

# SOIL SURVEY OF THE YORKTOWN AREA, VIRGINIA.

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## LOCATION AND BOUNDARIES OF THE AREA.

The area surveyed lies in southern tide water Virginia. It is bounded on the north by King and Queen, Middlesex, and New Kent counties; on the east by Mathews County and Chesapeake Bay, Mobjack Bay, and Hampton Roads; on the south by Hampton Roads and James River, and on the west by Charles City, New Kent, and King and Queen counties. It includes the counties of James City, York,

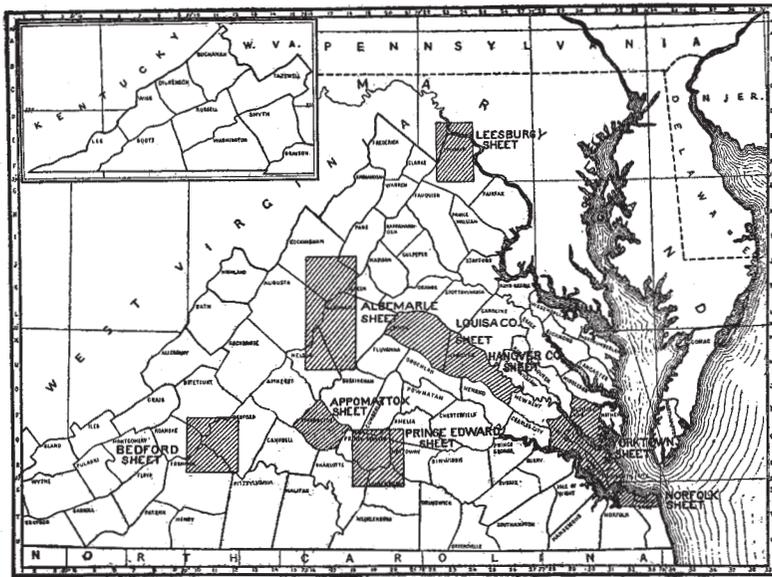


FIG. 8.—Sketch map showing location of the Yorktown area, Virginia.

Elizabeth City, Warwick, and Gloucester, comprising in all an area of about 598 square miles.

The flourishing cities of Newport News and Hampton lie in the southeastern part of the area, while the historic towns of Williamsburg and Yorktown are also within the area. An extension of the Chesapeake and Ohio Railway crosses the area in a southeasterly direction.

A plane-table traverse of the entire area was made by the party in the field, a chart of the Coast and Geodetic Survey supplying most of the coast lines. All the public roads were plotted, but a number of secondary and private roads were omitted, only such being traversed as were necessary accurately to locate soil boundaries.

#### HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The Yorktown area is one of the earliest settled regions of the United States, being the site of the first permanent English colony, established at Jamestown in the southern part of the area in 1607—three hundred years ago. There were over a hundred members in the first expedition, and two years later 300 others arrived at Jamestown.

At first the lands of the colony were owned and worked in common, but during Sir Thomas Dale's administration anyone paying a certain nominal sum into the treasury became entitled to 100 acres of land, 3 acres of which he obligated himself to cultivate in "corn," bringing annually  $2\frac{1}{2}$  barrels of corn to the public granary. As a result of this system, instead of the deficiencies of supplies which characterized the early years, there was always a surplus.

In 1616 the colony numbered 351 persons, of whom 25 were women and children. They were well supplied with horses, cattle, sheep, and goats, and during this period began to build more substantial houses. As the settlement grew large tracts of land were brought under cultivation, mainly for the production of tobacco.

The first land grant in Gloucester County, which was formed in 1652 from Pamunkee, one of the original eight shires into which Virginia had been divided, was made in 1635 to Augustine Warner. Prior to this time the colonists in this part of the area had been very cautious in pushing into the wilderness beyond the protection of the older colonies. In 1642 other grants were made in Gloucester County and the settlers began to push across York River to develop what was afterwards (in the early part of the eighteenth century) the most prosperous and populous of the Virginia settlements. The settlers built rude houses, which were afterwards to give way to more pretentious structures, and the crops grown and the methods pursued here were the same as in the other settlements. The principal crops were corn and tobacco, which were grown in small patches on newly cleared land. Many of the methods of cultivation were copied from the Powhatan Indians, who originally inhabited this county, and from whom the settlers learned to use fish for fertilizer and to plant them in the hills of corn. The yields are said to have been much greater then than now, and it is reported by one writer that an acre produced as much as 200 bushels of corn, peas, and beans. John Rolfe began the first cultivation of tobacco in the area in 1612, having learned the method from the Indians. This crop afterwards became

the chief product of the country and was used as a medium of exchange. To-day it is not grown in the area.

In 1650 there were upward of 1,500 people in this section of Virginia, and this number more than doubled in the next twenty years, largely the result of the execution of Charles I of England, which forced the Cavaliers to exile.

Jamestown was the capital up to 1699, when, owing to the unhealthy location of the town, Williamsburg, then known as Middle Plantations, became the seat of government. After the Revolutionary war it was again moved; this time to Richmond.

Prior to the Revolutionary war the development of the country had been slow though sure. During this struggle it came to a standstill, only to be renewed with increased vigor upon the return of peace. It was between this epoch and the beginning of the civil war that the country enjoyed its greatest agricultural development. It was then a great wheat-producing section, but the production of this crop almost ceased with the opening up of the western wheat fields. Tracts that were then under cultivation are now covered with forests of pine, and the old corn rows can still be seen in many places.

In 1881 the Chesapeake and Ohio Railway was built from Richmond to Old Point Comfort. Newport News was then only a small fishing town. It now has a population of over 19,000, while numerous other smaller towns have sprung up along the line of this railroad.

#### CLIMATE.

The climate of the Yorktown area is mild and equable, although changeable. The absence of extremes is particularly noticeable in the southern part of the area, as is evidenced by the fact that Newport News and Old Point Comfort are patronized both as summer and winter resorts. In the northern part of the area, as the distance from salt water and the altitude increases, the winters are slightly colder and the summers warmer. How much the proximity of the ocean and the neighboring waters modify the climate of the section can not be shown by actual records, but this is largely the cause of the freedom from early fall and late spring frosts in the tide water part of the area.

The annual precipitation ranges from 35 to 50 inches, an abundance for the needs of the crops. During the fall and winter seasons the rains are usually accompanied by easterly winds, which is true of the summer rains of long duration, the wind currents being easterly, particularly southeasterly, although thunder showers usually come from the west.

In the following table are given the temperature and precipitation as recorded by the Weather Bureau stations at Hampton, Norfolk,

and Spottsville, the latter situated inland and to a less extent influenced by the proximity of bodies of water. The figures for Hampton and Norfolk show the conditions along the water front particularly.

*Normal monthly and annual temperature and precipitation.*

Month.	Hampton.		Spottsville.		Norfolk.	
	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.
	°F.	Inches.	°F.	Inches.	°F.	Inches.
January .....	41.9	2.51	38.2	2.77	40.4	3.83
February .....	40.6	3.88	39.4	3.99	42.8	3.85
March .....	48.5	3.68	46.0	4.81	46.9	4.59
April .....	55.5	3.45	55.8	3.21	56.2	4.07
May .....	65.8	4.22	66.5	3.31	66.4	4.28
June .....	75.2	4.10	74.5	3.28	75.1	4.23
July .....	79.3	5.59	78.1	6.09	78.5	5.92
August .....	78.0	4.44	75.8	4.99	76.6	6.11
September .....	71.5	3.20	69.9	3.41	71.1	4.56
October .....	60.6	3.69	57.3	4.10	60.6	8.87
November .....	49.5	2.75	48.2	2.72	50.3	3.10
December .....	42.2	3.07	40.7	3.17	42.8	3.67
Year .....	59.1	44.58	57.5	45.85	58.9	52.08

The average dates of killing frost for the same stations are as follows: Hampton, last in spring March 24, first in fall November 13; Norfolk, last in spring March 30, first in fall November 13; Spottsville, last in spring April 14, first in fall October 21.

PHYSIOGRAPHY AND GEOLOGY.

The Yorktown area lies wholly within the Atlantic Coastal Plain, and is separated by the York River into two parts, Gloucester County lying to the north, and what is locally known as the "Peninsula," consisting of the other four counties, to the south. The total area has a length of about 43 miles in a northwesterly-southeasterly direction, and a breadth from Jamestown Island in James River across to the Piankatank River in Gloucester County of about 28 miles. The "Peninsula" is a long, narrow neck of land extending in a southeasterly direction between the York and James rivers, with Hampton Roads and part of the Chesapeake Bay as its southern and eastern boundaries. This part of the area has the shape of a dumb-bell, being larger at both ends than in the middle. Its length is about 44 miles, reaching from Old Point Comfort to Diascund Bridge, with a width varying from 6 to about 15 miles. It is narrowest on a line drawn between Oriana and Williamsburg.

The coast line along York River is very regular, consisting of perpendicular bluffs with an elevation decreasing from 90 feet near

Ware Creek to tide level in the marsh at Toos Point, only broken by the entrance of tributary streams, while to the south of the above point to Northend Point the coast line is much broken by many large tide-water indentations, chief of which are the Poquosin River and its tributaries, and Back River and its two prongs. The beach line from Northend Point to Old Point Comfort is distinct and regular. The elevations increase toward Newport News and well pronounced bluffs of low elevation extend up to the mouth of Warwick River. Here the country for a short distance along Mulberry Island is very low, being bordered with marsh and meadow lands. At the head of this island is a roughly circular break in the neck, giving this part of the area its dumb-bell shape, while to the north are the more broken shorelines of the flats of the James and Chickahominy rivers. The "Peninsula" is inclined toward the southeast. The surface features of the lowest terraces are low and flat. These terraces are bordered by large areas of marine marsh. The inland areas ascend slightly toward the northwest, with a varying altitude of from 4 to 30 feet.

From Leehall the country rises toward the northwest, until an altitude of about 125 feet is attained. The upland surfaces are composed of slightly rolling to dissected hills, the latter bordering the stream courses. In the southern part of the "Peninsula" the elevation above sea level is so slight that in places adequate drainage can not be secured, and as a result many large inland swamps occur.

The drainage of this part of the area is east, west, or south to the York and James rivers, and Hampton Roads, respectively. The tidal streams do not usually extend very far inland, although the heads of many of them reach the fall line. At their mouths they are frequently as large as rivers, but they decrease rapidly in size as they recede from the zone of tidal influence.

The northern part of the area, consisting of Gloucester County, is elongated in a general northwesterly-southeasterly direction between Mobjack Bay and York River, and is irregular in shape, being narrowest at the southeastern extremity. It has a length of 24 miles from Gloucester Point to Dragon Bridge and a width east and west that varies from 7 to 14 miles. The general inclination and drainage is southeasterly, or seaward, with the lateral drainage northeast into the Piankatank River, east into Mobjack Bay, and south and west into York River. The Piankatank River and Dragon Creek, forming the northern boundary of the area, flow in a southeasterly direction. Above Burkes Ferry the Piankatank narrows rapidly and becomes a meandering stream, along which is developed considerable marsh. The adjacent bottoms in places are well-defined terraces of low altitude, which abut upon the bluffs of the uplands. From Burkes Ferry eastward the river widens rapidly and is marked by bluffs

that range from 20 to 60 feet in elevation. These are frequently dissected by tributary streams, the transported material of which has been deposited as bottoms and sand bars.

Gloucester County is separated into two physiographic divisions marked by a distinct escarpment varying from 20 to 60 feet in height and extending in a north-northeasterly direction from Gloucester Point to the Mathews County line, or the northwest head of North River. This bluff is not continuous, having been lowered and broken in places by the eastern drainage system.

The forelands east of this escarpment are irregular in outline, forming many narrow necks and miniature peninsulas, and the North, Ware, and Severn rivers and their tributaries have large and deep tidal indentations. The forelands are characterized by broad, level necks, with an elevation that rarely exceeds 20 feet above mean tide, and which decreases slowly as Mobjack Bay is approached. The more southerly necks are fringed with marine marsh and mud flats. The fall in general is so slight that adequate natural drainage does not exist, and the result is that the more inland areas are characterized by swamps or wet woodlands.

The shore line of the York River is not so irregular as that of Mobjack Bay, probably on account of the swift currents in the former. This shore line is generally characterized by vertical bluffs which in the vicinity of Gloucester Point range from 20 to 60 feet, gradually decreasing in elevation to the eastward. The western shore is notched and lowered in places by the York River tributaries and bordered in places by marine marshes and mud flats.

The uplands of Gloucester County have a range in elevation of from 30 to 120 feet above sea level, the greatest height being attained in the northwestern part, in the vicinity and to the westward of Ebenezer Church. The surface is gently rolling or rolling, while the stream courses have generally notched through the unconsolidated materials, and are marked by roughly dissected hillsides.

The materials that go to make up the surface deposits of the area surveyed are known geologically as the Columbia formation, and have a thickness of from 10 to 30 feet. They consist of unconsolidated fine sands and sandy clays in alternating layers, together with occasional deposits of fine gravel. They have been derived from the eastern Appalachian region, and transported and deposited by streams in shallow estuaries and deltas during the building of the great Atlantic coastal flood plain. The weathering of these deposits has resulted in the formation of the soils of the area.

#### SOILS.

The classifications of the various soil types were based largely upon texture, physical properties, and position with respect to drainage.

The more doubtful areas along contacts were thrown with the types which they more nearly approximated in agricultural value.

The soils range in texture from clay and silt to fine gravel, although the predominating types consist of fine to medium sandy loams.

The following table gives the names of these several soils and their extent in the present survey. Many of them have a wide distribution throughout the Atlantic coastal region, as indicated by surveys already completed:

*Areas of different soils.*

Soil.	Acres.	Percent.	Soil.	Acres.	Percent.
Norfolk fine sandy loam ....	144,064	37.6	Portsmouth sandy loam....	20,032	5.2
Norfolk sandy loam.....	94,016	24.5	Norfolk coarse sandy loam..	4,288	1.1
Leonardtown loam.....	36,800	9.6	Portsmouth clay loam.....	2,176	.6
Portsmouth fine sandy loam	29,760	7.8	Galveston sand .....	1,984	.5
Swamp .....	26,368	6.9	Norfolk clay loam .....	1,856	.5
Galveston clay .....	21,568	5.7	Total .....	382,912	.....

PORTSMOUTH FINE SANDY LOAM.

The soil of the Portsmouth fine sandy loam consists of a light, friable sandy loam, of a generally fine texture, and from 8 to 24 inches deep, containing a few particles of coarse white quartz sand, while over the surface and throughout the profile there is in some localities a scattering of well-rounded gravel rarely exceeding one-half inch in diameter. Light to dark gray is the usual color of the surface soil when dry, but when wet it assumes blackish or brownish shades. The subsoil consists of a plastic sandy loam or sandy clay, sometimes of a rather impervious nature, to the depth of 3 feet, where it is generally underlain by coarse wet sand. The color of the subsoil is gray or drab, mottled with blues and browns.

A phase of this type occurs in some of the areas of poorest drainage. The soil is here generally slightly darker in color, rather heavier in structure, and finer in texture than in the main body of the type. The depth of the top soil is usually also somewhat more shallow. These areas generally grade almost imperceptibly into the lighter, looser surrounding soil of the Portsmouth fine sandy loam. Areas of this heavy phase are to be seen northeast of Gloucester Point, northeast of Phoebus, along the main road from Hampton to Newport News, and in a few other localities in Elizabeth City County.

The distribution of this type is confined to the lower or eastern portion of the area, or east of a line drawn south from Wormleys Creek to Newport News in the "Peninsula," and on the forelands east of the escarpment, in Gloucester County. It is well developed in a large unbroken area in the peninsula known as Guinea Neck, lying south of Severn River, though it is noticed to be less typical

nearest the escarpment and nearest the mud flats of Mobjack Bay. A good development of it is also seen north and northeast of Grafton, southeast of Poquoson, and north and northeast of Newport News, but it is less typical south of the southwest prong of Back River and in isolated patches south and east of Harrison Creek.

This type occupies level or depressed interstream areas, with an altitude that rarely exceeds 20 feet above mean tide, while in some places it is scarcely above high-water mark. In Gloucester County the lowest areas have an elevation of about 3 feet above mean tide. With few exceptions the Portsmouth fine sandy loam occurs in areas more or less remote from tidal streams. The fall is so slight that the greatest difficulty is experienced in getting adequate drainage, and as a consequence but a small proportion of the type is under cultivation. In fact, a great part of the area occupied by this character of soil material is covered with forest. During early spring it is wet or in a swampy condition. The worst of such areas have been mapped as Swamp, since there is little chance of improvement under present conditions.

A suggestion in this connection might not be amiss. It would seem possible to direct the waters of the swampy heads of the southwest prong of Back River to Salters Creek and drain the neighboring country by the extension of laterals to the main by surface ditching to the underlying sand. The surface water could then be carried off and drainage established. This would open up valuable tracts of land now unfit for agricultural purposes.

The original timber growth of this type is not known, but the forest areas now consist of old field pine, sweet and black gum, and oak. This type owes its origin to the reworking of the finer estuarine deposits with the sand bars developed by river currents.

The cultivated areas are used for the production of potatoes, corn, and grass, with such secondary crops as cabbage, lettuce, and root crops, or strawberries and small fruit. The character of the truck crops depends largely on condition with respect to drainage. The grasses are relatively unimportant on this soil. Little timothy is grown; orchard grass and red top are more in favor.

The following are the reported crop yields of this soil type: Irish potatoes, from 50 to 150 bushels to the acre, and sweet potatoes, an average of 200 bushels. The yield of corn is very low, only 10 to 20 bushels to the acre. Hay (red top and clover) yields 1 ton to the acre, while orchard grass returns 2½ tons in three cuttings. The fields are often cultivated in ridges to protect the crops from the accumulation of water after showers. Fertilizer is secured by turning under pasture sod and by the use of a small fish called "alewife" or "bunker."

These lands are valued at from \$12 to \$75 an acre, depending on improvements and location with respect to markets.

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

*Mechanical analyses of Portsmouth fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11376, 11379, 11383, 12262, 12264.	Soil .....	0.4	3.1	6.5	47.9	7.3	21.1	13.5
11377, 11380, 11382, 12263.	Subsoil .....	.2	2.2	4.2	32.8	9.2	27.4	21.5

NORFOLK CLAY LOAM.

The Norfolk clay loam consists of a chocolate-brown clay loam with a depth of about 6 inches, passing rapidly into a very dense, massive, waxy clay of a dark reddish-brown color. At about 24 inches it contains a small amount of very fine sand, while the color becomes somewhat mottled. In a few of the examinations of this type, at depths exceeding 3 feet, it was underlain by thin layers of shell marl. When in a normal moisture condition the surface of the soil possesses a fair tilth, but when wet it is very plastic and sticky, so much so that it balls in front of the plow and makes uneven furrows.

The Norfolk clay loam has a very limited distribution, occurring in a large unbroken area to the north of Shell Banks (normal school farm) and west of Brooks Point, and in a much smaller one 3 miles farther west. The surface has a flat or depressed appearance and lies at an elevation of about 10 feet above sea level.

The natural drainage is fairly well developed, although the fall is so slight that much of these areas is imperfectly drained, particularly in the wooded areas, where the water remains for long periods after rains.

The Norfolk clay loam is an estuarine deposit laid down in more recent Pleistocene time and subsequently elevated.

On this type the forest growth is made up largely of hardwood and old field pine. The cultivated areas are used largely for the production of hay and corn, but the greater part of the type is used as pasture. Corn has an average yield of about 30 bushels to the acre, although 60 bushels have been grown under good conditions. Timothy and clover hay yield from 2 to 3 tons to the acre, while the pastures are almost permanent.

Prior to the sixties this type was one of the most important wheat soils of the Peninsula. It is said then to have produced from 30 to

50 bushels to the acre, while now it rarely produces 10 bushels to the acre, and the cultivation of this crop has been practically abandoned.

The Norfolk clay loam, under good cultural methods, should be a very productive type for grass and grain.

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

*Mechanical analyses of Norfolk clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11399.....	Soil.....	1.0	3.2	7.6	22.6	7.1	34.8	23.9
11400.....	Subsoil....	.5	3.6	6.1	17.8	6.9	32.2	32.9

PORTSMOUTH CLAY LOAM.

The Portsmouth clay loam is locally known as the "black lands." It consists of a clay loam to about 6 inches deep, which grades abruptly into a very dense, massive, and waxy clay which at 24 inches contains a small amount of very fine sand. The local name of the type gives some idea of the color of the surface, which varies from ashy gray to brownish black. The immediate subsoil is usually a brownish black to about 24 inches, when it changes to mottled grayish blue. Marl sometimes occurs below 3 feet. Upon drying out the surface breaks up into cracks; where further shrinkage continues the soil breaks up in crumbs, which gives it a porous structure, but when wet it is very plastic and sticky, so much so that it is worked with the greatest difficulty and fails to scour from the plow.

The Portsmouth clay loam occurs in isolated areas throughout the forelands in Gloucester County, to which it is confined almost exclusively, and where it is partially or wholly surrounded by Portsmouth sandy loam.

The Portsmouth clay loam has an elevation of from 10 to 20 feet above mean tide and occupies flat or troughlike depressions. The greatest difficulty is experienced in securing adequate drainage, as there is but little fall to the neighboring watercourses. More generous surface ditching or tiling would do much to alleviate the poor drainage conditions of this type. Many of the present ditches were observed to be obstructed by an accumulation of trash and litter.

The type is an estuarine deposit. The same character of material is being formed at the present time in the shallow indentations, where the sluggish rise and fall of tide develops but little current.

The Portsmouth clay loam is used for the production of corn, wheat, and grass. The yields of corn range from 10 to 40 bushels; wheat, from 7 to 20; hay (mixed), from 1 to 2½ tons to the acre, while

the pastures last from 4 to 6 years. The Portsmouth clay loam is a strong productive type for grass and grain when well drained. The cultivation of this type is generally too shallow, rarely exceeding a depth of 4 inches.

The Portsmouth clay loam is valued at prices that range from \$15 to \$40 an acre.

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

*Mechanical analyses of Portsmouth clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
12278, 12280 .....	Soil .....	0.1	1.8	4.5	26.5	7.7	38.4	21.3
12279, 12281 .....	Subsoil .....	.2	1.9	4.9	28.7	4.8	38.2	21.0

PORTSMOUTH SANDY LOAM.

The Portsmouth sandy loam, locally known as the "gray land," consists of a fine to medium sandy loam of grayish-brown color, ranging in depth from 6 to 14 inches. This material passes rather abruptly into a heavy, massive, sandy clay of a mottled brown color, changing at a depth of 24 inches into a less sandy clay mottled with steel blue and gray and very similar in color and texture to the deeply lying substratum of the Norfolk clay loam.

The Portsmouth sandy loam occurs along the forelands in the eastern part of the area, with its best development east of the escarpment in Gloucester County. Here it wholly or in part surrounds the more local development of Portsmouth clay loam and swamp, occasionally abutting on tidewater, but more often bordered by the Norfolk sandy loam. The type occupies the major portion of Saddlers, Wares, and Robbins necks in Gloucester County, while south of the York River the largest areas typically developed border Queen Creek, northwest of Green Springs; several areas are also found in the vicinity of Poquosin River and the Northwest Branch of Back River.

The Portsmouth sandy loam has an altitude that ranges from 4 to 20 feet above sea level. The surface of the type is flat to gently rolling, sloping slightly toward the southeast. The type is fairly well drained as it nears the watercourses, but imperfectly so as it extends farther back where the fall is insufficient.

To obviate poor natural drainage most of the corn lands are thrown up in ridges with deep intervening furrows. Trenches are located at convenient intervals to catch what water accumulates on the surface.

The distribution of this soil seems to be governed by the local

reworking of fine sand with deposits of clay in the shallow water of estuaries. The topography of the type varies generally from level to slightly rolling. Very little of it supports the original growth of hardwood, although much of it is covered with a heavy growth of old field or loblolly pine which has taken possession of the fields since the war.

The Portsmouth sandy loam is used for the production of corn, wheat, and grass, supplemented by potatoes, peas, and such general truck and orchard products as are needed for home consumption. The following are the reported yields from areas representing the general productiveness of the type: Corn, 10 to 20 bushels; wheat, 7 to 15 bushels, and hay from 1 to 1½ tons to the acre. Yields greatly in excess of the above for corn and wheat were reported from fields in better condition, where the former was reported as high as 40 bushels and the latter 20 bushels to the acre. This type is easily worked and responds readily to good treatment.

The methods of crop rotation in use vary considerably. Corn may be planted for from one to three or four seasons on the same field, followed by wheat, in which timothy and clover are sown. After the grass has been cut for hay for one or two years the fields are used as pastures for indefinite periods. A common practice is to follow English peas and potatoes with corn, repeating each season. Sometimes cowpeas are sown with the corn at the time of last cultivation. To improve fields of this type the pasture sod is turned under, or such green manuring crops as cowpeas or German clover, on which is sown acid phosphate. Small fish known as alewives are sometimes used for corn.

In general this type is in very poor condition, natural drainage is frequently inadequate to carry off surface water, and were it not for the practice of ridge cultivation the crops of corn and potatoes would be much lower than they are at present.

The Portsmouth sandy loam is valued at from \$15 to \$150 an acre. Many wealthy people have built summer homes on the rivers and own large areas of this type.

The following table gives the average results of mechanical analyses of the fine earth of typical samples of this soil:

*Mechanical analyses of Portsmouth sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11393, 11395, 12274, 12276.	Soil .....	0.9	5.9	14.4	39.2	16.8	14.6	7.9
11394, 11396, 12275, 12277.	Subsoil ....	.5	5.1	12.0	38.4	4.7	16.9	22.1

## LEONARDTOWN LOAM.

The Leonardtown loam consists of an ashy-gray, yellowish-brown, or brown silty loam, 6 or 8 inches deep, grading into a silty clay of somewhat lighter color, which in turn is underlain to a depth usually exceeding 3 feet by a yellow or grayish silty clay in which a small amount of fine sand is sometimes present.

The Leonardtown loam occurs in large, irregular areas. A long, narrow area extends from Leehall nearly to Newport News, in Warwick County, while others are situated along the James and Chickahominy rivers, in James City County. In Gloucester County a large broken area extends for a distance of about 9 miles northwest from Whitemarsh, while another area of nearly 15 square miles extent, known as the "barrens," occurs in the northeastern part of the county, near the Mathews County line.

The surface is usually characterized by swampy depressions and kettle holes, in many of which standing water is found throughout the year. This type ranges in elevation from about 20 to 120 feet above sea level, but natural drainage is far from established and the greater part of it is in its present condition unfit for agriculture.

The greater part of the Leonardtown loam is covered with forest growth, although the original white oak timber has largely disappeared. The growth at present consists largely of loblolly or old field pine and scrub oak, with sweet gum in the poorly drained depressions.

The Leonardtown loam is one of the most important of the upland types and some of it is under a high state of cultivation. On the other hand, portions of it have reached the lowest degree of productivity.

The cultivated areas are used for the production of corn, wheat, grass, and potatoes. Wheat and potatoes are, however, of secondary importance.

The following are the reported yields: Corn ranges from 10 to 50 bushels; wheat, from 7 to 20 bushels; hay, from 1 to 1½ tons; potatoes, from 50 to 100 bushels to the acre.

A common treatment to improve the fields of this type is to use German clover or field peas as a green manure, on which is sown acid phosphate. The Leonardtown loam readily responds to this treatment. The cultivation of the type is generally shallow, although ridged for corn. The compact nature of the surface soil, together with the fine texture, does not permit of ready percolation of accumulating water, and the crops are generally late in starting and long in maturing as compared with lighter types.

The Leonardtown loam is well adapted to dairy farming or to stock raising. All the forage crops do well and the pastures are said to be almost permanent.

The following table gives the average results of mechanical analyses of typical samples of this type of soil:

*Mechanical analyses of Leonardtown loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11363, 11365, 12254, 12256.	Soil .....	0.7	3.9	4.5	21.9	14.7	42.2	13.7
11364, 11366, 12255, 12257.	Subsoil ....	.9	2.2	3.2	17.3	9.4	36.3	29.1

NORFOLK COARSE SANDY LOAM.

The Norfolk coarse sandy loam consists of gray or brown sandy loam, of a medium to coarse texture, containing some very fine gravel. The surface 6 inches is usually underlain by a less loamy sand of the same coarse texture, which at 24 inches becomes a coarse sandy or fine gravelly clay. This stratum rarely exceeds a thickness of 2 feet, and it more often occurs as a thin layer from 6 to 12 inches in thickness, and is in turn underlain by fine gravel and coarse sand. The surface soil has a peculiar porous structure and is slightly sticky from the presence of clay and silt, which envelops the sand and gravel particles. The darker color of the surface soil gives way to red and yellow as the depth increases. The subsoil proper (sandy or fine gravelly clay) has a structure similar to the surface, but with the interstices not nearly so pronounced.

The Norfolk coarse sandy loam, which occupies a relatively small area, occurs in one important tract on the river forelands northwest of Yorktown and in another extending almost due south of Wormleys Creek in a long, narrow strip to within one-half mile of the Poquosin River. Other narrow bands of irregular outline and small isolated patches occur in the Swamp areas throughout the southern part of the "Peninsula." It does not occur in Gloucester County.

This type occupies level to ridgelike topography. It probably owes its origin to the formation of bars or ancient beach lines or to deposition in rapid currents during the building up of flood plains.

The Norfolk coarse sandy loam generally needs underdrainage, particularly in the vicinity of the Swamp areas, where borings in many instances showed water at a depth of 3 feet or less. This nearness of the ground water to the surface restricts the adaptation of the land so affected, and corn and grass are produced to the general exclusion of other crops. The greater proportion of such areas, however, is occupied by woodland, approaching in condition the Swamp type. The tops of the ridges, or that part of the type with a low water table, is used for the production of early truck.

Corn yields from 10 to 20 bushels and hay about 1 ton to the acre. A wide variety of truck crops is grown. Used for this purpose the type is very valuable, as the crops mature about two weeks earlier than on any other soil, and the advantage of the highest market prices is secured.

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

*Mechanical analyses of Norfolk coarse sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11370, 11372.....	Soil.....	16.4	27.9	8.9	12.2	2.5	18.7	13.0
11371, 11373.....	Subsoil....	16.3	30.0	8.2	7.9	1.9	19.8	15.1

NORFOLK SANDY LOAM.

The Norfolk sandy loam, to a depth of about 8 inches, consists of a fine to medium sandy loam of a gray or yellowish-gray color. This material grades into a less loamy orange or yellow sand which retains the same general texture to depths varying between 8 and 24 inches, where it rests upon an orange or yellow sandy clay. The sandy clay of the subsoil proper is generally of a light character and frequently has a depth of not more than 12 inches, underneath which incoherent sand occurs. Where it attains a greater thickness it usually becomes much more massive as the depth increases. Nearest the tide-water streams along the edge of the escarpment in Gloucester County and in other positions where drainage and topography are favorable to the formation of a deep soil, the Norfolk sandy loam in many instances possesses the characteristics and agricultural value of Norfolk sand.

With the exception of the Norfolk fine sandy loam this type has the largest distribution of any in the area. It occurs in many parts of the "Peninsula," more particularly in the neighborhood of Hampton and to the south of Newport News. It is also found to the north of Leehall, extending from the James River across to the York River. Large areas of it are developed to the north of Toano and in the vicinity of Ewell and Lightfoot. In Gloucester County large areas are found throughout the length of the county immediately north of York River and also in narrower bands skirting the Piankatank, North, Ware, and Severn rivers. In its distribution it is neither confined to the uplands nor lowlands, although larger areas of it occur in the former than in the latter position.

The surface of the Norfolk sandy loam where it occurs in broad areas is usually level to gently rolling, although it is steep and hilly along stream slopes. The type is derived from materials belonging

to the Columbia formation of Pleistocene age and was deposited in marine waters during the building of the Coastal Plain.

Probably more of this type than any other is under cultivation, although much of it is at present unimproved. The timber growth consists almost altogether of old field pine and scrub oak. The Norfolk sandy loam is naturally the best drained soil in the area. It is used for light farming, particularly for the production of corn, potatoes, and truck crops. The following yields are reported: Corn from 10 to 30 bushels, with somewhat greater yields under the most favorable conditions; potatoes from 75 to 140 bushels; sweet potatoes, though not grown extensively, from 100 to 200 bushels; peas from 50 to 70 bushels, and peanuts, on a small acreage, from 50 to 100 bushels to the acre. Alfalfa has been successfully grown upon this type, though the acreage devoted to it is very limited. Yields of from 3 to 5 tons are reported for five cuttings.

Melons and early potatoes are the principal truck crops. Improved farms of Norfolk sandy loam favorably situated with reference to railroad and steamboat transportation lines range in price from \$50 to \$80 per acre.

The following table gives the average results of mechanical analyses of samples of this soil:

*Mechanical analyses of Norfolk sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11387, 11389, 12268, 12270.	Soil .....	0.4	9.4	13.8	46.3	10.3	11.3	7.6
11388, 11390, 12269, 12271.	Subsoil ....	.9	10.0	13.1	38.6	11.1	12.6	13.6

NORFOLK FINE SANDY LOAM.

The Norfolk fine sandy loam consists of a fine sandy loam of a gray or brown color, with a depth of about 10 inches, at which depth it usually grades into a more compact material of the same texture. This is underlain at depths varying from 12 to 24 inches by a reddish-yellow sandy clay, while at depths usually exceeding 3 feet the underlying material generally consists of alternating strata of clay and sand. The color of the subsoil is varied, although different shades of red and yellow predominate.

The Norfolk fine sandy loam, which is the most extensive type in the area, is found in broad bodies on the upland in all parts of the area surveyed west of a line drawn about north from Newport News. It occupies a level to rolling country, usually more rough and broken as it approaches the water courses, where a difference of from 20 to

60 feet in the elevation is not infrequent, making the slopes very steep. The Norfolk fine sandy loam is generally well drained, but occasional spots occur where the conditions are similar to those found in the Leonardtown loam.

Although this type covers the largest area of any type in the survey, probably less than 50 per cent of it is under cultivation. The remainder has a growth of small timber, loblolly pine and oak predominating. A great part of this growth has spread over the fields since the civil war.

The cultivated areas are used for a variety of crops, depending upon the depth of surface soil and the location with respect to market. In the areas more remote from the railroad or towns the production of corn and grass are the chief interests, supplemented by potatoes and such other truck crops as are needed for home use. Where, however, the surface soil is deeper (reference being made more particularly to the areas in the vicinity of Toano and to the north), a specialization is made in the production of early potatoes, melons, tomatoes, and cucumbers. In the areas more remote from markets yields of corn and potatoes are relatively low as compared with yields in the areas of deep soil, and the greater proportion of the acreage is used for grass and small grain, the yields of which are relatively large. The general system of cropping is to plant corn successively for three or four years and then to use the fields for pasture for indefinite periods. The pasturage consists of native grasses which come up voluntarily. A growing custom, however, is to follow corn with wheat in which timothy and clover are sown. Hay is then cut for two years, after which the fields are used for pasture. The productiveness of the field is maintained by turning under the pasture sod, crimson clover, and peas as green manure.

The following yields are reported for Norfolk fine sandy loam: Wheat, 7 to 20 bushels; oats, 20 to 30 bushels; corn, 10 to 35 bushels; potatoes, 50 to 200 bushels; hay, from 1 to 2 tons, and cucumbers from 2 to 3 tons to the acre. Apples, pears, and small fruits are also successfully grown. This type of soil is valued for agricultural purposes at from \$10 to \$100 an acre.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the Norfolk fine sandy loam:

*Mechanical analyses of Norfolk fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11357, 11359, 12243, 12250.	Soil .....	2.2	4.8	9.9	39.6	10.2	25.5	9.3
11358, 11360, 12249, 12251.	Subsoil ....	3.2	4.3	8.6	33.9	8.0	24.0	20.5

## GALVESTON SAND.

The Galveston sand is a fine to medium brown, yellow, or grayish-yellow sand with a depth of 3 feet or more. In some areas in Gloucester County there is an abrupt change in color at about 10 inches. Over the surface and throughout the soil in some of the areas mapped in Elizabeth City County there is a scattering of large, rounded black gravel, usually from 4 to 6 inches in diameter. This type occupies narrow strips of shore line along Hampton Roads, north of Old Point Comfort, and along York, Severn, and Ware rivers, the areas varying in width from one-sixteenth to one-fourth of a mile.

The Galveston sand usually occurs in hammocky or ridgelike bars sloping seaward. As the distance increases from the shore line the surface becomes gently rolling.

The material composing this type is a beach sand so incoherent when dry as to be readily moved from place to place by the force of the wind. The surface depressions are usually somewhat swampy, while the knolls are usually characterized by the growth of pine, scrub oak, laurel, and cacti.

Where covered with vegetation the surface soil is usually of a darker color from the presence of decomposed organic matter. Only a small proportion of the type is fitted for agricultural purposes.

The following table gives the average results of mechanical analyses of samples of this type:

*Mechanical analyses of Galveston sand.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		<i>Per cent.</i>						
11369, 12260 .....	Soil .....	0.8	19.8	21.8	49.9	1.7	3.4	2.5
12261 .....	Subsoil .....	1.6	22.8	26.7	36.0	2.4	6.6	3.7

## GALVESTON CLAY.

The Galveston clay consists of lowlands bordering nearly all the large and some of the smaller tidal streams. These are covered with water at high tide, and the vegetation is characterized by salt grasses of different varieties. The largest and most extensive areas are developed to the east and north of Messick on the Chesapeake Bay and Back River, and along York, James, and Chickahominy rivers. As the elevation increases the Galveston clay usually gives way to swamp. The areas of Galveston clay are of no agricultural value and could only be reclaimed by diking and pumping the water out.

## SWAMP.

The Swamp mapped in this area consists for the most part of irregular inland areas of woodland and narrow wooded areas skirting the smaller streams, above the influence of salt-water tides. Many of these interior areas of woodland swamp, which occur mainly between Oriana and the arms of Back River, and upon the lowland portion of the escarpment in Gloucester County, are susceptible of drainage, and when reclaimed will probably develop a type of soil quite similar to that of the Portsmouth fine sandy loam, valuable for the production of the heavier truck crops and for general agriculture. At the present time these areas are covered principally with loblolly pine, sweet gum, and willow oak.

## AGRICULTURAL METHODS.

The area surveyed lies in what is commonly known as the "corn belt" of Virginia. Corn is the chief product, but is not grown to the general exclusion of other crops, being supplemented generally by grass and truck crops.

The cultural methods are quite variable and depend largely on the character and condition of the soil. On some of the soil types, either as a result of the fineness of the texture or close structure, and on portions of the types poorly drained, the crops are so late in starting and slow in maturing that but one crop can be grown in a season. Among the types wholly or partly in this class are the Leonardtown loam, Portsmouth fine sandy loam, Norfolk clay loam, and Portsmouth sandy loam.

On the lighter types of soil or on those whose texture is coarse—with consequent more open structure—or on portions of the types already mentioned where drainage conditions are good, two or more crops are secured from the same field in a single season. Among such soils may be classed the Norfolk coarse sandy loam, Norfolk sandy loam, Norfolk fine sandy loam, portions of Portsmouth fine sandy loam, and Portsmouth sandy loam.

The customary practice on soils in the first group is to plant corn year after year until the soil has reached the minimum yield acceptable to the producer, when it is followed by grass which may or may not include clover, and the field used as pasture for indefinite periods or until the lands have recuperated sufficiently again to produce a profitable crop. Where corn follows corn, as above, a growing custom is to sow cowpeas or Canadian peas between the rows or every alternate row.

On the lighter types, particularly on the early truck soils—the Norfolk sandy loam, Norfolk coarse sandy loam, and the better-drained areas of Portsmouth fine sandy loam—the general practice is

to grow, season after season, garden peas and Irish potatoes, followed by corn the same year. The peas and potatoes are sown in alternate rows about 4 feet apart, and the corn is planted in furrows developed by plowing to remove the pea vines. Occasionally a field of potatoes is followed by corn, but in general corn does not have time to mature after potatoes, although the Norfolk sandy loam and portions of the Norfolk fine sandy loam along the shore of the Chesapeake Bay are early enough to permit this rotation.

Where the types last named occur in the vicinity of Hampton, Newport News, and Toano they are used almost entirely for the production of early truck. Some fields of this soil are used year after year for the production of Irish potatoes—either two crops, early and late, being produced, or the early crop being followed the same year by corn.

In the York River section of Gloucester County, where the trucking industry is carried on in the Norfolk sandy loam and the Norfolk fine sandy loam, the principal crops are potatoes and melons. The method of culture with melons is to plant them in hills 8 or 9 feet apart and to stir the soil with a cultivator and hand hoe until they begin vining, after which cultivation ceases and they are left to mature. They are graded according to the picking, the first bringing the highest prices. Melons are seldom grown on the same field twice in succession, and then only on a very small scale for home use. The hills in this case are usually located in the space between the old hills. Where grown commercially they are seldom grown on the same land at intervals of less than three years, and more often of four or five years. The longer the interval between the better the result, as the land is said to be "melon sick" after a crop has been removed. Melons are usually followed by corn, rye, or oats, or by such leguminous forage crops as Canadian field peas or cowpeas. Wheat is grown to some extent upon the heavier types of soil, such as the Portsmouth clay loam, Portsmouth fine sandy loam, and Norfolk fine sandy loam.

In harvesting the corn crop the custom in vogue is to pull the blades and cut off the tops of the stalk above the ear while it is still green. After the ears have ripened they are snapped off and hauled to the barn or cornercrib. When the field is to be prepared for another crop, the stalks are cut down with a hoe. The corn matures much better by this method than if the entire stalk were cut and shocked, but the labor is about twice as great as by the latter method.

The cultivation of most crops is generally shallow. On account of the inadequate natural drainage of a considerable portion of the country it is necessary to practice the ridged system of cultivation, especially with corn. Following the last plowing this leaves high ridges with deep intervening furrows. This practice is very necessary in the low forelands, though it is carried to unnecessary extremes

in the higher uplands, where the drainage system is fairly well developed.

Fertilizer practice varies almost with the individual. A common practice on the heavier soils, as already noted, is to sow cowpeas or Canadian peas with the corn. These are esteemed of great value in maintaining productiveness of the soil. The turning under of the pasture sod is held to be sufficient for the production of three or four crops of corn. Besides these practices some commercial fertilizer is used. The general plan in all inland areas is to use broomsedge or pine straw for bedding in stables and to incorporate it in the soil in spring or fall. Manure of this character is eagerly sought for. The pine straw is generally utilized in the fall and winter and hauled out in the spring, while the broom sedge, owing to its woody texture, requires much longer time to decompose, and is used in the stable during the summer, hauled to the field during the fall, and allowed to decompose in bulk during the winter. In parts of the area lying along the tide-water inlets a common practice is to fertilize with fish scrap or with small fish, commonly known as alewives or bunkers. This method of fertilization is used on fields prepared for corn.

The commercial fertilizers used are a 7 per cent and a 10 per cent on the basis of potash. The 7 per cent mixture is used for corn and the 10 per cent for truck. Of the green-manuring crops, crimson clover and cowpeas are most frequently used, and the practice of applying acid phosphate to help decompose the organic matter of these crops is not infrequent.

#### AGRICULTURAL CONDITIONS.

The chief interests of the area are its fisheries and its agriculture. The oyster fisheries of the Chesapeake Bay and tributary embayments are among the most valuable in the world, yielding annually millions of bushels of the finest quality of shellfish and giving employment to thousands. While all kinds of fish common to the middle latitudes abound in these waters, the waters that surround the east, south, and west of the area are not all natural oyster grounds. The oyster rock occurs in small areas in the more shallow waters and is developed for miles up the James River. The area along the shore line for several miles up that stream and extending out a distance of half a mile is controlled by the owners of abutting lands and is used largely for planting oysters. While the fishing and oyster interests are important occupations, they are generally followed in conjunction with agriculture, the oystering industry usually being carried on between the months of September and April.

Various degrees of prosperity exist in different parts of the area, although in general the conditions may be described as backward, and the area is still suffering to some extent from the effects of the civil war. Of the 382,912 acres surveyed, the census report of 1900

gives the number of acres in farms as 256,011, and only 109,316 acres, or about 42 per cent of the farm lands, as improved. The average size of all farms is given as 66 acres. A considerable part of the area is covered with a forest growth consisting mainly of loblolly and shortleaf pine and scrub oak and other hardwoods.

The most prosperous sections of the area, to judge from the character of the farm buildings and general improvements, are found in the tide-water trucking districts, especially in the vicinity of Hampton and Newport News, along some of the rivers connecting with Mobjack Bay, and on some of the forelands along York and James rivers. Appearances of relative prosperity are also marked in the inland areas in the vicinity of Williamsburg, Toano, and Gloucester.

The greatest diversity exists in the character of farm buildings, which vary from the old colonial manor to structures of the most approved modern pattern. Here and there are seen log huts with mud chimneys, but generally the farmhouse is a simple two-story wooden structure. The outbuildings consist of a barn for the accommodation of the work stock and a dairy cow or two, with room for the necessary forage, other small sheds for wagons and machinery, and a corn crib.

The proportion of the farms operated by the owners, as given by the Twelfth Census, is about 72 per cent. The remainder are in the hands of cash or share tenants. The cash rent demanded has a wide range—from \$1 to \$6 an acre—depending upon the location with respect to markets and the productiveness of the land. However, but a small proportion of the farms are rented for cash, most owners preferring to rent on a basis of a share of the crops, a practice which naturally stimulates the tenant to exercise greater care in the management of the land. Where rented on shares, the owner receives from one-fourth to one-third of the grain and an additional rental for the use of the farm buildings. Where trucking is practiced the tenant generally leaves every third or fourth row to be gathered by the owner.

The labor question is gradually becoming more and more of a problem for the farmers of the Peninsula. Laborers usually receive 75 cents a day, or, when hired for longer period, from \$10 to \$15 a month. During harvest as much as \$1.50 or even \$2 a day is paid for hands. A reliable, efficient hand has little trouble in securing employment, and the demand is so great that much difficulty is experienced in retaining him. It is not long before such men have begun to rent or to buy small farms. To another more restless class the opportunity for work in the near-by cities is more attractive, and the result is that only the less energetic and less thrifty are left. These are usually not reliable, and as soon as the fall comes the greater number are away to the free "oyster rock," where for the

first month or two they may make an occasional lucky catch bringing them from \$3 to \$5 a day. The last census report estimates the amount expended for labor in the counties comprised within the present survey at \$112,840.

That the wage is small for the more efficient labor is generally conceded, but for the class of hands secured it is usually as much as can be paid economically, because they exact almost constant supervision. Labor even of this class is growing more and more difficult to obtain, and the result is that during harvest it is not uncommon to lose a crop, while the scarcity during spring has gradually led to the abandonment of large productive areas.

Among the important crops of the area are corn, wheat, oats, hay, potatoes, sweet potatoes, peanuts, and truck. As was noted in the preceding chapter, corn is the chief crop. According to the Twelfth Census, 581,480 bushels were produced in the area in 1899, with an average yield of 14.7 bushels to the acre. Records of the yields gathered from the farmers frequently show an average for the farm as low as 5 bushels, while 60 bushels was not uncommon on the best cultivated areas. The low yield, in general, is attributed to exhaustive cropping without rotation. The most abundant yields are secured where judicious rotation is practiced, or where an endeavor is made to maintain fertility by the turning under of such green manures as crimson clover and cowpeas and by the application of acid phosphate or other fertilizers. Large yields are also secured on the Norfolk fine sandy loam near Toano, where the corn crop follows early potatoes, which are grown with heavy applications of commercial fertilizer.

Wheat is at present a crop of minor importance, although in antebellum days, before the opening up of the western wheat fields, the area was a flourishing wheat section. The census of 1900 gives the production as 16,870 bushels and the average yield per acre as about 7.2 bushels. Since these figures were prepared the acreage has increased to some extent. The production varies with the different types of soil, ranging from 5 to 20 bushels on the Norfolk fine sandy loam, Portsmouth sandy loam, Portsmouth fine sandy loam, Portsmouth clay loam, and Norfolk clay loam, the largest yields being generally secured from the last four types.

The oat crop is much more important, although not developed as it should be. The yield for 1899 was 19,200 bushels, an average of 13 bushels to the acre. The highest yields were reported from the Norfolk fine sandy loam and the Portsmouth sandy loam. Considerable quantities of wheat, oats, and rye are cut green and used as forage.

The production of clover crops has increased considerably in the last few years. The idea that red clover can not be produced without

a nurse crop is being disproved, and many fields are encountered. Crimson clover is rapidly acquiring a place as a soil renovator. The production of clover is given in the census report as 1,244 tons, and average yield per acre as 1.1 tons, while 5,578 tons is the estimated production of tame grasses other than clover, an average yield of a little over 1 ton to the acre. The grasses include timothy, redtop, orchard grass, and Bermuda grass. The production of timothy hay could be profitably increased.

The production of early potatoes for the northern markets is developing into an important industry. One buyer in 1904 spent \$13,000 in the purchase of this product for shipment to Detroit. The census of 1900 gives the production of the entire area as 135,323 bushels, or an average of  $79\frac{1}{2}$  bushels to the acre, the highest yields being reported from the Norfolk fine sandy loam and the Norfolk sandy loam. The industry has been extended considerably since 1899, the year to which the census figures pertain. The production of sweet potatoes is about one-half that of Irish potatoes, the average yield per acre being about the same.

The peanut crop is also becoming an important one, especially in the "Peninsula," and 28,036 bushels were produced in the area in 1899, an average yield per acre of 36 bushels. The production of English peas has developed considerably in the last few years. Cucumbers for pickling is another trucking crop grown to a considerable extent. These are sold to factories at Leehall, Williamsburg, Gloucester Point, and Toana and bring about 50 cents a bushel.

The varied types of soil and the conditions of climate and drainage within the area afford opportunities for a wide range of agricultural industries. The opportunity for investment in lands and the development of special crops is inviting. As a general suggestion it would be wise for the farmers of the area, except those engaged solely in trucking, to produce more grain, grass, and straw, and to feed more live stock than they do at present.

Transportation facilities in the area are excellent. The "Peninsula" is traversed in a northwest and southeast direction by an extension of the Chesapeake and Ohio Railway, which runs from Richmond to Old Point Comfort. Good service is rendered by the Old Dominion Steamship Company, whose boats ply the James, Ware, North, and Severn rivers, and by the Chesapeake Steamship Company, which runs a boat up the York River as far as West Point, and furnishes direct transportation to Baltimore. With the exception of some of the more perishable products, the greater part of the shipments are made by water. Freight rates by water are much lower than by rail. The chief markets for the products of the area are Richmond, Baltimore, Washington, and Philadelphia.

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