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letin 808

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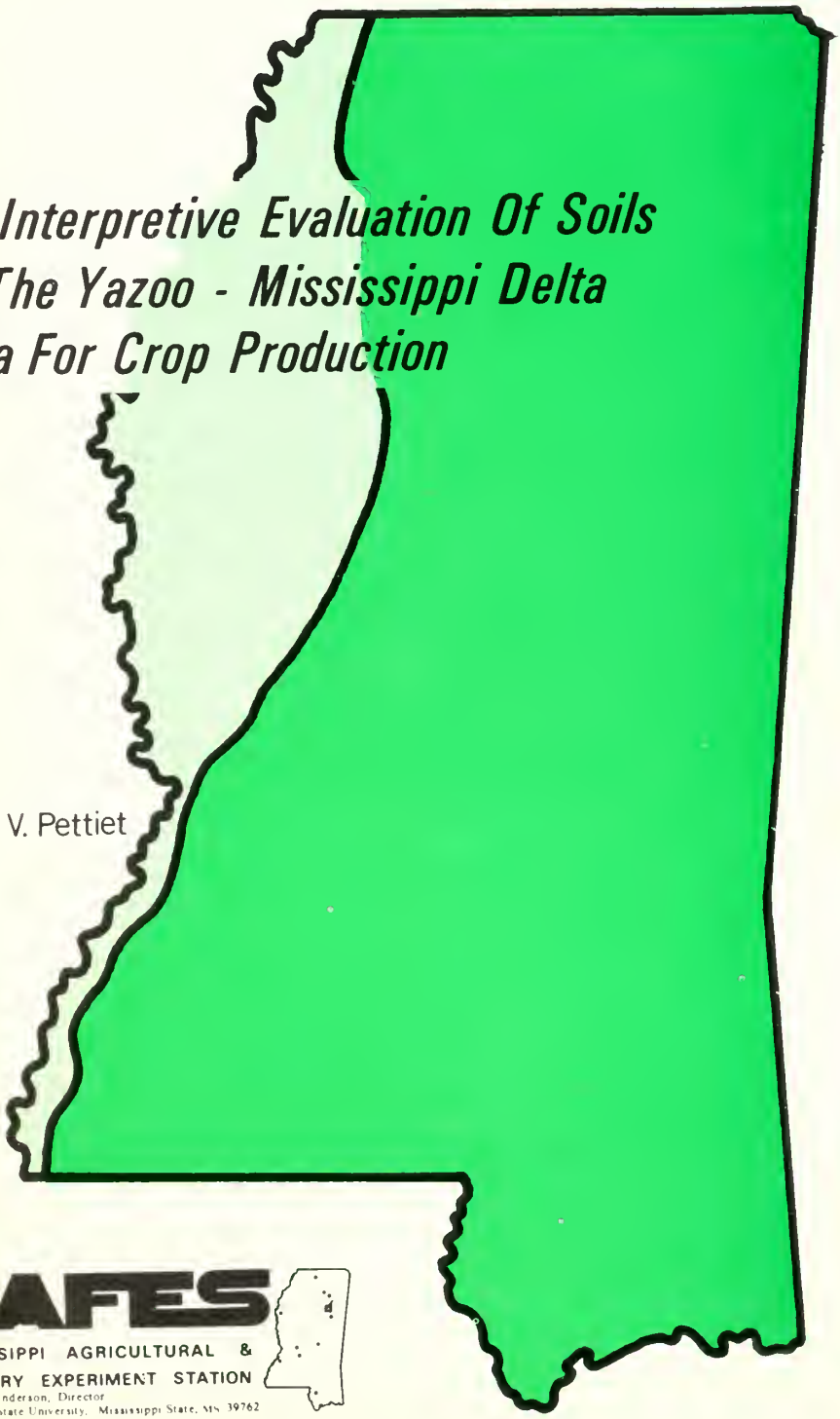

By Joe V. Pettiet

MAFES

MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION

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Bulletin 808

An Interpretive Evaluation of Soils in the Yazoo-Mississippi Delta Area for Crop Production

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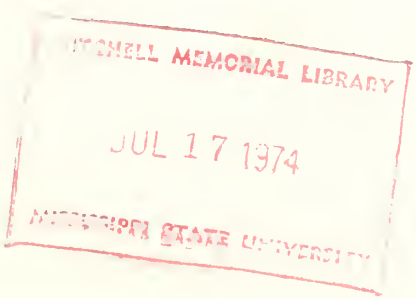

Table of Contents

An Interpretive Evaluation of Soils in the Yazoo-Mississippi Delta Area for Crop Production

The Southern Mississippi River Valley is one of the most important areas for crop production in the United States. Approximately 17 million acres of alluvium-derived soils are present within the states of Arkansas, Louisiana, and Mississippi. The crop value in these states exceeds that of crops produced on any area in the nation with similar acreage. Approximately five million acres make up the Yazoo-Mississippi Delta area in Mississippi.

The economy of Mississippi is highly dependent upon the Yazoo-Mississippi Delta since more than 40 percent of the gross annual income is derived from the sale of crops from this area. Despite the high level of crop production, the potential productivity of Delta soils have not been fully realized. This failure has been due in part to the extreme variations in physical, chemical, and mineralogical properties of available soils. While progress has been made in soil management, research workers and farmers lack expertise in modifying the chemical and physical soil properties needed for maximum crop yields.

The Soil Conservation Service, in cooperation with the Mississippi Agricultural and Forestry Experiment Station, has made extensive studies of the Yazoo-Mississippi Delta area, and has characterized the soils present in published Soil Surveys on a county basis (3). The purpose of this report is to supplement information contained in the county surveys, with emphasis on the four million acres of soils described in the 10 all-Delta counties and the Delta portion of Tallahatchie County, Mississippi. It is hoped that this information will provide a wider base for understanding soils in the area and enable farmers to better utilize soil maps contained in county reports on an 'individual' farm basis for better soil management and higher crop yields.

Soil Origin

The Yazoo-Mississippi Delta area is confined to the middle and eastern flood plain of the Mississippi River. The area encompasses ten all-Delta counties and portions of nine counties along the western foothills of the Brown Loam soil area. Delta soils

were formed from stream action of the Mississippi, Ohio and Missouri rivers. Sediment carried by these streams came from a watershed encompassing 20 states (1). The highly variable nature of the alluvium was the result of a long and complicated series of shifts in the position of major rivers and tributary streams. Rapid moving water brought sediment into the area. Sand and coarse sediments were first to settle as the streams overflowed their banks. Continuous overflows produced natural levees of coarse sediment near the stream channel; the levees being usually higher in elevation than the surrounding topography. Fine sand and silt sized particles were lost from the overflow water as it moved slowly toward the lower topographic positions. In the lower areas where water accumulates, the finer clay sediments were deposited. In time, the natural levees and stream bed itself were built up to a height above the surrounding flood plain. The meandering stream would then break from its channel and cut a new course toward the lower areas. This process of river migration was continually repeated and in time the Delta became interlaced with meander belts of old abandoned stream channels.

The old channels generally lie between natural levees which grade downslope into fine textured backwater areas. Texture of the downslope sediment grades from coarse sandy loams to fine clays, and internal and surface soil drainage changes from well drained to very poorly drained. The difference in soil drainage was one criteria used to classify the sediment into different soil units. The soil units have many things in common; they have similar parent material and were formed in about the same ti... period. They occupy the same relative topographic position (like on the old natural levees) but due to textured makeup, they vary in internal and surface drainage.

Soils in the Yazoo-Mississipp Delta were classified into four main groups (2):

1. Soils of the recent natural levees.
2. Soils of the old natural levees.
3. Soils of the backwater area.
4. Soils of the depressions.

Soils of the recent natural levees are considered the most recent in origin, and are found within a few miles of the present channel of the Mississippi River. Recent sediment left by the river contained free lime stone and the soils were slightly acid to near neutral in reaction. The *Crevasse* and *Robinsonville* soils occupy the highest topographic positions on the recent natural levees. The *Commerce* soils are usually found further from the channel and the *Mhoon* soils are present in the backwater areas.

The old natural levees appear somewhat older than the recent levees and are generally slightly acid to strongly acid in reaction. Soils found on the old levees in order of decreasing drainage (from excessive to poorly drained), are *Clack, Beulah, Bosket, Dubbs, Dundee,* and *Forestdale*. The first four soils are usually found on the higher positions near the old channel. Dundee and Forestdale soils occur on the lower levee positions near backwater areas.

Soils of the backwater areas are largely fine textured sediment. Locally called "Buckshot soils", they developed under conditions of slow

drainage. Differences in the physical makeup of backwater soils are not as evident as soils on the natural levees and to some extent the "Buckshot soils" are classified by soil reaction and soil color, which is influenced by differences in the thickness of the clay deposited on the sandy strata underneath. In order of increasing clay thickness, the *Bowdre, Tunica, Sharkey,* and *Alligator* soils, as well as clay soils (unclassified) are found in the backwater areas.

The depressional soils occur in the lowest topographic positions. They occupy the old abandoned river channels and tributaries. These soils provide waterways for the slow return of floodwater to the Mississippi river and each year are subject to overflow. In order of decreasing drainage, the *Ark, Souva* and *Dowling* soils occur in the depressions[1].

Other soils of mixed Loess origin occurring near the foothills of the Delta and in Bolivar County, are the *Pearson* and *Brittain* soils on the old natural levees, and the *Collins* and *Falaya* soils in the Loess bottoms. These soils are moderately well to poorly drained.

Soil Distribution

Standard Soil Surveys of Bolivar, Coahoma, Humphrey, Issaquena, Leflore, Quitman, Sharkey, Sunflower, Tunica, Washington, and the Delta portion of Tallahatchie County were reviewed to identify the major soils present (3). Eighteen soils and certain unclassified acres were found to make up 94% of almost 3.9 million acres in these counties (Table 1). Five soils (Dundee, Forestdale, Sharkey, Alligator, and Dowling) and the unclassified acreages make up 80% of the total land area. These same soils make up the major portion of the unclassified acreages. The soils occupy the low levees and the backwater and depressional areas.

Each soil was classified by surface texture, or the proportion of sand, silt, and, clay sized particles present in the topsoil. Six surface textures were reported: loamy sand, sandy loam, silt loam, silty clay loam, silty clay and clay (3).

Table 2 illustrates the distribution of soils by surface texture, the major soils present within each textural class, and counties with the largest acreages.

The sandy loams - These soils make up 9.17 percent of the Yazoo-Delta. Principal sandy loams in order of acreage are Dundee, Dubbs, and Bosket. The Bosket sandy loams are generally found in the western counties near the Mississippi River. The Dubbs and Dundee sandy loams are well distributed throughout the Delta area.

Silt loams and silty clay loams - These medium textured soils occupy about 25% of the total land area, and Dundee and Forestdale make up 71% of this acreage. The soils are more concentrated in the eastern Yazoo-Delta counties. Sunflower County has the largest acreage of the Dundee and Forestdale silt loams.

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[1] A number of soils that were mapped in the Delta are now inactive and have been absorbed into one or more soil series. For example, the Dowling soils are now considered Alligator or Sharkey depending on soil reaction and color.

Table 1. Percent of Yazoo-Mississippi Delta soils mapped by type[1].

Soil	*Textures present*[2]	*Percent of Delta*
Unclassified[3]	C	18.30
Alligator	SiCL, SiC, C	16.11
Dowling	C	13.03
Forestdale	SL, SiL, SiCL, SiC	11.95
Dundee	SL, SiL, SiCL, SiC	11.13
Sharkey	SL, SiCL, SiC, C	9.90
Dubbs	SL, SiL	3.07
Commerce	SL, SiL, SiCl, SiC	2.49
Tunica	SiC, C	1.83
Bosket	SL	1.66
Brittain	SiL, SiCL	1.04
Collins	SiL	0.91
Falaya	SiL, SiCL	0.68
Bowdre	SiL, SiC	0.44
Souva	SiL	0.41
Pearson	SiL	0.32
Crevasse-Clack	LS	0.23
Beulah	SL	0.21
Robinsonville	SL	0.18
Percent total acreage		93.89
Total acreage = 3,864,900		

[1]From Standard Soil Surveys of 10 all-Delta counties and the Delta portion of Tallahatchie County.
[2]Symbols LS, SL, SiL, SiCL, SiC and C represent loamy sand, sandy loam, silt loam, silty clay loam, silty clay and clay soil textures, respectively.
[3]Unclassified areas are primarily clay soils designated as alluvium, clay soil complexes, swamps and miscellaneous areas.

Silty clay and clay soils - About 60% of the land area is composed of fine textured sediment. Principal soils are Alligator, Dowling, Sharkey, and Forestdale, respectively. The Sharkey soils most frequently occur in the western counties bordering the Mississippi River, with 92% of the total acreage being in Washington, Sharkey, and Bolivar counties. Alligator soils are generally found east of Mississippi Highway 61, and like Dowling and Forestdale, they are well distributed throughout the eastern Yazoo-Delta counties.

Suitability of Soils for Field Crops

An interpretive evaluation of the relative suitability of soils for production of field crops is shown in Table 3. The criteria used to evaluate suitability were physical composition of soils, topographic position, internal and surface drainage, and crop productivity.

The sandy loam soils are generally well suited for most field crops, but moderately rapid water permeability through the soil profile makes them unsuitable for rice. Soybean production on the deep Bosket sandy loams can be limited some

Table 2. Textural distribution of soils within Yazoo-Mississippi Delta counties.[1]

Texture	*Percent of Delta*	*Major soils*	*Soil Drainage[2] Class*	*Old Soil Survey Number*	*Percent of Delta*	*Presence and acreages (× 1000) in major counties.*
Sandy loams	9.17	Dundee	SPD	436	3.06	Leflore (30), Coahoma (23), Washington (23), Tunica (13), Bolivar (13), Quitman (12).
		Dubbs	MWD	446	2.80	Tallahatchie (43), Coahoma (21), Leflore (20), Sunflower (10).
		Bosket	WD	456	1.66	Washington (26), Tunica (19), Coahoma (11), Bolivar (5).
Silt loams	12.89	Dundee	SPD	435	4.82	Sunflower (45), Tallahatchie (42), Coahoma (19), Leflore (16).
		Forest-dale	PD	425	3.97	Sunflower (59), Bolivar (21), Quitman (18), Humphreys (17), Leflore(17).
		Collins	SPD	535	0.91	Tallahatchie (20), Quitman (7), Leflore (3).
		Commerce	SPD	135	0.81	Bolivar (8), Coahoma (8), Sharkey (7), Tunica (5).
		Brittain	PD	825	0.80	Bolivar (15), Quitman (11), Humphreys (6).
Silty clay loams	12.29	Forest-dale	PD	424	6.04	Sunflower (43), Leflore (36), Humphreys (32), Quitman (28), Coahoma (18), Tallahatchie (18).
		Dundee	SPD	434	2.98	Bolivar (31), Coahoma (21), Washington (18), Leflore (12), Quitman (11).
		Alli-gator	VPD	314	1.23	Leflore (18), Humphreys (11), Tallahatchie (6).
		Commerce	SPD	134	.89	Sharkey (14), Washington (10), Bolivar (5), Coahoma (5).

(table 2, continued)

(table 2, continued)

Texture	*Percent of Delta*	*Major soils*	*Soil Drainage[2] Class*	*Old Soil Survey Number*	*Percent of Delta*	*Presence and acreages (× 1000) in major counties.*
Silty clay	6.29	Sharkey	PD	323	1.69	Bolivar (49), Quitman (14).
		Forest-dale	PD	423	1.59	Washington (17), Coahoma (15), Tunica (9), Sunflower (9).
		Alli-gator	VPD	313	1.58	Sunflower (36), Quitman (23), Bolivar (8).
Clay	53.25	Unclas-sified	PD-VPD		18.30	Tunica (140), Issaquena (120), Sharkey (96), Bolivar (76), Coahoma (70), Leflore (55), Washington (54).
		Alli-gator	VPD	312	13.30	Tallahatchie (106), Humphreys (92), Leflore (82), Sunflower (74), Coahoma (38), Washington (37), Sharkey (32), Bolivar (30).
		Dowling	VPD	212	13.03	Bolivar (104), Sunflower (89), Washington (60), Leflore (57), Coahoma (53), Tunica (44), Humphreys (38), Quitman (37), Issaquena (31).
		Sharkey	PD	322	7.62	Washington (139), Sharkey (60), Coahoma (30), Issaquena (25), Sunflower (17).

[1]From Standard Soil Surveys of 10 all Yazoo-Mississippi Delta counties and the Delta portion of Tallahatchie county.
[2]Soil Drainage Classes WD, MWD, SPD, PD and VPD represent well, moderately well, somewhat poor, poor, and very poor internal and surface drainage, respectively.

Table 3. Relative suitability of Yazoo-Mississippi Delta soils for production of field crops.[1]

Texture-Soil	Soil no.	Field Crops						
		Cotton	Corn	Grain Sorghum	Soy-beans	Oats	Wheat	Rice
Sandy loam								
Dundee	436	1	1	1	1	1	1	4
Dubbs	446	1	1	1	1	1	1	4
Bosket	456	1	1	1	2	1	1	4
Silt loam								
Dundee	435	1	1	1	1	1	1	3
Forestdale	425	2	3	2	2	2	2	1
Collins	535	1	1	1	1	1	1	3
Commerce	135	1	1	1	1	1	1	3
Brittain	825	2	3	2	2	2	2	1
Silty clay loam								
Forestdale	424	2	3	2	1	2	2	1
Dundee	434	1	2	1	1	1	1	2
Alligator	314	3	4	2	2	2	2	1
Commerce	134	1	2	1	1	1	1	3
Silty clay								
Sharkey	323	3	3	2	1	2	2	1
Forestdale	423	3	4	2	2	2	2	1
Alligator	313	3	4	2	2	3	3	1
Clay								
Unclassified		4	4	3	3	4	4	3
Alligator	312	3	4	2	2	3	3	1
Dowling	212	4	4	3	3	4	4	2
Sharkey	322	3	4	2	1	2	2	1

[1]**Suitability ratings of 1 = well suited; 2 = suited; 3 = poorly suited; and 4 = not suited, respectively.**

years by drought stress during the late summer; a time when the crop has the greatest moisture requirement.

The silt loams and silty clay loams are suited, to well suited for most field crops. Water losses by infiltration and percolation increases the irrigation costs for rice production on the Dundee, Collins and Commerce silt loams. Rice grows well on these soils, but a lower suitability rating was given because of water permeability. Forestdale and Brittain silt loams and silty clay loams normally produce shallow rooted crops which frequently suffer from drought stress during the summer months. These soils, including Alligator silty clay loam, occupy the lower poorly drained positions, and are hampered by excess moisture in the early spring. The soils are poorly suited for corn, but well suited for rice, and generally suited for other field crops (Table 3).

The silty clay and clay soils are better suited for rice, soybean, and grain sorghum crops. Cotton and corn productions are hampered by the poor physical conditions associated with clay, and by the wet na-

Table 4. Estimated average yields of major field crops produced on Yazoo-Mississippi Delta soils under good management.[1]

Texture-Soil	Old Soil Survey Number	Cotton (#lint/A) solid	Cotton (#lint/A) 2 × 1	Yield in bushels per acre: corn	Grain Sorghum	soybeans	oats	wheat	rice
Sandy loam									
Dundee	436	750	1020	100	65	28	80	35	--
Dubbs	446	800	1080	105	65	27	80	35	--
Bosket	456	750	1040	95	60	26	80	35	--
Silt loam									
Dundee	435	670	840	90	55	28	70	30	--
Forestdale	425	550	680	70	45	23	60	25	90
Collins	535	715	930	95	60	30	70	32	--
Commerce	135	775	1050	100	65	32	72	35	--
Brittain	825	580	720	72	50	25	65	28	90
Silty clay loam									
Forestdale	424	600	720	60	55	26	62	27	90
Dundee	434	650	810	70	60	30	65	28	85
Alligator	314	500	625	55	50	22	57	24	90
Commerce	134	700	910	80	65	32	70	32	--
Silty clay									
Sharkey	323	500	575	60	55	31	60	27	100
Forestdale	423	500	575	50	50	26	60	25	95
Alligator	313	470	540	45	50	25	55	22	95
Clay									
Unclassified	-	-	-	-	-	-	-	-	-
Alligator	312	450	515	40	45	24	55	20	100
Dowling	212	250	270	10	25	15	10	5	90
Sharkey	322	480	550	55	50	30	60	25	105

[1]Derived from the Standard Soil Surveys, Mississippi Agricultural Experimentation Bulletins and Information Sheets, and from personal experience with Delta soil types. Except for rice, all yield levels are for non-irrigated crops.

ture of these soils. Dowling and the unclassified clays are generally subject to flooding after heavy rains and, in general, should not be used for cotton, corn, oats, and wheat production.

Estimated Crop Yields by Soil Type

An estimate of present average yields for the major field crops produced on Yazoo-Mississippi Delta soils are shown in Table 4. The well, to moderately well drained sandy loam soils have higher yield levels for cotton, corn, oats, and wheat. Yield differences between sandy loam soil types are somewhat indicative of their ability to supply moisture for crops through the dry summer months.

Soil compaction, slow internal drainage, and shallow topsoil depth have the greatest influence on yields of silt loams and silty clay loams. Commerce, Collins, and Dundee soils occupy somewhat higher topographic positions which generally allows deeper root systems. The Commerce soils were judged best for crops other than rice because of their inherent natural fertility and high water holding capacity.

The effective rooting depths of plants and yields are influenced by the physical and chemical nature of the various soils. Current use of deep tillage practices increases the rooting depths of plants in the sandy loams, silt loams, and silty clay loams. The subsoil plow tends to reduce yield differences in these soil types.

Sharkey silty clay and clay soils are considered more productive than similar Alligator soils due to higher natural fertility, higher organic matter levels, and better tilth in the topsoil. Crops on Dowling and many unclassified soil areas in the depressions suffer from excess water in the spring, late planting, poor plant stands, and/or flooding prior to harvest. Production is not economically advisable on these soils for crops other than rice, soybeans or grain sorghum. However, many of the unclassified acreages do not fall into this group. At the time the soils were mapped, the unclassified areas were woodland or covered with water and were not considered suitable for crop production. Many areas have since been drained and cleared, and are considered relatively productive.

Summary

Soils of the Yazoo-Mississippi Delta area were formed from alluvial materials from the Mississippi, Ohio, and Missouri rivers. Approximately four million acres of highly productive soils are present in the 10 all Delta counties and the Delta portion of Tallahatchie County. Ten percent of the land area is composed of sandy loam soils, 30% of silt loams and silty clay loams, and 60% of silty clay and clay soil types.

The Dundee, Forestdale, Alligator, Dowling, Sharkey, and unclassified acreages make up 80% of the total land area. These soils are found on the lower levees, backwater and depressional soil areas. Dundee and Dubbs are the major sandy loams, Dundee and Forestdale the major silt loams, Forestdale and Dundee the major silty clay loams, and Alligator, Dowling, and Sharkey the major clay soils, respectively.

Most sandy loam and silt loam soils are suited for production of most field crops except rice. The silty clay loams are suited for all crops, including rice. The silty clays

and clay soils are better suited for soybeans, grain sorghum and rice.

Estimated average crop yields vary by soil type, as suggested by the crop suitability ratings. The sandy loam soils have high yield levels for cotton, corn, oats, and wheat. Soil compaction, slow internal drainage and shallow-rooting reduce the yields of these crops on the silt loams and silty clay loam soil types, but this can be partially overcome by deep tillage.

Sharkey silty clay and clay soils are considered more productive than similar Alligator soils. Crops on the Dowling and many unclassified soil areas suffer from flooding after rains, therefore production is not advisable for crops other than rice, soybeans and grain sorghum.

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