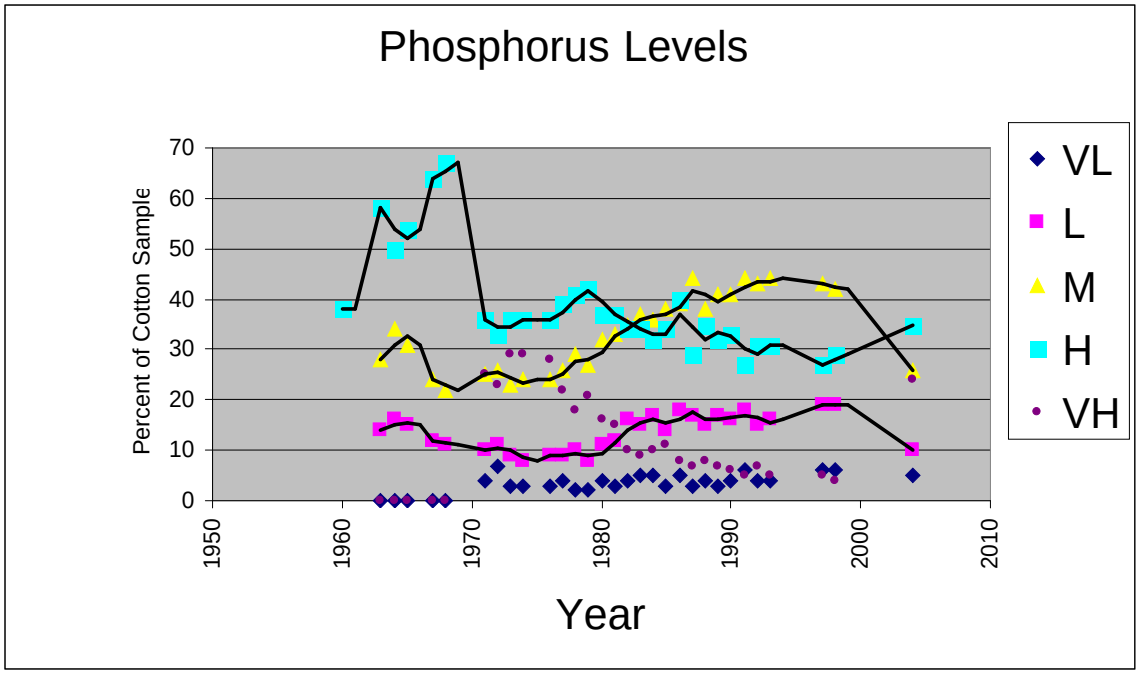

Figure 5. Trends in soil test P for Alabama cotton samples. VL= “very low” (Mehlich-1 extractable P< 6 mg/kg); L= “low” (M-1 extractable P = 6 to 12.5 mg/kg); M = “medium” (M-1 extractable P = 13-25 mg/kg); H = “high” (M-1 extractable P = 25 to 50 mg/kg); VH = “very high” (M-1 extractable P > 50 mg/kg).

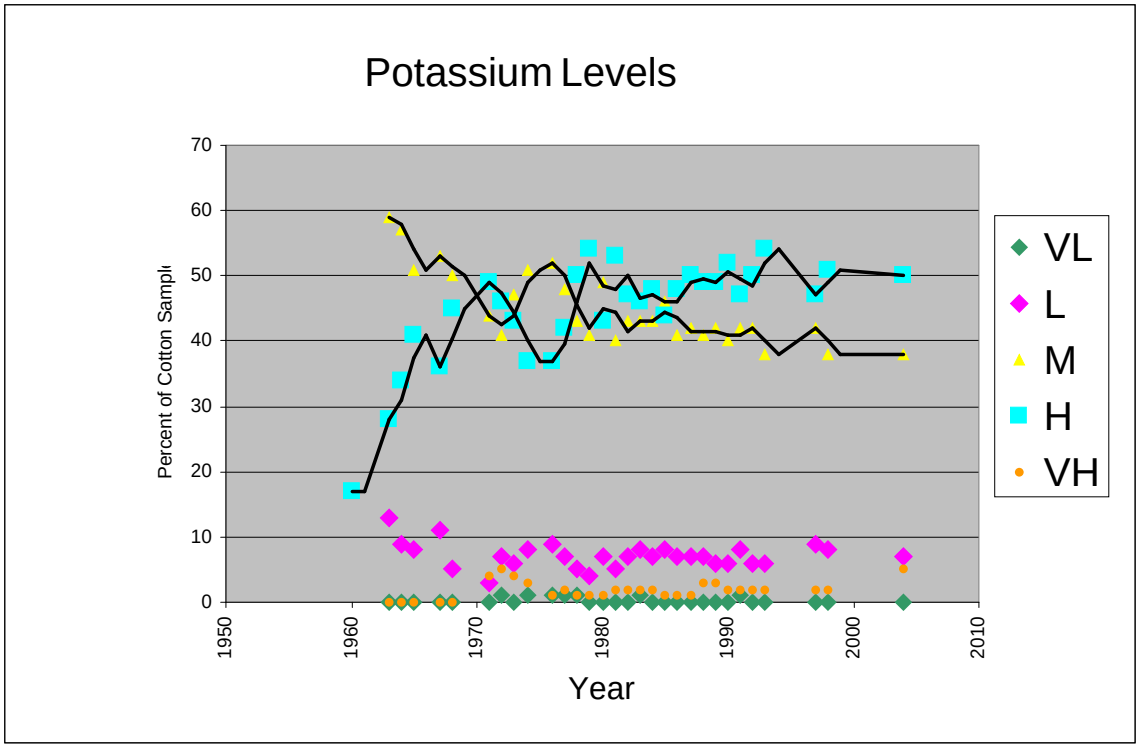

Figure 6. Trends in soil test K for Alabama cotton samples. Extractable P values for very low (VL), low (L), medium (M), high (H), and very high (VH) depend upon the soil texture and cation exchange capacity (Adams, et al., 1994).

Summary

Alabama cotton producers that have their soils tested by the Auburn University Soil Testing Laboratory are, in general, doing a very good job of maintaining a desirable soil pH and "high" soil test values for P, K, and Mg for optimum production. Long-term trends do not indicate any change in the fertility status of Alabama cotton soils. The A.U. laboratory tests about 1 sample each year for every 100 acres of cotton produced in the state.

Acknowledgements

The fact that some records have been kept over the years, which allow at least a partial summary of soil test results, is a credit to the past and present management of the A.U. Soil Testing Laboratory. Past directors of the laboratory are Dr. Clarence Wilson (1953-57), Dr. Dennis Rouse (1957-66), Dr. Tom Cope (19666-80), Dr. Clyde Evans (1980-92), and current director, Mr. Hamilton Bryant (1993-present). We also wish to acknowledge Ms. Julia Zhu who is making it possible to retrieve electronic soil test summaries for recent years.