

SOIL SURVEY OF GRANVILLE COUNTY, NORTH CAROLINA.

By R. B. HARDISON and DAVID D. LONG.

DESCRIPTION OF THE AREA.

Granville County is situated in the northern-central part of North Carolina. On the east it is bounded by Vance and Franklin Counties; on the south by Franklin, Wake, and Durham; on the west by Durham and Person; and on the north by the Virginia line. In shape the county is almost a rectangle with a maximum length of 36 miles from north to south and a width of 16 miles. It comprises an area of 334,080 acres, or 522 square miles.

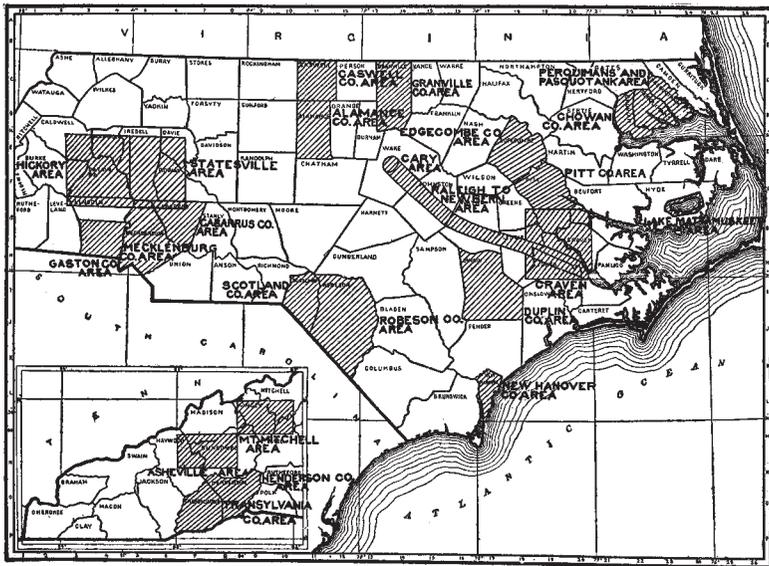


FIG. 9 —Sketch map showing location of the Granville County area, North Carolina.

The surface features of Granville County vary from gently rolling to hilly. The most even-surfaced part of the area is found around Creedmoor. In this section the interstream country is rolling to hilly, the hills being marked by bluff lines overlooking the stream courses. Narrow valleys along the streams represent the only gently sloping surface found in the area. The southeastern corner of the county, or that section known as the "Hurricane," is steeply rolling and hilly. The sections occupy the western part of Tallyho Town-

ship,¹ together with inextensive areas in the northeastern corner of Walnut Grove and the northern end of Oxford and Salem Townships.

By referring to the accompanying map it will be seen that two distinct watersheds traverse Granville County in a northwest-southeast direction, one north of Tar River and the other south of that stream. The first of these enters the county near the intersection of the Granville-Vance County line and the Henderson Branch of the Southern Railway, and passes northwestward 2 miles south of Lewis to Satterwhite, whence it continues northwestward along the Goshen road to Goshen and eventually leaves the county near the intersection of the road and the Granville-Person County line. North of this watershed the creeks flow northward or northeastward and finally enter either the Dan or the Roanoke River. The streams which drain this northern end of the county are Aarons, Johnson, Beech, Grass, Mountain, Little Grass, Spewmarrow, Little Island, and Island Creeks.

The more southern watershed intersects the Granville-Franklin County line near Mount Carmel Church and follows with little variation the road leading through Wilton to Bragg Crossroads and thence to Tallyho Church. Here it turns toward the northwest and follows the county road through Shoofly to Kittrell Crossroads, and finally leaves the county 5 miles northwest of the last-named place. South of this watershed all the streams flow in a southerly direction and finally empty into Neuse River. The drainage of the southern end of the county is effected through Knap of Reeds, Ledge, Robertson, Beaverdam, Smith, and Newlight Creeks.

South of the northern watershed the streams flow southward into Tar River, which crosses the county a little to the south of the central portion in a southeasterly direction. North of the southern watershed the creeks flow northward into the same stream. The largest of the streams draining the central part of the county and flowing into Tar River are Shelton Creek and the North Fork of Tar River, together with Bollens Run and Owen, Cattail, Gibbs, Ford, Sand, Adcock, and Johnson Creeks.

Granville County was formed in 1746 from Edgecombe County, but since that time has been reduced in area by the cutting off of territory to form, in whole or in part, Orange, Durham, and Franklin Counties. The first settlements in Granville County took place nearly two centuries ago. The original settlers were mainly English people, though some of them were of Scotch ancestry. The majority of the present population are the direct descendants of the original settlers.

According to the census of 1910 the total population of the county is 25,102, mainly whites. Although the county is fairly well settled,

¹ Owing to uncertainty of the correct location of the boundary lines between Tallyho and Dutchville and between Fishing Creek and Brassfield Townships, the lines are not shown in the map.

there is still much uncleared land not too rough for cultivation. The county possesses a great diversity of soils, and if these were farmed under a more intensive system their products would support many times the present population. Oxford, the chief town and county seat, is located a little east of the central part of the county. It has made rapid progress during recent years. It is one of the leading tobacco markets in this section of the State, possessing four large warehouses. It also has other business and manufacturing interests of importance.

Creedmoor, the town of next importance, is situated in the southern part of the county, on the Durham and Henderson Branch of the Seaboard Air Line Railway. It is an excellent tobacco market and a thriving business town. Stovall and Bullock, in the northeastern part of the county, are also prosperous business towns. The town of Virgilina is situated 25 miles northwest of Oxford, partly within North Carolina and partly within Virginia. The copper mines of the Virgilina copper mining district originally built up this town, but it has developed into a fairly good tobacco market. Stem, Hester, Providence, Tar River, Clay, Lyons, and Bennehan Station are small but prosperous towns.

Transportation at present is supported by the Southern and Seaboard Air Line systems. The Keysville and Durham Branch of the Southern crosses the county diagonally from southwest to northeast and serves as an outlet to Durham and Richmond. Oxford and Henderson, the county seats of Granville and Vance, respectively, are connected by the Henderson Branch of the Southern. The Durham and Henderson Branch of the Seaboard Air Line from Durham, by way of Dickerson to Henderson, runs parallel to the Southern at an average distance of 6 miles south, and offers transportation to a large part of Granville County. A short branch of the Seaboard Air Line connects Oxford with the Durham and Henderson Branch at Dickerson. The main line of the Southern from Danville, Va., to Norfolk, Va., cuts the northwestern corner of Granville County for a short distance, and a branch line here extends into the Virgilina copper district. There is need for extension of the railroad systems.

Granville is among the foremost counties of Piedmont, North Carolina, in the matter of road building. Nearly all the county roads have been partially relocated, graded, and surfaced, and this work of improvement is still in progress throughout the county. Many new roads have also been built through sections heretofore undeveloped. Only a few miles of macadam road have thus far been constructed.

CLIMATE.

As there is no Weather Bureau station in Granville County, the following table giving temperature and precipitation data has been

compiled from the records of the two nearest stations outside of the county—Henderson, 6 miles distant from the eastern boundary, and Roxboro, 10 miles distant from the western boundary. The data from these stations represent very accurately the climatic conditions of Granville County.

An examination of the tables shows an abundant rainfall well distributed throughout the year. Precipitation is heaviest during the growing season and summer months, and lightest during the fall months. There are usually about 12 inches of snow each winter, but it seldom remains on the ground for more than two or three days.

The average date of the last killing frost in Granville County in the spring falls about April 7, and of the first in the fall about October 31. This gives a growing season for tender vegetation of 200 days. The spring and fall months are very pleasant, and the summers are not excessively hot. The winters are mild, and considerable farm work can be carried on during the winter and early spring months.

Owing to relatively high elevation and rolling surface, with consequent good drainage, Granville County has a remarkably healthful climate.

Normal monthly, seasonal, and annual temperature and precipitation.
AT ROXBORO, PERSON CO., N. C.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches
December.....	40	69	0	3.1	3.1	5.6	3.0
January.....	37	73	0	3.1	2.5	2.2	3.7
February.....	38	71	- 7	4.6	5.6	1.1	4.8
Winter.....	38			10.8	11.2	8.9	11.5
March.....	50	86	11	4.1	4.3	3.8	0.5
April.....	57	91	22	3.7	6.2	6.2	0.2
May.....	67	95	35	5.1	2.6	9.2	0.0
Spring.....	58			12.9	13.1	19.2	0.7
June.....	74	100	42	3.5	2.0	1.9	0.0
July.....	78	100	52	5.6	6.7	5.7	0.0
August.....	76	100	48	4.0	0.8	11.9	0.0
Summer.....	76			13.1	9.5	19.5	0.0
September.....	70	100	35	3.8	1.5	5.5	0.0
October.....	58	88	25	3.4	2.7	1.3	0.0
November.....	49	79	13	2.6	2.8	1.7	Trace.
Fall.....	59			9.8	7.0	8.5	Trace.
Year.....	58	100	- 7	46.6	40.8	56.1	12.2

Normal monthly, seasonal, and annual temperature and precipitation—Cont'd.

AT HENDERSON, N. C.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	° F.	° F.	° F.	Inches.	Inches.	Inches.	Inches.
December.....	41	73	6	3.2	3.2	5.6	2.2
January.....	39	72	4	3.4	1.1	2.2	2.2
February.....	39	73	-2	4.9	6.8	0.7	6.9
Winter.....	40			11.5	11.1	8.5	11.3
March.....	51	88	18	5.0	2.9	4.7	0.7
April.....	57	98	26	4.5	2.3	6.1	Trace.
May.....	68	98	38	4.5	2.9	8.4	0.0
Spring.....	59			14.0	8.1	19.2	0.7
June.....	75	100	43	4.0	4.8	3.9	0.0
July.....	79	101	55	5.6	2.3	6.4	0.0
August.....	78	104	54	5.1	3.7	9.2	0.0
Summer.....	77			14.7	10.8	19.5	0.0
September.....	72	103	42	3.7	6.0	7.8	0.0
October.....	60	92	29	3.6	1.6	3.4	Trace.
November.....	50	80	17	2.7	3.8	1.3	0.2
Fall.....	61			10.0	11.4	12.5	0.2
Year.....	59	104	-2	50.2	41.4	59.7	12.2

AGRICULTURE.

Granville is one of the oldest counties in North Carolina, and one of the first to be developed agriculturally. According to the census of 1850 the production of corn and small grain was even then of importance. In 1849, the year covered by the census, 556,530 bushels of corn, 140,905 bushels of oats, 51,938 bushels of wheat, and 1,174 bushels of rye were produced in the county. The wool clip in the same year amounted to 14,600 pounds. These figures, it should be remembered, apply to a much larger territory than is included in the county at present.

From 1850 until 1860 the production of all crops increased and many new crops were introduced. Hay, flax, beans, peas, pumpkins, and many varieties of fruits and vegetables were grown for home consumption. Tobacco was a secondary crop until about 1850. The type of tobacco grown in the early days was dark and heavy. The increase in production of tobacco was very gradual until 1860. Prior to this time the greater portion of the crop not used at home was sold in Petersburg and Richmond, Va. Cotton had been introduced into

nearly all sections of the county, but in the early days it was grown to a limited extent only.

Just before the Civil War, and to a limited extent at an earlier period, considerable live stock—cattle, sheep, and hogs, as well as work stock—was raised in the county.

At the close of the war the agriculture was badly demoralized. Thousands of acres were thrown out of cultivation, conditions were unsettled, and the money market stringent. This condition, however, was more or less temporary, and with the recovery of business agriculture entered upon a new era. Tobacco rapidly assumed the place of first importance, and its production has gradually increased to the present time. The production of this crop will be discussed more fully in another section of this report.

With the increase in tobacco production the growing of grain has declined. There has also been a corresponding decrease in the number of cattle, hogs, and sheep raised. Corn holds the place of second importance in the list of agricultural products. Cotton has never received the attention it has in some adjoining counties, although it is an important product in the southeastern section of the county. The census of 1900 shows that in 1899 30,386 acres were devoted to the production of corn, with a yield of 472,600 bushels, or an average yield per acre of 15 bushels. Oats are grown to a greater or less extent throughout the county, but within recent years this crop has proved almost a complete failure in some sections. Wheat had ceased to be grown in the Creedmoor section 10 or 12 years ago, but its culture was again taken up in 1909 and 1910. It is now grown to some extent in all sections of the county. A greater acreage is being seeded to clover each year. The growing of other tame grasses has been recently tried in the southern part of the county. Some attention has been given to the production of other special crops besides tobacco. In several instances near Creedmoor and in a few other localities an attempt has been made to grow Irish potatoes on a commercial scale. The yields are good, and there is no apparent reason why this should not prove successful. Some sweet potatoes are also grown for shipment to outside points. On nearly every farm fruits, vegetables, and sorghum sirup are produced for home use, but none of these crops is grown for market.

The growing of peanuts on a commercial scale was undertaken on areas of the coarse sandy loam in 1910. There is no reason why this industry should not prove a success, not only upon this type of soil, but also upon the Durham soils and Cecil sandy loam.

Dairying has been attempted in the county only in a few instances. The local market demands are not great, and there seems little opportunity for the extension of this industry. Each farmer keeps enough cows to supply the home needs for milk and butter.

Hogs and beef cattle are raised in sufficient quantities to supply both the home demands and the local markets, but only a few animals are shipped from the county. The interest in stock raising is increasing.

As a rule the farmers recognize the fact that all soils are not equally well adapted to all crops, but in planting their fields, except in case of tobacco, little attention is paid to the selection of crops and still less to the selection of varieties peculiarly suited to the various types of soil upon their individual farms. The coarse-textured soils, such as Granville coarse sandy loam, Durham coarse sandy loam, and Durham sandy loam, should not be seeded to cultivated grasses unless much humus has previously been incorporated. The coarse-textured types are naturally the most droughty, and the grasses are likely to suffer for want of moisture. When these soils are put in good condition clover can be grown, which will tend to improve them for other crops. Clover is especially valuable as a crop to precede corn, Irish potatoes, and sweet potatoes. Where clover is to be grown for hay exclusively it should be seeded only on the heavier soils. Cecil clay loam, Georgeville silt loam, Iredell loam, and Alamance silt loam are naturally well suited texturally to wheat, corn, clover, and grasses, and should be more extensively devoted to these crops. This can be done profitably in connection with stock raising. The Granville coarse sandy loam, Durham coarse sandy loam, Durham sandy loam, and Durham fine sandy loam are the best soils for bright tobacco, and the farmers fully recognize this fact.

Systematic crop rotation is not generally practiced. The tobacco wilt has necessitated some rotation, and it is very probable that the cropping systems used in the Creedmoor section will become more general. One of the most common rotations in this section is crimson clover, followed by corn the second year and by tobacco the third year. This rotation is practiced to some extent in all sections of the county. It is generally conceded that corn planted on a clover sod will double in yield, even if given no fertilizer. Irish and sweet potatoes are gradually being worked into the rotation in some parts of the county.

The most successful farmers recognize the fact that the soils are generally deficient in humus, and they make some effort to replenish the supply by planting leguminous crops. Clover is frequently sown in cotton and corn at the last cultivation. Cowpeas are used as a catch crop in corn in the same way. On the more sandy soils cowpeas are frequently planted between the corn hills and the peas picked for seed.

As a general rule the land is not plowed deep enough nor pulverized thoroughly. More improved farm machinery could be used

advantageously, especially in connection with the cultivation of tobacco.

Labor is scarce; each farmer with the aid of his family does most of the work connected with the production of a tobacco crop on the smaller farms. On the plantations hired labor is necessary. Day laborers receive from 50 cents to \$1 a day. When hired by the month the price ranges from \$15 to \$20, with board. In that section of the county where cotton is the principal crop plow hands are hired from January 1 or March 1 to August 1.

Only about 32.5 per cent of the farms are operated by the owners. The remainder are farmed under different tenant systems. One of the most common practices is for the landowner to furnish stock, tools, and one-half the fertilizer, and receive one-half the produce. If the landowner furnishes the land only, he receives as his share one-fourth of all crops. The farms range in size from 50 to 1,000 acres, the latter being rare.

The price of farm land is rapidly advancing, and in the southern part of the county not many farms are changing hands. Any land that will produce bright yellow tobacco can not be bought for less than \$30 an acre. The price of land of other types of soil ranges from \$7.50 to \$30 an acre.

Many changes in agricultural methods have taken place within recent years, but in spite of this fact there is still much room for improvement along this line. Deep plowing, subsoiling, and liming are practiced by a few farmers in each section, and the good results following their use are gradually bringing about rather more general adoption. Farmers as a whole, however, are slow to change from earlier methods, and shallow plowing is the rule. All the upland soils of the county, especially the heavier types, should be broken deep in late autumn (November, if possible), thoroughly pulverized by harrowing, and allowed to absorb the winter rains. A leguminous crop should be turned under at the time of plowing, and a liberal application of lime should be given either immediately before or immediately after breaking.

In the "Southside" section a few experiments have been made with high-grade fertilizers in connection with tobacco growing, and the results warrant a more extensive use of the better commercial mixtures. Satisfactory results have been secured through the use of a mixed fertilizer averaging 8-6-6.¹ With an acreage application of 600 pounds of this mixture the tobacco grown was as good in color and one-third heavier than tobacco grown on a similar soil with an acreage application of 800 to 1,000 pounds of an 8-3-3 grade fertilizer.

¹ Formulas are stated in the order: Phosphoric acid, nitrogen, and potash.

The greatest possibilities of development in the northern part of the county lie in the adaptation of its soils to the production of corn, clover, grasses, and wheat. These crops can be grown to advantage in connection with stock raising. If this industry is once established there is every reason to believe that it will grow. With the addition of the barnyard manure secured through the feeding of cattle, the soils will undoubtedly produce better grass and grain crops each succeeding year.

Rye can be used profitably as a winter cover crop. Where cotton is grown it should be sown between the cotton rows not later than September 1.

Especial attention should be given to seed selection. Seeds from the most hardy and fruitful plants of each crop on each soil type should be carefully selected each year.

TOBACCO.

The growing of tobacco in the Granville County section of North Carolina had its inception during the time of early settlement and this crop has since held an important place in the agriculture of the region. The changes that have taken place in the methods of growing, curing, and marketing the crop constitute one of the most interesting chapters in the agricultural history of Piedmont North Carolina. At first there were neither local markets for this crop nor any means for putting it upon more distant markets. About the beginning of the nineteenth century Fayetteville, Wilmington, and Newbern became tobacco markets, and some of Granville County's product was rolled in hogsheads to these points for sale. Petersburg and Richmond, Va., were also early markets.

During the first half of the nineteenth century the increase in production of tobacco was gradual, owing to the distance of these markets and the difficulty of transportation. About 1850 the production had risen to 3,918,822 pounds and a number of local markets and factories were established, and by the year 1860 tobacco growing had become the chief agricultural pursuit of Granville County. During the early days of the industry, and as late as 1870, the quality of tobacco grown was much inferior to that grown at present. Nearly all of it was dark colored and coarse textured. A dark-colored tobacco was demanded by the market at this time, and in order to secure a dark, heavy leaf the crop was often grown on newly cleared land, rich in organic matter. The light-gray land around Creedmoor was avoided as much as possible, because of the fact that it produced lighter colored and lighter bodied tobacco than the red and black lands in other sections of the county.

With improvement in the methods of handling and marketing tobacco there have come corresponding changes in the type grown

and in the methods of curing the leaf. In former years tobacco was sun cured; later it was cured by means of charcoal fires built on the floor of the tobacco barns, and this finally led to the construction of barns with flues by which heat could be supplied without danger of burning the tobacco or the barn itself. The first flue-cured tobacco was placed upon the market in 1875.

One effect of the change from sun-cured to flue-cured tobacco was the adoption of a new standard of quality for the leaf. Tobacco cured by artificial heat was found to be much lighter in color than that cured by direct rays of the sun. This discovery led to the development of the bright yellow type of tobacco.

Tobacco is grown with some degree of success on every soil type in the county, except the Iredell clay loam, Rough stony land, Congaree silt loam, and Meadow. The most highly prized soils for this crop are the Granville and Durham soils, particularly the coarse sandy loams. The Granville coarse sandy loam is the dominant type on the south side of Tar River, and the leaf produced on this soil is known as "Southside tobacco." The Granville coarse sandy loam produces the very best grade of tobacco grown in the county. The best leaves of this type of tobacco are marketed as fancy wrappers, the grade selling this season (1910) at 35 to 60 cents a pound. The Durham coarse sandy loam, sandy loam, and fine sandy loam also produce fancy wrappers, and many planters consider these soils equal to any other for the production of bright tobacco. There is no question as to the excellency of the product secured from the Durham soils, but it is believed that a higher relative percentage of fancy wrappers in this county at least come from the Granville coarse sandy loam, although it will be admitted that the Durham coarse sandy loam is a very close second. The Alamance silt loam produces rather ordinary wrappers and good plug fillers. The quality of the leaf grown on the Cecil clay loam, Georgeville silt loam, Iredell loam, and Iredell stony loam is inferior to that of any of the other soils used for the crop. The leaf from these soils is heavy, coarse textured, and dark colored. To the south of Tar River, where there is a large area of Granville soil, the Cecil sandy loam and fine sandy loam are not extensively used for tobacco, but in some sections of the country both of these soils are used for this crop. They produce common wrappers and fair to good fillers.

The methods of preparing the fields for tobacco vary with different planters. As a rule, the most successful farmers break the land in the fall or early spring to a depth of 5 or 6 inches, harrow, and leave it until spring. In some instances, particularly in the case of red land (Cecil soils), the soil is plowed in the spring just before the rows are laid off. Tobacco is set out in April in rows $3\frac{1}{2}$ to 4 feet apart. From 500 to 1,000 pounds per acre of an 8-2-2 or 8-3-3 fertilizer is distributed in the furrows. Available stable manure is also put in

the furrows and the whole is covered by several furrows thrown up to form a bed. The tobacco plants are started usually in March on beds previously prepared by burning to kill weeds and insects. Barnyard manure and various fertilizer mixtures are applied to the bed before the seed is sown. Mixtures of cottonseed meal, acid phosphates, and kainit are commonly used, and occasionally applications of sodium nitrate made when the plants are well started. The plants are watered if the season is dry and are usually protected by a cheesecloth covering. About the 1st of May the beds in the fields are dragged off smooth with a log and the plants set at intervals of 3 feet. As soon as the plants have made a good start the fields are cultivated and the space between the plants is hoed to remove the grass. Later on furrows are run so as to turn the soil from the middle of the rows toward the plants. As a rule the crop receives only three plowings, the last one during the early part of June, when the middles are completely plowed out, leaving the stalks on a ridge. Often soil is drawn around the base of the stalks with hoes so as to leave the plants on slight mounds.

As in other tobacco sections, considerable trouble is experienced with insect pests, such as the budworm and hornworm. The leaf-cutting worms are picked off by hand, turkeys are turned into the fields to eat them, or poison is used on the plants.

About the last of June the plants are topped, usually to about 8 or 10 leaves. Some pruning of the lower leaves is also done, both the pruning and topping being to secure the best quality of leaf and the proper body and texture. Suckers appear after the plants are topped, and these have to be removed in order to prevent a too thin leaf growth.

The methods of gathering and curing the crop vary considerably in different sections of the county. Around Creedmoor, on the Granville coarse sandy loam, cutting begins about July 20, while in the vicinity of Oxford no cutting is done until about the last of July. In the northern part of the county, on the Cecil clay loam, Georgeville silt loam, and Iredell loam cutting begins about August 10, and on many of the fields none of the crop is cut before September 15. Occasionally the lower leaves, or lugs, are gathered before the stalks are cut. This is said to improve the quality of the leaves remaining.

In harvesting, the stalk is split from the top downward to near the bottom leaves, the stalk cut, and hung with the leaves downward astride a small stick about $4\frac{1}{2}$ feet long. Seven or eight of these stalks are hung on one stick, and the plants sometimes left in the field until the leaves are slightly wilted. The sticks are then hung in barns on tier poles usually placed $2\frac{1}{2}$ feet apart vertically and $4\frac{1}{2}$ feet apart horizontally. When the barn is filled firing or curing is begun within 12 hours. The heat is started at a low temperature, usually 95° to

100° F. Generally the barn is kept at this temperature for 10 to 20 hours, sometimes for 36 hours. This stage of low temperature is called the "yellowing" stage. When the yellowing is completed the temperature is gradually raised through a period of 3 to 4 days from 100° F. to about 180° F. This stage is known as the "killing" stage, and through it the leaf is carried to the first cured state. The heat is now withdrawn and the barn door is left open so that enough moisture can be absorbed to make the leaf sufficiently pliable to handle without breaking. From the barn the tobacco is carried to the packing house, where it is either bulked down or hung on tier poles. The tobacco may remain in the packing house until all other curing is done or until it is ready for stripping, which is done at the convenience of the farmer. The leaf sometimes becomes too dry in the packing house for stripping and must be "ordered" before this process can proceed. Ordering is accomplished in several ways. Some growers have ordering barns in which the tobacco is hung and steam forced in until the tobacco becomes pliable enough to be handled without breaking. Others have ordering pits, in which the tobacco is put and the necessary moisture is absorbed from the earth. Still others have simply an air-tight room adjoining the stripping room, into which the tobacco is placed and allowed to absorb moisture evaporating from water standing in receptacles. These air-tight rooms have no floor, and some of the moisture comes from the ground.

As stripping progresses the tobacco is separated into six or seven grades, as follows:

1. (a) Burnt lugs; (b) trash lugs; used for cheap smoking tobacco.
2. Cutters, leaves inferior to wrappers; used for cigarettes and good smoking tobacco.
3. Wrappers; the most perfect leaves (lemon-yellow wrappers); used as fancy plug wrappers and for chewing tobacco. Often sells for \$35 to \$60 per 100 pounds.
4. Common wrappers; used as plug wrappers for medium grades of chewing tobacco.
5. Strips; used as plug fillers and inside wrappers. Most of this goes to the English market.
6. Tips, or fillers; used as plug fillers.

When the tobacco is stripped and graded each grade is bound into neat bundles or "hands" of 8 to 10 leaves each and these are hung on small pine sticks. The sticks are $4\frac{1}{2}$ feet long, and 20 to 30 hands are hung on each stick. The tobacco is now ready for marketing at the warehouse.¹

¹ For further discussion of bright tobacco culture see Bulletin No. 143, Bureau of Plant Industry.

The Granville tobacco wilt, a bacterial disease that has caused serious damage in Granville County and other portions of the country, was first noticed in the Creedmoor district some 10 or 15 years ago. This disease causes the plant to wilt and die, and as yet no effective remedy has been found. The bacteria that cause the trouble live in the soil for years. Cultivation to other crops for long periods appears to be the best means of handling the problem, and this does not insure protection to the plants. The only way to avoid the disease completely is to plant on land not infected with the wilt bacteria.¹

SOILS.

Granville County lies wholly within the Piedmont Plateau. The soils are largely upland residual, and owe their individual characteristics to the character of the underlying rocks from which they have been derived through processes of rock weathering. These processes acting through long periods of time have caused the rocks to break down and decay.

Along the streams there are narrow strips of alluvial soils which are made up of material washed from the uplands and deposited over the contiguous flood plains. A general discussion of the dominant rocks is necessary in order to bring out the essential points upon which the differentiation of the residual soils is based.

A line drawn from a point on the western boundary of the county some $2\frac{1}{2}$ miles southwest of Kittrell Crossroads and extended in a northeasterly direction across the county to Dexter marks roughly the southern boundary of a group of rocks which appear to be closely associated with the rocks of the "Carolina Slate Belt," or "Carolina Metamorphic Slate and Volcanic Belt."² These rocks seem to be divided in a general way into slates and greenstone. The slates of the Gold Hill mining district,³ of which the area under discussion appears to be a general continuation, have been described as being probably pyroclastic in origin.⁴ Under the head of "slate rocks" have been included laminated slates and some massive rocks without slaty structure. The slates proper vary in color from light gray to greenish gray and in texture from very fine grained to moderately coarse grained rocks, including whetstone, or honestone.

The more massive slates are in some instances nearly the same in color as the true slates, but they are oftener slightly darker and fresh fractures frequently show red spots, due probably to the oxidation of iron compounds. These more massive slates are exceedingly

¹ For a more complete discussion of this disease see Bulletin 141, Part II, Bureau of Plant Industry, U. S. Department of Agriculture.

² See physiographic map of North Carolina and descriptive matter, pp. 54-57, Bul. No. 2, N. C. Geol. Sur. See also Chap. III, Bul. No. 21, N. C. Geol. Sur.

³ See Bul. 21, N. C. Geol. Sur.

⁴ Loc. cit., pp. 28-29.

hard and brittle and are very resistant to weathering. The term "greenstone" has been applied to a great variety of rocks of predominating green color, each of which has a broadly varying mineralogical composition. Some of the minerals more or less common to all of these rocks are hornblende, feldspar, epidote, chlorite, apatite, calcite, magnetite, ilmenite, pyroxine, and quartz. Various combinations of these minerals, together with other minerals, give rise to andesite, rhyolite, diabase, chlorite and chloritic schists, and many other rocks.

The soils derived from the slates and greenstone are the Alamance silt loam, Georgeville silt loam, Iredell loam, Cecil clay loam, Iredell stony loam, and Rough stony land. The one common characteristic of these types is the uniformly very fine or silty texture.

In this general belt of slate rocks there are several areas of soil which do not owe their origin exclusively to slate formations. The largest of these is the area of Durham fine sandy loam occupying the central-eastern part of Walnut Grove Township. There is undoubtedly included in this body of soil, material derived from the slates, but it appears that granitic formations are the main parent rocks. Another important area is the body of Iredell clay loam occurring in the northwestern corner of Walnut Grove Township. The soil here is derived from diorite.

Passing southward from the slate and greenstone belt the second in areal importance of Granville County's three principal rock belts is encountered. This belt includes principally granite and gneiss. A few outcrops of the slates and greenstones may be seen south of Oxford along Fishing Creek and Tar River, but these are of very small extent.

In shape this belt is an irregular V, the right arm of which extends southwestward to a point on the county boundary $1\frac{1}{2}$ miles west of Knap of Reeds, while the left arm follows the eastern boundary of the county and passes out into Franklin and Wake Counties. The most northerly portion of this belt has its beginning near Dexter and is made up almost exclusively of a coarse-grained binary granite, the gneiss being confined to the southeastern portion. The soils derived from these granites and gneisses are the Durham coarse sandy loam, the Durham sandy loam, the Durham fine sandy loam, the Cecil sandy loam, the Cecil fine sandy loam, and a small proportion of the Cecil clay loam.

The southern central portion of the county is occupied for the most part by the Triassic sandstone formation, which gives rise to the Granville coarse sandy loam.

Throughout the granite and gneiss and Triassic sandstone formations there are numerous areas of diorite, which give rise to the Iredell clay loam and fine sandy loam. The diorite occurs mainly as dikes.

In the southwestern corner of the county there are found within the diorite soil, Iredell clay loam, small areas of the Triassic sandstone soil, Granville coarse sandy loam, which in places are so thin that they can be bored through to the Iredell material or diorite with a 3-foot soil auger. This would seem to indicate that the diorite is here developed as a dike which did not reach the surface or possibly as a sill.

The first-bottom alluvial soils are comprised under the heads Congaree silt loam and Meadow. These are made up of material deposited by overflow and repeated additions of soil material borne in suspension by the waters coming from the uplands.

The Altavista silt loam occurs on a stream terrace and apparently represents material laid down when the waters of the stream flowed at higher levels.

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.
Alamance silt loam.....	57,408	17.2	Cecil fine sandy loam.....	15,040	4.5
Granville coarse sandy loam....	39,296	13.0	Meadow.....	14,784	4.4
Shallow phase.....	4,096		Iredell clay loam.....	11,648	3.5
Cecil clay loam.....	35,776	10.7	Iredell fine sandy loam.....	10,560	3.2
Cecil sandy loam.....	30,080	9.0	Rough stony land.....	4,096	1.2
Georgeville silt loam.....	27,264	8.2	Congaree silt loam.....	1,920	.6
Durham fine sandy loam.....	23,552	7.0	Iredell stony loam.....	1,600	.5
Durham sandy loam.....	21,248	6.4	Altavista silt loam.....	832	.2
Durham coarse sandy loam.....	17,856	5.7	Total.....	334,080
Shallow phase.....	1,216				
Iredell loam.....	15,808	4.7			

IREDELL FINE SANDY LOAM.

The surface soil of the Iredell fine sandy loam, in its typical development, consists of a grayish-brown, heavy, fine sandy loam, 4 to 8 inches deep. Small, round iron concretions (black oxide of iron) are numerous on the surface and throughout the soil.

The subsoil is an exceedingly plastic and sticky greenish-yellow or greenish-brown clay, passing into the decomposed parent rock at a depth of 24 to 30 inches. The subsoil is impervious to water, a property which causes the heavy phases of the type to puddle when cultivated in a too wet condition.

There is some variation in the texture of the soil, inasmuch as there had to be included occasional areas too small to map, in which the surface material approaches a sandy loam or sometimes even a coarse sandy loam in texture. The coarser phase occurs near the

boundary of the Granville and Durham coarse sandy loams, and the coarser phases of several other types. The heavier phase either occupies slight depressions within the typical soil, or is found near the boundary with the Iredell loam, Iredell clay loam, or some of the heavier Cecil and Durham soils. In those instances where the Iredell fine sandy loam lies next to the Durham, Cecil, or Granville soils, its color varies from the typical to the extent of blending with that of the contiguous soil.

One of the largest typical areas of this soil extends along the Oxford-Creedmoor road from Foundery Branch to a point one-fourth mile south of Belltown. Another typical occurrence is that lying a short distance north of Tar River, and extending from the Oxford-Stem road across the Oxford-Creedmoor road, to Bollens Run. Tar River Academy is located upon a fairly typical body of this soil. There is another comparatively large body of the Iredell fine sandy loam at Dixon Store, two others in the vicinity of Tallyho Church, another near Providence, one between Oxford and Lewis, and still another 6 miles north of Stovall. Numerous smaller areas occur scattered throughout the county.

As a general rule the large areas of Iredell fine sandy loam have a gently rolling to level topography, which feature, together with the imperviousness of the subsoil, causes the drainage to be poor. Restricted areas along stream courses have a quite rolling to broken topography, and good drainage. As a general rule, however, such areas have suffered greatly from erosion, and in many instances the parent rocks have been laid bare, thus giving rise to limited stony areas.

Iredell fine sandy loam is a residual soil derived mainly from diorite. The soft, disintegrated parent rock is invariably found at a depth of about 24 to 30 inches, and hard bedrock at about 4 to 6 feet. This shallow rock weathering is due, in part at least, to the protection offered by the overlying impervious clay.

The native vegetation on Iredell fine sandy loam consists principally of blackjack oak; post oak, hickory, and shortleaf pine are also found. The second growth is shortleaf pine almost exclusively.

The Iredell fine sandy loam is fairly well suited to the production of corn, cotton, wheat, oats, and clover. Tobacco gives moderate returns on the lighter and better drained phases of the type. Corn yields range from 5 to 15 bushels per acre, with an average of 10 bushels. Cotton yields are low, the average being not over one-half bale per acre. The plants make an excellent growth, and it fruits fairly well, but on account of the comparatively cool climate, together with the cold nature of the soil, the fruit does not mature well. Phosphoric acid will hasten the maturity of bolls, and the use of this fertilizer in liberal quantities is recommended. Wheat,

under the ordinary methods, yields from 7 to 15 bushels per acre, while the average oat yield is about 20 bushels per acre.

The fertilizer requirement for the different crops on this soil is never taken into consideration, but the same grade (8-2-2 or 8-3-3) is used for every crop. The relation of fertilizers to soils and crops should receive more attention. The common fertilizer application for cotton is 200 to 400 pounds per acre. Tobacco receives from 500 to 1,000 pounds per acre. Corn, as a rule, is not fertilized, but is planted on clover sod. Neither wheat nor oats is fertilized, except in rare instances. The use of lime will be found advantageous in correcting the acidity and improving the structure of this soil.

The Iredell fine sandy loam can be bought at prices ranging from \$10 to \$20 an acre, depending upon the location.

IREDELL LOAM.

The soil of the typical Iredell loam, to a depth of 6 to 8 inches, consists of a mellow to compact loam to silt loam of a light brown or light brown tinged with greenish color. Black iron oxide concretions are often numerous on the surface and throughout the soil. Many of these are so small as to resemble coarse rounded grains of sand.

The subsoil is a stiff, plastic, impervious, heavy clay of a yellowish-brown to dingy-brown or greenish-brown color. The material is exceedingly sticky when wet; on drying, as in road exposures, it shows the fractures typical of "joint clay." Usually the soft, partially decomposed rock is encountered at about 24 to 28 inches, and hard bedrock at about 4 to 5 feet below the surface. Water and air circulation is extremely slow through this dense clay, and in consequence the parent rock has been protected from deep weathering.

A large part of this type as it occurs in the northeastern part of the county varies from the typical phase in that the surface soil is of a much lighter color and is less compact. The soil of this phase closely resembles that of the Alamance silt loam, and in many instances the gradation between the two is almost imperceptible and it is a difficult matter to locate a definite line of separation. There is also a stony phase—that is, there were included in the type a number of small stony patches in which angular fragments of rock are of common occurrence on the surface and in the surface soil.

The small-sized iron concretions characteristic of the Iredell series are not uniformly present over the type, but are found in abundance on the surface and in the soil of much of this land. Such areas constitute a phase of the type locally called "black gravelly" land. The type is also called "pipe-clay" land on account of the heavy plastic clay subsoil.

This soil has a comparatively limited representation in Granville County. Its most extensive development is in the northeastern half of Sassafras Fork Township, where it constitutes about one-half of the total area. The largest typical areas are found in Oak Hill Township, 2 miles southeast and 3 miles southwest of Wilbourns Store. The greater proportion of the type in the western part of Walnut Grove Township is also of the typical phase.

Inextensive interstream areas of this soil are possessed of fairly smooth surface features, but as the streams are approached the surface becomes more rolling, and in some instances the type is somewhat eroded, though badly broken or excessively eroded areas do not exist. As a whole the topography of the type is conducive to good surface drainage. However, the underdrainage is far from good, owing to the imperviousness of the heavy clay subsoil. When once saturated the subsoil retains water for a long time, thus preventing thorough soil aeration and frequently occasioning the immediately surrounding soil to be seepy or springy.

Like the other members of the series in the area, the Iredell loam is derived in place mainly from diorite. Diabase and andesite have given rise to a part of the type. All of these rocks are very fine grained and it is difficult to distinguish between them with the unaided eye. In the northeastern part of the area the rock formations giving rise to this soil are much more complicated than in those areas where the soil is more uniformly typical. In this section it frequently happens that the diorite occurs in close association with slates and that a portion of the soil material is derived from such slaty rocks. This accounts probably for the lighter color of the type as developed in this locality.

The uncleared portion of Iredell loam supports a growth of black-jack oak, white oak, dogwood, hickory, and shortleaf pine. The crops grown are tobacco, clover, and some wheat. When tobacco is properly fertilized and cultivated the yields on the better drained phases of the type are unusually large, reaching in some instances as high as 1,200 pounds per acre. The average yield per acre, however, is not more than 750 pounds. The leaf is dark colored and coarse textured. It is used mainly for the manufacture of plug tobacco. Corn yields 5 to 25 bushels per acre, according to season and treatment. Cotton is not extensively grown in the northern half of Granville County. Cotton makes a good stalk growth and fruits well, but in this climate it frequently happens on this late soil that a considerable number of bolls are damaged by frost. It is believed that the liberal use of acid phosphate would force an earlier maturity and consequently prevent much of the damage done by frost. Potatoes and wheat are grown for home use only, and the yields of both are low.

The Iredell loam is naturally well adapted to the production of wheat, clover, and grasses, and these crops could be grown to advantage more extensively, especially in connection with stock raising.

Fertilizers are used rather indiscriminately, as in case of the other soils of the area. A liberal use of acid phosphate or other phosphatic fertilizer to hasten crop maturity, and kainit to prevent the frenching of corn and "rust" of cotton are points that should be given careful consideration in connection with fertilizer practices. An acreage application of about 1 ton of burnt lime unquestionably would cause considerable improvement in the structure of the type at least. Deep fall plowing is also beneficial. As an individual type it is not highly valued for agricultural purposes. Some of it near Virgilina, Va., is believed to be mineral bearing, and is held at \$20 to \$30 an acre, while near Bullock it can be bought for \$10 to \$20 an acre.

IREDELL CLAY LOAM.

The soil of the Iredell clay loam, to an average depth of 6 inches, consists of a dark-brown to black heavy clay loam carrying a high percentage of small-sized iron concretions. The subsoil is a yellowish-brown to greenish-brown, plastic, sticky, heavy clay, which at about 24 inches passes into the partially decomposed parent diorite. It carries very little sand, and is decidedly impervious to water, poorly aerated, and resistant to proper root development. Where it comes close enough to the surface to be reached by the plow it makes tillage very difficult, even under the most favorable moisture conditions.

Within the larger bodies there are some small areas on which the surface soil mantle is not more than 1 or 2 inches deep. These would have been mapped as Iredell clay had they been of sufficient size. A few patches consist of clay from the surface downward. In other places, more particularly near the boundary between the Iredell clay loam and the Granville coarse sandy loam, the soil is more nearly a sandy loam or coarse sandy loam and would have been mapped as such had the areas been large enough. On the surface of this soil there is usually found a large percentage of round to angular diorite rock fragments, ranging in diameter from 2 to 12 inches.

The occurrence of the dark-colored Iredell clay loam in association with the light-gray Granville or the red Cecil soils presents a striking contrast in soil color. The type is locally called "black ground" or "black land."

The most important occurrences of the Iredell clay loam consist of three large bodies, the largest of which is found in the southwestern corner of the county, the second in the extreme northwestern corner of Walnut Grove Township, and the third immediately southwest of Clay. In addition to these numerous other smaller areas are found in the southern end of the county, surrounded by the Granville

coarse sandy loam. The area in the southwestern corner of the county is of very irregular outline and is not continuous, several small areas of Granville coarse sandy loam being inclosed by it. The most typically developed portion of this area lies to the southwest of Wilkins.

The surface features of the Iredell clay loam vary from flat to sloping or rolling. The greater part of the type is quite flat, and this and the impervious subsoil cause the type to have poor surface drainage and underdrainage. Where the type occupies hillsides the drainage is fairly good. The Iredell clay loam is derived from diorite.

As a rule the Iredell clay loam is not heavily forested. The native timber growth consists principally of blackjack oak, and for this reason the soil is sometimes called blackjack land. The second growth is usually shortleaf pine, with a few cedars and an undergrowth of broom sedge.

The topographic position of this type, together with the impervious nature of the subsoil, renders the soil cold and wet, and it is therefore not suited to the production of tobacco, cotton, peanuts, potatoes, or truck crops. Where good drainage can be secured, wheat, oats, and grasses do well. Deep subsoiling in the fall, with the addition of lime, will have a tendency to flocculate the clay particles of the subsoil and thus create better drainage conditions. At present corn is about the only crop grown, and this is grown only on areas where the soil is at least 4 inches deep. Usually an acreage application of 100 to 200 pounds of an 8-2-2 fertilizer is made. The yield ranges from 10 to 25 bushels per acre.

The shallow, flat cultivation which is practiced should be supplanted by cultivation in beds or lands with water furrows crossing the beds in such a way that the water from the land furrows will be removed as rapidly as it accumulates.

While the Iredell clay loam is not looked upon favorably as an agricultural soil, it is nevertheless well suited to both wild and cultivated grasses, and most of the type is now in wild-grass pasture. Sheep raising could be profitably carried on on this type. Farms of the Iredell clay loam can be bought for \$7.50 to \$10 an acre.

IREDELL STONY LOAM.

The soil of the Iredell stony loam to an average depth of about 6 inches consists of a brown loam having a slight greenish cast. In color, texture, and depth the subsoil is somewhat variable. Pre-vaillingly it consists of a friable, yellowish-brown silty clay loam, which quickly passes into an extremely plastic and sticky reddish-yellow clay which in turn grades into a greenish-brown sticky clay, and then at about 24 inches into decomposed rock. It is not uncommon for the surface soil to pass abruptly into greenish-brown plastic

sticky clay which is underlain at about 24 inches by partially decomposed rock. In other instances the soil is underlain at a depth of 6 inches by a yellow friable silty clay which grades into a brown plastic clay at a depth of 18 inches to 20 inches. Outcrops of the solid bedrock are frequent, and the decomposed rock is invariably found at a depth of not more than 28 inches. Scattered over the surface and disseminated throughout the soil there is a sufficient amount of rock fragments (quartz and greenish and gray schistose rocks) to interfere with cultivation.

The Iredell stony loam is of slight extent in Granville County. Only four small areas were mapped. The two largest of these occupy parallel ridges, one of which extends entirely across the northwestern corner of the county in a northeast and southwest direction, and has a length within the county of about 2½ miles. The second is of nearly the same length, but does not reach the Halifax County, Va., boundary. In width the areas vary from slightly less than one-fourth mile to three-fourths mile. Another small area occurs 2 miles northwest of Oak Hill, and still another is found on the county boundary 5 miles southwest of Virgilina, Va.

The typical Iredell stony loam is derived from what seems to be altered andesite, carrying considerable epidote. All the rocks of the immediate vicinity are copper bearing, and it is on the Iredell stony loam that the Holloway and Bluewing mines are located.

The timber growth consists of blackjack, post and white oak, and hickory, together with some shortleaf pine. Owing to the unevenness of its surface features and its stony nature, only a small percentage of Iredell stony loam is under cultivation. The principal crop is corn, and the yield is not more than 10 bushels per acre. Potatoes and vegetables are grown for home use in small patches near the houses. The soil is better suited to grasses than to any other crop. Wheat would also prove a good crop if planted on areas where stones would not interfere with harvesting. Fruit trees have proved a failure, owing probably to the fact that the root zone is too shallow.

As an agricultural soil the Iredell stony loam has only low value. Nevertheless, on account of the mining rights none of it can be bought for less than \$20 an acre.

The following table gives the results of mechanical analyses of the soil and subsoil of the Iredell stony loam:

Mechanical analyses of Iredell stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
24923.....	Soil.....	2.4	4.2	3.0	9.5	11.2	60.3	9.2
24924.....	Subsoil.....	3.5	7.0	4.0	7.8	4.6	58.3	14.6

DURHAM COARSE SANDY LOAM.

The soil of the Durham coarse sandy loam to a depth of 8 to 15 inches consists of a yellowish-gray to gray coarse sandy loam of an open porous structure. The subsoil is a yellow or pale yellow heavy coarse sandy loam which quickly grades into friable, yellow, coarse sandy clay, showing in places reddish mottling in the lower portion.

The most typically developed area of Durham coarse sandy loam is found immediately northeast of Oxford and extends from a point near Dexter in a southwesterly direction to a point 3 miles south of Oxford. On the knolls within this area the soil is usually not more than 8 inches deep, but this depth usually increases as the stream courses are approached. It is only in rare instances, however, that the yellow coarse sandy clay subsoil lies deeper than 15 inches. On forested areas the surface 2 or 3 inches of the soil is slightly darker in color than the average of the type, owing to the presence of more organic matter, but just below this stratum the color is a light gray.

To the west of Oxford, and especially in the vicinity of Stem, the texture ranges from medium to coarse, and the soil carries a noticeable quantity of small quartz fragments.

In addition to those areas of Durham coarse sandy loam which occur near Oxford, in the vicinity of Stem and east of Wilton, numerous smaller areas are found throughout the central-eastern section of the county.

The Durham coarse sandy loam occupies rolling to gently rolling and level interstream country, and this, together with its coarse texture and porous structure, insures excellent natural drainage. Practically all of the interstream ridges have a gently rolling to level topography, while the most rolling areas are found on the hillsides overlooking stream courses.

The Durham coarse sandy loam is of residual origin, having been derived from a coarse-grained binary granite composed principally of feldspar and quartz. Granite boulders occur occasionally throughout the type, but as a general rule the parent rock is weathered to a depth of several feet.

Nearly all of this type is under cultivation. Forested areas support principally hardwood growth, consisting chiefly of white oak, post oak, red oak, hickory, and dogwood. Shortleaf pine is found in some sections; most of the pine, however, has been cut.

The Durham coarse sandy loam is admirably adapted to the production of bright tobacco, and it is held in high esteem for this crop. The yields range from 500 to 1,000 pounds per acre, the average being about 700 pounds. Corn, wheat, clover, and sweet potatoes are also grown, and under proper methods of cultivation and fertilization fair yields are secured. Corn yields from 10 to 40 bushels per

acre, averaging about 15 bushels. The average wheat yield is not more than 10 bushels per acre. Cotton is grown on the type to a limited extent in the vicinity of Oxford. The type is well suited to the production of truck crops, such as Irish and sweet potatoes, beans, and peas. Cantaloupes and watermelons can be successfully grown. Oats, peanuts, cowpeas, vetch, and soy beans would do well.

Fertilizer is applied for tobacco in quantities varying from 700 to 900 pounds. Ordinary mixtures analyzing 8-3-3 or 8-2-2 are used in most instances. Some good farmers sow crimson clover as a soil improver. The results secured have been decidedly encouraging, the yields of succeeding crops of corn having shown in a number of instances a marked increase without the aid of fertilizers. As a general rule wheat is not fertilized.

The Durham coarse sandy loam is one of the high-priced soils of the county. Practically none of it can be bought for less than \$30 an acre, and near Oxford it brings from \$40 to \$50 an acre.

Durham coarse sandy loam, shallow phase.—The most noticeable variation from the typical soil is a shallow phase which occurs in the southeastern part of the county 3 miles east of Wilton. This is shown by cross lines in the map. Here the surface soil ranges from a coarse sandy loam to gravelly loam, usually grading into an undecomposed coarse-grained granite at a depth of 6 to 24 inches. In a few instances all the soil material has been washed away, exposing the hard granitic rock. Granitic boulders also are seen in this section.

This shallow phase has a lower value than the typical soil. It is less retentive of moisture both on account of its coarser texture and the nearness of the disintegrated rock to the surface. Its best use will be in the production of cowpeas, sweet potatoes, and truck crops.

DURHAM SANDY LOAM.

The soil of the Durham sandy loam consists of a light-gray to yellowish-gray porous sandy loam 8 to 10 inches deep. Below this in most cases the material passes into a stratum of slightly heavier soil of lighter color, which usually has a thickness of 4 or 5 inches.

The subsoil is a yellow friable heavy sandy loam to sandy clay, becoming heavier and sometimes mottled with reddish colors in the lower portion. In some places the subsoil in the lower part is quite like that of the Iredell, but this phase is not at all typical.

The soil is for the most part of medium texture, though local areas carry a noticeable amount of coarse sand and small quartz fragments. In forested areas and depressions the surface 2 or 3 inches of the soil is darker colored than the average of the type, owing to the presence of organic matter.

The most important area of the Durham sandy loam consists of that portion of the type occupying the greater part of the country

from Oxford westward and southwestward to Tar River. The most typically developed portion of this area is found in the vicinity of Enon Church. Those areas about 5 miles to the southeast of Oxford are also quite typical. Other important bodies are found 2 miles north of Berea, near Culbreth, 3 miles southeast of Wilton, and in the southern-central part of the county. Many small isolated areas are found throughout the southern half of the county.

The Durham sandy loam occupies undulating to gently rolling country. The undulating areas are found in interstream country, and where isolated are, as a rule, not extensive. As the streams are approached the surface becomes more rolling and areas overlooking streams are hilly. Broken, abrupt, and badly eroded areas of this type do not exist. The drainage is thorough to excessive, the crops sometimes suffering from lack of moisture in dry seasons.

The Durham sandy loam is derived almost exclusively from granite. The larger part of this type is under cultivation, while the remaining portion is forested to hickory, white oak, post oak, and red oak, with some shortleaf pine.

The Durham sandy loam is highly prized for the production of bright tobacco. It is also well suited to sweet potatoes, watermelons, cantaloupes, cucumbers, garden peas, peanuts, and forage crops. With proper cultivation and liberal use of manures and fertilizers good yields of tobacco, corn, wheat, and oats can be secured. Tobacco yields from 500 to 1,000 pounds per acre, averaging about 700 pounds; corn, from 7 to 25 bushels; and wheat, 7 to about 13 bushels. Sweet potatoes do well, but are grown for home consumption only. Apples, peaches, small fruits, and garden vegetables give very satisfactory returns.

The fertilizer practice on the Durham sandy loam is practically the same as for the other soils of the area. Tobacco is the most heavily fertilized crop, receiving acreage applications of 500 to 900 pounds of low grade mixtures. Corn is usually planted on a crimson clover sod and is given no commercial fertilizer.

The Durham sandy loam is in many instances in a low state of cultivation, owing mainly to the fact that it has been greatly depleted of humus through the continuous growing of tobacco. It is claimed that tobacco planted the year after clover or cowpeas gives a product of inferior quality, being dark colored and coarse textured. If corn is planted the first year after the leguminous crops and tobacco the second year, then both quantity and quality are better. The type is greatly in need of organic matter, such as can be cheaply supplied by plowing under rye, cowpeas, or crimson clover.

The value of the Durham sandy loam and the Durham fine sandy loam is nearly the same, ranging from \$10 to \$20 an acre.

DURHAM FINE SANDY LOAM.

The soil of the Durham fine sandy loam consists of a gray to yellowish-gray fine to medium sandy loam 8 to 10 inches deep. Quartz fragments are conspicuous over small areas here and there, especially on the occasional knolls. The subsoil consists of a friable yellow fine sandy clay of very compact structure, sometimes mottled slightly in the upper portion with gray or white colors and in the lower portion with reddish colors. Frequently at a depth of 24 to 30 inches the friable yellow fine sandy clay grades into a brownish-yellow plastic clay containing little sand.

The largest and most important area of Durham fine sandy loam occurs as an irregular shaped body varying in width from 4 to 5 miles and extending from Danes Store northward to Satterwhite. This area includes small areas of other soils. Other important areas of Durham fine sandy loam are found 2 miles northwest of Knap of Reeds Creek, 3 miles west of Berea, immediately east of Shoofly in the vicinity of Culbreth, and one-half mile east of Clay. Numerous isolated areas of limited extent are found throughout the county.

The Durham fine sandy loam occupies undulating, gently rolling, and rolling country, and is usually well drained. Depressions in some instances need artificial drainage. Such areas, however, are not extensive, and are also of infrequent occurrence. As a whole the type is probably possessed of as smooth surface features as any soil of the area. The least broken phase of the type is included in the large area extending from Danes Store northward to Satterwhite. Those areas in the vicinity of Culbreth and the one 3 miles west of Berea constitute the most rolling portions of the type.

The Durham fine sandy loam is a residual soil derived principally from a fine-grained granite. In some instances, particularly along the contact of this type and the fine-textured soils of the northern part of the county, epidote schists, carrying principally epidote and feldspar, have also entered into the composition of the soil. Such areas are small, however, and do not conform to the average of the type. The lower portion of the subsoil has in numerous instances been derived from diorite and diabase.

The greater part of the Durham fine sandy loam has been cleared and is under cultivation. The forested portions support a growth of hardwoods and shortleaf pine. Among the hardwoods hickory, white oak, red oak, post oak, and dogwood are prominent. This soil is well suited to the production of bright tobacco. Corn, wheat, oats, clover, and cowpeas are also grown. Sweet potatoes, Irish potatoes, and garden vegetables, such as beets and garden peas, are grown for home use, and could be grown on a more extensive scale. Tobacco is the most heavily fertilized crop to which the Durham

fine sandy loam is planted. The ordinary grades are commonly used, and the applications range from 600 to 1,000 pounds per acre. Corn, as a rule, is not heavily fertilized. The yields range from 5 to 25 bushels per acre. Oats yield an average of 15 bushels per acre with little or no fertilizer. The average wheat yield is about 8 bushels per acre. Peanuts should do well.

Durham fine sandy loam is among the most desirable soils of the area and sells for fair prices. When desirably located it is held at \$30 an acre, while farther away from towns it can be bought for \$15 to \$20 an acre.

ALAMANCE SILT LOAM.

The soil of the Alamance silt loam to a depth of 6 to 12 inches consists of a gray to nearly white compact silt loam. The subsoil is a compact, brittle, yellow silty clay, occasionally faintly mottled with grayish and reddish colors.

On some of the more rolling areas much of the surface soil has been washed off in a way to expose slate and quartzite fragments in considerable numbers. In other places, especially in the vicinity of Virgilina, Va., outcrops of quartz veins have given rise to what is locally termed "white flint rock" knolls and ridges. As a whole, however, this type is comparatively free of stony areas, and is of a uniform silt loam texture. The soil material has a smooth, flour-like feel, which property, coupled with the light color, has given rise to the local name, "white, floury land."

The subsoil of the typical areas is a friable heavy clay, of yellow color, sometimes showing slight red-and-white mottlings in its lower depths. Where the type grades into the Cecil clay loam it was such a difficult matter to draw a sharp boundary between them that some small areas were included with the Alamance silt loam, in which the subsoil color is a dull red.

This type is quite extensively developed. It is the predominant type of the northern third of the county, and is well developed in the western part of Tallyho Township, as far south as Roberts Chapel. Some of the most typically developed areas of the type are found north of Dexter, 3 miles east of Virgilina, near Wilbourns Store, and around Tar River School.

The topographic features of the Alamance silt loam are somewhat varied, but the prevailing surface configuration ranges from nearly flat or undulating to generally rolling. There are a considerable number of hilly to broken areas of limited extent. These variations in surface features are not confined to any particular section of the country, but are more or less characteristic of the type as a whole. With the exception of the flat areas the natural surface drainage is fairly good.

The Alamance silt loam owes its origin to the weathering of slates and a number of volcanic rocks which, although the geology has not been worked out, are believed to belong to that group of "slate" rocks sometimes referred to as the slates of the "Carolina Slate Belt."¹ The most common of the parent rocks is a blue, very fine grained slate.

The timber growth on the Alamance silt loam is white, post, and red oak, hickory, and some shortleaf pine. On poorly drained areas sweet gum, black gum, water oak, willow oak, ash, and elm are also of common occurrence.

This soil, on account of its close texture and prevailingly good drainage, is naturally well suited to the production of wheat and other grain. Before the Civil war yields of 25 bushels per acre were not uncommon; at present the average wheat yield is less than 10 bushels per acre. The crops most commonly grown at present are tobacco, corn, wheat, and oats. Tobacco yields range from 600 to 900 pounds an acre, averaging about 750 pounds. According to the best farmers and also to the tobacco buyers, this soil produces a medium grade of wrapper and an excellent filler. The average corn yield is about 15 bushels per acre, although in numerous instances yields of 40 bushels have been obtained under more careful methods of fertilization and cultivation. Oats on this soil, as well as on some of the other types near Stovall, have proved almost a complete failure during recent years. The decreased yield of all crops, and especially of the small grains, on this type is evidently due to the depletion of the organic matter in the soil through continuous planting to clean-culture crops. It will be found that the quickest, cheapest, and most effective means of establishing the productiveness of the type will be to follow systematic rotation of crops, including the legumes, in addition to the liberal use of barnyard manure.

The price of the Alamance silt loam depends largely upon its location. Near Virgilina none of it can be bought for less than \$20 an acre for the reason that the quartz veins found in the type usually carry copper. Farther away from Virgilina it can be purchased for \$7.50 to \$15 an acre.

GEORGEVILLE SILT LOAM.

In texture, structure, and topography the Georgeville silt loam is quite similar to the Alamance silt loam, the basis for separation being determined chiefly by the difference in color of soil and subsoil. The

¹ See "The Distribution of Ancient Volcanic Rocks along the Eastern Border of the United States," by George H. Williams, *Jour. of Geol.*, vol. 2, pp. 23-29; also *Bul. No. 21*, N. C. Geological and Economic Survey, pp. 73-74; see also "Geological Report of the Midland counties of North Carolina," by Ebenezer Emmons, 1856, p. 41 et seq. A quartzite occurs in alternating beds with the slate and other rocks underlying the Alamance silt loam, and it is believed that it enters into the composition of the soil to a certain extent.

surface soil to a depth of 4 to 8 inches consists of a pinkish or dull-red silty loam or silt loam of rather compact structure. In many places, however, particularly along the contact with the Rough stony land, there is found a comparatively large percentage of angular rock fragments, ranging in size from gravel to boulders. When dry, following thorough breaking, the soil has a mellow structure. If plowed when wet it runs together and upon drying again bakes or hardens so as to be difficult to cultivate. The subsoil consists of a compact clay or silty clay of light-red color, the color becoming more decidedly red as depth increases.

With the exception of a few very restricted areas in the western part of Tallyho Township, the Georgeville silt loam is confined to the northern half of the county. The type is closely associated in occurrence with the Alamance silt loam, as it is also in origin. Typically developed areas of the soil occur $1\frac{1}{2}$ miles northeast of Stovall, around Cornwall, and in the locality of Oak Hill. The topographic features of this type are varied, the prevailing surface configuration being rolling to hilly. Some of the largest areas occupy the hill slopes overlooking streams in the northern part of the county, and many of these owing to their steeply sloping surface and to poor methods of management, have been badly washed.

The Georgeville silt loam owes its origin to the same series of rocks that give rise to the Alamance silt loam. The slates entering into the composition of the type are slightly darker in color and harder than those giving rise to the Alamance silt loam. The quartzite of the Georgeville silt loam also has physical properties somewhat different from those of the Alamance silt loam quartzite, particularly in the slightly pinkish tinge and greater hardness.¹

The native forest growth on the Georgeville silt loam consists of red oak, white oak, post oak, hickory, shortleaf pine, and dogwood. Near the streams there is usually found some poplar, sycamore, water oak, and elm.

On account of the texture and structure of this soil it has comparatively high waterholding capacity, a factor which would tend to make the soil well suited to the production of wheat, oats, clover, and grass crops. It is a somewhat stronger soil than the Alamance silt loam, although the yields secured under the ordinary methods are about the same. The crops grown at present are corn, wheat, tobacco, oats, and clover. Sorghum cane, Irish potatoes, sweet potatoes, and some garden vegetables are produced for home use. The corn yields range from 5 to 35 bushels per acre, the average yield being about 15 bushels per acre. The tobacco yield varies from 500

¹ According to G. H. Williams, these rocks are of pyroclastic origin—that is, they are made up of volcanic ash and lava, both of which were laid down in water. The present mineralogical composition of these rocks is ascribed to the effects of dynamic metamorphism.

to 900 pounds per acre. The leaf is dark and heavy. The average wheat yield is about 8 bushels, and the average oat yield about 20 bushels per acre. Under better methods of treatment much larger yields could be secured.

The fertilizers applied to crops on the Georgeville silt loam are of the same analysis as are commonly used throughout the county. Corn is sometimes given an application of 100 to 250 pounds, but more commonly this crop is not fertilized. Tobacco is usually fertilized at the rate of 500 to 800 bushels per acre. The small grains are, as a rule, grown without fertilizers. It will be found that this soil is one of the best in the county for grasses and clover, and it can profitably be utilized for these crops, especially in those sections of the county where stock raising is beginning to be practiced. The productiveness of the type as a whole can be materially increased by deep plowing, liming, and a systematic rotation of crops, including the legumes.

As in the case of the other soil types of the county, the value of Georgeville silt loam depends upon its location. Near Oxford and Stovall it sells for \$18 to \$20 an acre, while farther from the towns it can be bought for \$8 to \$10 an acre.

CECIL SANDY LOAM.

The soil of the typical Cecil sandy loam to a depth of 4 to 12 inches consists of a gray to slightly reddish gray fine to medium sandy loam of rather loose structure.

The subsoil is a friable to compact stiff red clay, becoming heavier with depth. In places it may be slightly mottled with yellow. In the southeastern part of the county the presence of considerable quantities of mica gives the material a greasy feel. In color and depth of surface soil, however, the Cecil sandy loam is probably the most variable soil of the area, for in a single field there may be seen light-gray, reddish-gray, and even red areas. Those areas whose surface is light gray have, as a rule, a deeper and more porous soil than the reddish-gray or red areas and are considered a more desirable soil for all crops. The red areas usually occupy knolls of limited extent, and their existence is due to the fact that the originally sandy mantle has been removed by surface washing. This phase of the type would have been mapped as Cecil clay loam had the areas been of sufficient size. As regards texture, the Cecil sandy loam does not vary greatly, though the areas near Oxford are coarser than the average and could have been mapped in part at least as a coarse sandy loam had the coarse-textured bodies been large enough. The finer textured phases occupy slight depressions of very limited extent lying within the area that occurs along the southeastern boundary of the country.

Quartz fragments are a distinctive feature of the Cecil sandy loam, from 10 to 15 per cent of such coarse material being found on the surface and in the surface soil over a considerable proportion of the type. These stony areas occur chiefly in the southeastern section of the county.

Practically the only important area of Cecil sandy loam consists of a more or less discontinuous body varying in width from 2 to 4 miles and extending along the southeastern boundary of the county from Dixon Store to the Wake County line.

The Cecil sandy loam occupies undulating to gently rolling and rolling country, the surface becoming broken and hilly as stream courses are approached. The smoothest part of the type occupies the country to the southeast of Dixon Store as far south as Banks Chapel. In the southeastern part of the area between Grissom and Newlight the surface is rolling to hilly. The Cecil sandy loam has excellent natural drainage.

The soil owes its origin principally to the weathering of a medium-textured granite. The parent rocks of limited area appear to be eruptives, consisting principally of epidote, feldspar, and chlorite. Basalt and andesite also influence the type in a few instances.

The natural forest growth consists of hickory, white oak, red oak, post oak, dogwood, and some shortleaf pine. The second growth is shortleaf pine almost exclusively.

The crops grown, in order of their importance, are cotton, corn, oats, wheat, clover, cowpeas, rye, tobacco, sweet potatoes, and sorghum cane. Cotton produces one-third to three-fourths bale per acre, averaging somewhat less than one-half bale. Corn yields range from 5 to 45 bushels per acre, with an average of about $12\frac{1}{2}$ bushels. The oat crop as a rule is fed in the straw. If thrashed, the average yield would be about 18 bushels per acre. The average wheat yield is not more than 10 bushels per acre. The quality of tobacco grown on the Cecil sandy loam varies. On the lighter colored and deeper phases of the type some medium grade wrapper and excellent filler are grown. As a rule, however, the tobacco produced in this soil is dark and heavy. No tobacco is grown on the Cecil sandy loam south of Smith Creek. The yields of this crop range from 600 to 1,000 pounds per acre, the average being about 750 pounds. Sweet potatoes and sorghum cane are grown for home use only. For cotton an application of about 400 pounds of an 8-2-2 or 8-3-3 fertilizer is used. Corn as a rule is not fertilized, but some farmers apply 200 pounds per acre of a low grade mixture. In a few instances modern methods of culture are being practiced on this soil, and where so handled it has been made to produce 45 bushels of corn and an average of nearly three-fourths bale of cotton per acre.

The value of the Cecil sandy loam land varies from \$8 to \$30 an acre.

CECIL FINE SANDY LOAM.

The soil of the Cecil fine sandy loam to a depth of 4 to 6 inches consists of a gray to slightly reddish brown fine sandy loam, carrying a small percentage of fine quartz fragments. The subsoil is a stiff brittle red clay. Quartz veins are frequently seen cutting through the subsoil.

The area southeast of Clay is probably the most typical development of the soil, although there is some variation in the texture even here, some patches running as coarse as a sandy loam.

In the southeastern corner of the county there is a phase in which angular quartz fragments from the size of small gravel to pieces several inches in diameter are scattered over the surface of the soil and disseminated throughout it. The subsoil of this phase has a greasy feel, due to the presence of mica flakes. In the lower portion it is decidedly micaceous.

The Cecil fine sandy loam is not confined to any particular section of the county. Besides the area in the southeastern corner of the county and the one immediately south of Clay, numerous smaller bodies are found throughout the central part of the county.

The topography of the Cecil fine sandy loam varies from undulating to hilly. As a general rule, however, this type is possessed of very uneven surface features. The more even-surfaced portion lies near Clay. The area in the southeastern corner of the county is very hilly and broken. The surface and subsurface drainage of the type are excellent.

Cecil fine sandy loam is derived from granite gneiss and some other igneous and metamorphic rocks. On account of its topographic position the type has suffered greatly from erosion, and on many knolls the subsoil has been laid bare, thus giving rise to very limited areas of Cecil clay. On the other hand, in some instances, the depth of the soil has been increased by wash from higher lying land, this being particularly true of areas which occupy gently sloping hillsides near the sources of small streams.

Some areas of Cecil fine sandy loam are heavily forested, the virgin growth consisting of hickory, white oak, red oak, post oak, and an occasional dogwood. The second growth is almost exclusively short-leaf pine.

In the central and southeastern parts of the county cotton and corn are the principal crops. Cotton yields range from one-third to one-half bale per acre. The crop is usually fertilized, from 200 to 400 pounds of ordinary commercial mixtures being applied per acre. In some instances as much as 600 to 800 pounds per acre is used, and in such cases the average yield per acre is somewhat greater. Corn is not fertilized as generally as cotton, and the ap-

plications are in most instances smaller. This soil produces a dark, heavy tobacco, and for this reason only a small acreage is devoted to the crop. It yields from 400 to 600 pounds per acre, with applications of low-grade fertilizer ranging from 600 to 900 pounds per acre. The acreage sown to wheat is small and the yield is low, ranging from 5 to 10 bushels, with an average of about $7\frac{1}{2}$ bushels per acre.

The productiveness of the Cecil fine sandy loam can be permanently improved by deep fall and winter breaking, by planting and turning under leguminous crops with lime, and by the systematic rotation of crops.

The price of land of this type of soil depends mainly upon its location. In the southeastern part of the county it can be bought for \$7.50 to \$12.50 an acre, while nearer Oxford it is held at \$10 to \$20 an acre.

CECIL CLAY LOAM.

The soil of the typical Cecil clay loam, to a depth of 6 to 8 inches, consists of a reddish-brown to red clay loam to heavy clay loam. In color and depth the surface soil is locally quite variable. In most cases the upper 2 or 3 inches consists of a fine to medium sandy loam of a grayish-brown color. In other places the immediate surface soil is a bright-red to dark-red clay loam, carrying only a small percentage of sand. In some places iron concretions are present in small amounts in the soil and subsoil of the reddish areas. Some patches are also quite stony, owing to the presence of quartz fragments from occasional quartz veins. The subsoil of the Cecil clay loam consists of a compact bright-red to dark-red stiff brittle clay. South of Oxford it usually contains a high percentage of mica, which imparts to it a smooth, greasy feel.

The most important areas of the Cecil clay loam occur along stream courses in the northern half of the county. The most extensive area lies along Little Grass Creek and its tributaries, from a point $2\frac{1}{2}$ miles southwest of Gela northward to within 1 mile of the North Carolina-Virginia line. The type is also typically developed near Stovall. Long strips of this soil varying in width from less than one-fourth mile to $1\frac{1}{2}$ miles are found in the western part of Walnut Grove Township, along Tar River and Shelton Creek, and similar areas are also found along the streams in Oak Hill Township. The largest area of the southern half of the county occurs $2\frac{1}{2}$ miles south of Providence on the south side of Tar River.

The surface of Cecil clay loam varies from gently rolling and rolling to hilly and broken. That portion of the type overlooking stream courses is usually the most broken, and in many instances the soil has suffered greatly from erosion. The gently rolling or most even surfaced areas of the type consist of small areas of inter-stream country included in the more extensive bodies of the type.

The rolling and hilly surface of the type is conducive to good surface drainage, but the close texture of the soil renders internal drainage less perfect than is the case with its coarser textured correlatives, and it can not be cultivated as soon after rains. On the other hand, it retains moisture longer than the Cecil sandy loam or Cecil fine sandy loam and in that respect it is a more desirable soil.

The Cecil clay loam is a residual soil, but unlike the Cecil series of most other areas, it is not derived chiefly from granite and gneiss. That portion of the type developed in the southern half of the county appears to come from granite, while most of that occurring in the northern half is derived from what appears to be altered basalt or andesite. There is present in the parent rock a large amount of magnetite, and the red color of the soil is probably due to oxidation products from iron constituents. In addition to magnetite the rock also carries feldspar, chlorite, epidote, and apatite. A portion of the type is derived from chlorite schist. The Catoctin schist is also developed here.¹

A large percentage of Cecil clay loam is under cultivation, while the remaining portion is forested to a heavy growth of hickory, red oak, white oak, and post oak. Some areas of this soil were at one time heavily forested to shortleaf pine, but most of the merchantable timber has been cut. The Cecil clay loam is one of the strongest soils of the area. Those portions of the type which are not subject to severe erosion or in which erosion has been checked or prevented by terracing produce excellent yields of corn and dark tobacco, and by a systematic rotation of crops, proper manuring, and cultivation they can be made to produce good yields of wheat and oats. This soil is also well suited to apples, small fruits, and garden vegetables. Corn yields from 10 to 50 bushels per acre, averaging about 15 bushels. The tobacco grown is coarse textured and dark. The yields range from 700 to 1,400 pounds per acre. Wheat produces on an average 10 bushels per acre and oats about 18 bushels per acre.

Much of the type is in an unfavorable condition for the production of crops, owing to shallow plowing over long periods and to continuous cultivation to tobacco or other clean culture crops. It responds readily to good treatment, and there is no quicker or more effective way of increasing its productiveness than by deep fall or winter plowing and systematic crop rotations. According to the North Carolina Department of Agriculture, the following rotations have been found to be exceptionally good, not only on the Cecil clay loam, but on all the soils of the Cecil series: First year, corn with cowpeas in June; second year, fall oats or wheat followed by soy beans or cowpeas in June; third year, wheat with red clover; fourth year, red

¹ Representative specimens of the parent rocks were identified by W. J. McCaughey, of the Bureau of Soils. For description of Catoctin schist, see "Geology of the Catoctin Belt," by Keith, 14th Ann. Rept., U. S. Geological Survey.

clover. If a three-year rotation is preferred, the following is recommended: First year, corn with cowpeas sown broadcast at last cultivation; second year, cotton with crimson clover sown broadcast at last cultivation; third year, spring oats with soy beans. It will be noticed that neither of the above rotations includes tobacco, the chief money crop of Granville County; consequently they should prove more beneficial in connection with stock raising. If it is the intention of the farmers to grow tobacco on this soil, an excellent rotation is: First year, fall wheat followed by cowpeas in June; second year, corn; third year, tobacco. The use of fertilizers on the Cecil clay loam is practically the same as on the other soils of the area, tobacco being the most heavily fertilized crop. It will probably be found that phosphoric acid in conjunction with stable manure is the most economical fertilizer that can be applied to this soil. These have been tried in a few instances, and the results have been decidedly satisfactory.

The price of the Cecil clay loam depends to some extent upon location. Improved areas near town sell for \$30 an acre, while in less desirable locations it can be bought for \$10 to \$12.50.

GRANVILLE COARSE SANDY LOAM.

The soil of the Granville coarse sandy loam, in its typical development, consists of a grayish coarse sandy loam, which at a depth of 4 or 5 inches becomes yellowish and more loamy. The subsoil is a yellow sandy clay, sometimes mottled with gray, and occasionally including, especially in the lower portion, a rather plastic Indian-red clay (this red clay is really Penn material). A typical section of the type shows almost the exact physical characteristics of the Durham coarse sandy loam, except that grayish or Indian-red clay is usually encountered somewhere near 3 feet. Also the subsoil contains on the average more clay and is slightly more plastic than that of the Durham coarse sandy loam. The substratum, as seen in road cuts, is usually variegated in color, showing Indian-red, purplish, greenish-gray, drab, and white. Where the Indian-red clay comes near the surface, the soil is shown as a shallow phase of the type wherever the areas are of sufficient size to be indicated on a map of the scale used.

A number of "gall spots" are included in the type, representing areas where the surface soil has been washed away and grayish or Indian-red stiff plastic clay exposed. In the utilization of the type farmers sometimes haul sandy material over these eroded spots to improve the structure, as the raw clay produces a poor grade of tobacco. The Indian-red material usually contains more mica than the typical yellow sandy clay subsoil, sometimes enough to give the material a decidedly greasy feel.

Owing to translocation of the soil material from higher to lower levels by wash, there is some variation in the depth of the surface

soil. Water-rounded pebbles, mostly quartz, are frequently noticed on the surface. These also are occasionally encountered throughout the soil mass. Indian-red and olive-colored sandstone underlies the type, and sometimes is encountered within the 3-foot section.

The Granville coarse sandy loam is derived from Triassic sandstone, the upper stratum of which is decidedly coarse grained. It would seem that the characteristic yellow color of the subsoil as distinguished from the Indian-red color of the subsoil of the Penn soils, which are also derived from Triassic sandstone, is due to changes brought about by weathering, possibly through leaching processes. The topography is gently rolling to rolling or slightly hilly. The drainage is good to excessive, or about the same as that of the Durham coarse sandy loam. As a rule, the deeper portions of the type occupy gently sloping hillsides or slightly rolling interstream areas. The shallower areas are found on steep hillsides or in a position which has been conducive to erosion.

The Granville coarse sandy loam is confined to the south-central part of the county, where it is the predominant soil. It occurs in a single body of irregular outline. The type is interrupted only by narrow strips of Meadow and Iredell clay loam.

The greater proportion of the type is under cultivation. The timber growth of forested areas consists principally of white, post, and red oak, hickory, and dogwood. Shortleaf pine is also of considerable importance in some localities.

The Granville coarse sandy loam is considered by the majority of farmers the best soil in the county for the production of bright tobacco, and it is upon this type, together with the Durham soils, that all of the best bright tobacco is grown.

High-grade fertilizers are used only in rare instances. Usually an application of 650 to 1,000 pounds per acre of an 8-2-2 or 8-3-3 mixture is made for tobacco. The yield ranges from 550 to about 800 pounds per acre, averaging about 650 pounds. Besides tobacco, corn, wheat, oats, rye, crimson clover, sweet potatoes, and Irish potatoes are grown. Corn yields from 10 to 30 bushels per acre, averaging about 15 bushels. The production of wheat on this soil was practically discontinued for some 10 to 12 years, but was again taken up in 1909. The yield has reached 30 bushels per acre, but the average is not more than 8 or 10 bushels. Oats are fed in the straw to stock; very low yields are secured. Peanuts are beginning to be grown and should prove a success on this soil. Fair yields of both Irish and sweet potatoes are obtained. Fruit trees have not been properly cared for. With spraying and proper cultivation¹ certain varieties of apples, especially summer varieties, plums, and peaches could be successfully grown. As a rule corn is planted on a clover

¹ See Farmers' Bulletin No. 146, United States Department of Agriculture.

sod without fertilization. Potatoes in some instances are given acreage applications of 600 to 800 pounds of a high-grade fertilizer, 8-6-6 or 8-5-6 being commonly used. Cotton is not grown at all, but there is no reason why good results could not be had with this crop. The yields would be light unless liberal additions of fertilizers were made. The soil is very much in need of organic matter, such as can easily be supplied by growing and occasionally turning under crops like cowpeas, crimson clover, and vetch.

The Granville coarse sandy loam can not be bought for less than \$30 an acre.

Granville coarse sandy loam, shallow phase.—The soil of the Granville coarse sandy loam, shallow phase, to a depth of about 6 inches consists of a gray to purplish gray medium coarse sandy loam. The subsoil is a coarse sandy clay of variegated color (purplish, bluish, Indian red, and gray or white), to a depth of about 24 to 36 inches, grading into sticky, plastic, micaceous clay of a greenish-gray or Indian-red color. This is an erosional phase, representing areas from which the original coarse material has been partially removed. In some places the surface soil has been completely removed, exposing the subsoil. Such patches are called "gall spots." Where the covering of coarse sandy loam is over 6 inches in depth the soil was included with the typical phase. With decrease in the depth of surface soil the land is more difficult to cultivate. The gall spots are decidedly hard to cultivate, owing to the intractable nature of the material.

This phase is not extensively developed. It invariably occupies knolls and rolling hillsides near streams. Like the typical development of the type, this phase is derived from Triassic sandstone.

It is used for the same crops, given the same fertilizer treatment, and held at the same price as the typical phase, but the yields and quality of crops, especially of tobacco, are quite different. Tobacco gives a stronger and darker leaf of a lower selling price than on the typical soil.

Below are given mechanical analyses of typical samples of the soil and subsoil and of a shallow phase of the Granville coarse sandy loam:

Mechanical analyses of Granville coarse sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
Typical:		<i>Per cent.</i>						
24910, 24913.	Soil.....	15.3	23.9	10.4	14.5	8.1	19.2	8.0
24911, 24914.	Subsoil.....	9.2	14.5	6.5	10.1	4.9	31.1	23.3
24912.....	Lower subsoil.	2.6	5.3	4.1	16.2	5.7	30.4	35.6
Shallow phase:								
24915.....	Soil.....	15.1	23.7	14.1	22.6	8.0	12.7	3.2
24916.....	Subsoil.....	1.0	2.1	3.1	21.9	12.4	34.7	24.6

ROUGH STONY LAND.

The surface soil of Rough stony land consists of a mellow to compact loam or silt loam of pale red or pink color, while the subsoil consists of a compact light-red clay or silty clay with a smooth, flourlike feel. In places the soil is light gray to nearly white and the subsoil a yellow silty clay with some red mottling. Scattered over the surface and disseminated throughout both soil and subsoil there is found from 25 to 35 per cent of angular rock fragments and in many places there are huge outcropping bowlders and ledges of rock.

The two largest areas of Rough stony land are developed on Meadows and Bowldings Mountains, in the western part of the county. Other areas of the type are found 1 mile northeast and 2 miles northwest of Satterwhite and 4 miles south of Stovall. The type is developed on high hills, and is exceedingly rough in topographic features. The type is too stony for cultivation, but may be used for pasture. This soil is derived from the more massive and weather-resistant varieties of slate. Only a small percentage of it is under cultivation. It is forested with a heavy growth of hickory, white oak, red oak, black gum, and chestnut. This land can be bought for \$6 to \$10 an acre.

CONGAREE SILT LOAM.

The surface soil of the Congaree silt loam consists of a light-brown to chocolate-brown loam or silt loam 8 to 10 inches deep. Between the soil and subsoil there is usually found a thin stratum of material having the same texture and structure as the soil, but which is a shade lighter in color and shows slight gray or drab mottlings. The subsoil is also very similar in texture to the soil, but as depth increases the structure becomes more compact, the color lighter, and the mottling more pronounced.

The largest body of this soil occupies the low lands along Neuse River and Knap of Reeds Creek, in the southwestern corner of the county. A small body is found also about 9 miles south of Oxford, on Tar River.

The surface of the type is nearly level, there being only a gentle slope to the streams and in the direction of their flow. Drainage is effected by means of open ditches.

The soil is of alluvial origin, being composed chiefly of silt, very fine sand, and clay. These materials were washed from the neighboring hills and deposited during periods of overflow.

Much of the type is still forested, the timber growth consisting of white oak, hickory, red oak, elm, sycamore, ash, sweet gum, and black gum.

The Congaree silt loam is inherently a very fertile soil, but its situation is such that it can be used to best advantage for corn, oats, and forage crops only. During the winter months, and until about April 1, the greater part of the type is covered by standing or overflow water. This is especially true of that tract which occurs along Knap of Reeds Creek. Here the back water from Neuse River would drown any small grain crops which might be sown during the fall months. Corn, when given an acreage application of 200 pounds of a low-grade fertilizer, yields 10 to 25 bushels per acre, the average yield being not more than 20 bushels. The type is usually cultivated flat, a practice which should be supplanted by cultivation in "lands" to assist the drainage.

Farms of Congaree silt loam, with adjoining upland, can be bought for \$10 an acre.

ALTAVISTA SILT LOAM.

The soil of the Altavista silt loam, to a depth of 8 to 10 inches, consists of a light-gray to pale-yellow compact silt loam to silty clay loam, having a smooth, floury feel.

The upper part of the subsoil is a compact silty clay of yellow color, showing bright-red mottlings. At a depth of 24 inches the subsoil grades into a stiff plastic clay of yellow color mottled with gray or drab. In places the bright-red mottlings of the deeper layers are replaced by gray.

There is only a small total acreage of the type. The two small areas about 9 miles south of Oxford along Tar River amount to less than 2 square miles. The type occupies a second terrace along Tar River, and is subject to overflow only in time of extremely high water. The flat terrace land is locally called "flat-woods land."

The soil is of alluvial origin and is composed chiefly of silt, very fine sand, and clay washed from the uplands and deposited during freshets in the streams.

The greater part of the type is still forested, the timber growth consisting of white oak, red oak, post oak, hickory, and dogwood, with some shortleaf pine.

The principal crop grown is corn, the yields ranging from 25 to 40 bushels per acre. This soil is admirably adapted to the production of wheat, oats, and grass. It is not at all suited to the production of tobacco, and none of this crop is grown. Ditching would prevent the damage done by standing water following heavy rains.

Altavista silt loam is held in high esteem, not as an individual soil type, but as complementing the adjoining upland types. Farms containing this and other soils can not be had for less than \$30 an acre.

MEADOW.

The soil mapped as Meadow includes those areas lying along stream courses at an elevation only slightly above the normal water

line of the stream. The soil is decidedly variable in texture, ranging from loam or silt loam to coarse sandy loam, or from fine sand to coarse sand. In some places the soil is the same as the Congaree silt loam. The entire extent of Meadow is subject to frequent overflow, and it often happens that the character of the surface soil is entirely changed in a very short period by the deposition of fresh material.

The largest areas of Meadow are found in the southern part of the county, along Robertson, Beaverdam, Smith, and Newlight Creeks. Considerable areas are also found in the northern part of the county, along Little Island, Grass, Little Grass, Spewmarrow, Johnson, and Aarons Creeks.

On those areas which have been drained, corn and oats are grown, and as a rule good yields are secured. Much more of this soil could be reclaimed by straightening and deepening the stream channels and by cutting small lateral ditches across the poorly drained areas, so as to empty into the streams. On areas where water does not stand the soil produces good crops of hay. Many of the areas make excellent summer pastures.

SUMMARY.

Granville County, with an area of 522 square miles, or 334,080 acres, is situated in the north-central part of North Carolina, on the Virginia State line.

In the southern part of the county the surface is for the most part gently rolling or rolling with smaller areas near streams decidedly broken. In the western and northwestern sections the surface is rolling to steeply rolling and hilly.

The county is traversed in a northwest and southeast direction by two distinct watersheds, which direct the drainage of the central part of the county into Tar River. Numerous creeks flowing in a northerly direction drain the northern end of the county and eventually empty into either the Dan or the Roanoke River. The drainage of the southern part of the county flows into Neuse River.

The county is fairly well settled, but there is still much undeveloped land suitable for farming.

Oxford, the chief town and county seat, is the best tobacco market in the county. Creedmoor is also an excellent tobacco market.

The transportation facilities of the county are not as good as could be desired. Branch lines of the Southern and the Seaboard Air Line traverse the area.

The climate of Granville County is mild, healthful, and the rainfall is evenly distributed throughout the year. Crops rarely suffer from drought.

The growing of tobacco in that section of the State of which Granville County is now a part dates back to the days of the earliest

settlements. As late as 1850 or 1860 the type of tobacco in greatest demand was dark, heavy, and strong, whereas it is now the aim of most farmers to produce yellow tobacco of a velvety texture. Tobacco culture is now the leading agricultural interest in the county.

The soils of Granville County are derived from three principal rock belts, the largest of which occupies the greater part of the north-western half of the county. The rocks of this formation are of pyroclastic origin and give rise to soils whose common characteristic is a uniformly fine texture. The second largest belt is made up of granites and gneisses, which give rise to well-established soil series, viz, the Durham and Cecil series. The third belt occupies the south-central part of the county, and is made up exclusively of Triassic sandstone, which gives rise to the Granville coarse sandy loam. A minor diorite formation gives rise to the Iredell clay loam, the Iredell fine sandy loam, and the Iredell stony loam.

The light-gray coarse sandy loams, sandy loams, and fine sandy loams are especially well suited to the production of bright-yellow tobacco and are held in high esteem for this crop. The heavy loam and clay loam soils are well suited to grain and grass crops, and could be utilized profitably for these crops in connection with stock raising.

Agricultural lands range in price from \$7.50 to \$30 an acre, the price varying with location and type of soil.

The soils of the county offer excellent inducements to persons wishing to engage in stock raising, trucking, and fruit growing, as well as in the culture of tobacco.

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at <http://offices.sc.egov.usda.gov/locator/app>.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotope, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.