Changes in Agricultural Tillage Practices in Mississippi from 1997 to 2002

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ABSTRACT

Changes in agricultural land use, tillage systems, and conservation programs have resulted in a meaningful saving of soil resources for Mississippi over the past twenty-five years. Approximately 5,000 acres of cropland has been taken out of production since 1977. Over two thousand acres have gone into the Conservation Reserve Program (CRP) since 1985. It is doubtful that any of these acres will ever return to cropland production. Tillage operations for major field crops have gone from 10 passes across the field before planting in 1977 to less than 2 passes across the field today. Average soil erosion for the state dropped from 5.2 tons per acre in 1982 to 3.7 tons per acre in 1997. Attitudes of producers concerning practices using reduced tillage or no-tillage has moved from the extreme, where intensive tillage was practiced in 1977, to a moderate approach today, where conservation tillage is an acceptable practice for farming.

KEYWORDS

Conservation tillage, Conservation Reserve Program (CRP), soil resources

INTRODUCTION

Agriculture and forestry have played major roles in Mississippi's history. When the state was first settled, people counted on the abundant natural resources for food and shelter. In 1999, it was calculated that one of every five employees in the state had a job related to agricultural or forestry products (USDA-ERS, 1999).

Land grant universities have conducted research that has focused on expanding production while cutting inputs and expenses. At the county level, extension agents and district conservationists provide technical assistance so those land managers may become more adept at protecting the land and water resource base.

Since the mid 1970's, The Natural Resource Conservation Service (NRCS), the Mississippi Extension Service, and the Mississippi Agricultural and Forestry Experiment Station have placed a heavy emphasis on conservation tillage and no-till production. Research on tillage systems has greatly influenced farming methods across the state in the past twenty-five years.

METHODOLOGY

The bulk of data for this report came from the Agriculture Census and National Resources Inventory. Census of Agriculture: Since 1840, the Census of Agriculture has provided information on county, state, and national agricultural production. Uses of the data include implementing farm program policies by Congress and allocating funding for extension service programs, agricultural research, and land-grant universities. Census data provides private industry with the information necessary to increase production and distribution. National Resources Inventory (NRI): The Rural Development Act of 1972 and the Soil and Water Resources Conservation Act of 1977 directed NRCS to collect natural resources data. The purpose of these and other acts was to assess the status, condition, and trends of soil and water, which includes land cover and use, soil erosion, prime farmland, habitat diversity, wetlands, selected conservation practices, and related resources on the nation's non-federal lands. The NRI is designed to produce statistically reliable data at the national, regional, state, and multi-county levels.

DISCUSSION

Farm characteristics

The total number of farms in Mississippi in 1977 were 58,000; by 2002 the farm numbers had decreased by over 27,000. The percentage of farms owned by individuals, families, or family corporations has remained above 90%

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Table 1. Number of farms, average farm size and total acre in farms for Mississippi.

Year	No. of farms	Avg. size (acres)	Total acres
1860†	43,000	370	15,000,000
1930‡	313,000	55	17,300,000
1977§	58,000	259	15,100,000
1997¶	31,318	323	10,100,000
2001 (estimated)	30,000	350	10,000,000

†USDA , Mississippi Agricultural Statistic Service, Ag Report

‡Mississippi Agricultural Statistics Supplement No. 5. Jan 1963

§Mississippi Agricultural Statistics 1974-1980 Supplement No. 15

¶1997 Census of Agriculture

since 1982. As the number of farms decreased from 1982, the average age of farm operators increased from 52 to 56 years. Also, the percentage of operators with farming as a principal occupation decreased from 71.7% in 1982 to 40.7% in 1997.

Even though the number of farms and land in farms decreased from1977 to 2002, the average farm size increased by 70+ acres. Farm size in Mississippi has steadily increased since 1930, when the average size of a farm was 55 acres, to 350+ acres in 2002. During this time period the number of farms decreased from 313,000 to 30,000. The total acres in agricultural land have dropped from 15,000,000 acres to 10,000,000 acres during this time period (Table 1.).

Crop land use

Acres by selected land use have been changing over the Over the past 100 years, Mississippi has moved from primarily cotton and corn production to producing a variety of agriculture crops. Soybean, cotton, and corn are the major cultivated croplands in Mississippi for 2001 (Table 2). Nationally, Mississippi ranked fourth in 1997 for cotton acreage and bales produced. For soybean, Mississippi ranked 12th for bushels produced and 11th for acres harvested. Mississippi ranked 5th for rice (*Oryza sativa* L.) in total acres.

From 1982 to 1997, total soil erosion was estimated to decrease from 61,377,989 tons to 31,871,347 tons annually. Average soil erosion per acre decreased from 5.2 tons

Table 2. Land use and annual soil erosion by selected land use in Mississippi.

	1977†		1997‡		2001§	
Land use	Acres	Erosion	Acres	Erosion	Acres	Erosion
	x 1000	est. tons acre^{-1} year^{-1}	x 1000	tons acre^{-1} year^{-1}	x 1000	est. tons acre^{-1} year^{-1}
Corn	250	10.4	419.3	6.1	400	5.5
Sorghum	60	12.4	33.6	5.7	90	5.5
Soybean	3,750	8.0	2295.9	4.3	1,160	4.3
Cotton	1,090	7.8	1280.4	7.9	1,100	6.9
Peanut	7.5	26.3	6.0	8.5	6	6..0
Wheat	140	6.6	106.6	4.3	110	4.3
Rice	112	1.9	239.0	2.3	235	2.3

† (est) estimated soil erosion were made using NRI and SCS data for 1977

‡ 1997 NRI Survey; USDA Ag Report Mississippi Agricultural Statistics Service

§ NRI 1997 and NRCS data for 2001.

Table 3. Acres and estimated soil erosion for crops grown on hydric soils and highly erodible land in Mississippi. Data for 1977, 1982, and 1997 are based on the 1997 Census of Agriculture. 2001 data are based on estimates.

Crop / Year	Hydric Soils Acres	Hydric Soils Soil erosion	Highly erodible land Acres	Highly erodible land Soil erosion
	x1000	tons acre^{-1} year^{-1}	x1000	tons acre^{-1} year^{-1}
Corn				
1977	7.6	†	210.0	21.1
1982	22.4	5.1	127.1	16.3
1997	78.6	4.5	69.2	14.4
2001	80.0	4.3	70.0	12.8
Cotton				
1977	448.5	6.0	206.7	21.3
1982	485.3	5.9	167.4	19.5
1997	436.0	6.1	157.9	18.3
2001	400.0	5.5	140.0	12.0
Rice				
1977	111.0	2.0	†	†
1982	286.1	1.9	†	†
1997	215.4	2.2	†	†
2001	250.0	2.0	†	†
Sorghum				
1977	2.5	3.5	40.0	25.0
1982	6.3	3.3	32.2	22.3
1997	14.8	3.5	6.4	12.6
2001	7.5	3.5	1.3	14.0
Soybean				
1977	1200.0	4.0	990.0	22.0
1982	1633.6	3.8	1024.6	20.5
1997	1430.5	3.4	167.6	13.2
2001	850.0	3.3	145.0	12.0
Peanut				
1977	†	†	1.6	25.0
1982	†	†	1.4	26.3
1997	1.3	6.5	1.7	17.5
2001	1.3	6.5	1.7	17.5
Wheat				
1977	103.0	4.5	77.0	15.0
1982	108.9	4.2	80.9	12.6

† Could not be estimated because of missing census data.

per acre in 1982 to 3.1 tons per acre in 1997. This reduction in total soil erosion was attributed to the decrease in cropland acres. Multiple tillage trips usually associated with sweetpotato (*Ipomoea batata* (L.) Lam) and vegetable production were attributed to the high soil erosion rates for these crops.

Soils

Within Mississippi, 186 soil series are recognized. Smithdale (fine-loamy, siliceous, subactive, thermic Typic Hapludults) had the most acres with over 3.714 million acres. Pikeville (fine-loamy, siliceous, subactive, thermic Typic Paleudults), rock outcrop, and Frost (fine-silty, mixed, active, hyperthermic Typic Glossaqualfs) had the fewest with 1,300 acres each. Sharkey (very-fine, smectitic, thermic, Chromic Epiaquerts) had the most cultivated and total cropland acres while Talla (fine-loamy, siliceous, active, thermic Glossaquic Natrudalfs) had the fewest cropland acres. Providence (fine-silty, mixed, active, thermic Typic Fragiudalfs) had more acres enrolled in CRP with an estimated average annual soil erosion of 0.5 ton per acre in 1997.

Hydric soils

Mississippi has over 6.2 million acres classified as having hydric soils (USDA-SCS, 1994). A query of the State Soil Geographic Database (STATSGO) showed that most hydric soils are found in the Delta and near the Pascagoula-Black-Chickasawhay Rivers. Best managed for wetlands, hydric soils are highly productive for agricultural use. Also, hydric soils may sequester C and enhance soil quality with less crop residue management. Approximately 34% of cotton, 62% of soybean, and 90% of rice acres in 1997 were grown on hydric soils (Table 3). Crops grown on hydric soils tended to have less soil erosion when compared to all acres Sharkey is the predominant hydric soil in the state with 1,284,300 acres. Of this, 910,900 acres were in cropland during 1997. Approximately 17.8% of nut crops, 25% of soybean, and 45.7% of rice acres were planted on a Sharkey soil in 1997 (data not shown). The NRI does not include hydric inclusions.

Highly erodible land

Highly erodible land (HEL) can serve as an environmental indicator. As more HEL is used for agricultural production, soil erosion can increase,

Table 4. Acres and annual soil erosion, irrigated acres, and acres developed by 1997 of prime farmland in Mississippi (NRI, 1997).

Land use	Acres	Soil loss	Acres irrigated
		tons acre^{-1}	
	x1000	year^{-1}	x1000
Corn	351.7	5.0	52.6
Cotton	1027.6	7.4	185.1
Rice	203.2	2.4	203.2
Sorghum	23.2	5.5	2.7
Soybean	1769.2	3.9	526.3
Peanut	4.7	9.0	†
Wheat	88.4	4.5	24.1

and thus, decreasing soil quality. Between 1982 and 1997 the number of acres of HEL has decreased by 655.3 thousand acres (Table 3). A decrease in soybean acres of HEL was a leading reason. Mississippi had 500,000 acres of soybeans in 1952, 3,750,000 acres in 1977, and 2,300,000 acres in 1997. Generally, soil erosion decreased with each land use from 1977 to 2002 for HEL. Loring (fine-silty, mixed, active, thermic Oxyaquic Fraqiudalfs), found mainly in the Brown Loam, had 222,800 acres of HEL in 1997 (data not shown). Of this, 157,500 acres were in cropland.

Prime farmland

Prime farmland is defined as land with the best combination of physical and chemical characteristics for food, feed, forage, fiber, and oilseed crop production and is also available for these uses (USDA-NRCS, 1999). According to STATSGO, Mississippi had 6.2 million acres that could be classified as prime farmland (Code 1). Soils in the Delta and the Brown Loam are classified as prime farmland only when protected from flooding or not frequently flooded during the growing season (Code 3).

Delta soils Sharkey, Alligator (very-fine, smectitic, thermic Chromic Dystraquerts), Dundee (fine-silty, mixed, active, thermic Typic Endoaqualfs), and Forestdale (fine, smectitic, thermic Typic Endoaqualfs) are the top four soils with the most acres of potential prime farmland and cropland on prime farmland (data not shown). Of the prime farmland soils with 2,000 plus acres, Memphis (fine-silty, mixed, active, thermic Typic Hapludalfs) and Loring had the highest soil erosion rates, 14.5 and 10.5 tons acre^{-1} year^{-1}, respectively. In 1997, approximately 80, 77, and 85% of the total acreage of cotton, soybean, and rice were planted on prime farmland, respectively. Soil erosion associated with these crops tended to be less on prime farmland than on all acres (Table 4).

Conservation practices

Conservation practices such as terraces, filter strips, and grassed waterways help improve water quality by reducing the amount of sediment and attached pesticides reaching water bodies. The average use of fluometuron and norflurazon in Mississippi is among the highest in the nation (USGS, 1998). Research in the state has shown that filter strips can reduce loss of these compounds by at least 63% (Rankins *et al*., unpublished data). In another study, loss of metribuzin and metolachlor from runoff was less than 3% of the total amount applied, or half that of the unfiltered check, when tall fescue (*Festuca arundinacea* Schreb.) was used as a filter strip (Tingle *et al*., 1998).

Conservation tillage

Conservation tillage (CT) (>30% residue after planting) has been shown to have agronomic, economic, and environmental benefits; however, land operators in Mississippi have planted only approximately 25% of cropland acres with CT from 1992 to 1997 (CTIC, 1997). Mississippi ranked 31st nationally in percentage of acres planted using CT and 6th in the Southeast.

Over half of double-cropped soybean was planted using CT from 1992 to 1997 (CTIC, 1997). Conservation tillage acres for corn, one of the crops easiest to grow with CT, were less than 30%. Research in the state has shown that highly erosive crops such as cotton (Stevens *et al*., 1992; Bloodworth and Johnson, 1995), peanut (*Arachis hypogea* L.) (Bloodworth and Lane, 1994), and sweetpotato (Bloodworth and Lane, 1994) can be successfully grown with CT; however, less than 9% of acres for these crops were planted using CT in 1997. With a drastic downturn in the agriculture economy, a large number of producers are converting to no-till farming as a means of survival.

Annual crop yields of long-term no-till soybean (*Glycine max*) and conventional-till soybean at Holly Springs, Mississippi were summarized for a 16-year period, 1984-1999. McGregor *et al*. (1992), McGregor *et al*. (1999), and Cullum *et al*. (2000) indicated probable trends for increasing soil losses with time under conventional-till history and minimal soil losses with time for no-till history. Differences and trends in crop yields between no-till and conventional-till soybean on a soil overlaying a fragipan were recorded over the 16-year period. Crop yield results and computations with the revised universal soil loss equation indicate that soil loss from conventional-till soybean on fragipan soils reduces long-term crop productivity, while the soil resource base is maintained on these soils under no-till soybean. No-till crop productivity under no-till also is maintained at a higher level than under conventional-till. Although poor soybean yields from both no-till and conventional-till were produced during several years, the sustained trend for lower yields from conventional-till as compared to no-till indicated an adverse effect of excessive erosion and tillage on soil productivity. Continued erosion of the soil overlying a fragipan soil creates an environment where crop yields cannot be maintained even under optimum climatic growing conditions.

Crop rotation

Crops are commonly grown in a rotation in order to reduce pest competition, improve soil conditions, and reduce soil erosion. To date, the NRI is the only statistically reliable national survey that records cropping history. For each inventory year, land cover use is recorded for the preceding three years thus providing data for four years. A query was conducted from the 1997 NRI to determine acres in either a monoculture or a crop rotation cropping practice. Acres and average soil erosion for each crop and cropping practice are presented in Table 5.

Essentially, all rice in Mississippi was in a four-year crop rotation while 78% of cotton was grown in a monoculture practice. Soybean acres were evenly split between the two practices. Soil erosion for each cultivated crop in a rotation tended to decrease except for rice.

Corn is a popular rotation crop since it can be easily grown with CT, increases soil organic matter, and decreases soil erosion. Acreage of corn in 1997 rotated with cotton, rice or soybean tended to increase from 1994 to 1996. Acres classified as land not planted decreased during the three years prior to 1997 except for corn and sorghum. Soybean was the crop most commonly used in a rotation.

CONCLUSION

Demand for a readily available and safe supply of food and water is projected to increase. Therefore, Mississippi must continue to conserve its natural resources. Many of the acres taken out of cropland production were entered into the CRP, thus reducing sediment in lakes and rivers. Implementing various conservation practices and management options such as buffer strips and precision farming help decrease nutrient and pesticide runoff. Research by the Mississippi Agricultural and Forestry Experiment Station, USDA-ARS Soil Sedimentation Laboratory, USDA-NRCS Plant Material Center and advances in equipment, technology, and herbicides have proven CT is a viable alternative for reducing costs while maintaining crop yields. Adoption of CT practices began to stagnate in the state in the mid 1990's. With a downturn in agricultural commodity prices in the late 1990's and continuing in the 2000's, CT has increased rapidly during this period. Cropland development has been on a downward trend since 1987, but efforts should be made to conserve irrigated cropland and prime farmland. Mississippi is a leader in funds spent for agricultural and forestry research for developing conservation practices. Programs and demonstration projects from agencies such as the MSU-Extension Service and NRCS have greatly enhanced the dissemination of research data and practices over the past twenty-five years.

Table 5. Acres and average annual soil loss for crops in a monoculture or four-year crop rotation cropping practice in Mississippi, 1997 (Source: NRI 1997).

	Monoculture		Crop rotation	
Crop	Acres x 1000	Soil los tons acre^{-1} year^{-1}	Acres x 1000	Soil los tons acre^{-1} year^{-1}
Corn	89.7	6.6	329.6	6.0
Cotton	1002.3	8.3	275.1	6.4
Rice	3.7	1.8	235.4	2.3
Sorghum	9.5	6.6	24.1	5.4
Soybean	1151.4	4.5	1144.5	4.0
Wheat	21.2	6.8	85.4	3.6

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