Issued September 9, 1909.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF GRADY COUNTY, GEORGIA.

BY

HUGH H. BENNETT AND PARTY.

[Advance Sheets—Field Operations of the Bureau of Soils, 1908.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1909.

[PUBLIC RESOLUTION.—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., January 2, 1909.

SIR: The work of the soil survey in Georgia during the field season of 1908 included the mapping of the soils of Grady County. This county lies in the section of the State where tobacco growing, both under shade and in the open, is becoming an important industry, and aside from the general purpose of extending our knowledge of the soils of the United States the project has in view a careful study of the types best adapted to the production of high-grade cigar wrapper and filler tobacco. Requests for this work bore the indorsement of the Hon. James M. Griggs.

I transmit the manuscript report and map covering this survey and recommend their publication as advance sheets of Field Operations of the Bureau of Soils, 1908, as authorized by law.

Very respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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MAP.

Soil map, Grady County sheet, Georgia.

SOIL SURVEY OF GRADY COUNTY, GEORGIA.

By HUGH H. BENNETT and Party.

DESCRIPTION OF THE AREA.

Grady County, situated in southwest Georgia, on the Florida line, is bounded on the north by Mitchell County, on the east by Thomas County, on the west by Decatur County, and on the south by Gadsden and Leon counties, Florida. Cairo, the county seat, located near the center of the county, is in a direct line about 198 miles south of Atlanta, 200 miles southwest from Savannah, and 30 miles nearly north from Tallahassee, Fla. The area of the county is 294,080 acres or approximately 459 square miles. The base map is on the scale of 1 inch to the mile and shows the location of roads, towns, shoolhouses, churches, dwellings, railroads, streams, etc. It was made by the plane-table method of surveying, as the soil mapping progressed. The territory now included in the county was covered in an early survey by which it was divided into lots theoretically containing 250 acres each. In the present survey there was not sufficient time to resurvey these land-lot lines; in fact, this was considered unnecessary, as the location of the bodies of the various grades of soil, the primary object of the sur-

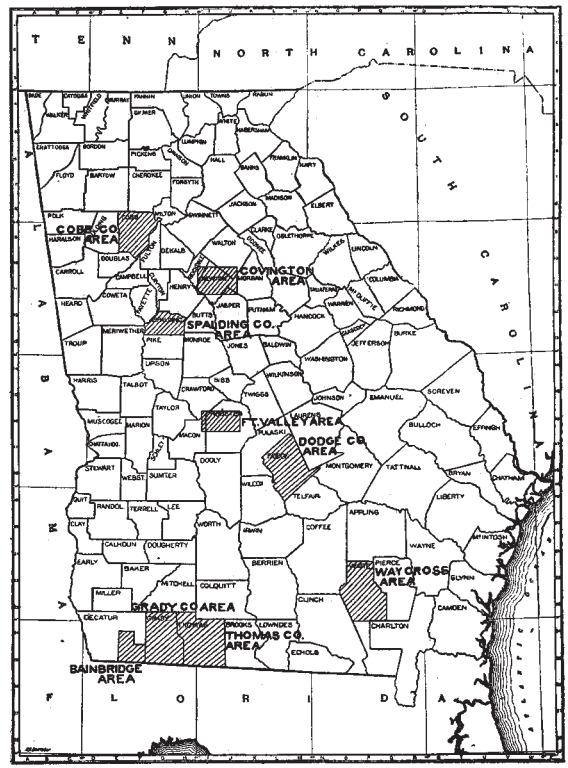

FIG. 1.—Sketch map showing location of the Grady County area, Georgia.

vey, was satisfactorily accomplished with reference to other well-known and established points.

In its topographic aspect Grady County presents the appearance of a plain more or less interrupted by minor surface alterations due to erosion. The lay of the land would be described in a general way as flat or only gently undulating to gently rolling, varied here and there by minor ridges, hills, swales, and sink-hole depressions, and rather shallow, narrow stream valleys. There are few, if any, points in the county from which very extensive views of the surrounding country can be had. The altitude at Cairo is 235 feet and that at Meigs, just over the line from the northeastern corner of the county, is 341 feet. There are some conspicuously rolling sections, as in the neighborhood of the large streams, where erosion has been most active in dissecting the land surface. To the south of Cairo is found the most uneven country, and here the stream valleys are widest. The surface is sufficiently eroded, however, in places along Barnetts Big and Little Tired, and Turkey creeks, and the Ocklocknee River to give the land a fairly rolling topography.

The black-jack lands of the northern and northwestern parts of the county are often rather hilly, even at considerable distance from the larger drainage ways, but the hills are low and usually quite rounded. A peculiar topographic feature is presented in the low, flat, or "slough" lands of the northwestern part of the county, as is interestingly seen in the "Big Slough," a perfectly flat stretch of country having the appearance of a well-defined stream bottom without a stream, excepting the small branches entering from the adjacent higher country. All water entering this slough gradually disappears by sinking into the ground.

The many sink-hole openings into the underlying limestone give rise to some very interesting surface features. There is a beautiful water fall[a] at the Lime Sink just west of Spring Hill Church in Lime Sink district, where a perennial stream of considerable size flows over the brink of the sink hole in a fall of about 65 feet to disappear in the limestone cave below. The sudden entrance of the stream into this sink hole without any noticeable change in the surrounding topography affords a striking illustration of the peculiar surface configuration that may be encountered in a country underlain by limestone. In this sink there is exposed a good geological section, the upper portion of which consists mainly of a mottled sandy clay several feet thick representing the sedimentary material deposited over the limestone during the existence in this region of a prehistoric sea. Limestone, the color of which varies from light gray to greenish gray, underlies this soil layer to the bottom of the sink hole.

[a] McCallie refers to this as Forest Falls, Bul. 5, Geological Survey of Georgia, pp. 55–56.

This rock contains numerous fossil shellfish and occasional bones of prehistoric animals. The depth of the depression is gradually diminishing because of the sand accumulation by deposition from overloaded drainage water, especially that from the nearby road. The vast quantities of soil material carried off underground through such erosional activity undoubtedly illustrates the process by which some of the low "slough lands" of this region have been formed. In Blowing Cave district there is an opening into an underground passageway known as the Blowing Cave on account of the peculiar alternate passing in and out of a current of air from the opening in the bottom of the shallow lime sink.

Other very interesting surface features due to the uneven dissolution of the basal limestone are seen at various points as at the water falls south of Blowing Cave, the deep conical depression known as Bay Sink, etc.

The larger streams all have unbroken stretches of flat bottom land ranging from narrow strips to the broad "river flats" of the Ocklocknee River. Low bluffs extend along the river here and there, but they quickly recede to give way to the flat bottom land again. These bottom lands are cut by streams, old stream channels, minor depressions, and hummocks. They are all subject to overflow. In places the outer margin of the bottom land is marked by a distinct bluff, above which stretches away a perfectly flat country, having somewhat the appearance of a second bottom, as illustrated in the flat lands between Pine Park and the river to the south. That they are not true second bottoms is shown by the fact that there are throughout the county similar broad, flat stretches in the interstream upland country having identically the same soil characteristics. Again, there may be a gradual ascent from the bottom land to the flat upland level, with nowhere any marked break in the surface configuration.

The small streams, in places mere wet weather drainage-ways, are fringed by strips of low, wet land supporting growths of magnolia, bay, black gum, sweet gum, and other water-loving trees and shrubs.

Although the turpentine and lumbering industries have exhausted the merchantable timber over large sections of the county, there are some extensive bodies of longleaf pine, interspersed here and there with slash pine, black pine, scrub oak, and dogwood. Small bodies of "hammock" land are found, which support a growth of hardwood, principally magnolia, beech, dogwood, white, red, post, water, live, and black-jack oaks, hickory, poplar, maple, bay, black gum, and sweet gum. True stream bottom land is timbered principally either with pine—longleaf and shortleaf—or with hardwood interspersed with pine, the latter mixed growth usually occupying the heavier bottom land. The shallow upland ponds and "sloughs"

support thick growths of cypress, mayhaw, or black gum, and are called, according to the growth, "cypress," "mayhaw," and "black gum ponds" or "sloughs."

Grady County, laid off from Decatur and Thomas, was organized January 1, 1906. Settlement began in the present territory of the county in the early part of the nineteenth century, but advanced slowly until given an impetus by the opening of the Atlantic Coast Line Railroad. The settlers came largely from the older section of the State and from other Southern States. One section of the county is referred to as the "North Carolina Colony," for the reason that the inhabitants here immigrated largely from North Carolina.

The Atlantic Coast Line crosses the county about its center from east to west, affording quick transportation to a large part of the area. Public roads are very good, on which account distance to market becomes much less a burden to many outlying farms.

CLIMATE.

The climate of Grady County is quite similar to that of Thomas, and the following table, showing the mean monthly and annual temperature and precipitation, as recorded by the Weather Bureau station at Thomasville, may be taken to represent closely the conditions here:

Normal monthly, seasonal, and annual temperature and precipitation.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	In.	In.	In.
December	53	79	13	3.9	2.5	7.0
January	52	81	17	3.5	3.5	3.8
February	54	81	2	5.0	4.1	4.8
Winter	53			12.4	10.1	15.6
March	61	87	22	4.7	3.4	5.4
April	67	92	35	3.6	3.4	5.8
May	74	101	43	3.7	1.3	7.7
Spring	67			12.0	8.1	18.9
June	80	102	48	5.4	6.6	8.8
July	82	106	62	6.8	7.7	4.8
August	81	101	61	6.3	4.3	5.5
Summer	81			18.5	18.6	19.1
September	77	99	46	4.8	0.7	6.4
October	68	97	35	3.4	3.3	2.0
November	59	88	26	2.7	0.5	3.1
Fall	68			10.9	4.5	11.5
Year	67	106	2	53.8	41.3	65.1

The winters are comparatively warm. Snow very rarely falls and a temperature lower than 30° F. seldom occurs, although during the period between November 20 and March 1 killing frosts and thin formations of ice are not uncommon. Flowers, such as violets, roses, and japonicas, are in bloom throughout nearly the entire winter and some vegetables can be grown the year around. A great number of early vegetables can be grown without much danger from frost after the middle of February, especially if cloth or some other material, as pine needles, is kept handy for covering the tender plants in threatening weather. Blackberries, dewberries, and cabbage seldom suffer from too much cold. Peaches and pears occasionally are damaged.

The long warm summers are moderated by breezes which make the nights in particular quite pleasant. June, July, and August, the hottest months, have a mean temperature of about 81° F. Temperatures of 100° F. are reached occasionally, and there may be even hotter days, but such weather is rather exceptional.

The rainfall is ordinarily sufficient for all crops, though corn, sugar cane, and watermelons sometimes suffer during dry spells in May, June, and July, especially on the light, sandy soils. Cotton is seldom damaged by drought, but it is injured at times by too much rain. With abnormal, heavy precipitation it is likely to go too much to stalk on the Norfolk sand and fine sand and on the deep phases of the Norfolk sandy loam and fine sandy loam. Tobacco also sometimes suffers considerably on the lighter types of soil from lack of moisture, on which account the production of the wrapper type should not be attempted on the Norfolk fine sand and sand without irrigation. Some tobacco growers are putting in irrigation systems for all their wrapper tobacco land under shade.

The shading of tobacco creates a more or less artificial climate, according to the completeness of the shading. Under cloth the atmosphere, owing to the high humidity and increased temperature, has a moist, tropical effect, favorable to a more rapid growth and earlier maturity of the plants, while the shade tends to increase the size of the leaves and to decrease their thickness. It is sometimes stated that the soil inside the cheese cloth tent dries out more rapidly than that outside, but experiments would indicate the contrary. Stewart says, "* * * the tent markedly affects the soil and atmospheric conditions. It affects the atmosphere by, first, slightly increasing the temperature; second, by increasing the relative humidity a great deal; and, third, by reducing the velocity of the wind. The last two of these reduce evaporation at the soil surface, which

conserves the soil moisture and maintains the soil more nearly at the optimum water content." [a]

AGRICULTURE.

Cotton and corn have been the staple crops grown in the territory now included in Grady County practically from the beginning of agriculture. Potatoes, rice, oats, peas, and beans were grown quite generally in the early days for home use.

Live stock—principally cattle and hogs—had an important place in the early agriculture of this general region. Land, except cultivated fields which were fenced, was considered as open range, and the stock, kept in the woods the year around, naturally deteriorated. The wild cane which grew along the branches at first afforded green feed in the winter, but with constant grazing this soon disappeared, except on the larger plantations where much land was fenced. Some wild cane is yet to be seen on a few of these old plantations in the northern part of the county. Stock, cotton, and other surplus products of the farm were shipped to outside markets by the Flint River.

Hammock land was selected at first to the exclusion of the "piney-woods" soil, by reason of its greater productiveness, but in time it was learned that the latter would produce the same crops and make as good yields as old hammock land. As very little manure was used in the early days the impoverishment of land was met temporarily through the expedient of abandoning old land and taking up newly cleared ground, a practice that led to the gradual utilization of the longleaf pine lands to supplement the rather limited extent of hardwood land. The gravelly soils in the northern part of the county, which for a time were considered as undesirable for agricultural purposes, were found upon trial to be admirably suited to cotton. Thus every grade of soil in the county, with the exception of the poorly drained Portsmouth, the Grady loam, and bottom-land soils, which have never been used, has proved satisfactory in varying degrees for farming purposes. Those fields turned out on account of the lessened productivity either were brought again under cultivation after periods of "rest," or allowed to grow up to pine, which, where not too severely hindered by fire, quickly reforests the old fields.

Until about 1845 the farms were largely self-sustaining, though producing cotton as the main money crop. About this time there began a change. On the large plantations, where slave labor was employed exclusively, cotton was made almost the sole crop. This one-crop system proved unprofitable in many instances, particularly so as the lands became more and more run down, and finally a remedy was sought in the use first of Peruvian guano and then of commercial fertilizers. Here, as throughout the South generally, the use of chemical fertilizers has gradually increased since their introduction.

[a] Bul. 39, Bureau of Soils. Effects of Shading on Soil Conditions, p. 15.

The production of rice, which for a long time was grown on many farms, has practically ceased. Notwithstanding long-staple cotton is grown on a considerable number of farms, it is not believed that its acreage is being extended. Within the last twenty-five years sugar cane for sirup has been grown in a quite profitable way and its production has been increasing gradually for a number of years. Watermelons have been an important crop for a considerable time.

Some time before 1860, "Florida tobacco," a distinct cigar-wrapper type, was grown on a small scale within the limits of Grady County. About fifteen years ago the production of the Cuban type of cigar-filler tobacco was taken up in the southwestern part of the county and a few years later the Sumatra cigar-wrapper type appeared and immediately proved a success. While some of the Cuban type is yet grown, the Sumatra leaf, almost since its introduction, has been the most important and profitable type. The tobacco industry, already well established in the Calvary section, appears to be spreading northward gradually. A number of farmers in the vicinity of Cairo, who grew their first crop in 1907, were not able to dispose of the product satisfactorily, partly for the reason that the financial depression of that year led buyers to curtail their purchases of leaf and partly because the crop grown in the sun on soils only moderately adapted to this type of tobacco was not altogether what the trade demanded. Finding themselves practically at the mercy of the buyers in the matter of disposing of their crop, some of the small producers did not put in a crop this season (1908), but most of the new growers who produced crops under shade and on the right soil were so well pleased with results that they planted again this year, some growers increasing their acreage considerably. Fields of shaded tobacco ranging in size from 5 to about 20 acres were grown near Cairo.

Most crops suited to the climate of this region can be grown successfully in Grady County. At present the important crops are cotton, corn, sugar cane for sirup, sweet potatoes, watermelons, peanuts, oats, velvet beans, and cowpeas. A great variety of vegetables and a number of fruits, particularly the pear, fig, grape, blackberry, and plum, find the soils highly adapted to their requirements.

Both the short and long staple (Sea Island) varieties of cotton are grown. That the long staple is produced on such a comparatively small scale is due rather to its longer growing period, the more intensive cultivation required, and the greater difficulty in the picking, rather than to poor yields. The long-staple cotton deteriorates quite rapidly unless new seed is secured now and then from the Sea Island regions, or great care is exercised in the selection of seed from the home-grown crop. In this connection Orton says:

> Without seed selection Sea Island cotton can not be grown successfully for more than a few years in any latitude. The interior growers have always de-

pended on the skillful seed selection of the Carolina planters and have continued to neglect the matter since this seed supply has been cut off by a growers' organization. No more improved seed can be had from the Sea Islands, and nothing is more certain than that the crop will continue to deteriorate rapidly until the interior growers begin work to improve it. They undoubtedly will rise to the occasion when they realize that their industry is at stake. They may be assured in advance that they will succeed to a degree limited only by the care and skill they expend.[a]

Cotton does best on the Tifton sandy loam, the "pimply," shallow areas of the Norfolk fine sandy loam and sandy loam, and on the Orangeburg fine sandy loam. On the deep sandy soils both the long and short staple varieties are inclined to go very much to weed in wet seasons. Although many farmers are careful in selecting their cotton fields, on the whole too little attention is given this matter, a result of which is that the crop is grown more or less on all the well-drained soils throughout the county. The best average yields of the long staple are made on the "pimply" lands, particularly the Tifton sandy loam.

Cotton is planted on ridges from 2½ to 3½ feet apart prepared by rebedding on the old middles or by bedding up land first plowed level. The latter plan is considered generally as the better, particularly where the breaking is done in the fall or early winter. With the exception of the sands and deep phases of the sandy and fine sandy loams, the land should be broken in the fall to a depth of from 5 to 8 inches, turning under all the vegetable matter left by preceding crops. The usual cultivation with sweeps and hoes ordinarily is as efficacious as could be desired.

Some damage is done to the crop on small areas by cotton wilt or black root. Such spots should be plowed deeply in the fall and cultivated to other crops than cotton for several years. An excellent rotation for areas thus affected is corn with velvet beans, oats, and sweet potatoes or peanuts. Cowpeas, except the variety called Iron, probably should not be used on these diseased areas.[b] Injury from this source seems to be most common on the clay or "gall" spots.

Cotton occasionally suffers from rust on the deep sandy soils, but by keeping these well supplied with organic matter, as can be done advantageously by introducing crops of velvet beans and cowpeas in rotation with corn and cotton, and by using barnyard or stable

[a] Farmers' Bulletin 302, U. S. Dept. of Agriculture.

[b] In the matter of crops grown in rotation with cotton on wilt-affected lands Orton (Farmers' Bulletin 302, p. 18) says: "On the other hand they are open to the serious objection that they (cowpeas) are very subject to root knot and greatly increase this disease. On land infected by cotton wilt or black root the loss is increased by the presence of root knot. Fortunately the Iron cowpea is immune to root knot and can be used with safety. In fields where it is certain there is no root knot any pea can be planted, but the trouble is that root knot frequently appears where its presence was not suspected."

manure and fertilizers high in potash and phosphoric acid, the damage from rust can be reduced to a minimum.

Practically no attention is given the matter of seed selection further than occasionally to secure from other sections an improved variety of cotton, which when grown indiscriminately on all soils gives at best varying results. It has been shown that cotton bred on a stiff clay soil, as that found in the red lands of Piedmont, Ga., for instance, in all probability will not prove a success when grown on a decidedly different soil, such as a droughty sandy loam. Much improvement would result from persistent selection of seed grown at home from the most fruitful stalks not only of cotton, but also of corn, oats, and other crops.

Corn is planted both on beds and in the water furrow. In the latter case early cultivation usually is delayed for the reason that furrows can not be run close to the plants until they have attained a size sufficient to prevent their being covered up, as is quite liable to happen with the plants standing in a gutterlike furrow. Another objection to this method is that water sometimes stands around the young corn long enough to retard its growth materially. With the ridge system, where the bed is about 4 to 6 inches above the bottom of the intervening furrow, which in case of flat land is decidedly the better method, the cultivation is somewhat the same as for cotton, though not as intensive. A more nearly flat cultivation, as is approached in a degree where land is flat broken and the corn planted in the shallow "streaking off furrow," would probably give better results than the present ridge system. Planted either on the bed, in the water furrow, or "streaking off furrow" the corn is finally left at "laying by time" on tolerably high ridges.

Oats are grown by seeding broadcast on roughly prepared ground and in open furrows. Though the fall season is the best time to put in this crop, seeding is usually done in the spring, when the plants often are retarded by unfavorable moisture conditions in the soil, so that only moderate or poor average yields are made. When planted in furrows from about 15 to 24 inches apart, covered lightly and given shallow cultivation between the rows, it appears that the best average results are secured, especially on the lighter types of soil, such as the Norfolk sandy loam. The oat crop is either mowed or harvested with cradle or reaper. In either case it is used for hay on the farm. The cultivation of oats could be profitably extended as a winter cover crop and as a late winter and early spring grazing crop.

Oats do best on the Orangeburg fine sandy loam and shallow phases of the Norfolk sandy loam and fine sandy loam. Seeded on thoroughly prepared land—that is, land well harrowed and smoothed—the crop does especially well after velvet beans, particularly when

moderately fertilized with barnyard manure and the usual cotton and corn fertilizers. The rust-proof varieties should be grown.

Velvet beans are grown like peanuts, on ridges between corn rows, in fields by themselves, or in the rows with corn. The best cultivation is about the same as that given corn. The vines make such a rank growth that it is often difficult to harvest the corn grown with them, and it is well-nigh impossible to harvest the vines themselves for hay; therefore they usually are utilized for pasturage. As a forage crop velvet beans rank high. A further argument in favor of a general extension of this crop is the fact that it not only replenishes any deficiency in organic matter, but also improves the structural conditions of soils by shading them. The crop does well on all the well-drained soils.

Cowpeas generally make a good vine growth on the Norfolk and Orangeburg soils, but occasionally they fail to fruit satisfactorily, particularly in wet seasons on the deep sandy soils. Planted in late June and early July better fruiting results as a usual thing. The Unknown, Iron, Whippoorwill, New Era, Black, and "Crowder" are varieties quite well suited to the area, the last four fruiting freely. Cowpea hay for marketing would prove a remunerative crop on a large number of farms. The crop affords also excellent forage for hogs and cattle, at the same time improving the soil immensely.

Cowpeas and velvet beans can be substituted for each other in several good rotations that should be more generally practiced. A good rotation is to follow velvet beans or cowpeas with corn, then with fall-sown oats; in the succeeding spring cowpeas or sweet potatoes should be grown, and the next year cotton. Such a scheme of course can be changed in detail to suit the conditions, the important point being to crop the land in such a way as to return sufficient organic matter to the soil to prevent its getting in that apparently lifeless condition favorable to excessive crusting and compacting. A crop of cowpeas plowed under in the half-matured stage is decidedly helpful to soils that have come into unfavorable structural conditions for want of proper rotation and fertilization. From 25 to 40 bushels of burned lime per acre applied to the surface, following the incorporation of green or partly green vegetation, as cowpeas, assists in a rapid conversion of such vegetable matter into humus.

The Orangeburg sandy loam and fine sandy loam and the shallow Norfolk soils in particular should be broken in the fall to a depth of from 6 to 10 inches, turning to the surface a thin layer of the heavy subsoil where possible. Instead of burning off the grass and the cotton and corn stalks, or any waste vegetation, in the effort to make cultivation easier, these should be plowed under in the fall or long enough prior to planting to permit decomposition of their organic material.

Commercial fertilizers are used almost universally for cotton, corn, watermelons, sugar cane, and tobacco. Many different brands analyzing on the average 8–2–2 [a] are used ordinarily in acreage applications of from 200 to 400 pounds for cotton and from 150 to 250 pounds for corn, indiscriminately on all soils. Green cotton seed is largely used as a fertilizer, it being the custom with many farmers to plow the seed under a short time before planting the crop, thus allowing a large proportion of the seed to come up. In the use of seed a better plan, according to a number of quite successful farmers, is either to kill them before planting or to turn them under when the ground is cold enough to kill them rather than to cause sprouting. It has been demonstrated that as a fertilizer for sugar cane cotton seen can not be used as profitably as the same value in cotton-seed meal.[b] The best practice unquestionably is to use the cotton-seed meal where distance to market does not make the exchange or sale of seed an economic disadvantage. An excellent fertilizer is made by composting cotton seed with barnyard and stable manure or these together with acid phosphate or kainit, or both. The home mixing of fertilizers is recommended in all cases and a number of farmers do this, using cotton-seed meal, kainit, and either acid phosphate or bone meal. It is an easy matter to mix these materials so as to bring the fertilizer up to any desired standard by knowing the percentage content of nitrogen, phosphoric acid, and potash of the various ingredients.[c]

Oats and peanuts are rarely fertilized, though both crops respond readily to the proper application of manures. From 200 to 250 pounds per acre of the ordinary cotton and corn fertilizers have been used with very good results for these crops. Commercial fertilizers when used on most of the well-drained soils of the county should be applied in conjunction with some form of organic matter so as to make their effects more lasting and beneficial.

The flat, shallow running sweeps and "scrapes" so largely used in the cultivation of crops are well suited to the soils of this region, in that they allow a portion of the disturbed soil to fall behind the plow so as to make a moisture-protecting surface mulch. In dry seasons the weeder is an effective implement to keep surface crusts and young grass destroyed, particularly in the cultivation of corn. It is best not to plow the flat, shallow surface soils when in a soggy condition, though very little trouble actually comes from plowing the soils of this region in general when too wet. Few cultivators and disk plows are in use, notwithstanding they could be used to advantage, especially in fields free of stumps. In the breaking of land the

[a] 8 per cent phosphoric acid, 2 per cent nitrogen, and 2 per cent potash.

[b] Bulletin No. 75, Bureau of Chemistry, U. S. Dept. of Agriculture, p. 23.

[c] Farmers' Bulletin 44.

light "dixie" plow should be largely replaced by disk and large turning plows.

Beggarweed, crab-grass, Bermuda, crowfoot-grass, and sandspurs are valuable crops for hay and pasturage, but very little attention is given these, with the exception of crab-grass, which is cut to a considerable extent where left as a kind of second crop in watermelon fields. Bermuda does well on the well-drained soils and affords excellent summer grazing. Sorghum also succeeds admirably, affording good summer pasturage for all kinds of stock, especially hogs and sheep. This crop comes in very timely to supplement failing summer pastures. Winter vetch and rape could be grown to advantage as winter and spring forage crops.

There are few sections that so easily produce an abundance of forage crops. The opportunities for an extension of stock raising are most excellent. Green feed can be supplied readily the year around. Beginning with rye and oats in the spring and following with sorghum, cowpeas, Bermuda, velvet beans, peanuts, vetch, ruta-baga, rape, etc., hogs and cattle can have a succession of succulent green feed throughout the year. Fed regularly on such crops and finished on corn and potatoes, hogs can be grown for market profitably. It is estimated that in this improved way pork can be produced at a cost of from 2½ to 3 cents a pound.

Several systems of renting farming lands are in vogue. A number of landowners turn over to renters a certain area of cleared land, a "one-horse" or "two-horse" farm, including from about 35 to 40 acres to the horse, for a stipulated rental of lint cotton—usually one 500-pound bale for a "one-horse" tract. Such renters usually grow little else but cotton. Considerable land is tenanted on the "half-cropper" plan, that is, the tenant, for the use of land, tools, stock, stock feed, and for one-half the fertilizer bill, turns over to the landlord one-half of the staple crops produced. Probably 60 per cent of the farms are operated by the owners, who often have no other help than their immediate families. A large number of these owned farms could be classed as small farms, a fact which in no small degree accounts for the general prosperity obtaining among the farmers of Grady County. The renting of land, although often quite profitable in immediate returns, as a rule is not conducive to soil improvement. A large number of tenants are rather migratory in their inclinations, moving from one farm to another without expending any undue effort to accumulate property, in consequence of which they are never especially interested in building up the soils.

Labor has been scarce in some sections of the county for a number of years. The turpentine and lumbering interests draw considerable labor from the farm by paying higher wages than farm hands receive.

It has long been so easy to make a comfortable living in Grady County that many farmers have not especially desired to exert themselves strenuously beyond this point. Notwithstanding this, diversification is gradually becoming more popular and farmers are getting more and more interested in matters outside their immediate neighborhoods and are studying the methods and results of farmers in other sections. They are thinking more about crop adaptations, the exact manurial requirements of their soils, and the best methods of handling them. The rural free delivery of mail and the introduction of tobacco have helped to inculcate a desire among farmers to know their agricultural relationship and the value of their products to other sections of the country. While there remains much to be done in the way of agricultural betterment, the soils are adapted to such a variety of crops that greater diversification and development must, in the natural course of events, come about. The county offers great inducements to the man of small means as well as to the capitalist desiring to invest in farm lands. The best grades of land can be bought at very low figures—in some sections at $10 to $15 an acre or even less, that is, for land not supporting valuable timber and turpentine forests. Of course there are sections, as for instance those in which the tobacco industry is highly developed, where land values are higher.

SPECIAL INDUSTRIES.

TRUCKING.

Although there is in Grady County a large extent of soil adapted to vegetables, the trucking industry, aside from watermelons, has not attained an important place in the agriculture of the county.

A large crop of watermelons is annually grown for shipment. The well-drained medium and deep phases of the Norfolk fine sandy loam and sandy loam and the Orangeburg fine sand and sandy loam are the best suited to the crop. The Tifton sandy loam and the "pimply" areas of the Norfolk soils, as well as the Orangeburg soils, produce an extra early melon. The Norfolk sand and fine sand, though used for this crop, are too droughty to give good average yields. With moderate fertilization the average yield is about one-half carload an acre.

The general method of preparing the land consists of flat breaking to a depth of 5 or 6 inches, checking off to bring the hills from 10 to 12 feet apart each way, and listing on the fertilizers applied either continuously in the drill or only in the hill. Fall breaking to a depth of about 8 inches, followed with a rebreaking in February, would seem to be advisable. The seed are planted about the first of March on ridges thrown up with two or more furrows, and weekly replanting follows to insure against damage from frost. Cultivation is done

in one direction first with a "dixie" plow, which throws the dirt toward the vines until the entire middle is plowed out. Later cultivation is done with sweeps.

The best fertilizer is stable or barnyard manure or cotton seed-manure compost, used at the rate of from about 5 to 10 tons an acre, according to condition of the soil, in conjunction with 500 or 600 pounds of fertilizer analyzing about 10–3–4.

The Kolb Gem, Blue Gem, Triumph, and Rattlesnake melons are the best shippers. Other more delicate and better eating varieties, as the Thomas, Kleckley, Pierson, and Ice Cream, are grown for home use.

Watermelon wilt usually does such damage to succeeding crops that it is the practice not to use the same land again for melons until after a lapse of five to eight years. The vines and refuse fruit should be done away with as soon as possible in order to destroy material liable to cause a spreading of the disease to other fields.

Cantaloupes and cucumbers can be grown particularly well on the shallow and medium deep Norfolk soils. These crops offer inducements to the specialist.

There is a good opportunity to build up a profitable industry in the production of sweet potatoes for early shipment. A large crop of potatoes is grown for home use, but as yet almost no attention has been given this crop with the object of selling to outside markets. There is no reason why this general region should not make large shipments of early potatoes in competition with other sections less favored in point of earliness.

The medium and deep phases of the Norfolk sandy loam, fine sandy loam, and Tifton sandy loam are admirably suited to the crop. "Spanish yams," "parrot yams," "red yams," and a large list of other varieties are grown.

Planting should be done on ridges from 8 to 10 inches high, previously fertilized with a 8–2–10 fertilizer, mixed thoroughly with the soil at the rate of 500 to 1,000 pounds to the acre.

Potatoes do particularly well after grain and on new ground, for the reason that the incorporated vegetable matter gives the soil an open structure favorable to the development of good tubers. Strong stable manure used too liberally is apt to injure the crop, causing the potatoes to crack. From 100 to 200 bushels of Irish potatoes per acre can be grown on the Norfolk and Orangeburg soils having a depth of at least 10 inches of sandy loam overlying the sandy clay subsoil. Barnyard manure or cotton-seed meal used liberally in conjunction with 300 or 400 pounds to the acre of a phosphate-potash fertilizer analyzing about 8–6 or 8–8 can generally be counted on for good results. A light crop of rye turned under green a short time before planting the potatoes also is beneficial.

Early cabbage does well on the medium and deep phases of the Norfolk fine sandy loam, with heavy applications of stable or barnyard manure in conjunction with 1,000 pounds of a 9–4–4 fertilizer to the acre. The growing of collards for the seed has proved quite profitable with a number of farmers. The seed is sold to commercial seedsmen.

Late sweet potatoes do well after collards. Tomatoes, turnips, radishes, lettuce, okra, English peas, and beans can all be grown very successfully on the Tifton sandy loam and Norfolk soils. Extra early crops can be secured from the "pimply" areas of the Orangeburg and Norfolk types.

All conditions except distance to market and special freight rates are favorable to the development of an important trucking industry. With a growth of the industry freight rates very likely would be adjusted to encourage this line of agriculture.

FRUITS AND NUTS.

LeConte, Kieffer, and Bartlett pears do well on all the well-drained soils, but the growing of pears has not become extensive because of the devastating effects of blight. Very good returns are had from the pears shipped, and there is a good opportunity for an extension of the industry along lines that would prove decidedly profitable to growers. Little or nothing is done now to control the ravages of pear blight, a disease which can be kept in check by pruning the affected branches and burning root and branch of the badly diseased trees. Of the varieties grown the Kieffer is the most resistant to blight.

Plums, blackberries, and dewberries do very well on all the soils, where drainage conditions are good. The fig finds the soil and climate preeminently suited to its requirements, and this fruit can be grown with but little attention. Strawberries do well on the heavier phases of the Norfolk and Orangeburg soils. The Scuppernong, Concord, and a number of other varieties of grapes well suited for wine and marketing can be grown successfully, particularly on the well-drained Norfolk soils, and on the Tifton sandy loam.

Pecans do exceptionally well, especially on the Norfolk fine sandy loam and upland hammock land. A good many trees are being set out in the vicinity of Cairo, and pecan nurseries are operated successfully near that place. A few peaches are grown for home use. Better results could be had with modern methods of culture.

SUGAR CANE.

Grady is the leading county in Georgia in the production of sugar cane strictly for sirup, Cairo with an annual shipment of 10,000 to 15,000 barrels (33 gallons each) being the most important shipping point for this commodity. The county embraces a large area of

land highly adapted to this crop, and there are almost unlimited opportunities for further development of this already important and growing industry.

The medium deep phases (10 to 20 inches to subsoil) of the Norfolk fine sandy loam and sandy loam are the very best soils for the production of sugar-cane sirup of excellent quality. The deep sandy Norfolk and Orangeburg soils produce a very good grade of sirup, but require expensive applications of fertilizers, besides being rather too droughty for best results. The Tifton sandy loam, the shallow phases of the Norfolk fine sandy loam and sandy loam, and the Orangeburg sandy loam and fine sandy loam make heavy yields of sirup, but usually the quality does not equal that made on the other soils named.[a]

Sugar cane is planted on ridges from 3 to 5 feet apart and is cultivated much like corn, the important difference being that in the plowing less dirt is thrown around the cane stalks during the early stages of growth. Ordinarily all fertilizers used are applied at once in the drill. In planting, either the whole cane stalk or 18-inch sections are laid directly on the fertilizers or on the soil previously mixed with the fertilizer and then covered to a depth of 2 or 3 inches. Any surface crusting should be destroyed with a shallow running implement, so as to prevent retardation of the young sprouts and to permit the plants to enter upon their long growing season as early as possible. Cultivation, including hoeing and interrow tillage, is carried on longer than in the case of either corn or cotton. When a good growth has been made, which usually is about the middle of June, dirt should be thrown about the stalks with sweeps, so as to stop suckering or stooling. Following this, interridge cultivation is continued and the crop laid by about the middle of July with from 4 to 5 sweep furrows, which leaves the stalks upon a well-rounded high ridge. Cutting should begin as soon after frost as possible. Sirup making usually begins about the last of October and continues until after Christmas.

Sugar cane is one of the crops that is always fertilized. Barnyard manure, cotton-seed meal, various brands of commercial fertilizers, and home mixtures of phosphoric acid, kainit, and cotton-seed meal are used. About a ton of commercial fertilizer analyzing approxi-

[a] Wiley, speaking of the effect of soil and fertilizers on the chemical composition of sugar cane, says: The principal effect which a soil has upon the crop is shown in the quantity produced. It is well known, however, that the character of the soil also influences to greater or less extent the chemical composition of the crop. Crops which are grown on a very fertile soil are usually coarser in texture than those grown on one less fertile. If therefore we are seeking for a particular flavor, taste, or character of product it is to be remarked that the fertility of the soil has an influence of quite a marked character in many particulars. Bul. 75, Bu. of Chemistry, U. S. Dept. of Agr., p. 20.

mately 8–2–2, in conjunction with from 25 to 50 bushels of cotton seed and about 5 tons of barnyard manure, is considered a good acreage application, though the average application is much less than this. The method of procedure in fertilizing is to vary the application with the soil texture—that is, the lighter the soil the heavier the application. Most farmers apply all fertilizing materials just before seeding. Some, however, apply all the cotton seed, barnyard refuse, and compost, together with one-half of the commercial fertilizer used, at the time of seeding, then the other half of the fertilizer about the first of June.

Experiments conducted on the Norfolk fine sandy loam indicate that for the medium phase of this type 1,200 pounds of a 10–3–5 fertilizer per acre before seeding, followed later with two applications of 100 pounds each of sodium nitrate alongside the plants at intervals of a week or two in June, is a very good plan of treatment. For best results with the deeper sandy soils the acreage application of the above fertilizer should be increased to from 1,500 to 2,000 pounds.[a]

Heavy applications of stable manure or well-rotted barnyard manure often give the sirup a dark color and an unpleasant taste. Sirup secured from rich "cowpen" land usually has an undesirable dark color and salty taste. However, either barnyard manure or compost when used in moderate quantities is very efficacious as a sugar-cane fertilizer. Cowpeas and velvet beans put the soil into good condition for a following crop of cane, and sweet potatoes also leave the soil in an especially good mechanical condition. It is generally considered that corn and watermelons do better after sugar cane than does cotton. A good part of the nitrogen needed should be supplied by growing the legumes.

The typical, medium deep, sugar-cane soils should be fall plowed to a depth of 7 to 9 inches. Stubble cane burned over in late winter or early spring, and "barred off" and disked, makes with the same cultivation and fertilization nearly as good yields as seeded cane. However, more attention is given the seeded crop; in fact, a second or rattoon crop is not always grown.

Seed cane is protected through winter by covering in windrows lightly with earth. The canes are often damaged by unfavorable weather conditions, and it would seem that some better method of saving them could be worked out. The stubbles ordinarily winter over in the rows without any protection further than an occasional

[a] It is fairly safe to conclude that there is little if any waste from an excessive application of potash and phosphate on plant canes, as the succeeding stubble crop will get the benefit; but an excessive application of ammonia will be lost, as it has practically all disappeared by the following year. (Bul. No. 93, Bureau of Chemistry, U. S. Dept. of Agriculture, p. 30.)

light covering of earth and blades stripped from the last crop. The red cane, which does especially well, and other varieties are grown.

The yields of sirup run from 200 to about 600 gallons per acre, according to soil, cultivation, and fertilization. With fair treatment an average acreage yield of 400 gallons can be reasonably expected, provided the right soil is selected.

There are two evaporating establishments near Cairo which manufacture a large proportion of the sirup made in the immediate vicinity, but a good part of the product of the county is made in open kettles by the farmers. Occasionally the question of establishing a sugar factory is agitated, but such an enterprise probably would be inadvisable under present conditions, because it is not at all likely that enough cane would be grown within a reasonably limited area to supply a large sugar mill. A sugar factory recently established in Decatur County proved rather disappointing to the owners for this reason.

TOBACCO.

Grady County embraces a large area of the medium deep phase of the Norfolk fine sandy loam, the type of soil best suited to the production of Sumatra cigar-wrapper tobacco. There are other types, as the deep Norfolk fine sandy loam and the Norfolk fine sand, that produce a very fine grade of tobacco; but in seasons of drought the crop suffers to such an extent on these types that, without irrigation, tobacco growing is rather a hazardous industry. The Orangeburg fine sand, with a depth of about 24 inches to the heavy subsoil, makes a very fair leaf, especially where there is a light reddish tint to the sandy soil material below a depth of 16 or 18 inches. In the Amsterdam, Laingkat, and Attapulgus sections of Decatur County and in adjacent Florida territory some tobacco is grown on the Orangeburg fine sandy loam, but the product is inferior to that grown on the contiguous Norfolk fine sandy loam. It is claimed that the barn-cured leaf takes the color of the soil on which it is grown. At present the trade demands the light-colored wrapper produced on the Norfolk fine sandy loam having a depth of from 10 to 20 inches to the yellow fine sandy clay subsoil. The Cuban type of cigar-filler tobacco does best on the Orangeburg fine sandy loam, which is found in considerable areas in the southern part of the county.

The growing of Sumatra wrapper and Cuban filler tobacco began in the southwestern part of Grady County several years ago. The production of wrapper proved so profitable from the first that the industry has gradually spread and there is every reason to believe that there will be a considerable further extension. Several large fields of shaded tobacco were grown this year (1908) in the vicinity of Cairo. The producers of the best shade-grown leaf are getting remunerative prices, but a few who have not been careful in the

selection of their soil, especially those growing crops in the open fields, have been somewhat discouraged in the disposition of their crops, this being particularly true of small growers in years of depressed market conditions. Farmers should not rush headlong into this highly specialized industry, but instead should first thoroughly acquaint themselves not only with the details of growing and curing the leaf, but also with the soils best adapted to the crop and with the market conditions affecting the disposition of the product.

The cost of shading an acre of tobacco with slats ranges from $200 to $250. The posts for carrying the slat supporters usually are set 12 by 20 feet apart and stand 9 feet clear. The intervals between the slats should be so arranged that from 40 to 60 per cent of the ground will be shaded, and in order to insure an even distribution of shade on the plants the slats should be laid north and south. In areas with a great depth of soil above the clay subsoil the leaf produced is lighter in texture than is the case on shallower soil, and therefore more sun is needed to give the leaf the desired "body" or texture—in other words, the depth of the surface soil should determine the width of space between slats. A substantially built shade should last for five years.

A barn 120 feet long, 40 feet wide, and 20 feet to the plates has a capacity of curing easily 5 acres of tobacco, and costs from $650 to $1,000. The barn should be located in the open, so as to insure good circulation of air.[a]

The seed should be sown from February 15 to March 15 on a moist sandy soil or in a "box bed" kept well watered and shaded with cloth. Tobacco land should be broken flat in the fall and to a depth of from 10 to 14 inches, using a subsoiler but avoiding the turning up of too much of the lower material. Twenty 2-horse loads of stable manure to the acre should be broadcasted about the 1st of March, and immediately plowed under to a depth of 6 inches. Follow this treatment with an acreage application of 400 pounds of slaked lime, which should be harrowed in thoroughly with a disk. About two weeks before transplanting, a mixture of 1 ton of cotton-seed meal, 400 pounds of steamed bonemeal, and 300 pounds of potassium carbonate or 400 pounds of potassium sulphate should be drilled in broadcast. Where this mixture is used in the drill it should be mixed thoroughly with the soil, which should be rebedded just prior to transplanting. Rows should be 4 feet apart and the plants from 10 to 14 inches apart in the row. The plants should always be watered when set out, as this causes the soil to settle nicely about the roots. In order to get a good stand and uniform growth the field should be gone over several times soon after transplanting for the purpose of setting new plants

[a] For description of tobacco barns see Rept. No. 62, U. S. Dept. of Agr., pp. 25–29.

in the place of the unhealthy or dead ones. The best time for transplanting is from the 15th of April to the 20th of May, though good crops have been made when set late in June. The disadvantage of setting too early is that the cold soil causes a slow growth which tends to thicken the leaf, thus reducing the percentage of good wrappers, while on the other hand late setting tends to produce a leaf of undesirably light texture and affords the additional disadvantage of injury from the increased number of insects. In the preparation of land for a second year's crop of tobacco it has been found advisable to turn up the soil with a disk or turning plow at intervals of about two weeks during the winter—a process that puts the soil into an excellent, mellow condition.

About five or six days after setting the plants cultivation should begin. The first cultivation should be deep and close to the plants, using a scooter plow. Later plowing should be shallow near the plants and a little deeper toward the middle. Such cultivation should be done once a week or as often as is necessary to keep the soil well mulched, it being especially necessary to plow as soon as possible after rains in order to destroy any surface crust. It is the practice of some to plow the alternate middles of a field during the first part of the week, then the uncultivated middles in the latter part of the week. This has the advantage of avoiding disturbance of the entire root system at one time. Cultivation often continues until or even after pruning begins.

Bud worms and horn worms are destroyed by hand and by various mixtures of Paris green. Plants should be topped before blooming. Suckers appearing at the joint of leaf and stalk after topping should be removed, so as to direct the entire energy of the plant toward the development of the ripening leaves. On the strong Norfolk and Orangeburg fine sandy loams top suckers sometimes are allowed to bloom, so as to prevent too thick top-leaf development. The suckers are rarely harvested.

A good crop of Sumatra will run from 50 to 60 per cent wrappers, 22 leaves to the stalk being a good crop. The size and texture of the leaf varies with the soil, fertilization, and rate of growth. A slightly rounded leaf something like 18 inches in length makes a very desirable wrapper.

Priming usually begins about sixty days after transplanting. The leaves are picked from the bottom of the stalk as they ripen and carried immediately to the barn, where they are strung at the rate of 30 to 40 to a stick and hung to cure. The first 3 or 4 bottom leaves (having a length of at least 10 inches), which make "sand" wrappers and binders, should be picked a little green, otherwise they are inclined to cure with insufficient body. The middle leaves, which make light and medium wrappers, should be picked when the tips first show a change to light green or a mottled color. The top leaves

are always heaviest and cure rather dark. The "tops" are used largely for binders.

In hanging in the barn the leaves should be distributed and spaced according to their texture, so that they will not cure too rapidly, in which event they are apt to have a poor color and an undesirable body. The light sand leaves, 40 to a stick, should be hung in the peak of the barn from 2 to 3 inches apart, where the humidity is sufficiently high to cause slow curing; the middles, 30 to 35 leaves to the stick, and tops, 30 to the stick, should be hung below the sand leaves and spaced 4 inches at the plate to about 7 inches at the bottom of the barn. Much care must be taken in the curing to prevent pole sweat, pole burn, and stem rot—the undesirable results of improper curing and unfavorable moisture conditions. With good, open weather the barn should be closed for three days after hanging or until the tips of the leaves begin to turn yellow, then windows should be opened during the day and closed at night, depending of course on the weather, to let in air enough to cause the leaves to dry out and yet retain pliability. In very warm weather the barn should be closed during the day and opened at night. In damp weather it is necessary to build small blazing fires here and there over the floor to drive out excessive moisture. When the color is set and the leaf in good case—that is, good pliable condition—which stage is reached with the drying out of the midrib, usually at the end of about three weeks, the tobacco is cured so far as the farmer is concerned, and is ready for further treatment—fermenting, aging, and assorting at the warehouse.

Sun-grown Sumatra is grown and handled about the same as the shade-grown. Its texture is always inferior to the shade-grown and the price received is much less.

It is believed that irrigation should be more generally practiced, especially in dry seasons when the growth is retarded, with the result that the quality is inferior and the yield less. Fields having a suitable surface could be irrigated by flooding the rows from pipes or troughs at a very moderate cost, especially where a good well or one of the many perennial streams is handy. The usual practice is to irrigate where cheese cloth is used. Very heavy yields can be secured and the effect of soil depth on the quality of the leaf can be materially lessened by creating the desired humidity in the air and by controlling soil moisture conditions.

Some tobacco growers buy cattle and feed them for the purpose of securing plenty of good manure. It is likely that a crop of winter vetch would improve tobacco land, especially where a light growth is turned under and followed with a surface application of 500 pounds of lime per acre. A heavy crop of green manure turned under might cause a too rank, heavy growth of leaf.

The usual yields of shade-grown Sumatra without irrigation range from about 700 to 1,300 pounds per acre. Where the clay comes near the surface, especially in case of the Orangeburg fine sandy loam, heavier yields of an inferior product are secured.

The Cuban filler tobacco is grown very much the same as the Sumatra wrapper. A good fertilizer for the Cuban variety consists of a mixture of 1,200 pounds of cotton-seed meal and 300 pounds of sulphate of potash to the acre. This type of tobacco should be grown on the Orangeburg fine sandy loam and rotated so as to give an occasional green manuring crop. While very little Cuban is grown at present, there are good opportunities for an extension of the industry, inasmuch as the product is a very superior one.

SOILS.

The soils of Grady County are in the main identical with those of Thomas County. They are predominantly sandy, ranging from light sand to moderately heavy fine sandy loams. Over about 80 per cent of the county the grayish or pale-yellow sandy surface material, sometimes carrying iron concretions, grades into either a bright-yellow or a bright-red heavy sandy or fine sandy loam to clay loam at a depth anywhere from 5 inches to 3 or 5 feet—such material representing the various types of the Norfolk and Orangeburg soils. In small areas the sand or fine sand surface stratum persists to a depth of 10 or more feet. Ordinarily a compact sandy clay of variegated colors—pinkish-red, drab, and yellow mainly—is encountered at a depth of from 4 to 6 feet.

About 3 per cent of the county is occupied by dark-colored, poorly drained soils in which the surface material, high in organic matter, grades at a depth of from 10 or 15 inches to 3 or 4 feet into a compact, grayish-drab or mottled, saturated material. This character of material forms the Portsmouth soils.

There are but few clay exposures in the county, and these represent small areas from which the surface layer of sandy material has been removed by erosion, as is seen in the "gall spots" of slopes, where the surface flow-off has been most rapid. These heavy spots, as well as some small wet depressions and occasional hummocks of sand and gravelly areas, on account of their small extent and sometimes inaccessibility, had to be included with the more predominant types as nonconformities.

There is a marked absence of coarse sand and quartz gravel, the limit of coarseness in the original materials laid down as marine sediments being pretty closely represented by medium sand. The iron concretions, so abundant in the northern part of the county and found in small spots throughout the area, evidently have been formed in situ through processes of weathering since the recession of marine water. It is possible these pebbles are not true concretionary formations, as they show neither a concentric structure nor

weak internal cementation, but they are usually rounded and always represent sandy or clayey material cemented solidly by iron oxides and hydrates, the result of precipitation of iron compounds from soil solution.

Differentiation of the sedimentary deposits by pre-emergence water action and by later post-emergence erosional processes due to surface unevenness largely accounts for the variety of soil types. The two main effects of erosion have been the removal of surface material bodily, thus bringing the heavy underlying material nearer the surface, and the washing out of fine material, leaving superficial sandy layers. While it is probable that the assorting action of water before the complete emergence of the country occasioned much differentiation in the component materials, translocation of the finer silt and clay particles by rain water since emergence has had considerable effect in the formation of the superficial sandy layers. That there were differences, however, in the depth of the sandy mantle at the time of emergence is evidenced by the occasional sandy ridges which could hardly represent other than original deep sand beds or beach lines.

Solution and chemical changes, particularly oxidation processes, have been active agencies of weathering, especially in relation to color changes and the formation of ferruginous pebbles. The better drained and aerated surface soils have tended to assume light colors, while the heavier subsoils through the oxidation of iron components have tended to assume red colors. The high oxidation of the iron compounds, as seen in the bright-red color of the Orangeburg subsoils, probably has resulted from the better drainage and aeration of the Orangeburg materials which, certainly in some places, accounts largely for the difference between this and the Norfolk series with its uniformly bright-yellow subsoils. There is very little difference in the soil components of these two series, both being similar texturally and made up of quartz sands, silt, and clay, with decidedly few complex mineral fragments. Both the Orangeburg and Norfolk series carry ferruginous pebbles similar in character of composition and mode of origin. Sometimes the Norfolk soils grade so imperceptibly from flat upland locations into the Orangeburg, occupying slopes with better drainage, that the line of separation is very indistinct—gradations that do not suggest marked differences either in the manner or time of deposition. However, the fact that the Orangeburg occupies extensive areas in the southern part of the county where comparatively little Norfolk is found, the converse being true in the northern part of the county, would indicate probable differences either in the time of deposition and emergence or in the manner of formation. The drainage of these Orangeburg soils in the southern part of the county is much more nearly perfect than that of the Norfolk soils to the northward. This is due to the greater surface unevenness and to the more mature drainage system in the former region.

The Portsmouth soils owe their distinguishing characteristics mainly to poor drainage, which has favored the accumulation of organic matter and inhibited oxidation in the deeper soil and subsoil.

The subsoil of the Susquehanna fine sandy loam represents closely the character of the deep underlying materials of the area, but with this type there are in places indications of some slight influence from the underlying calcareous formation. It is probable that the material forming the soil belongs to a transition stage between the underlying Eocene and the later formations which give rise to the Orangeburg and Norfolk soils.

Meadow land in places represents more a soil condition, the result of poor drainage, than distinctive soil material. Usually the material is largely alluvial, lacking in textural uniformity, and is always soggy or poorly drained.

Swamp land simply represents intensely poor drainage conditions existing in alluvial soils of highly diverse character.

The Chastain fine sandy loam embraces the broad "river flats" and stream-bottom alluvium, having enough uniformity in composition to constitute a fairly well-defined soil type.

The Orangeburg soils according to geological classification belong to the Lafayette formation, while the Norfolk belong to the later Columbia formation. The former may have been exposed by a removal of the Columbia material, or they may represent earlier deposits not markedly altered since deposition.

There are in the county several small exposures of limestone, probably representing the Vicksburg-Jackson of the Eocene. A large part or all of the area is underlain by limestone which can be seen in several sink-hole exposures or openings into which streams sometimes enter. Portions of this limestone have been shown to contain phosphoric acid,[a] but no experiments have been made to determine whether such lime rock would be valuable as a fertilizer. The ordinary sink-hole depressions, as well as the more notable "lime sinks," like Lime Sink, Bay Sink, and Blowing Cave, are due to the unequal dissolution of the underlying limestone formation allowing the overlying materials to sink in. Some small areas of nearly white or greenish-yellow plastic clay exposures, as seen along stream slopes, apparently have been affected to a certain degree by the underlying calcareous material. Fuller's earth is found in a number of locations. In a few places in the northern and northwestern parts of the county where the limestone approaches closely to the surface small limy concretions or fragments of limestone are seen intermingled with the soil, but they are not in quantities sufficient to affect materially the character or crop value of the soil.

[a] Bul. 5. Geological Survey of Georgia.

Drainage conditions, texture, and surface-soil depth are factors that strongly and directly influence soil productiveness. The organic matter practically controls structural conditions, directly affects the supply of moisture in the soil, and indirectly affects the productiveness to a great extent. Soils well supplied with organic matter are very much less inclined to bake or crust, are easier to cultivate, and are always more productive than the apparently lifeless, crusty, droughty lands deficient in organic matter.

According to relative percentage contents of gravel, of the medium, fine, and very fine grades of sand, of clay, and of silt, as determined by analysis, the soils have been classified into sands, fine sands, fine sandy loams, and sandy loams. These classes or types have been grouped into series having similarity in color, structure, topography, drainage conditions, etc. The Orangeburg series include the well-drained types having bright-red, friable subsoils; the Norfolk series, the gray or pale-yellow types, underlain by bright-yellow friable subsoils; the Portsmouth series, the black or dark-colored poorly drained types having drab and mottled subsoils; and the Susquehanna, though represented here by a single type, normally includes those soils characterized by mottled red and drab, plastic clay subsoils. The Chastain fine sandy loam, standing by itself as a local type, is probably found along many streams of southern Georgia.

The following classification shows the soils of the county grouped according to mode of origin and process of weathering:

Description.	Soil.
Gray soils with red subsoils derived from old sedimentary material (Lafayette), under best drainage conditions.	Orangeburg sandy loam. Orangeburg fine sandy loam. Orangeburg fine sand.
Gray soils with yellow subsoils derived from later sedimentary material (Columbia), under moderately good drainage conditions.	Norfolk sand. Norfolk fine sand. Norfolk fine sandy loam. Norfolk sandy loam. Tifton sandy loam.
Dark-colored soils with light-colored subsoils derived from Lafayette and Columbia material, under poor drainage or semiswampy conditions and intermittent wet and dry stages.	Portsmouth sandy loam. Portsmouth fine sandy loam. Portsmouth fine sand.
Grayish soils with mottled, plastic subsoils derived from the exposed formation underlying the later sedimentary material or representing the deeper substratum.	Susquehanna fine sandy loam.
Grayish-brown loam with heavy slightly mottled subsoil. Depression soil probably derived from sedimentary materials.	Grady loam.
Alluvium	Chastain fine sandy loam.
Unclassified alluvium and poorly drained upland depressions.	Meadow.
Unclassified alluvium very poorly drained	Swamp.

The local names of soils have been brought out in their proper relationship to the several types under the type description. When soil boundaries have not been drawn absolutely accurate owing to the impracticability of perfect delineation, and when small inaccessible bodies of soil and areas too small to map on the scale used (1 inch to the mile) have been included with the predominant types, careful consideration of the type description will eliminate possibility of confusion on the part of one using the soil map. In some cases where small areas embraced wide diversity in soils it was necessary to map the predominating type or represent the average soil condition, relying upon the soil descriptions to bring out the detailed features.

The following table gives the names and areas of the several soil types shown on the accompanying map:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Norfolk fine sandy loam	123,392	41.9	Susquehanna fine sandy loam	4,096	1.4
Norfolk sandy loam	37,440	12.7	Portsmouth fine sand	4,032	1.4
Orangeburg fine sandy loam	32,256	11.0	Portsmouth fine sandy loam	2,624	.9
Meadow	31,360	10.7	Portsmouth sandy loam	1,088	.4
Norfolk fine sand	24,320	8.3	Orangeburg sandy loam	1,024	.3
Tifton sandy loam	9,088	3.1	Grady loam	896	.3
Chastain fine sandy loam	8,000	2.7			
Orangeburg fine sand	7,936	2.7	Total	294,080	
Norfolk sand	6,528	2.2			

TIFTON SANDY LOAM.

The Tifton sandy loam is a yellowish-brown to dark-gray heavy sandy loam, underlain at from 5 to 15 inches by yellow to bright yellow friable sandy clay. sometimes the soil, at a depth of about 28 inches, passes into a friable, compact yellow clay slightly mottled with reddish colors. A characteristic feature of the type is the presence of varying quantities, 10 to 40 per cent, of small, rounded iron pebbles disseminated through the soil mass. These pebbles are most abundant in the surface soil found on the flat or undulating areas in relatively high positions and on the knolls and crests of ridges. They gradually disappear with descent of slope, until the type passes into the Norfolk sandy loam or the Norfolk fine sandy loam on the lower slopes. The pebbles consist of ferruginous sandstone or claystone and apparently have been formed in the soil by the cementing of small quantities of sandy or clayey material by iron salts. The interior color of these pebbles is usually dark red and the structure quite firm, but occasionally in the lower subsoil a soft or rotten pebble will be found which has a yellow interior. The soft

character and yellow color may be due to incomplete oxidation of the iron salts or to decomposition and hydration processes going on within the mass of pebbles. A reddish-hued yellow is sometimes seen in the subsoil of the better-drained areas.

Although the presence of large prominent grains of sand gives to the average of this type a rather coarse feel, there is present sufficient interstitial material to make the texture quite favorable to the maintenance of moisture. However, during protracted dry spells the soil unless properly handled is apt to get into a hardened condition which sometimes makes cultivation quite difficult. Plows are worn dull very rapidly in this soil.

The subsoil conserves moisture well and is near enough the surface to bring its store of moisture within easy reach of growing crops. As a rule crops do not suffer very greatly from drought, while on the other hand the very best crops of cotton made in the county, in wet years, come from this type and the "pimply" areas of other shallow surface soil types.

The Tifton sandy loam occupies nearly level and undulating upland, the gentle slopes along streams, the crests of ridges, and tops of low hills. The largest area lies to the southwest of Humphries School. Isolated areas are of frequent occurrence in the northern part of the county. The surface drainage is good everywhere, except, of course, in the unimportant swales and sink-hole depressions.

The Tifton sandy loam, locally called "hard, pimply land," is an excellent agricultural soil. Good average yields of cotton, corn, and sugar cane, the chief crops grown on the type, are made under the ordinary methods of culture. This is the best long-staple, or Sea Island, cotton soil in the area, though but little is grown on account of the long growing season and the greater care required in the production of this variety. Both long-staple and short-staple cotton give yields of from one-third to 1 bale per acre, according to fertilization and cultivation. Oats, corn, peanuts, cowpeas, velvet beans, sorghum, early Irish potatoes, onions, early melons, cucumbers, strawberries, and blackberries all do well on this land. The type is rather heavy and a little too compact in dry weather for the best results with sweet potatoes, though fair crops are made. This is a particularly fine early vegetable soil, but owing to the distance from railroads and markets little has been done along the line of trucking. Velvet beans and cowpeas improve wonderfully the structure and consequently the productiveness of the soil, and one or the other of these crops should be grown regularly in rotation with the staple crops. Crimson clover could be grown successfully for winter and early spring forage, as could also rye, vetch, turnips, and rape.

The ordinary grades of commercial fertilizers and cotton-seed meal are used extensively for cotton, corn, and sugar cane. A good

rotation is corn with cowpeas or velvet beans the first year, sugar cane or oats the second year, and cotton the third year. Grown under this system and fertilized with from 400 to 500 pounds of a 10-2-5 fertilizer, cotton would average nearly a bale to the acre, while the yields of sugar cane, oats, and corn would run considerably above the present average. Very little nitrogen should be bought, as it can be secured readily by growing the legumes. Along with an increase in the production of forage crops more stock should be kept on nearly all the farms on this type. Barnyard manure is the most efficacious fertilizer on this soil for all crops except sugar cane and potatoes. Too heavy an application of barnyard or stable manure gives a dark color and poor flavor to sugar-cane sirup, and sometimes gives to sweet potatoes an inferior quality.

Cotton is generally planted on beds laid off closer together and is cultivated shallower than on the less gravelly soils. Fall plowing would be very beneficial, as would also an occasional incorporation of a half-matured crop of cowpeas.

The following table gives the results of mechanical analyses of fine-earth samples of soil and subsoil of this type:

Mechanical analyses of Tifton sandy loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18862	Soil	2.3	11.8	9.3	43.5	12.6	11.1	9.3
18863	Subsoil	1.3	9.2	6.8	32.1	13.9	8.3	28.3

NORFOLK SAND.

The Norfolk sand is a gray sand usually slightly darkened in the surface 6 inches with organic matter. Below 6 inches, the color is a yellowish gray to pale yellow. Generally coarser grains are found in the lower portion, although there may be present more fine material here than in the overlying soil. The grains are angular, but not especially sharp. There are several small areas of a lighter colored coarse phase carrying a small percentage of rounded quartz gravel. This phase, commonly styled "white sand," is very incoherent and has in its present condition but little value as an agricultural soil.

The component materials of the Norfolk sand consist almost entirely of quartz grains, there being little evidence of other minerals. The silt and clay, though in very small amounts, help to bind together the coarser grains so as to make this a fairly compact, rather than a loose and open, incoherent soil. However, if cultivated without fre-

quent replenishment of the organic matter, which is exhausted rapidly in cropping, it becomes a loose, droughty, and unproductive soil.

The type is found mainly in the northern and northwestern parts of the county. The largest body is the one which extends from the Mitchell County line along the Big Slough and the Decatur County line southward for a distance of 5 or 6 miles. The topography of this main body, although largely undulating, is varied by the occurrence of many slight depressions and sink holes. The timber growth is longleaf pine, interspersed with a scrubby growth of black-jack and other species of oak. There is a sparser growth of wire grass than on the heavier Norfolk soils. The deep substratum of this large area frequently is a very stiff, compact, mottled pinkish-red, yellow, and drab sandy clay. Several other widely separated areas of considerable size are found occupying stream slopes in the northern part of the county.

The Norfolk sand is a well-drained, somewhat droughty, and only moderately productive soil. Very little of it is under cultivation. Owing to its thorough aeration and drainage, it is a warm soil and well suited to certain kinds of vegetables. With heavy applications of barnyard manure or compost, in conjunction with liberal quantities of commercial fertilizer, good crops of early English peas, radishes, beans, cantaloupes, cucumbers, sweet and Irish potatoes, strawberries, and watermelons can be grown. For the reason that cultivation causes rapid depletion of the organic matter, a contingency that materially affects the productiveness of the soil, all crops should be grown in rotation with cowpeas or velvet beans. One or the other of these legumes should be turned under in the half-matured stage once in every two or three years. In this way the supply of humus may be readily maintained.

An excellent quality of sugar-cane sirup can be made, but the yields are so light without very heavy applications of fertilizer that very little of the soil is used for this purpose. Cotton, corn, and oats make only very moderate yields, and the soil should not be used for these crops where the heavier types are available.

Cotton is subject to rust on the Norfolk sand, and for that reason requires a fertilizer high in potash. Too heavy applications of barnyard manure or commercial fertilizer will cause cotton to "fire" or burn. A fertilizer analyzing approximately 10–2–8, used at the rate of about 300 or 400 pounds an acre, in conjunction with barnyard or stable manure, compost, or with some green crop turned under, will produce from one-fourth to one-half bale or more of cotton per acre in favorable seasons. It can be readily seen that such yields do not make cotton a very profitable crop. It has been the experience of some successful farmers that phosphoric acid and potash fertilizer in the percentage ratio of about 2 to 1, used at the rate

of 800 to 1,500 pounds to the acre, is a very satisfactory application for sweet potatoes, melons, and vegetables. From 500 to 1,000 pounds of cotton-seed meal in conjunction with a phosphate-potash mixture would be a good application for Irish potatoes. With judicious management from 80 to 175 bushels of sweet potatoes and from 60 to 150 bushels of early Irish potatoes can be secured.

Fall plowing is not important except to turn under green vegetation. Frequent surface cultivation is necessary to conserve moisture.

The following table gives the results of mechanical analyses of the samples of soil and subsoil of the Norfolk sand:

Mechanical analyses of Norfolk sand.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18851	Soil	4.0	23.1	14.3	35.2	11.6	7.9	4.0
18852	Subsoil	3.2	23.4	12.3	36.4	13.3	7.2	4.2

NORFOLK SANDY LOAM.

The Norfolk sandy loam occurs in two phases differing essentially in the depth to the subsoil. The shallow phase is a medium sandy loam underlain at about 10 to 15 inches by a mealy, friable, bright-yellow sandy clay. The surface few inches of the soil is usually gray or dark gray, while that below is pale yellow in color.

The soil of the deep phase consists of a gray to dark-gray, rather open, light sandy loam, overlying a pale-yellow material of the same texture. The subsoil of this phase is a light-yellow mealy sandy clay. Ordinarily the soil of both phases grades into the subsoil through a thin stratum of heavy sandy loam. There is always considerable fine material in the soil of the Norfolk sandy loam, although the larger medium grains often stand out so prominently that they give the soil a deceptive coarse feel. The interstitial fine material makes the soil in this area rather more loamy than is typical of the Norfolk sandy loam in other regions. On account of this fine material, the soil, especially the shallow phase, is inclined to run together during heavy rains and to harden at the surface under the heat of the sun. Sometimes a thin crust is thus formed which should be broken up as soon as practicable after the rains have ceased in order to restore the soil to a tilth favorable to the conservation of soil moisture. Vegetable matter when decomposed and thoroughly incorporated with the soil effectively counteracts this tendency to crust.

In local areas small iron pebbles occur in considerable quantities over the surface, throughout the soil mass, and in irregular layers anywhere in the soil profile. Where these pebbles occur in the sur-

face soil the land is locally styled " pimply soil." Such gravelly land generally produces better than the average of the type. In some places in the northwestern part of the county, especially where black-jack oak is of common growth, the deep subsoil is quite stiff and plastic, this being particularly true where resistant fragments of rock, derived from outcrops of the underlying limestone formation, are found scattered over the surface. This stiffness in the deep subsoil disappears as the more dominant piney-woods phase is approached.

The Norfolk sandy loam is restricted largely to the northern half of the county. The surface varies from flat to hilly, the hills being low and generally rounded. The deep phase is most commonly found on slopes where accumulations of material washed from above has increased soil depth. The large area northwest of Whigham is almost flat. The shallow phase of the type is quite diverse in its topographic features, the more rolling areas being found in the black-jack hammock lands in the northwestern part of the county.

The timber growth mainly consists of longleaf pine, though in ome locations there is considerable black-jack oak. Wire grass is found everywhere in the longleaf pine woods. Natural drainage is very good. The soil conserves moisture surprisingly well, and most of the crops grown rarely suffer from drought where frequent shallow cultivation is given. Corn, however, is inclined to suffer in dry seasons, especially where the organic matter has been depleted. In general the crop value of the Norfolk sandy loam depends upon the depth of the surface soil and the organic matter content. The type as a whole is a fair cotton soil, but the better yields are secured from the shallow phase, especially the " pimply " areas. The effect of manure is always more lasting where the soil depth is shallowest.

The Norfolk sandy loam is well suited to corn, sweet potatoes, Irish potatoes, sugar cane, sorghum, forage crops, watermelons, cantaloupes, beans, and tomatoes. The soil depth should be at least 10 inches for best results with potatoes, corn, sugar cane, and wrapper tobacco. The principal crops are cotton, corn, sugar cane, oats, peanuts, sweet potatoes, and watermelons. The yields per acre range from one-third to three-fourths bale of cotton, 10 to 20 bushels of corn, 300 to 450 gallons of sirup, 100 to 300 bushels of sweet potatoes, and from 15 to 25 bushels of oats. These yields do not represent the maximum capacity of the soil, but rather what may be expected under the prevailing methods of soil management. Heavier yields, especially of cotton, sugar cane, and oats, can be secured easily from the shallow and " pimply " areas with proper management. Long-staple cotton succeeds very well on the gravelly and shallow surface soil areas. Some good crops of sun-grown wrapper tobacco have been secured where the soil texture runs somewhat finer than the average of the type. As a

general thing this soil is too open for best results with wrapper tobacco, but pretty fair crops could be grown where the soil has a depth of from 10 to about 15 inches over the heavy subsoil and is not of a distinctly coarse, incoherent character. This latter phase would be too droughty for good results without irrigation. Peanuts do well everywhere on this soil. Strawberries, English peas, and pears could be grown more extensively for market, as they do remarkably well.

The soil is susceptible of rapid improvement by growing cowpeas and velvet beans. A crop of cowpeas turned under occasionally very much improves the structural conditions of the soil. Commercial fertilizers of the ordinary grades are used generally at the rate of from 350 to 400 pounds for cotton, 150 to 250 pounds for corn, 300 to 600 pounds for watermelons, and from 500 to 1,600 pounds for sugar cane. Oats and peanuts are very seldom fertilized, although they would be benefited by the same applications used for cotton and corn. According to the experience of the most successful farmers, a fertilizer analyzing 10–2–3 for the shallow phase and about 10–3–5 for the deep phase is the most efficacious commercial mixture that can be used for corn, oats, and cotton. Where the organic matter content of the soil is low, chemical fertilizers should be used always in conjunction with such organic manures as compost, barnyard or stable manure, or a crop of half-matured vegetable matter, preferably cowpeas. Sweet potatoes do not need so much organic manure, but moderate applications of rather coarse barnyard refuse in conjunction with 500 to 1,000 pounds to the acre of something like a 8–2–10 fertilizer give excellent results. Nitrogen should be largely supplied by growing the legumes. Fall plowing to a depth of 9 to 10 inches should be practiced generally on the shallow phase and also on the deep phase, where there is a growth of vegetation that could be converted into humus.

The following table gives the average results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Norfolk sandy loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18573, 18866	Soil	2.1	15.1	13.3	38.5	15.3	9.1	6.5
18574, 18867	Subsoil	1.2	10.0	8.6	33.6	11.3	8.7	26.5

NORFOLK FINE SAND.

The Norfolk fine sand is a rather loose, gray to dark-gray fine sand, underlain at from 6 to 15 inches by a light-gray to pale-yellow, incoherent, velvety fine sand. Considerable areas of this type are found adjoining the stream bottoms either as sloping or as comparatively

flat land ranging from a few feet to 30 or more feet above the level of the bottom. This phase usually supports a growth of longleaf pine interspersed with a scattering growth of scrub oak. A few isolated scrub-oak areas occur in the uplands as slight ridges and knolls. This phase is considered a droughty soil and but little is under cultivation.

Another phase found along stream slopes and as isolated upland areas supports a growth of magnolia, beech, dogwood, several varieties of oak, black and longleaf pine, and other hardwood timber, and is called "sandy hammock land." The soil here is more loamy owing to the accumulation of leaf mold, and when cleared produces good crops of corn, cotton, sugar cane, and peanuts for several years, or until the store of organic matter has become exhausted. After the depletion of organic matter, heavy applications of fertilizers, or manure, are required for good results, just as with the scrub-oak phase.

The soil mapped as Gadsden sand in the survey of the Bainbridge area, a portion of which has been revised in the survey of Grady County, has been included with the Norfolk fine sand for the reason that from further study it seems to represent in the main the hammock phase of this type.

The Norfolk fine sand, particularly the fresh hammock phase, would produce good light wrapper tobacco with irrigation especially under cheese-cloth shade. From 10 to 20 bushels of corn, 600 to 900 pounds of wrapper tobacco, 250 to 400 gallons of excellent light-colored sugar-cane sirup, and from one-third to one-half bale of cotton per acre can be secured under good management.

Only moderate yields, however, of corn, cotton, and sugar-cane sirup are secured under the ordinary methods of management. The soil is adapted to about the same crops as the Norfolk sand, though considered a little more productive than that type. Cowpeas and velvet beans should be grown frequently in rotation with other crops in order to maintain in the soil a good supply of organic matter.

The Norfolk fine sand is really a special-purpose soil, being well adapted to vegetables, such as Irish potatoes, sweet potatoes, watermelons, cantaloupes, radishes, lettuce, and English peas. For these crops heavy applications of fertilizers are always required. Irish potatoes and sweet potatoes, particularly, could be grown for early market. Sugar cane, watermelons, and tobacco (without irrigation) suffer so much from scarcity of moisture in dry seasons, while on the other hand cotton makes such a heavy growth of weed in rainy seasons, that, as a rule, these crops can not be profitably grown either on the incoherent scrub-oak phase or the "run-down" hammock phase without too expensive an outlay for fertilizers. Cowpeas also are apt to produce mainly a vine growth in wet years.

The occasional plowing under of green vegetation like cowpeas is very beneficial for all crops, in fact profitable utilization can not be made of the soil except by keeping it well supplied with organic matter—either barnyard or stable manure or other vegetable matter. Commercial fertilizers always are more lasting and beneficial when used in conjunction with some form of organic matter.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Norfolk fine sand.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18854	Soil	1.4	13.4	8.0	47.0	16.3	9.9	4.1
18855	Subsoil	1.6	12.4	8.7	48.7	18.4	7.1	3.1

NORFOLK FINE SANDY LOAM.

The Norfolk fine sandy loam is one of the most important agricultural soils in the county or in this general region. It is so variable in the depth to its clay subsoil, and these variations affect its agricultural value so materially, that the type was separated into three phases and these outlined on the map. Broadly speaking, the type is a gray to dark-gray fine sandy loam, underlain somewhere between 5 and 36 inches by a friable yellow sandy clay. Frequently small iron sandstone pebbles in varying quantities may occur scattered over the surface, disseminated throughout the soil mass, or principally in a section of the soil profile. Such areas where the pebbles are abundant in the surface soil are called "pimply land," and the soil is considered stronger than where the pebbles are lacking. Very little of this "pimply land" is found south of the Atlantic Coast Line Railroad. The deep substratum as exposed in road cuts and streams is generally a compact fine sandy clay mottled pinkish-red, yellow, and drab.

The timber growth consists mainly of longleaf pine. "Slash" pine is found occasionally in the poorer drained situations, as is also magnolia, dogwood, and hickory. A hardwood growth is often encountered on slopes and here and there, in comparatively small areas, in the uplands. Such hardwood timbered land is called "hammock land" and is always considered exceptionally good soil. As a rule the hammock land seems slightly more loamy and mellow, and the content of organic matter is a little higher and apparently in a better condition than in case of the "piney woods" land. After two or three years' cultivation without supplying organic matter the soil of the "hammock" areas assumes the same characteristics as the

piney woods land. There usually is a good growth of wire grass over the pine-timbered land. Gallberry bushes grow scatteringly in the damp places.

Shallow phase.—The shallow phase of the Norfolk fine sandy loam is a light to moderately heavy fine sandy loam, underlain at a depth of 10 inches or less by a yellow heavy fine sandy loam which quickly passes into a bright-yellow fine sandy clay. The color of the soil, usually a dark gray or brownish gray in the surface 4 or 5 inches, changes to a pale yellow below. Where the land has been under cultivation for several years without restoring organic matter, the color is distinctly a lighter gray than in the timbered land. Again, where plowing is done deep enough to turn up the subsoil, the color of the soil is thus artificially changed to pale yellow. The subsoil is generally quite friable when moderately dry, but in wet weather it sometimes becomes noticeably plastic and soggy. There are small eroded areas on some of the slopes where the clay subsoil has been exposed. Pebbly areas of this phase are referred to as "hard pimply land."

This grade of soil is found in small flat and undulating areas here and there over the county. Only a small area was mapped, but there are other bodies which, owing to their small size, were included with the medium phase. The soil is inclined to become waterlogged in protracted spells of wet weather and to harden in dry weather. Where the surface is flat, ditching would improve these conditions. Shallow cultivation as soon as possible after soaking rains is necessary to destroy any surface crust.

This is a very good soil for long-staple and short-staple cotton, oats, peanuts, and forage crops. Corn, watermelons, sweet potatoes, cantaloupes, and tobacco do better on the deeper phases. Heavy yields of sirup are secured, but the quality is inferior to that produced on deeper soils. Medium late crops of tomatoes, Irish potatoes, beans, and peas could be grown successfully. By plowing deep so as to turn up a portion of the subsoil, and by seeding in the fall, oats would do well, especially after a leguminous crop.

Commercial fertilizers when used should be applied in conjunction with organic manures, lot manures, the stubble refuse of cowpeas and velvet beans, or even with cowpeas turned under when partly matured.

Medium phase.—The medium deep Norfolk fine sandy loam consists of a light to medium heavy gray to dark-gray fine sandy loam, underlain, at from 10 to 20 inches (averaging about 15 inches), by a yellow heavy fine sandy loam which quickly passes into a bright-yellow friable fine sandy clay. The surface few inches of the soil is always darker colored than the portion below. The color in cultivated fields is lighter than that under timber, particularly under hardwood, while the color in poorly drained situations is sometimes almost black.

This phase carries less silt and clay than the shallow phase, yet there is present enough fine material to cause surface crusting with sunshiny weather following rains. In the well-drained situations the subsoil possesses a mealy structure very favorable to conservation of moisture in the condition most readily available to crops in time of dry weather. On the poorly drained areas and on the lower slopes of streams, where sometimes the color is reddish yellow, the subsoil not infrequently is slightly plastic. Under such a condition the type is less productive. In the northern and northwestern parts of the county there is a " black-jack hammock " phase which is quite rolling to slightly hilly. In this section the subsoil is often quite stiff and heavy, especially in proximity to the Susquehanna fine sandy loam areas. The soil here, too, seems to be lighter colored and lower in organic matter than under the average conditions.

The medium deep Norfolk fine sandy loam is also found in the low, flat, poorly-drained slough land situated in the northern part of the county. The greater part of this phase, however, occupies flat, undulating, and gently rolling country. The natural drainage is excellent, and but little erosion has taken place.

Cultivation is possible under a fairly wide range of moisture conditions, but the soil should not be disturbed while wet or miry. Tendency to crust and harden varies with the content and condition of the organic matter. There is no need of the soil getting into unfavorable structural conditions when it is so easy to grow crops like cowpeas and velvet beans which add humus and open up the soil and subsoil to the beneficial action of the air. Such crops are beneficial whether cut, grazed (in good weather), or plowed under. A half matured crop of cowpeas should be turned under occasionally. These crops should be grown regularly in rotation with cotton, corn, oats, and other staples.

The medium deep phase of the Norfolk fine sandy loam, as a whole, is the best soil in the county. It is well suited to a wide range of crops and is the most certain to produce good average yields. All the crops grown in the county do at least fairly well on this grade of soil. The average yields per acre are about one-third bale of cotton, 8 to 25 bushels of corn, 200 to 450 gallons of sirup, 15 to 20 bushels of oats, and 100 to 200 bushels of sweet potatoes. These yields could be increased largely by fall plowing, by growing more leguminous crops, and by using commercial fertilizers in conjunction with some form of vegetable manure; as compost, barnyard refuse, or green manure. The pebbly areas are best for both long-staple and short-staple cotton, early melons, and Irish potatoes. It is as well suited to corn as any other soil in the county, the best yields being made where the soil portion is deepest.

This is the best wrapper-tobacco soil in the county, being identical with that on which the best grades of wrapper tobacco are grown in Florida and in Decatur County, Ga. It is capable of producing from 1,000 to 1,300 pounds or more of shade grown, and from 500 to 1,000 pounds of sun-grown wrapper tobacco to the acre. The hammock land, when first cleared, is an especially good wrapper-tobacco soil. This is also the best sugar-cane soil, producing 600 gallons of sirup per acre, with proper fertilization. Early sweet potatoes and early cabbage could be profitably grown for market. Peanuts, cantaloupes, cucumbers, sorghum, and small berries do well. Pecans find this soil as it occurs in the gently rolling to undulating areas admirably suited to their requirements.

Ordinarily, applications of from 500 to 1,500 pounds of commercial fertilizer are used for sugar cane, 500 pounds for watermelons, 150 to 250 pounds for corn, and from 200 to 500 pounds for cotton. The experience of successful farmers on this soil would indicate that the best fertilizer for cotton and corn should analyze 10 per cent phosphoric acid, 2 per cent nitrogen, and 5 per cent potash. Sweet potatoes, especially the Spanish or Parrot yam varieties, fertilized with about 1,000 pounds of something like an 8–2–10 mixture should yield about 400 bushels per acre. Excellent crops of crab grass are made after watermelons without seeding. Tobacco culture on this soil was discussed under the heading "Special Industries."

There is a large area of the medium deep Norfolk fine sandy loam in the county.

Deep phase.—The deep phase of the Norfolk fine sandy loam is very similar in color and texture to the medium phase and differs from it essentially in its greater depth to the subsoil clay. The soil carries a little less silt and clay, and on that account is generally less compact and less inclined to crust than the two shallower phases. Typically developed, this phase is a gray to dark-gray loamy fine sand to light, fine sandy loam, underlain at from 20 to 30 inches (averaging about 24 inches, by a yellow, heavy fine sandy loam which quickly passes into a bright-yellow clay loam or fine sandy clay. The organic matter is more rapidly exhausted under cultivation than with the shallower phases.

This phase of soil is found throughout the area, occupying nearly every variety of topography peculiar to the county, but more generally occurs along slopes and on indistinct ridges. The medium-deep phase of the Norfolk fine sandy loam frequently grades so imperceptibly into this deep phase with descent of slope that it is difficult in places to establish the boundary between them.

The natural drainage of the deep phase is good in the main, but some of that found in the low, flat situations so common in the north-

western part of the county is poorly drained, soggy, and rather unproductive under present conditions. These flat areas, however, could be ditched and made desirable agricultural lands. The higher lying cultivated areas in which the organic matter has been allowed to run so low that the soil has a lifeless appearance are apt to be droughty. The tendency for crops to suffer on such areas in dry weather can be largely overcome by turning under occasionally crops of cowpeas and by sowing cowpeas and velvet beans in regular rotation with other crops.

This soil is especially adapted to watermelons, sugar cane, sweet and Irish potatoes, and corn. Cotton is inclined to run to weed in wet seasons. Cowpeas frequently fail to produce seed in wet seasons. The yield of sugar-cane sirup is lower than on the heavier phases, even with the same amount of fertilizer, but the sirup is light colored and of superior quality. From 1,500 to 2,000 pounds of fertilizer can be profitably used in growing sugar cane, the yields varying with such applications from 300 to 450 gallons per acre. There is not a better watermelon soil in South Georgia, provided from 400 to 800 pounds of a good grade fertilizer are used. The best grade seems to be one analyzing something like 10–3–4. Sweet potatoes yield from 150 to 300 bushels per acre when well fertilized. Pecans do very well on this soil. Cotton yields from one-fifth to one-third bale under ordinary methods of treatment. Cotton fertilizers should run higher in potash and phosphoric acid than those used for the crops just mentioned—about 10–2–8 is a good mixture—and should be applied at the rate of about 500 pounds to the acre and always in conjunction with some form of organic manure. Oats can not be grown very profitably unless fertilized. Cabbage, English peas, and tomatoes do well with heavy applications of manure. The soil is a little too light for best results with peanuts and onions. Good crops of crab-grass hay can be grown.

Fall plowing is not needed, except to turn under green vegetable matter.

The following table gives the average results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Norfolk fine sandy loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18856, 18858, 18860	Soil.....	0.6	7.3	8.9	39.5	26.1	11.1	6.5
18857, 18859, 18861	Subsoil...	.9	6.3	5.5	37.3	17.9	9.7	21.9

ORANGEBURG SANDY LOAM.

The Orangeburg sandy loam is a grayish-brown medium sandy loam, underlain at 10 to 15 inches by a bright-red friable sandy clay. There is generally enough fine material in the soil to impart a moderate degree of loaminess. A small percentage of coarse quartz sand is a prominent characteristic of the subsoil.

The type occupies gently undulating slopes and uplands. The natural drainage is good, while the structure and texture of both soil and subsoil are such as favor the conservation of moisture. Cultivation is possible over a wide range of moisture conditions, without much danger of puddling the soil. Unfavorable structural conditions, however, are likely to follow those methods of treatment which allow the organic matter in the soil to become depleted. As on the Norfolk sandy loam, cowpeas or velvet beans should be grown regularly in rotation with other crops, and occasionally, at least once in three years, a crop of half-matured cowpeas or some other legume should be turned under in late summer or early fall.

The Orangeburg sandy loam is admirably adapted to cotton, peanuts, watermelons, and forage crops, and produces good crops of oats, Irish potatoes, sweet potatoes, and various vegetables. Strawberries would do well on this land.

There is only a small extent of the Orangeburg sandy loam in the county. It occurs in widely separated areas in the northern part of the county.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Orangeburg sandy loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18872	Soil	6.0	12.1	6.4	35.4	21.9	10.7	7.6
18873	Subsoil	3.1	9.1	4.2	32.4	15.9	7.2	27.7

ORANGEBURG FINE SAND.

The Orangeburg fine sand is a grayish-brown slightly loamy fine sand, underlain at a depth of from 15 to about 28 inches by a reddish fine sandy loam which quickly passes into a friable red fine sandy clay. The color of the clay, although generally bright red, varies from dull red to deep red.

This type of soil occupies stream slopes and rolling uplands. That on stream slopes is quite variable in depth to the subsoil, being generally shallower in the higher positions.

The greater part of the type is found south of the Ocklocknee River. It is so well drained that crops sometimes suffer from drought, particularly where the organic matter content has been allowed to run low. Susceptibility to crusting following rains is not as noticeable as with the Norfolk soils. Maintenance of favorable structural conditions is aided wonderfully by applications of barnyard manure and by turning under half-matured cowpeas. The growing of velvet beans in rotation with other crops also results in marked improvement of the soil.

With good soil management cotton will yield from one-fourth to one-half bale per acre, corn from 15 to 40 bushels, and oats from 15 to 40 bushels. The average yields, however, are somewhat lower, owing to the prevailing rather indifferent methods of soil management. Cotton suffers sometimes from rust. Potash is a very efficacious fertilizer on the Orangeburg fine sand and should be used in a somewhat larger proportion especially for cotton than on the other soils. The results obtained by the most successful farmers in this and other sections show that a commercial fertilizer analyzing about 8 per cent phosphoric acid, 2 per cent nitrogen, and from 6 to 10 per cent of potash, when applied at the rate of from 300 to 500 pounds per acre, is probably the best form to use for cotton and the general farm crops. Wherever practicable commercial fertilizer should be used in conjunction with organic manure. Nitrogen should be supplied largely by growing leguminous crops, cowpeas, and velvet beans. Watermelons, cantaloupes, and Irish and sweet potatoes do well. Good sugar cane sirup can be produced, especially where the soil is 18 or more inches deep. Sorghum always does well when properly treated. Peanuts succeed on the shallower phase of the type. Very fair Sumatra cigar-wrapper tobacco can be grown on the Orangeburg fine sand where the depth to clay is at least 20 inches. Cuban filler does well, particularly on the shallow phase.

The following table gives the results of mechanical analyses of the soil and subsoil of the Orangeburg fine sand:

Mechanical analyses of Orangeburg fine sand.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18868	Soil	0.3	1.0	0.9	55.4	28.4	7.2	7.0
18869	Subsoil	.2	1.1	.7	48.6	10.4	5.5	33.8

ORANGEBURG FINE SANDY LOAM.

The Orangeburg fine sandy loam is a grayish-brown to reddish-brown fine sandy loam, underlain at 5 to 15 inches by a bright-red friable fine sandy clay. Occasionally the color of the subsoil is a

dull yellowish red near the line of contact with the Norfolk soils, indicating a gradation between the Norfolk and the Orangeburg series. Generally the deeper the soil the more nearly does the surface material approach a gray color, except in those areas where the red subsoil material has been exposed or washed down from "gall spots" lying at higher elevations. The subsoil sometimes gets quite plastic on the lower slopes bordering streams, approaching here closely the characteristics of the Susquehanna fine sandy loam subsoil.

Small iron concretions occur here and there on the surface and through the soil mass. Such pebbly areas are spoken of locally as "pimply land." These concretions are more commonly encountered in the higher positions, particularly on knolls and the crests of ridges.

The depth to the subsoil on slopes generally increases with the descent, owing to the accumulation of wash material from above. Some areas having a greater depth to the clay than 15 inches (properly Orangeburg fine sand) had to be included with the dominant type on account of their limited extent.

The Orangeburg fine sandy loam is more inclined to wash than the other soils of the county. "Gall spots," or small areas in which the subsoil has been exposed through the removal of the sandy surface soil by erosion, are seen occasionally on the steeper slopes. The susceptibility of the type to wash could be reduced to a minimum by plowing deeper and by incorporating more organic matter with the soil, thus increasing its water-holding power, by having the rows follow the contours of the hills, and by terracing. The fences on this type often catch and hold much material washed against them from above.

While small isolated areas of the Orangeburg fine sandy loam are found here and there in the northern part of the county, the type is confined largely to that part of the county lying to the south of an east and west line drawn through Connells and Wesleyan churches. In its surface configuration the soil usually is gently rolling. The greater part is found on stream slopes, although it not infrequently extends up to and even upon the highest elevations. The largest areas occur along or near the Florida line, south of the Ocklocknee River. Here the country is slightly hilly, but the slopes are smooth and gentle.

The natural drainage of the type is excellent. The subsoil is especially favorable to the maintenance of moisture in quantities favorable to good plant development, and crops suffer very little from drought.

The timber growth is mainly longleaf pine. Hardwoods, such as dogwood, beech, maple, magnolia, and oak, are encountered here and there on the small hammock areas. Ordinarily a hardwood growth is an indication that the depth to clay is less than with the general

run of the type, and also indicates that the supply of organic matter, the result of leaf-mold accumulation, is exceptionally favorable.

The Orangeburg fine sandy loam is a strong, productive soil, highly adapted to cotton, oats, and forage crops. Corn does hardly as well as on the Norfolk soils, yet enough can be grown easily for all needs of the average farm. Heavy yields of sugar-cane sirup are made, but the quality, especially the color, is generally inferior to that produced on the Norfolk types. Sorghum also does well. The average yields of cotton range from one-third to three-fourths bale; corn, from 8 to 15 or 20 bushels, and oats from 15 to 30 bushels, according to fertilization and the thoroughness of cultivation. Better yields of oats could be secured by sowing in October or November, after a crop of cowpeas or velvet beans. A bale of cotton to the acre can be produced in favorable years with thorough culture.

The best commercial fertilizer for cotton, corn, and oats on this soil, according to the experience of successful farmers, is one that analyzes approximately 10 per cent phosphoric acid, 2 per cent nitrogen, and from 4 to 5 per cent potash. Applications generally should be made at the rate of 300 to 500 pounds per acre for cotton, and from 250 to 350 pounds for corn and oats. Barnyard manure, stable manure, or half-matured vegetation, preferably some legume, should be used in conjunction with commercial fertilizers, for the reason that the effect is generally very much more lasting when used in this way. Cowpeas and velvet beans should be grown regularly in rotation with cotton, oats, and corn. Watermelons, cantaloupes, and cucumbers do very well on the Orangeburg fine sandy loam, and Irish potatoes could be successfully grown where the surface soil is at least 10 inches deep. Where the soil is shallow the potatoes are apt to be soggy and of poor keeping quality. Sweet potatoes do moderately well. Peanuts find the soil very well suited to their requirements.

The Orangeburg fine sandy loam is the best Cuban filler tobacco soil in the area or in this general region. From 500 to 700 pounds per acre can be grown with ease. Sumatra wrapper tobacco can not be grown to best advantage on this soil for the reason that the leaf produced is too thick and heavy.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Orangeburg fine sandy loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18870	Soil	0.1	0.9	1.1	63.4	23.2	4.5	6.5
18871	Subsoil	.0	.9	.6	38.9	14.6	6.4	38.3

PORTSMOUTH SANDY LOAM.

The Portsmouth sandy loam is confined to the belt of the coarser textured soils in the northern part of the county, where it occurs as narrow strips along stream slopes and as swales and small basin-like depressions. Some of the lesser bodies were too small to map on the scale used in the survey. The soil is often locally called "black mud land" and "bugle land," the last name on account of the growth of pitcher plants, called "bugles." As the soil is of limited extent in the county and has poor drainage, it is of little agricultural importance.

The Portsmouth sandy loam is a dark-gray to nearly black loamy sand to light sandy loam, underlain at from 10 to 20 inches by a gray or drab sandy loam, which is generally slightly mottled in the lower portion with yellowish and reddish colors. The undrained condition of the soil has favored the accumulation of dark-colored organic matter. The soil material is very much the same as that of the Norfolk sandy loam, the distinguishing characteristics being due to drainage conditions as the result of position. Artificial drainage would be feasible, except in case of some of the small valleylike swales and the deep sink-hole depressions. The stream slope phase often has a substratum of very stiff, impervious mottled clay, which makes the soil rather springy or soggy and which is further objectionable for the reason that it offers a decided obstacle to artificial drainage.

Well-drained areas, especially where the subsoil is a sandy loam and not too plastic or impervious, would produce fair crops of cotton, corn, rice, and sugar cane, while some vegetables, for instance celery, probably would succeed.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Portsmouth sandy loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18876	Soil	2.9	15.3	13.7	42.2	12.7	7.7	4.6
18877	Subsoil	1.0	8.5	12.3	44.3	12.4	5.1	16.3

PORTSMOUTH FINE SAND.

The Portsmouth fine sand consists of a very dark-gray to black slightly loamy fine sand, underlain at from 15 to 20 inches by a light-gray to drab fine sand, sometimes mottled in the lower portion with yellowish and reddish colors. The subsoil is ordinarily saturated and quite compact, tending when exposed in excavations to flow from beneath the firmer surface soil. This "quicksand" subsoil

makes it very difficult to effect drainage with open ditches as they quickly fill with this sand.

The soil is sometimes locally referred to as "black mud land." The greater part occurs as very poorly drained flat stretches. It supports a good growth of longleaf pine, some "slash" pine, a large undergrowth of gallberry bushes, scattering palmetto, and often "bugles." There are small strips along stream slopes here and there and occasionally patches are found in basinlike depressions. There is a low, flat body of considerable size west of Spring Hill Church, near the county line. The largest areas are found along the Ocklocknee River at an elevation ranging from a few feet to about 30 feet above the river "flats." A typical area is the one just south of Pine Park Station.

None of the Portsmouth fine sand is under cultivation, and extensive ditching or tiling would be necessary before any agricultural use could be made of it, unless it be the production of rice. With good drainage it is probable that sugar cane, Irish potatoes, onions, and corn could be grown. Experience with this same soil in other sections has demonstrated the fact that the organic matter is exhausted rapidly under cultivation despite the present high organic matter content. The turning under of green crops of cowpeas, velvet beans, or other vegetable matter would be necessary to maintain even moderate productiveness. The use of lime in conjunction with green manures such as those mentioned would prove beneficial for this character of land.[a]

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Portsmouth fine sand.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18874	Soil	0.1	2.1	3.0	49.7	30.3	12.5	2.1
18875	Subsoil	.2	1.8	2.5	58.7	24.9	9.3	2.3

PORTSMOUTH FINE SANDY LOAM.

The soil of the Portsmouth fine sandy loam is a dark-gray to black very fine sandy loam averaging about 12 inches in depth. The subsoil, usually a light-gray or drab or a mottling of these colors with yellow and reddish yellow, averages a moderately heavy fine sandy loam, usually compact and saturated in the lower portion. In the

[a] Soil survey of the Waycross Area, Georgia, page 303. Field Operations of the Bureau of Soils, 1906.

higher lying, better drained situations the subsoil sometimes is quite uniformly yellow.

The type occupies flat to gently undulating uplands, stream slopes, and low, flat situations above the heads of streams. It is also found in numerous small sink-hole depressions and swales. That found about the heads of streams and on stream slopes is usually springy and remains water-logged throughout the year. The deep subsoil here is often a stiff, impervious, mottled drab and yellow, sandy clay. The disadvantage of this impervious underlying material, coupled with the further objectionable feature of seepage from above, practically precludes the possibility of good drainage in such situations. In the depressions the soil is generally more loamy than the average, and is always quite wet. Here also the subsoil frequently is a stiff, mottled drab, sandy clay. Cypress, black gum, and mayhaw are common to these depressions, especially where water stands throughout a good part of the year. Longleaf and "slash" pine constitute the usual timber growth on the other areas. Gallberry is very abundant everywhere, and palmetto and pitcher plants, or "bugles," are especially common on the poorly drained areas.

Considerable areas of the Portsmouth fine sandy loam are found throughout the northern part of the county. In the northwestern part there are a number of areas occupying the low, flat situations common to this section.

Very little of the soil is under cultivation. Much of it could be drained by means of open ditches and be made to produce rice and sugar cane and possibly fair crops of corn and strawberries. However, it is not likely that any of this soil will be used for agricultural purposes in the near future in view of the fact that there is available so much well-drained productive land throughout the county.

SUSQUEHANNA FINE SANDY LOAM.

The Susquehanna fine sandy loam occurs in several phases, differing mainly in topography and depth to subsoil. A slope phase is found in narrow strips along the lower slopes bordering stream bottom land. Here the soil depth is quite variable, depending largely upon the position and the steepness of the slope. From the higher positions on steep slopes not infrequently the soil portion has been washed off, leaving a stiff clay exposed or very near the surface. Where the slope is not so steep the material removed from above has been deposited lower down, so that the depth to subsoil usually increases toward the stream, the accumulation sometimes being deep enough to warrant classification of the surface material as colluvial Norfolk fine sand. The soil here consists of a dark-gray to dull-brown fine sandy loam, while the subsoil generally is a plastic, putty-like sandy clay, mottled pinkish red, yellow, and drab. Sometimes

the upper portion of this subsoil is distinctly yellow, and occasionally this yellow color persists to a depth of about 3 feet, but a stiff, mottled clay is always encountered somewhere below. Greenish yellow to nearly white material resembling fuller's earth is found in places, generally below the mottled clay. Fragments of rotten limestone are also seen in the subsoil of some of the areas.

These narrow strips of Susquehanna fine sandy loam, found here and there throughout the county, are usually spoken of locally as "pipe clay land." The original timber growth consists principally of beech, dogwood, oak, and pine.

In the Lime Sink and Blowing Cave districts, the Susquehanna fine sandy loam occupies the flat to undulating "slough" country lying from 20 to 40 feet below the general upland level. This phase is a light-gray to dark-gray fine sandy loam running high in silt, especially in the low, flat, situations. There are several small areas in the "slough" lands which in texture approach closely a silt loam and which have dark-colored subsoils. In this section of the county the type is also found in small areas along the slopes of hills. At about 12 inches the surface soil of this hill-slope phase passes into a stiff yellow clay which at a lower depth grades into a plastic clay mottled pinkish red, drab, and yellowish. This subsoil carries more sand than that of the stream-slope phase and in the mottling the reddish color is less conspicuous. Occasionally, however, the subsoil here is quite red, at first sight resembling that of the Orangeburg. In these higher rolling areas fragments of a rather cherty limestone are abundant on the surface and throughout the soil mass. These fragments have been derived from outcrops of the underlying Vicksburg-Jackson limestone formation.

Sink holes are quite common in the flat areas and occasionally streams empty into these as in the Bay Sink and the Lime Sink. It appears that these sink holes have played some part in the formation of these low, flat "slough" lands through increased erosion in the vicinity of such openings into subterranean passages. Large quantities of soil material have been and are being carried off from local areas by these underground streams.

That the subsoil portion of some of this type was derived in part from or has been influenced in some degree by the underlying limestone is suggested by the fact that outcrops of limestone are commonly associated with the type. The soil proper unquestionably is composed largely of either the material that gives rise to the Norfolk types or the material underlying the Norfolk soils.

Where the drainage is good and the depth of soil 10 inches or more, good crops of corn and peanuts can be grown. It is said that cotton is inclined to suffer from black root on this soil. The production of tobacco and potatoes should not be attempted. The removal of sur-

face water from the flat areas by ditching would be quite effective in the reclamation of such lands for agricultural purposes. In the wet, springy, depressed areas the subsoil is so impervious and stiff that not much improvement can be effected by artificial drainage. The soil is not of sufficient extent to warrant at present any great effort or expense toward reclaiming it.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Susquehanna fine sandy loam.

No.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18849	Soil	0.8	8.3	9.1	27.4	22.4	22.7	8.8
18850	Subsoil	.6	8.9	6.3	22.4	11.8	13.3	36.1

CHASTAIN FINE SANDY LOAM.

The Chastain fine sandy loam occupies the broad "river flats" of the Ocklocknee and the stream bottoms of some of the larger creeks. Though varied by hummocks of sand, small outcrops of a mottled red and drab impervious clay, and by depressions containing dark mucky soil, the type consists for the most part of a grayish to dark-gray loamy fine sand to light fine sandy loam, underlain at depths ranging from a few inches to 3 feet or more by an impervious, mottled drab, yellow, and sometimes reddish clay. Probably from 80 to 90 per cent of the soil averages a fairly uniform, very light fine sandy loam. However, the type is less uniform in its textural composition than the other types of the area, and some of the nonconformities would have been separated and mapped if they had been of sufficient importance to justify such detail. The surface generally is flat except for occasional sloughlike and rounded depressions. The impervious clay subsoil is often the undisturbed sedimentary material.

These bottoms vary from narrow strips to areas nearly a half mile or more in width. They are subject to overflow and are generally considered nonproductive. At present they are valuable only for their excellent growth of longleaf and "slash" pine. There is usually present a scattering growth of palmetto and gallberry bushes.

It is probable that the type could be improved for grazing purposes, and with extensive drainage and heavy fertilization could doubtless be made to produce sugar cane and corn. It is not likely, however, that any of this land will be brought under cultivation in the near future for the reason that there is plenty of available, well-drained, productive land throughout the county. Along some of the creeks where overflows are not so serious as in the river bottoms the land could easily be brought under cultivation by ditching.

GRADY LOAM.

The Grady loam is a dull brown, light-textured loam, underlain at 15 to 20 inches by an extremely stiff bluish-drab clay mottled slightly with reddish and yellowish colors. It is found in a single flat, low-lying body crossing the northwestern corner of the county from Mitchell to Decatur County. Lying from 20 to 30 feet below the general upland level, which is reached through an almost abrupt rise from the marginal boundaries of the type, this flat body of land presents in its meandering direction and varying width a close resemblance to an old stream bed.

The area is known locally as the "Big Slough," for the reason that the waters of the several streams which flow into it from its upper boundaries in Mitchell County to the point where it blends with and disappears into the sandy belt bordering the Flint River,[a] sink into the soil so rapidly that there is a perceptible flow in the direction of the slope to the southwest only in seasons of heavy rainfall. The "Big Slough" is covered by water in wet weather, but this seeps off rapidly in dry seasons, there remaining generally throughout the summer only small ponds of water here and there in the sink holes and swales. Though much water is absorbed by the soil, the greater part probably reaches underground passageways through the sink holes. In several places the limestone, which undoubtedly underlies the entire area, crops out. The soil portion of the type unquestionably consists largely of material washed in from the surrounding upland, but the origin of the subsoil, whether representing sedimentary material entirely or sedimentary material influenced by the limestone, is questionable, but the last-named possible origin seems the most probable one. If there is any lime in the soil it is present only in traces.

Mayhaw and water oak, for the most part, constitute the sparse or clumpy timber growth. The "Big Slough" is famous for its mayhaw berries, which are gathered in large quantities for making a delicious jelly. Under present conditions of drainage the soil is too wet and clammy for cultivation, and on account of the danger of being flooded during heavy rains at any time of the year it is not likely that much headway will be made in its utilization for agricultural purposes until a thorough system of drainage has been installed. At present cattle and hogs find good grazing here during the summer. If drained, alfalfa, corn, grass, and rice undoubtedly could be grown with success.

[a] The Flint River in this part of the area is peculiar in that it does not receive any surface tributaries of any kind and has no border of low, wet land to mark its flood level. (Field Operations of the Bureau of Soils, 1904, p. 250.)

With a system of ditches or canals emptying into the sink holes or carried through or into the flat country southward toward the Flint River, it would seem that this body of land could be put in good condition without an unreasonable expenditure.

There are several low, flat stretches of country ("slough lands") in the northern part of Grady County into which the waters of small streams flow and sink, but none of these have as well-defined bottom land and the soils in such situations never show the marked uniformity as does the Grady loam, nor do they appear in any way closely related to the latter type.

The peculiar topography of the "Big Slough" is rather inexplicable, unless it be accounted for by a sinking in of the land overlying a limestone cavity or by intensified erosion in the vicinity of a chain of sink holes.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Grady loam.

No.	Description.	Fine gravel.	Course sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
18845	Soil	1.6	15.8	9.2	22.7	10.2	17.1	23.1
18846	Subsoil	.7	7.9	4.5	10.7	6.3	10.6	59.1

MEADOW.

Under the term Meadow has been included those poorly drained areas found along small streams and in upland swales and depressions. Bordering nearly every branch and creek in the county are found these strips of wet, soggy land, supporting a dense growth of magnolia, bay, "slash" and longleaf pine, maple, black oak, gallberry bushes, and other water-loving growths. The texture of the more truly alluvial phase, although consisting for the most part of sandy material, is so variable that it could not be classified as a distinct type of soil. Some of this bottom land is underlain by a bluish and drab, plastic, "crawfishy" sandy clay, either in the form of lenses interspersed through a sandy matrix or as a uniform substratum. In other places Meadow is merely a soil condition; that is, in the swales along branches often only wet-weather drainage ways, the soil receiving so much seepage water that it is always in a waterlogged condition. In such situations there is always a dense growth of gallberry bushes, and the surface soil is decidedly mucky on account of organic matter accumulations from the dense growth. The subsoil of this springy land is always a clammy, drab or mottled material, varying in texture from sandy clay to nearly pure sand.

Another grade of Meadow is found in the quasi-bottom lands in the southern part of the county, where in some of the broad valleys and swales deep layers of soil have been deposited by wash from the adjacent uplands. The streams here are small, or really little more than wet-weather drainage ways. The land, especially when ditched, is admirably adapted to the production of corn and oats. Live oak is very common on this soil.

Another grade of Meadow is found in the shallow sink-hole depressions and swales of the uplands which hold water for a part of the year. Such wet places generally support a dense growth of cypress, mayhaw, and black gum, and are often referred to as "cypress," "mayhaw," or "black gum ponds." Some of these areas could be ditched and utilized for the production of corn and rice. The stream depression and stream bottom phases of Meadow would be very hard to drain, and at present none of such land is under cultivation.

SUMMARY.

Grady County is situated in southwest Georgia and comprises an area of 294,080 acres or about 459 square miles.

The topography is flat to gently rolling. Drainage for the most part is good.

The climate is mild, roses and other flowering plants blooming throughout the year, though occasional frosts occur between November 15 and March 1. The summers are long and hot, though modified by breezes from the Gulf, which is only about 40 miles distant.

Transportation facilities are good for a large part of the county. The public roads are kept in fairly good condition.

Sugar cane for sirup, shade-grown and sun-grown Sumatra cigar-wrapper tobacco, Cuban filler cigar tobacco, long-staple cotton, and watermelons are special crops that are proving a success. Irish and sweet potatoes, cantaloupes, and other truck crops are specialties, the production of which could be profitably extended. In addition to the above, the usual staple crops of the South are produced to advantage.

The soils range all the way from loam to loose sand. Their organic matter content is higher and the power to retain moisture greater than in many Coastal Plain sections.

The Norfolk fine sandy loam was mapped in three phases according to differences in crop value, as determined by differences in soil depth. The shallow phase is well suited to cotton, oats, peanuts, and forage crops, but is too heavy for best results with tobacco, corn, sugar cane, watermelons, potatoes, and truck generally. The medium deep phase is the best sugar cane and Sumatra cigar-wrapper tobacco soil of this general region. It also produces good corn, sweet and Irish potatoes, forage crops, and vegetables, and fair cotton. Pecans, pears,

plums, and grapes do well. The deep phase makes very fair corn, excellent sugar-cane sirup, and various vegetables, but is rather too droughty for tobacco without irrigation. The varieties of cotton grown are inclined to go too much to weed on this phase. All crops require extra heavy applications of fertilizers and manure, especially organic manures.

The Norfolk fine sand is very similar in its crop adaptation to the deep phase of the Norfolk fine sandy loam, but it is a little more droughty and makes somewhat lighter average yields. It is a good vegetable but rather a poor cotton soil.

The Norfolk sandy loam produces very fair yields of a great variety of vegetables and forage crops. Cotton does well where the depth to the subsoil is not over 15 inches, as also do peanuts and potatoes. Sugar cane, corn, and sweet potatoes do best where the surface soil depth ranges from 10 to about 20 inches. Strawberries, cantaloupes, and cucumbers would do very well. A fair to medium grade of wrapper tobacco can be grown where the soil, with a depth of from 10 to 20 inches to subsoil, is of the finer texture. The crop yields on the type average something less than on the Norfolk fine sandy loam.

The Norfolk sand is a loose, rather droughty soil, which requires heavy fertilization, particularly with organic manures, for profitable returns. Crops like half-matured cowpeas should be turned under occasionally to improve the structure of the soil. This is a warm soil well suited to early vegetables. The varieties of cotton grown go badly to weed in wet years and suffer from rust in dry years.

The Tifton sandy loam is the best cotton soil of the county, making with proper treatment from one-half to 1 bale per acre. Heavy yields of sugar-cane sirup are secured, but the color is usually a little darker than that produced on the lighter soils. Corn, oats, and forage crops succeed very well; watermelons, cantaloupes, and sweet potatoes do fairly well. Extra early vegetables can be grown, but as a general rule the type is not admirably adapted to truck crops. Long-staple, or Sea Island, cotton does probably better on this than on any other type, with the possible exception of the " pimply " areas of the Norfolk sandy loam and fine sandy loam, which give about the same results.

The Orangeburg fine sandy loam is admirably adapted to the production of the Cuban type of cigar-filler tobacco. Cotton, Irish potatoes, oats, and forage crops do well. The soil depth should be at least 10 inches for best results with Irish potatoes. Corn, peanuts, sweet potatoes, and watermelons do fairly well. Heavy yields of sugar-cane sirup are made, but often the color is quite dark, especially where the red-clay subsoil comes near the surface. Vegetables as a rule are only moderately successful. Pecans, pears, figs, and plums do well.

The Orangeburg sandy loam is adapted to about the same crops as the Orangeburg fine sandy loam, but the yields average a little less than those on the latter type.

The Orangeburg fine sand makes very fair yields of corn, forage crops, and truck. The varieties of cotton grown are inclined to go badly to weed in wet seasons and to rust in dry seasons. Sweet and Irish potatoes and watermelons do well. Sumatra-wrapper cigar tobacco does fairly well under shade, where the depth to clay is at least 22 inches.

The Portsmouth soils, owing to their poor drainage, are not cultivated and under present conditions could scarcely be used for the profitable production of any crop. Where the sandy surface material is over 20 inches deep the Portsmouth types would be rather unproductive even though artificially drained. Rice and sugar cane would probably do fairly well on the heavier phases of the fine sandy loam and sandy loam types. It is not likely that the cultivation of any great part of these soils will be attempted in the near future on account of the abundance of other well-drained and productive soils throughout the county.

The Susquehanna fine sandy loam is not an important agricultural soil because of its unfavorable topographic position and the unfavorable structure of the subsoil. Some of the areas, however, make moderate yields of the general farm crops.

The Grady loam is not a very extensive soil, and the present drainage conditions are such as to prohibit its utilization for agricultural purposes.

The Chastain fine sandy loam or stream bottom soil is not used at all for agricultural purposes. It would require thorough artificial drainage and perhaps some diking for its reclamation. Local esteem holds it as soil too unproductive to warrant any attention except for the growth of longleaf pine.

Meadow comprises the undrained wet stream and depressed areas and is used only to a very little extent for agricultural purposes although much of it could be reclaimed so as to produce rice and corn. Some of the broad, better drained areas in the southern part of the county make excellent crops of corn.

The methods of cultivation in general are very well suited to the soils and conditions, especially so in the production of sugar cane, tobacco, cotton, melons, and peanuts. Some improvement in methods, however, might well be made in respect to corn, oats, and truck crops. Fall plowing should be more generally practiced on the heavier types; more organic matter returned to the soil by growing vetch, cowpeas, and velvet beans; and more attention given to crop rotation and to improving the varieties of each crop by proper seed selection. The

home mixing of fertilizers should be more commonly practiced, and commercial fertilizers, when used, should be applied generally in conjunction with vegetable manures. As grazing can be done the year round on green forage, such as vetch, rape, rye, oats, Bermuda grass, cowpeas, sorghum, and velvet beans, it would seem that the raising of more live stock would be quite profitable; the mere fact of thus having a larger quantity of manure to apply to the cultivated fields should be an important consideration in this connection.

There are good opportunities for the further development of agriculture in Grady County. The soils are adapted to an exceptionally wide range of crops, and suitable land can be bought at very moderate prices. It is safe to say that few sections offer more attractive inducements to the man of small means or to the capitalist desiring to engage in either specialized or general farming.

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