Mississippi No-tillage Update Report

Edited by

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No-tillage systems of crop production have not been as widely accepted by farmers in Mississippi as in the midwestern farm states or even in some neighboring southern states. Mississippi had 161,171 acres in no-till in 1985 as compared to 749,727 and 4,791,354 in minimum and conventional tillage, respectively, according to the mid-March issue of No-Till Farmer (Vol. 15, No. 6, No-Till Farmer Inc., 260 Regency Court, Waukesha WI 53186). Adoption of complete no-till has been slowed by a number of primary factors, including unique soil resources, drainage characteristics, topography, and crop mix in major farming areas -- and by a number of studies indicating significant yield reductions in crops grown without some form of tillage. A closer look at Mississippi reveals why no-till farming has not. been widely used and points to areas of the state where it has potential.

Mississippi encompasses a total land area of approximately 30 million acres. Major land resource areas of the state (shown in Fig. 1) are as follows: Southern Mississippi Valley Alluvium (Delta), Southern Coastal Plain, Southern Mississippi Valley Silty Uplands, Mississippi Blackland Prairie, and Gulf Coast Flatwoods. The loess deposits or Silty Uplands, commonly called Brown Loam, and Coastal Plain are further subdivided on a state level. General land use in the state is as follows: cropland 24 percent; pasture 13 percent; forest 56 percent; other agricultural lands 2 percent; urban and built up areas 4 percent: and small water areas (7 to 40 acres in size) 1 percent. The state's population is approximately 2.5 million and is 55 percent rural and 45 percent urban. The standard of living in Mississippi as measured by per capita income is just over two-thirds that of the U.S. average, and the overall economy is highly dependent on agriculture and forest products.

Average annual rainfall across the state ranges from 50 to 64 inches with the highest values near the Gulf Coast. Mean annual temperature ranges from 62°F in the extreme north to 68°F in the extreme south with an average of 194 and 264 frost free days, respectively. Thus, much of the state has a long growing season and is suited to a variety of doublecropping systems.

Approximately 22 million acres of land in Mississippi have an erosion problem. Of this total there are about 1.8 million acres, primarily in the Mississippi Valley Silty Uplands, which have a critical erosion problem. At least 2.5 million acres of productive agricultural land have a problem related to excess surface water during most years.

Acreages and recent changes in acreages of five major crops are given in Table 1. Soybean acreage peaked at 4.2 million in 1979 and has declined

Table 1. Acreages of major crops planted in Mississippi, 1978 to 1984.

Crop	1978	1979	1980	1981	1982	1983	1984
	1000 acres						
Soybean	3,900	4,200	4,000	3,800	3,700	3,200	3,300
Cotton	1,200	1,090	1,150	1,230	1,000	687	1,045
Wheat	100	150	375	650	1,100	7?0	770
Rice	220	210	250	340	250	162	195
Corn	215	190	170	180	150	100	120
Grain Sorghum	35	35	27	20	25	24	30
Total	5,670	5,885	5,972	6,270	6,225	4,893	5,460

Source: Mississippi Agricultural Statistics, 1978-1984, Supplement No. 19, Mississippi Crop and Livestock Reporting Service and USDA Statistical Reporting Service, Jackson, Mississippi.

by almost a million acres since that. time. Cotton and wheat rank second and third in total acreage, with approximately three-fourths of the wheat doublecropped on the same land base with soybeans. Other crops of importance include rice, corn, and grain sorghum, but the combined acreage of soybeans and cotton has made up 80 to 90 percent of the total cropland during the past 5 years. Grain sorghum increased by a factor of 10 or more in 1985 and 1986 acreage is expected to be near 0.5 million acres.

Most tillage research in Mississippi during recent years has been conducted on soybeans, under both monoculture and doublecrop situations. Tillage effects on cotton, wheat, corn and grain sorghum have been studied, but not to the same degree as with soybeans. Agronomic and short-term economic aspects of tillage intensity have been studied most, followed by engineering and physical aspects associated with compaction, soil density, runoff, and erosion. Both agronomists and weed scientists are familiar with the potential impact that weeds, especially perennials, may have on minimum-till and no-till systems and this problem has been researched thoroughly with a large variety of chemicals. However, little information has been collected on how tillage and specific chemicals impact not only plants, but insect and disease related ecosystems as well. Some studies currently underway or planned will look at selected soybean insect pests and their natural predators under a variety of tillage systems. This type of information is important in pest management programs within any cropping system.

Although climatic patterns in Mississippi are similar to those of other states in the Southeast and Midsouth, soil materials, topography and drainage characteristics of the most, commonly used agricultural soils in Mississippi are somewhat different from those of some neighboring states in the Region. The highest concentration of cropland in Georgia and Alabama, for example, is on medium to coarse textured soils in the Southern Coastal Plain and Southern Piedmont. In Mississippi, the highest concentration of cropland is found in the Mississippi Alluvial Floodplain, or Delta as it is commonly called, and the Blackland Prairie. Both of these land resource areas are dominated by soils which have fine to very fine texture. However, sizable acreages of cropland are found in the Interior Flatwoods of the Coastal Plains as well as in the flatter areas in the Silty Uplands (Brown Loam) and Upper Coastal Plain. The Lower Coastal Plain and Gulf Coastal Flatwoods in the southern third of the state are dominated by timberland. Soils of the Interior Flatwoods are predominantly of a silt loam texture and overlay acid shale that is impervious to water movement, thereby causing many of these soils to be waterlogged for long periods since most of the area has level to gently sloping topography.

Soybeans are grown throughout the state but predominantly in the Delta and Blackland Prairie. Cotton is grown primarily in the Delta but is still an important crop in some areas of the Brown Loam and Upper Coastal Plain. Wheat and grain sorghum are widely dispersed but grown primarily in the Delta and Blackland Prairie. Corn is grown everywhere but the Delta, while rice is grown only in the Delta.

Corn acreage is low in Mississippi (making up less than 5 percent of the cropland), and has decreased in recent years as has soybean acreage. Rice and sorghum acreage has fluctuated somewhat, but present acreages are similar to those of 5 years ago, with both making up about 5 percent of the total cropland. Wheat acreage has increased substantially in recent years, going from 100 thousand acres in 1978 to 1.1 million in 1982.

Although many soybean tillage practices, developed and supported by research, have been adopted by farmers throughout the state, few farmers have gone to complete no-till farming systems. The major reason for this can be related to results of field research conducted on fine and very fine textured soils in the Delta and Blackland Prairie, and other results from silt loam soils in other parts of the state. A number of researchers have found that complete no-till monocrop soybeans produce lower yields and lower net returns on fine and very fine textured soils most years and on silt loam soils of the Silty Uplands some years, in comparison to systems that use primary tillage. A similar trend has been found for doublecrop soybeans following wheat, although the differences are not as dramatic. On fine and very fine textured soils, soybeans planted no-till in standing wheat straw usually yield lower than those planted in a prepared seedbed. Several researchers have found that doublecrop soybeans planted no-till after burning wheat straw usually out yield those planted into straw on the fine and very fine texture soils in Mississippi. However, these beans do not usually perform as well as those planted in a prepared seedbed after burning wheat straw when moisture is adequate at planting. Although burning is not a practice recommended by most agronomists due to certain hazards associated with wild fires, smoke, and loss of organic matter, many farmers of fine textured soils utilize burning as a cheap and easy method of handling wheat

straw regardless of whether they plant doublecrop soybeans no-till or in a prepared seedbed.

With good weed control, no-till monocropped soybeans generally compare favorably with or give improved yields over those of conventionally tilled soybeans on the coarser textured soils in the Coastal Plain. Any mulch, including wheat straw, appears to improve moisture use efficiency on coarser textured soils. This gives no-till doublecropped soybeans a favorable response over conventional soybeans some years. Even with comparable yields, net returns from no-till in the short term have not always been better than those for conventional methods. In many cases, the extra costs of chemicals needed for adequate weed control have more than offset the decrease in fuel consumption and equipment costs associated with no-tillage. However, if dollar values are placed on topsoil and nutrient losses due to erosion, no-till systems compare more favorably on many upland soils. Current research in Mississippi will evaluate the effects of various tillage intensities on long-term productivity of major upland soils in the Mississippi Blackland Prairie.

A large number of researchers and farmers now believe that any tillage practice which does not return more than it costs by increasing yield or improving soil conditions should be eliminated. Although thera are those who still adhere to and follow proven traditional practices because less risk is involved, the number who believe any tillage activity beyond that needed to assure optimum crop production and weed control has no value is steadily increasing. Tillage research conducted throughout Mississippi, thus far, indicates that the tillage requirement for optimum soybean production is variable and highly dependent on soil texture.

No one doubts that no-till or many forms of reduced tillage decrease soil erosion in summer row crops like cotton and soybeans, especially on upland soils. Mississippi data supports this fact. However, cotton is usually grown as a monocrop and a preferred practice is burying all residue with fall plowing. Fall plowing in the Delta and bottomland areas is also used to facilitate earlier planting the following spring. These areas are not usually prone to high erosion. However, during recent years more residue has been left on upland sites during winter months, and interest has increased in reduced tillage and the use of legume cover crops for nitrogen and erosion control in upland cotton.

Most cotton is grown on ridges to facilitate machine harvest. These ridges and the woody nature of stalks and roots interfere with no-till planting in the same row even after residue has been shredded. More research is needed to study the potential of no-till or reduced tillage in upland cotton. No-till cotton yields from upland Coastal Plain soils in north Mississippi have been comparable to yields from conventional planting methods.

Tillage research on fine textured soils with corn and grain sorghum is somewhat limited since neither is a major crop in Mississippi. However, grain sorghum seems to be replacing part of the acreage previously used to grow soybeans. General trends however, show that reduced tillage on the fine textured soils limits growth and yield of both crops most years in comparison to systems receiving primary tillage. However, these reductions

are not as severe as those for soybeans and appear to be eliminated during years of good rainfall distribution. The fine and very fine textured soils of the Blackland Prairie appear to limit root growth and uptake of water and nutrients when primary tillage is eliminated. This is brought about by the high density and mechanical impedance associated with smectite type clays which exhibit tremendous forces during wetting and drying cycles due to shrinking and swelling. Apparently these soils can self compact to a density near 1.5 g/cm^3 as water is removed. Many of the fine textured soils in the Delta have similar clays. Primary tillage prior to planting prevents this self compacting effect during most of a single growing season, but by the next growing season the effect of primary tillage from the previous year has disappeared. Corn and grain sorghum have generally responded favorably to no-till on coarse textured soils, provided weed control has been adequate. Recently, there has been renewed interest in using legume cover crops in reduced tillage or no-till systems with corn or grain sorghum.

Very little research has been conducted on how tillage intensity affects wheat yields in monocrop on doublecrop systems. Little research data are available on the effects of fertilizer placement in minimum-till and no-till systems. Most tillage studies in Mississippi have been conducted without irrigation, and there is some indication that a strong interaction may occur between irrigation and tillage on the finer textured soils. If this is the case, many earlier conclusions would have to be re-evaluated. Irrigation could expand no-till production in the future, especially in association with doublecropping systems.

This brief overview and summary of no-till in Mississippi was prepared with input from the following scientists who are among some three dozen federal and state research workers involved in tillage studies at Mississippi State University Agricultura1 and Forestry Experiment Station and its outlying Branch Experiment Stations.

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MAJOR LAND RESOURCE AREAS OF MISSISSIPPI

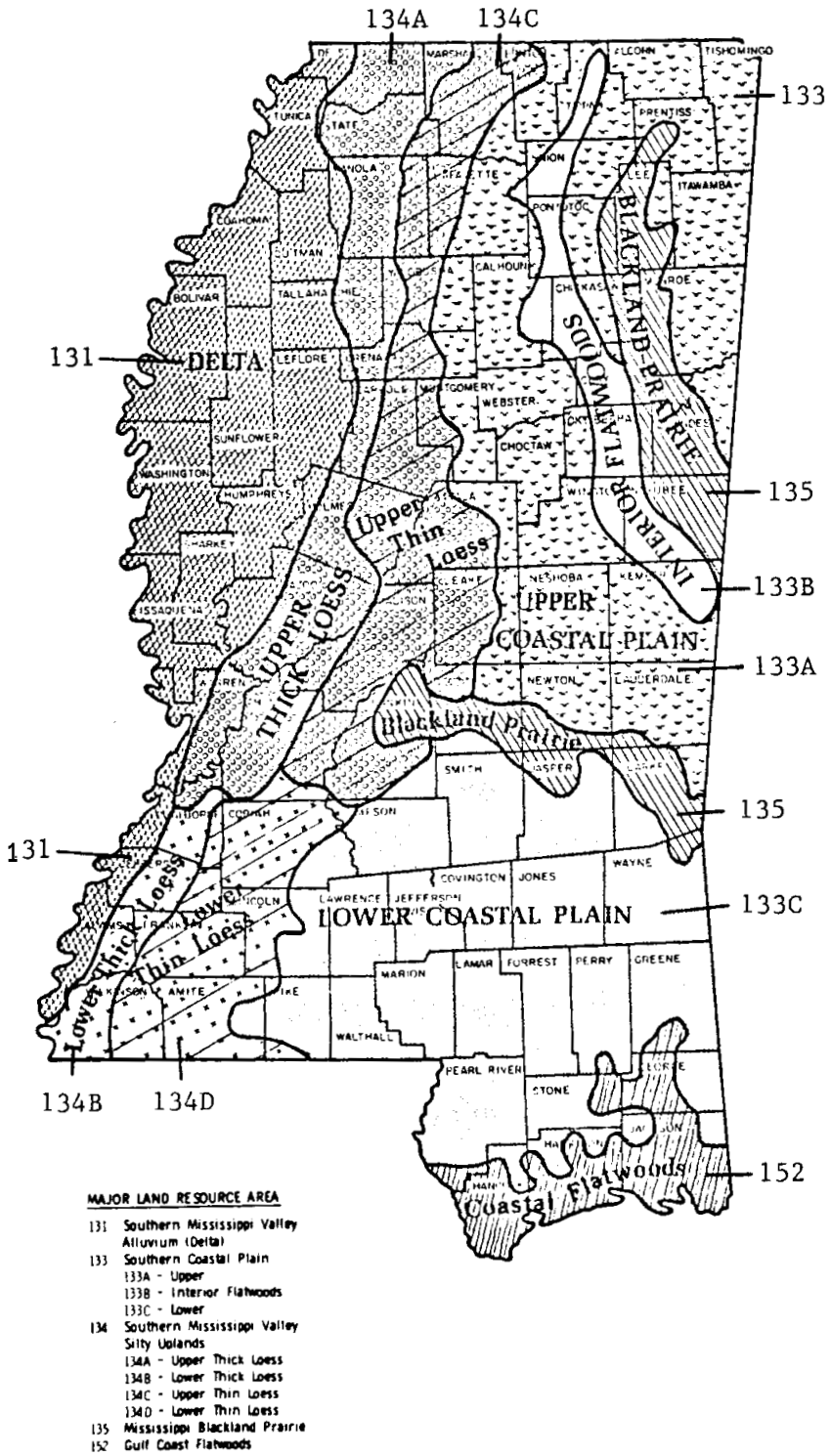

Figure 1.