

# SOIL SURVEY OF CHESTER COUNTY, PENNSYLVANIA.

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## LOCATION AND BOUNDARIES OF THE AREA.

Chester County is situated in the southeast part of Pennsylvania, and is bounded on the northeast, north, northwest, and west by the counties of Delaware, Montgomery, Berks, and Lancaster, of the same State; on the south by Cecil County, Md., and on the southeast by Newcastle County, Del.

The county includes an area of 486,214 acres or approximately 760 square miles, and is irregular in shape, its width being about two-thirds its length, with the longest median line extending northeast-southwest.

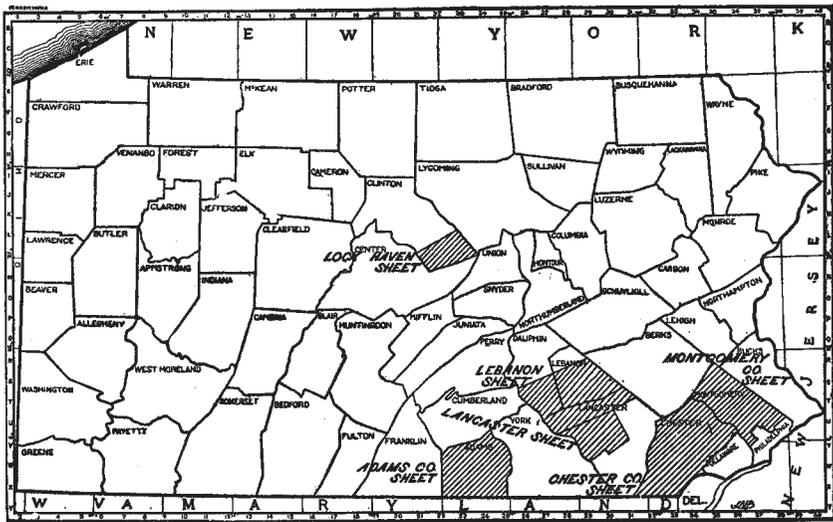


FIG. 4.—Sketch map showing location of the Chester County area, Pennsylvania.

## HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Chester County is said to have been laid off by William Penn in 1682, a year after he had obtained from the King his patent to the territory. Owing to the broad policy pursued by Penn in welcoming settlers of all nationalities and creeds, with the promise of freedom to believe as they chose, the settlement of the section took place with

comparative rapidity. English, Germans, Swedes, Welsh, Scotch, and Irish all settled within the confines of the county, and conditions of government and religious freedom were made so broad by Penn that the tranquil and prosperous early development of the county was steady and strong.

The location of the county seat on the extreme edge of the county at Chester finally led to so much dissatisfaction as to cause its removal to near the center of the county at Westchester in 1786.

The practice of agriculture grew apace. Indian corn was found under cultivation by Indians. Wheat was introduced by the first settlers, and barley, oats, and rye were early cultivated. The Mediterranean wheat was introduced about the year 1838. Barley continued to be cultivated for a long time, as it was used in the brewing of malt, and was sold readily to the Philadelphia brewers. About 1822 the farmers of Chester and Delaware counties, under the impression that the brewers were combined to keep the price of barley at a low figure, organized the Farmers' Brewery Company and erected a brewery in Philadelphia. This was not a successful venture, and the growing of barley gradually declined and after 1840 very little was produced. Buckwheat and flax were also generally grown during the last century. Clover was early introduced from Lancaster County, but the practice of sowing it did not become universal until about 1825.

Efforts for the improvement of farm stock were begun early. About 1818 some grade Durham cattle were brought from Kentucky, and in 1839 a small importation from England was made. The Spanish Merino sheep were introduced soon after 1810. By fortunate crossing of blood and careful management this county has produced a breed of hogs known far and wide as the Chester Whites.

In the early settlement of the county, when fences were scarce and only the cultivated ground was inclosed, all kinds of stock were allowed to run at large, and each farmer identified his own by branding. By the range system, with scanty forage at times, the animals became stunted, and by promiscuous interbreeding the stock degenerated in quality. With the development of the county all stock was inclosed and a systematic improvement of breeds followed.

In 1784 the number of farms in Chester County was 3,558; horses, 8,020; cattle, 10,107; and sheep, 11,896.

Philadelphia has always been the principal market for the dairy products of Chester County. In early days butter, eggs, and poultry were taken thither often by women, on horseback, in butter pails suspended at the horses' sides. Peddlers gathered the surplus provisions of those who did not wish to attend market in person. As the demand increased farmers from the eastern townships drove their wagons to the city loaded with produce for the weekly markets.

When the county was first settled the forests were far from dense, because the Indians had kept the timber from growing by setting fires on the high ground to destroy the undergrowth, thereby facilitating the pursuit of deer, and on the low ground and valleys to enable them to hunt the buffalo. After the departure of the Indians the growth of timber was rapid, and about the period of the Revolutionary war the forests were dense. These were gradually reduced in extent.

Orchards were planted extensively at an early date, and apples especially were abundant. There were also many peaches. Distilleries were erected in many places by which apples and peaches were converted into brandy. But the peach has almost disappeared, as well as plums and cherries, and apple trees have become less productive.

Rye and corn were the principal crops, though some flax was generally cultivated. The corn was planted in rows which ran in one direction, usually north and south, and about 6 feet apart. It was "topped and bladed," and rye was sown between the rows. Even fifty years ago but little wheat was grown, and "coffee" made of rye was in common use. Buckwheat was raised in small quantities. In winter farmers depended on the stripped blades of corn for feed for horses, and on hay obtained from the meadows for cattle and sheep. After the introduction of clover and timothy and the necessity which arose of preparing the ground for the use of the scythe the old method of planting was abandoned, the corn being cut off and entirely removed before the sowing of the winter grain.

Few oats were grown until after the construction of Horseshoe Pike, when the larger number of teams passing along that road with goods for the West made a market for this grain at the taverns along that highway.

It is only since 1835 that the present rotation of crops—corn, oats, wheat, and grass—has been followed.<sup>a</sup>

#### CLIMATE.

Chester County is far enough north for the ground to freeze solidly in the winter, and yet it escapes much of the rigor of climate found nearer the Canadian line. The ground thaws sufficiently early in the spring and freezes late enough in the fall to insure a growing season of good length, which, with a well-sustained supply of moisture, is very favorable for crop production.

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<sup>a</sup>The historical facts included in this chapter were taken principally from History of Chester County, by Futhey and Cope.

The following table shows the normal monthly and annual temperature and precipitation of the county as observed at the Weather Bureau stations of Coatesville and Kennett Square:

*Normal monthly and annual temperature and precipitation.*

Month.	Coatesville.		Kennett Square.		Month.	Coatesville.		Kennett Square.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	° F.	In.	° F.	In.		° F.	In.	° F.	In.
January.....	30.2	3.80	30.6	3.74	August.....	72.9	4.05	72.6	4.80
February.....	30.1	4.81	30.7	4.79	September...	65.9	4.92	66.1	4.95
March.....	37.9	4.81	39.0	4.46	October.....	53.0	3.52	53.9	3.47
April.....	50.2	3.56	49.4	3.60	November...	43.0	3.81	43.4	3.71
May.....	61.1	4.95	60.8	4.66	December...	33.6	3.98	34.0	3.63
June.....	70.5	3.26	70.0	3.47	Year...	51.9	50.73	52.1	50.08
July.....	74.4	5.26	74.3	4.80					

In the following table are given the dates of the first and last killing frosts in the fall and spring and also the average dates for the period between 1898 and 1904:

*Dates of first and last killing frosts.*

Year.	Coatesville.		Kennett Square.	
	Last in spring.	First in fall.	Last in spring.	First in fall.
1898.....	Apr. 9	Oct. 27	Apr. 28	Oct. 28
1899.....	Apr. 17	Oct. 2	Apr. 11	Oct. 2
1900.....	May 11	Oct. 20	Apr. 15	Oct. 20
1901.....	Apr. 12	Sept. 26	.....	Oct. 19
1902.....	Apr. 10	Oct. 22	May 29	Oct. 22
1903.....	May 2	Oct. 29	May 2	Oct. 27
1904.....	Apr. 4	Sept. 22	Apr. 4	Oct. 8
Average.....	Apr. 18	Oct. 13	Apr. 25	Oct. 18

#### PHYSIOGRAPHY AND GEOLOGY.

Chester County is a part of the large physiographic province known as the Piedmont Plateau, with the exception of about 1 mile of the extreme southeast point, which belongs to the Atlantic Coastal Plain.

Geologically the county is composed of metamorphic, sedimentary, and igneous intrusive rocks of Archean, Paleozoic, and Mesozoic ages.

Physiographically the county is best characterized as diversified uplands, to distinguish it from the undiversified lowlands found to the eastward along the Atlantic coast. These uplands are covered by a thick mantle of soil and, as a whole, are nearly free from stones, but along steep-sided stream courses and on the tops and upper slopes of the highest hills areas of a stony loam and of Rough stony land are found associated with six of the seven soil series represented in the county.

The most conspicuous topographic feature of the area is a straight valley (Chester Valley) which extends northeast and southwest across the middle of the county, with a width varying from less than 1 mile at the Lancaster County line to a width of about 2 miles at the Schuylkill River. This valley is occupied by heavily bedded Paleozoic crystalline limestone, which has determined the form of the valley. Hills, usually abrupt and ranging from 100 to 200 feet in elevation, fringe both sides of the valley throughout its length, and from the tops of these hills the country extends as diversified uplands. The floor of the valley itself is not level, but varies from nearly level to moderately rolling and in minor places hilly. The valley does not serve as a principal avenue of drainage for any stream. The drainage of the area is to the southeast, and Chester Valley is cut at right angles by such other steep-sided narrow valleys as those in which flow East and West Brandywine and Octoraro creeks. These larger streams have formed courses which are independent of the structure and character of the rock floor, but the smaller tributary streams are more or less adjusted to the underlying rock formations. From the bottoms of the larger streams to the tops of the hills the difference in elevation varies from 100 to 250 feet, while from the bottoms of the smaller tributary streams to the tops of the near-by hills the difference in elevation varies from almost nothing to about 100 feet.

The altitude of the lowest point in the area, which lies within the narrow southern extension of the county between Maryland and Delaware, is 100 feet, and the highest point is 940 feet, thus including a range in altitude of 840 feet. If the comparatively slight depressions made by all of the present streams were filled in, a nearly level plain sloping gradually seaward would result.

The diversification of the uplands, however, caused by the carving of very irregular channels by stream courses and the subsequent wearing-down agencies of weathering and erosion, has given to the country both north and south of the Chester Valley a most varied and picturesque landscape. In the southeastern part of the county, and best developed around and northeast of Westchester, is a broad, gentle to moderately rolling area, of which the contours are seldom sharp; the elevations are low and well rounded, and the topography may be characterized as smoothly rolling. This area, though not as well defined as the limestone valley, is, in a general way, parallel to it, and toward its northern part ascends at first gradually and then more steeply to the top of the ridge, which then slopes abruptly to the limestone valley. Southwest from this area, beginning with the east bluff of the Brandywine and extending through Kennett Square and Strickersville to the Maryland line, and thence north to the Chester Valley, the land surface is not so smooth in contour, for the elevations are often steep sided and the stream courses more deeply cut, thus

giving more pronounced topographic features. Gently rolling areas of variable size grade into moderately rolling surroundings, which in turn give way to the steep slopes and broken areas along the major stream courses.

Descending slightly from the ridge of Potsdam sandstone and quartzite which borders the Chester Valley on the north is a broad area of uplands similar in topography to those south of the valley, and, with the exception of the slates, derived from the same character of crystalline and semicrystalline rocks, gneiss, schists, and trap. Along a line north from Caln Township to French Creek the topography is so broken, irregular, and steep that the accumulation of soil has been insufficient to cover the derivative rocks, and large areas of stony loams occur. The topography is also much broken along the northern border of this formation where it descends in the northeast part of the county to the general level of the Mesozoic sandstone and shale which in a belt from 2 to 6 miles wide extends to the Schuylkill River. This sandstone formation slopes gradually back from the river in some places and again forms precipitous bluffs, but in general its surface is gently or moderately rolling and marked here and there by a prominent rounded hill or ridge. With increased distance from the river the formation becomes more steeply rolling and makes, as a whole, a steady ascent until it meets the metamorphic rock formations to the southward. The only rough areas associated with the Mesozoic sandstone lie near its western terminus north of the falls of French Creek.

The several geological formations have been and are still in numerous instances of economic importance to the farmers. Large quantities of lime were formerly burned and applied to the land. This has been discontinued for the most part, but refined lime products are still produced on an extensive scale at one plant. Quarries yielding a good grade of marble are also located along the border of the limestone valley. From the serpentine formations green building stone has been extensively quarried and used in the construction of excellent dwellings in some localities, while the Mesozoic sandstone formation along the Schuylkill River furnishes large quantities of red stone for building or masonry purposes.

SOILS.

In Chester County twenty-two soil types were recognized, which are shown by different colors on the soil map accompanying this report. The actual and relative extent of each type is given in the following table:

Soil.	Acres.	Percent.	Soil.	Acres.	Per cent.
Chester loam.....	202,368	41.6	Lansdale silt loam.....	5,248	1.1
Manor loam.....	75,840	15.6	Conowingo clay.....	4,160	.9
Manor stony loam.....	33,408	6.8	Penn stony loam.....	3,520	.7
Penn loam.....	28,672	5.9	Conowingo barrens.....	2,944	.6
Brandywine loam.....	24,000	4.9	Chester fine sandy loam.....	1,472	.3
Chester stony loam.....	20,864	4.3	Dekalb shale loam.....	1,408	.3
Meadow.....	20,480	4.2	Cecil clay.....	1,088	.2
Hagerstown loam.....	19,456	4.0	Lickdale clay loam.....	832	.1
Dekalb stony loam.....	14,528	3.0	Portsmouth silt loam.....	512	.1
Dekalb loam.....	11,456	2.4	Norfolk silt loam.....	6	.0
Rough stony land.....	8,320	1.7			
Dekalb fine sandy loam.....	5,632	1.2	Total.....	486,214	.....

CHESTER LOAM.

The surface soil of the Chester loam to an average depth of 10 inches consists of mellow, medium brown loam, containing enough medium and occasionally coarse sand to make it feel somewhat coarse in texture. The subsoil to a depth of 36 inches most often consists of brownish-yellow gritty loam, which in the northern part of the county is frequently replaced at an average depth of 24 inches by a gritty light clay loam, and in an area northwest of Parkesburg by a red clay, while in the southwestern part of the area it grades in places into a clayey loam, thus approaching in texture the subsoil of the Brandywine loam, which is most extensively developed in that section.

In the central part of the county, extending in a general northeast-southwest direction, occurs a large area of an important phase of the Chester loam. The surface soil consists of mellow brown silty loam or silt loam from 10 to 16 inches deep. The texture of this material is exceptionally smooth, there seldom being any noticeable content of particles as coarse as medium sand, and yet the related amount of clay is not high enough to give the soil the character of a clay loam. So smooth and plastic is this subsoil that it feels like butter, and the cut of the auger leaves the soil as even and perfect as if done with a sharp knife. This character of material usually extends to a depth of many feet. The silt content, while often insufficient to constitute a true silt loam, is a dominant characteristic of both soil and subsoil. In yields of corn, grass, and spring rye this phase exceeds the typical Chester loam by 20 to 33 per cent.

Where the metamorphic rock formation narrows to a width of about 2 miles between Phoenixville and the Chester Valley the Chester loam includes a phase which well illustrates the manner of its formation. This section is hilly, and the slopes are sufficiently pronounced to be somewhat seriously affected by washing, and the soil has thus not accumulated to as great depth as with the true type and represents a less advanced stage of soil formation. Both soil and subsoil contain large amounts of grit, consisting of angular fine fragments of metamorphic rocks, principally gneiss. These fragments range in size similar to fine and coarse gravel, but are rarely ever sufficiently rounded to be classed as gravel. Such material in a more advanced stage of disintegration is the source of the fine gritty particles occurring in parts of the Chester loam subsoil and occasionally in the surface soil, and remain in sharp contrast to the smooth-textured phase of this type in the central part of the county above mentioned.

Aside from the important area in the central part of the county already described, the Chester loam occurs extensively both north and south of the Chester Valley. From Westchester southeast to Parkersville, Unionville, Kennett Square, and Westgrove, and thence to the Delaware line, it is the most important type, and it is also well developed in West Marlboro and Easttown townships. To the north of the Chester Valley the Chester loam is the principal soil type. It extends north to French Creek and the Welsh Mountain, or nearly to the boundary line between Chester and Berks counties, east to a line through Hallman and West Pikeland, and west to the Chester-Lancaster county line. The continuity of this extensive soil type is broken in certain sections of the county by frequent small areas of Cecil stony loam.

The topographic features of the Chester loam include a wide range. In the central part of the county the type comprises rolling valley land which often includes well-rounded broad hills with gentle slopes. These may be from 100 feet to 150 feet above the general level of the valley, but are not sharp in slope. In the large area southwest from Westchester and in the vicinity of Honeybrook, and extending east as far as Glenmore and north to Warwick, the surface is moderately rolling. An irregular area, including Wallace, Milford Mills, Lionville, Eagle, and West Marlboro Township and local areas south from Westgrove, may be classed as steeply rolling, while the area embracing Chester Springs, Nantmeal village, East Nantmeal village, and St. Peters is hilly. In this rough section there are numerous areas of Cecil stony loam, and the Chester loam itself is sometimes found to have stones and bowlders upon the surface, though not in sufficient amounts to interfere materially with cultivation or to warrant mapping it as stony loam.

Good surface drainage obtains on the Chester loam except in low positions, where it is sometimes so defective as to require artificial drains if the soil is to be cultivated to advantage. In many instances these have been supplied, but in others such areas are used as pasture. These low-lying areas are never too wet to afford excellent pasturage, but, on the other hand, most of them could be drained sufficiently at small expense to convert them into very profitable fields for corn and grass. The texture of the soil and subsoil, moreover, is such as to maintain a favorable supply of moisture, and crops seldom suffer from drought. Such conditions of drainage render this soil exceptionally safe from the effects of untoward seasons, and if efficiently farmed at least a moderate crop is assured every season.

The Chester loam is derived principally from gneisses, but also to some extent from mica schists in which the amount of mica present is much less and more finely divided than in the mica schist from which comes the Manor series and the Brandywine loam.

Chester loam is well adapted to general farming, and corn, oats, wheat, and grass are successfully grown. For the cereal grains it is the best type in the area derived from metamorphic rocks. On the steep hillsides, where there is a large amount of gritty material in the subsoil, and in the areas where the type approaches the Brandywine loam the yields are somewhat lower than where the topography is not so broken.

The average crop yields for Chester loam are, shelled corn, 65 bushels; oats, 40 bushels; wheat, 23 bushels; potatoes, 140 bushels, and hay 1½ tons per acre.

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

*Mechanical analyses of Chester loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13683, 13685, 14317, 14325, 14327.	Soil.....	3.3	7.5	3.3	8.9	9.3	48.2	19.3
13684, 13686, 14318, 14326, 14328.	Subsoil.....	2.8	6.7	3.1	7.7	6.8	49.3	23.3

**BRANDYWINE LOAM.**

The surface soil of the Brandywine loam consists of brown loam from 8 to 10 inches deep, in which the relatively high content of fine sand, the presence of a little finely divided mica, and more or less sharp, gritty material, consisting of the small unweathered fragments of the derivative rock, are sufficient to give the effect of a light loam, or in some cases of a heavy fine sandy loam. The subsoil to a depth of 36 inches consists of light-brown to yellowish light loam to heavy

fine sandy loam, usually somewhat greasy from finely divided mica. In some sections the mica particles increase in quantity with the depth and become a pronounced feature below 24 inches. The size of these particles also commonly increases with depth until the lower subsoil becomes "flaky," and at a depth of about 36 inches the soil mass consists principally of small mica flakes and small rock fragments. The subsoil sometimes contains a considerable quantity of the small unweathered rock fragments, which give it the texture of a micaceous sandy loam. This phase is most common in the vicinity of Marshallton. A characteristic feature of this type is that the subsoil is always lighter in texture than the soil.

The Brandywine loam is located in the southern, southwestern, and central parts of the county. The largest areas are found in the vicinity of Marshallton, Oxford, and near Lewisville, along the Pennsylvania-Maryland line.

The topographic features of the Brandywine loam are irregularly rolling and hilly. The slopes are steep to moderate, and practically none of the type occupies a gently rolling position. The valley walls of the creek bottoms in the southern part of the county consist largely of this type and are quite steep and in many cases somewhat serrated.

The Brandywine loam has excellent drainage—in fact, it is much too well drained; for the topographic features admit a rapid flow of the surface water, while the loose texture of the subsoil allows a rapid downward flow of soil water. For this reason fertilizers are not retained for a long period, but are soon dissipated by the rapidly flowing surface water or washed down through the porous subsoil by the soil water.

Some areas of the type are so steep that the soil is eroded quite badly and cultivation is very unprofitable. Such areas are most commonly kept in pasture or forest growth.

The Brandywine loam is residual in origin, being formed in situ by the weathering of the underlying mica gneiss, pegmatite, or sometimes mica schist. Where the soil is derived from a mica gneiss the texture is inclined to be gritty on account of the unweathered small, irregular fragments in the soil and subsoil. The rocks from which the soil is derived weather quite rapidly, as is evidenced by the numerous small creek valleys throughout the type.

The natural forest growth of the Brandywine loam consists of chestnut, hickory, and some oak. The type is generally cultivated, although some of the steeper slopes are left as pasture or woodland.

The soil is adapted to no special crops, but is used for general farming, for which purpose it is only moderately productive. It responds readily to fertilizers or to barnyard manure, but their effect is not very lasting, as the soil is porous and so does not hold fertilizers well. Frequent applications of small amounts of commercial fertilizers or

stable manure would prove more beneficial and economical than large applications less frequently. The type is locally termed a "quick" or "hungry" land, and owing to its thin character and somewhat steep topographic feature has to be cultivated very carefully to obtain the best results.

The type is used as pasture to some extent and is fairly good for this purpose. Under average conditions corn yields 40 bushels, oats 30 bushels, wheat 17 bushels, hay 1 ton, and potatoes 110 bushels per acre.

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

*Mechanical analyses of Brandywine loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14309,14311.....	Soil.....	2.5	5.7	3.1	12.0	13.1	42.7	20.8
14310,14312.....	Subsoil.....	2.9	8.5	4.1	19.9	13.3	33.1	18.1

CHESTER STONY LOAM.

The surface soil of the Chester stony loam, to an average depth of 10 inches, consists of medium or heavy brown loam, underlain by a red or yellowish-red clay loam which usually grades into stiff, red clay at depths ranging from 24 to 36 inches. Stones and bowlders are scattered over the surface and mixed with both soil and subsoil in quantities varying from 30 to 60 per cent, while in size the variation is from 2 inches to 4 feet in diameter. When the large bowlders are present upon the surface the small stones are often wanting, and the converse is also true. In local areas the soil contains a small amount of coarse material, while the subsoil is so completely filled with small stones and fragments of disintegrated rock that it is impossible to bore more than 8 or 10 inches. In texture the fine earth of the Chester stony loam very closely resembles the Chester loam.

The Chester stony loam occurs as small irregular areas, closely associated with the Chester loam. These small areas lie chiefly to the north of the Chester Valley, between French Creek and the east branch of the Brandywine River, though a few other areas are found in various parts of Chester County.

The areas of Chester stony loam at Rockville and to the southeast of Barneston are moderately rolling in topography, while the remainder of the type is rolling to hilly. Its usual occurrence is along the steep slopes and on the tops of hills and ridges, though it is sometimes found in narrow strips along stream courses.

On account of the irregularity of surface the superficial drainage of this type is good, and its texture is such as to conserve a favorable water supply.

The Chester stony loam is derived from the weathering of metamorphic rocks, principally gneiss, but some schist and trap. A few areas are derived from granite.

Where the slopes are not too steep and the surface is cleared of stone, good crops are produced upon this type, but much of it is used as permanent pasture, and to this purpose all the more stony and rough areas are best adapted. The average yields of the Chester stony loam are as follows: Corn, 50 bushels; oats, 35 bushels; wheat, 20 bushels; potatoes, 120 bushels, and hay, 1½ tons per acre.

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

*Mechanical analyses of Chester stony loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14313,14315.....	Soil.....	3.5	7.3	2.8	5.7	5.3	52.0	23.1
14314,14316.....	Subsoil.....	4.3	5.9	2.3	5.5	5.5	45.1	30.9

CHESTER FINE SANDY LOAM.

The surface soil of the Chester fine sandy loam consists of brown, heavy, fine sandy loam 8 to 12 inches deep. On steep slopes, where the type is somewhat deficient in organic matter, the color is brownish yellow or even yellow and the texture in spots approaches a medium sandy loam. The subsoil, to a depth of 36 inches, consists of yellow fine sandy loam to fine sand, with a trace of medium and coarse sand and occasional small stones, and is generally underlain at greater depths by yellow fine sand.

The Chester fine sandy loam occurs only in small detached areas lying southwest from Westchester toward Westgrove and Kennett Square. The largest area of the type is located northwest of Marshallton, where it occurs as a long and narrow ridge, a characteristic example of its topographic features, which include also small, steep-sided hills and irregular slopes.

The Chester fine sandy loam is very susceptible to droughty conditions because of its open texture combined with its steep topographic position.

The type is derived primarily from a very fine-grained sandstone, which is often associated with scattering occurrences of limestone so deeply covered that it has no material influence on soil formation.

The type is one of the poorest in the county for general crops, but where its topographic position is suitable moderately early garden crops and potatoes could be grown with profit, and light farming could be advantageously followed.

At present the best parts of the type are used most often for growing rye and potatoes or for general farming and the remainder is left in forest.

The following table shows the results of mechanical analyses of typical samples of the soil and subsoil of this type:

*Mechanical analyses of Chester fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13687.....	Soil.....	2.1	10.4	6.9	23.3	19.7	26.8	10.8
13688.....	Subsoil.....	2.9	9.1	7.5	29.0	19.7	22.8	8.6

CECIL CLAY.

The surface soil of the Cecil clay, to an average depth of 9 inches, ranges from a brownish-red silt loam to a red silty clay loam, and in spots possesses the characteristic of pushing instead of turning well before the plow. The subsoil is more red than the soil, and the clay content increases with depth until at about 30 inches it becomes quite stiff and tenacious. At depths ranging from 4 to 10 feet the type passes into decomposing fragments of the rock from which it is derived.

Scattered upon the surface and disseminated through both soil and subsoil are fragments of gabbro, diorite, and some quartz. Originally there were scattered upon the surface a considerable number of large, dark-colored boulders with rusty exteriors. Many of these rocks have been gathered and utilized as fences.

The type is relatively unimportant in the county because of its small area. It is limited to spots and strips along the Mason-Dixon line.

In topographic features it is usually an elevated rolling country and consists largely of irregular hills having a northeast-southwest trend. There are places, however, where it occurs as gently rolling areas.

Owing to its usual topography it is naturally a well-drained type, and there are few instances within the area where artificial drainage would be beneficial. The soil and subsoil absorb moisture well, and in dry times the type does not suffer from drought.

It is a residual soil derived from the decomposition of gabbro and diorite, and in places the latter rocks are associated with peridotite. Whenever such is the case, however, it is along the boundary line between Cecil clay and the Conowingo types.

The type is very well adapted to all of the general farm crops of the area, and, owing to the texture of the soil and character of the subsoil, it is naturally a productive type and responds readily to careful treatment. The effects of fertilizers are noticeable for a number of years.

Corn, wheat, oats, potatoes, hay, and apples are the crops grown, with the following average yields per acre: Corn, 70 bushels; wheat, 25 bushels; oats, 60 bushels; potatoes, 150 bushels, and hay, 1½ tons. Apples do fairly well, but no peaches are grown. The application of lime on this type seems to be beneficial to all crops and especially so for clover.

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

*Mechanical analyses of Cecil clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14323.....	Soil.....	0.9	2.8	1.3	3.5	6.5	60.2	24.8
14324.....	Subsoil.....	2.5	3.5	1.7	4.3	5.7	43.4	38.9

CONOWINGO BARRENS.

The surface soil of the Conowingo barrens, where it has accumulated to a sufficient depth for classification, consists of drab or rarely yellowish-brown silt loam, silty loam, or loam to an average depth of 12 inches. This material is extremely silty to the feel, and, although nearly devoid of coherence, yet is very firm and compact. These same textural characteristics are almost as prevalent in the subsoil, which has, however, a clay content somewhat greater than that of the surface soil and is consequently of heavier texture and slightly plastic, though still inclined toward incoherency. In its lower depths the subsoil changes in color to a brown.

The Conowingo barrens are principally developed in the southern part of the area, along the Mason-Dixon line. In the northeastern part of the county they occur as a series of small detached areas beginning about a mile south of Paoli and extending southwest for a few miles.

The topographic features of the type are rather uniform and consist of very narrow and low, steep-sided ridges, which in a few instances broaden so as to form small, flat-topped ridges. So narrow are some of these elevations that they could not be shown on the map, but their significance is such that where possible their positions have been indicated, even at some risk of exaggeration. In the south part of the area the barrens occur in larger areas as a succession of ridges and hills and small intervening hollows.

The Conowingo barrens are always ill drained on account of the position of the derivative rock. Serpentine underlies this entire formation and usually comes near enough to the surface to render the soil unproductive. In many places the soil is too thin to afford root space or sufficient moisture for growing crops, whereas in small depres-

sions, or flat areas on the ridge tops, where the soil has accumulated to a depth of from 1 to several feet, the position of the underlying derivative rock renders drainage so defective that moisture is retained long enough to injure greatly or even to destroy any crop, and consequently no attempt is made to farm it.

This type of soil is residual and is derived from serpentine, which is an alteration product from the igneous intrusive peridotite. In the areas near the Mason-Dixon line this serpentine is closely associated with gabbro, which weathers into Cecil clay. The serpentine rock is soft, but owing to its chemical stability it weathers extremely slow.

In numerous places the greenish serpentine rock outcrops, and the entire formation is dotted with quarries from which much choice building stone has been taken and extensively used for the construction of dwellings within the county.

Owing to the thinness of the soil and its small water-holding capacity the type is almost sterile. There are no farms upon the type, and the region is wild and desolate and in marked contrast with the surrounding county. Where the rock comes to the surface there is no vegetation, and where it comes within a couple of inches of the surface there is usually no vegetation except a vine which gives to the hills a characteristic pink appearance. Where the soil has accumulated to a greater depth there is a scanty growth of scrubby white oak, red oak, and black-jack oak, stunted cedars, and dwarfed white pine.

The Conowingo barrens have no agricultural value, being very unsatisfactory even for pasture. In the southern part of the area the barren lands are owned largely by one mining company. Chrome and corundum are the principal paying mineral products, and in places where pegmatite veins occur with it the latter are often profitably worked for feldspar.

In the following table are given the results of a mechanical analysis of a sample of the fine earth of soil and subsoil taken from a flat upland topographic position, where without washing the soil had accumulated as fast as formed until it had acquired a depth of more than 3 feet.

*Mechanical analyses of Conowingo barrens.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13701.....	Soil.....	0.3	1.6	1.0	1.5	2.7	75.7	17.1
13702.....	Subsoil....	.2	1.3	.5	1.5	2.2	69.5	24.5

CONOWINGO CLAY.

The surface soil of the Conowingo clay consists of drab or brownish-gray silty clay loam or heavy silt loam from 9 to 12 inches deep. The subsoil consists of pale yellow silty clay loam, silty clay, or heavy silt

loam and rests upon the underlying rock at depths ranging from 2½ feet to 15 feet. In the lower depths close to the underlying rock the subsoil has a greenish, gummy appearance. In a few localities both soil and subsoil are reddish and resemble Cecil clay; but such instances are where the serpentine has been largely decomposed into soil, leaving behind fragments of siliceous iron rocks, and the oxidation of these iron silicates imparts to the material a reddish color. If sufficient areas of this phase had been encountered, it would have been mapped as a separate soil type, because of its higher agricultural value.

The largest areas of Conowingo clay are located near the boundary line with Cecil County, Md. In the northeastern part of the county the type is found about a mile south of Malvern, where as a belt a little less than a mile wide it extends in a northeast-southwest direction for a distance of nearly 4 miles.

The topographic features of the type include very low, flat-topped hills and the shallow depressions between them. At irregular intervals rise the narrow ridges of the Conowingo barrens, which give to the type a more broken aspect than it ever presents within itself. The boundaries of such ridges are often sharply drawn and the Conowingo clay lies directly at the bases; but where the ridges broaden, as they commonly do after extending for some distance in abrupt outline, the Conowingo clay spreads over them.

The Conowingo clay is never well drained, and for most of the type drainage is very deficient. This is due not only to the closeness in texture of the type, but also to the position of the underlying serpentine, which in many places may be found at depths ranging from 2½ to 6 feet beneath the surface.

The type is residual, being derived from the same character of serpentine rock as the Conowingo barrens, and differs from the latter type mainly in topographic features and in the depth of its soil. Upon the gently rolling uplands and the gentle lower slopes adjacent to streams the rate of weathering is greater than that of erosion; hence the soil has a chance to accumulate.

Only selected fields of Conowingo clay are used for tilled crops, while more of it serves as pasture. The type is generally considered very poor for tillage purposes and most of it is very sour, owing largely to defective drainage. So pronounced is the acid condition that a single application of lime has, in some instances, effected a good crop yield, while on a part of the same field not limed the crop has been practically a failure. There is very little standing timber and many of the fields seem to have been abandoned and allowed to become covered with sage grass.

If adequately drained, limed, and manured the Conowingo clay would produce moderate yields of the staple farm crops and should yield excellent crops of timothy or pasturage. There are a few cases

where the type has been built up by such treatment and all of the general farm crops of the region are grown with the following average yields per acre: Corn, 40 bushels; wheat, 15 bushels; oats, 35 bushels; and potatoes, 80 bushels. Timothy does fairly well, but clover does not make a satisfactory stand.

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

*Mechanical analyses of Conowingo clay.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13699,14333.....	Soil.....	0.5	2.6	1.4	3.4	4.6	61.6	25.7
13700,14334.....	Subsoil.....	1.3	4.2	2.3	5.2	4.9	56.3	25.8

PORTSMOUTH SILT LOAM.

The surface soil of the Portsmouth silt loam consists of yellow silt loam from 8 to 12 inches deep. The subsoil to a depth of 36 inches consists of a mottled yellow and gray heavy silt loam or silty clay loam. Both soil and subsoil have a tendency to pack somewhat hard, and this gives the type the superficial field appearance of a clay.

There are only two small areas of the Portsmouth silt loam in Chester County, and these are located in the same southern extension of the county as the Norfolk silt loam.

The topographic features of the Portsmouth silt loam are nearly level or gently rolling, the mean elevation above sea level being less than 200 feet.

The drainage features of this type in Chester County are fairly well established, although near-by, low-lying areas in Cecil County, Md., need artificial drainage to obtain good results on account of the packed condition of the soil.

The Portsmouth silt loam is located in the Coastal Plain region and owes its origin to the poorly drained condition of certain loamy parts of the Columbia formation.

In its natural state this soil is covered with a growth of oak. The principal crops grown and to which this type of soil is best adapted are wheat, oats, grass, and pasturage. Wheat yields on the average 17 bushels, oats 30 bushels, and hay 1½ tons per acre. Corn does not do so well and yields about 30 bushels per acre. These yields apply to the well-drained soil.

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

*Mechanical analyses of Portsmouth silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14345.....	Soil.....	0.1	1.0	0.5	1.1	4.6	72.4	19.6
14346.....	Subsoil.....	Trace.	.3	.2	.5	4.8	72.2	22.0

NORFOLK SILT LOAM.

The surface soil of the Norfolk silt loam consists of brown heavy silt loam from 12 to 14 inches deep. The subsoil, to a depth of 36 inches, consists of a yellow silty clay loam.

The Norfolk silt loam in Chester County comprises only a few acres in the very extremity of the wedge-shaped portion of the county which lies between Cecil County, Md., and Newcastle County, Del., coming to a point a few miles south of where it enters the Coastal Plain.

In topographic features the Norfolk silt loam is very nearly level in Chester County, and the adjoining area in Delaware extends for miles eastward, with level or but slightly rolling surface features; and similar large areas are found near by in the Coastal Plain region of Maryland, Delaware, and New Jersey.

Surface drainage is fairly well established on the type, and the subsoil is not so impervious as to render the downward flow of soil water too slow nor so open as to allow excessive drainage.

The Norfolk silt loam is derived from the weathering of beds of material which constitute portions of the Columbia formation.

The Norfolk silt loam is adapted to a wide range of crops. It is utilized for general farming and is also suited for truck and small fruit growing. Corn yields an average of 50 bushels, wheat 20 bushels, oats 30 bushels, and hay 1½ tons per acre. Much higher yields are secured in unusually good seasons, and the type can be made highly productive.

The following table shows the results of mechanical analyses of typical samples of the soil and subsoil of this type:

*Mechanical analyses of Norfolk silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14360.....	Soil.....	0.3	0.9	0.6	1.5	7.4	73.5	15.6
14361.....	Subsoil.....	Trace.	.4	.2	.6	6.7	67.7	24.1

## MANOR LOAM.

The surface soil of the Manor loam consists of medium to heavy brown silty loam from 8 to 10 inches deep. In wooded areas which have not been cultivated for a long time the soil is yellow or yellowish-brown, and in this respect is in contradistinction to most soils, which become lighter colored under continued cultivation as a result of the depletion of organic matter. The surface soil not infrequently contains from 5 to 10 per cent of mica schist fragments from one-fourth inch to 3 inches in diameter, and occasional areas contain as much as 25 per cent of this material. Such areas, however, are most common in the northern part of the county. The subsoil, to a depth of 36 inches, consists of yellow or reddish-yellow heavy loam to friable silty clay loam or yellow clay loam, the former sometimes grading into the latter at a depth of about 18 inches; and again, the clay loam may immediately underlie the surface soil. The color of the subsoil grades from yellow to yellowish-red, the approach toward the red often being accompanied by an increase in heaviness of texture. The proportion of mica schist present in the subsoil is variable, fragments being in turn entirely absent, fewer, or more numerous than in the surface soil. Both soil and subsoil have usually a smooth feel, but local areas are somewhat gritty, a feature more pronounced in the subsoil than in the surface.

In the southwest part of the area the subsoil at an average depth of 24 inches usually becomes micaceous, the mica content gradually increasing until at a depth of 36 inches the soil mass consists largely of small mica particles, which render it feathery and fluffy, giving it also a greasy feel when rubbed between the fingers.

The Manor loam lies principally in one large body, extending in a northeast-southwest direction entirely across the county. The width of this area, which is about 14 miles near the Lancaster County line, gradually decreases until it is only 1 mile at the Montgomery County boundary.

The topographic features of the Manor loam range from gently to moderately rolling, with occasionally hilly areas. Sometimes the type occupies the lower and more gentle slopes of ridges and less frequently of hills, whose upper slopes and summits are occupied by the Manor stony loam.

Good surface drainage is secured by the sloping surface features of most of the type. In the northeastern part of the county, where the type is most steeply rolling, this ready surface drainage often causes destructive washing, but the greater part of this is due largely to the neglect which accompanies the field management of considerable areas of this type, and could be prevented, and in many cases easily remedied where it has already taken place, by careful tillage. The

texture of both soil and subsoil is such as to maintain a good supply of moisture for crops.

The Manor loam is derived from hydromica schists, of which there are three colors, and the presence of schist fragments causes the type to be called, according to the color of the schist, "dark-slate land," "red-slate land," or "white-slate land." The productiveness of the three kinds follows the order named, but with the "white-slate land" this is due in part at least to texture, for the surface soil is lighter and the subsoil more micaceous in places.

In the southwestern part of the county, where extensively developed, the Manor loam is well adapted to general farm crops, but in the northeastern part, where adjacent to the Manor stony loam, it is only moderately productive. The natural forest growth, where still standing, consists mostly of chestnut and chestnut oak, with which are interspersed red, white, and black oaks and scattering trees of other kinds; but in the southwest part of the county little forest growth remains. The type is best adapted to the staple farm crops of the area, but is of considerably less value than the Chester loam.

Where best developed, in the western part of the county, corn yields 60 bushels, oats 40 bushels, wheat 22 bushels, potatoes 125 bushels, and hay 1½ tons per acre. The yields in the northeastern part of the county are not quite as high.

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

*Mechanical analyses of Manor loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13691, 14349, 14351.	Soil.....	1.9	3.5	1.3	5.2	11.1	55.3	21.4
13692, 14350, 14352.	Subsoil.....	3.0	4.7	1.7	5.9	9.7	50.2	24.6

MANOR STONY LOAM.

The surface soil of the Manor stony loam, to an average depth of 7 inches, consists of heavy loam, yellow or reddish-brown in color. On the surface and mingled with the soil are from 30 to 60 per cent of mica schist fragments. Most of the fragments are small and thin, and because of their thin schistose cleavage are called "slate," but larger pieces from 6 to 10 inches in diameter and from 1 to 2 inches thick are strewn over some areas. The subsoil consists of heavy loam or clay loam, yellow or reddish-yellow in color, these colors often alternating in layers a few inches thick. The amount of schist fragments in the subsoil is usually less, but sometimes more than in the surface soil, and it is seldom possible to bore more than from 6 to 10 inches. The type differs from the Manor loam principally in the amount of stones present and in its steeper topographic position.

The Manor stony loam is associated with the Manor loam in the large area adjoining Chester Valley on the south and extending across the county.

The topographic features of the type include upper slopes and the crests of steep ridges and hills and sharp descents to stream courses within the general areas of Manor loam. Such topography causes very rapid surface drainage and the soil where under cultivation is often injured seriously by washing.

The Manor stony loam is derived from dark-gray, reddish-yellow, or nearly white mica schists, which are for the most part well broken up, rocks of this material seldom being found, except as revealed in excavations.

The Manor stony loam is not a very productive soil. The least stony parts produce fair to light yields of the staple crops, but much of the type is not farmed and is covered with second-growth chestnut, several kinds of oak, and scattering trees of other varieties. Corn brings an average yield of 40 bushels, oats 25 bushels, wheat 15 bushels, potatoes 75 bushels, and hay 1 ton per acre.

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

*Mechanical analyses of Manor stony loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14356,14358.....	Soil.....	2.9	5.3	2.1	7.5	11.7	44.9	25.2
14357,14359.....	Subsoil.....	6.3	9.6	2.8	8.8	15.3	36.3	20.2

HAGERSTOWN LOAM.

The surface soil of the Hagerstown loam consists of dark-brown, heavy, smooth silt loam or silty clay loam, in which the silt content is so high as to give the feel of a heavy fine loam, and the character of this material in actual field working is that of a loam, even though the clay content may be as high as 30 per cent. In local areas from 5 to 20 per cent of chert and small angular fragments occur, and in such places there may be sufficient grit present to give the soil the nature of a heavy brown loam rather than a silty loam, but it is probable that even in such cases the silt content is relatively high, though its presence is largely obscured by coarser material. At a depth of 10 inches the surface soil is underlain by a lighter brown, heavy silt loam, or silty clay loam, which is very smooth and free from grit. Such material is underlain at an average depth of 20 inches by a heavy, silty clay loam, yellow, fawn colored, light brown, or in places brownish red in color, and this at a depth of 30 inches sometimes grades into silty clay.

A frequent, though by no means universal, feature of the Hagers-

town loam of the Chester Valley may be seen on some of the highest knobs and little hills, where the soil consists of a heavy, medium, or light loam, which in antithesis to the true type grows lighter with increasing depth, and at about 24 inches gives way to a light brick-colored, sticky, sandy loam of a mealy texture. In similar physiographic position are small areas of Hagerstown fine sandy loam, but their extent does not allow of their indication on the map. The two variations just mentioned are slightly less productive than the true type.

A phase of this type exists in the western end of the Chester Valley, extending from Pomeroy to the Lancaster County line, a distance of several miles, the width ranging from one-fourth to one-half mile. This material consists of a brown loam from 8 to 12 inches deep, underlain by a red or yellow heavy loam, or clay loam, which usually contains a considerable amount of mica, the mica content, however, not usually becoming pronounced at a depth of less than 24 inches. Notwithstanding its departure in texture from the typical Hagerstown loam, this phase is called limestone land and is valued as highly as the typical soil.

The location of the Hagerstown loam practically coincides with the physiographic division known locally as the Chester Valley, which enters the county on the southwest from Lancaster County and extends northwest in a belt from one-fourth mile to 2½ miles wide entirely across Chester and passes into Montgomery County.

The topographic features of the Hagerstown loam are those of moderately rolling valley land. The Chester Valley is bounded on each side by steep ridges of metamorphic rock formations, which in places broaden and so leave the valley walls less abrupt. The surface of the valley itself is varied and uneven. Broad, well-rounded hills and flat-topped ridges of gentle contour rising from 25 to 100 feet above the general level of the valley floor are a prevalent feature. The slopes of these elevations are rarely so steep as to be a serious hindrance in cultivation, but in a few minor instances some damage has resulted from washing.

Adequate surface drainage obtains on this type, owing to the varied topographic features. The texture of the soil is such, also, as to maintain a most favorable supply of moisture for growing crops. Stream bottoms are for the most part too well drained to be classed as Meadow, and are used for tilled crops or permanent pasture, as the position may warrant.

The Hagerstown loam is derived from limestone of varying degrees of purity. The greater part of the type is free from chert and other impurities, but such material, especially near the sides of the valley, indicates the more impure character of the lime rock in those positions. The phase at the west end of the valley is derived from a

micaceous schistose limestone which is interbedded with or veined in the purer limestone.

The Hagerstown loam is exceptionally well adapted to the production of general farm crops, producing excellent yields with a low or moderate application of fertilizers. Formerly large quantities of tobacco were grown, but this is no longer considered profitable.

The average crop yields of the type are estimated as follows: Corn, 75 bushels; oats, 40 bushels; wheat, 28 bushels; potatoes, 150 bushels, and hay, 2 tons per acre.

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

*Mechanical analyses of Hagerstown loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13689,14347.....	Soil.....	0.4	1.5	0.6	3.3	7.4	69.4	17.2
13690,14348.....	Subsoil.....	.5	1.2	.8	3.1	6.4	69.3	18.5

DEKALB STONY LOAM.

The surface soil of the Dekalb stony loam, to a depth of 8 to 12 inches, consists of a gray or drab medium to fine sandy loam or light loam. This grades into a subsoil of the same texture and color or into a light, yellow sandy clay or clay loam. Both soil and subsoil contain a large quantity of fragments of sandstone and conglomerate, and it is often impossible to bore more than from 12 to 16 inches. Large boulders frequently occur upon the surface, and along steep slopes the underlying rocks sometimes outcrop.

There are three distinct occurrences of Dekalb stony loam within Chester County. The first extends in a narrow, broken strip along the north side of the Chester Valley, beginning a short distance above Bacton and reaching to the Chester-Lancaster county line. The second area, which is also broken and irregular, begins at Brandywine Manor and extends in a southwesterly direction, becoming gradually broader until it is 3½ miles in width, where it reaches the Chester-Lancaster line. The third area lies along the slopes of what is locally called the "Welsh Mountain." It begins where Chester, Lancaster, and Berks counties join, and extends in a northeasterly direction along the Chester-Berks county line to a point 3 miles northeast of Elverson.

The Dekalb stony loam occupies the steep slopes of the descent into the Chester Valley, and in the other areas above referred to it lies along the slopes and on the tops of hills and ridges, and as a type may be classed as rough and broken.

The Dekalb stony loam is derived from the disintegration of sandstone and some quartzite of Potsdam age.

The natural drainage of this type is good or excessive, and owing to its physiographic position and stony character it is not very productive. Only a small percentage of the type is under cultivation. The cultivated parts consist of a few small fields from which the stones have been removed. The remainder of the type is timbered chiefly with chestnut.

The crops grown are those common to the county, but as the area under cultivation is small and as the yields are irregular no satisfactory averages can be given.

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

*Mechanical analyses of Dekalb stony loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13709.....	Soil.....	6.7	15.9	5.3	12.5	11.6	35.0	12.7
13710.....	Subsoil....	7.3	16.5	4.5	10.4	11.0	31.2	19.1

DEKALB LOAM.

The surface soil of the Dekalb loam consists of gray-brown or brown coarse loam from 8 to 12 inches deep. This material ranges from a medium to a light loam, but there is always present enough coarse material to constitute a coarse loam, and in extreme cases a very gritty loam. The subsoil consists of gray-yellow or yellow plastic, gritty clay loam. In exposed topographic positions, where the soil has not accumulated to so great depths as on more level areas, the amount of the gritty material steadily increases with depth until it constitutes at 36 inches or below a gritty clayey sandy loam. On local areas and near the boundaries with the Dekalb stony loam small pieces of sandstone and quartzite occur, but never in amounts sufficient to interfere with cultivation.

The Dekalb loam is all located north of the limestone valley and most of it along the border of that valley, the largest area being about 3 miles north of Downingtown. It is generally associated with the Dekalb stony loam, and its topographic features include the lower slopes of hills and ridges whose upper slopes and summits are occupied by the Dekalb stony loam, and also adjoining small near-by level areas.

On account of the superficial features of the type surface drainage is ample, yet seldom excessive, and the texture of the subsoil is such as to maintain a good supply of moisture.

The Dekalb loam has been derived from Potsdam sandstone and quartzite, and the gritty material, which is a prominent characteristic of the type, represents the disintegrated particles of these rocks. In

some instances the original soil has been modified somewhat by the material washed from higher surroundings.

The Dekalb loam, with careful treatment, will produce moderate yields of all the staple farm crops, but is noticeably less productive than the Chester loam. Corn brings an average yield of 40 bushels; oats, 35 bushels; rye, 18 bushels; wheat, 15 bushels; potatoes, 100 bushels, and hay, 1 ton per acre.

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

*Mechanical analyses of Dekalb loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13707, 14339.....	Soil.....	3.7	14.2	7.9	17.7	8.7	32.6	14.7
13708, 14340.....	Subsoil.....	3.6	13.6	7.4	15.4	7.1	33.6	18.7

DEKALB FINE SANDY LOAM.

The surface soil of the Dekalb fine sandy loam consists of gray, or rarely yellow, fine sandy loam or fine sand to an average depth of 9 inches. In a few spots the presence of organic matter gives the soil a dark-gray color, and in areas of similar consequence the sand is medium rather than fine. If this latter occurrence had been of sufficient extent it would have been mapped as Dekalb sandy loam. The subsoil consists of gray to yellow fine sandy loam to fine sand. With both soil and subsoil are found small bits of sandstone and quartzite, and occasional stones of the same material are on the surface and in the soil mass.

The Dekalb fine sandy loam is confined to small, narrow areas within the Dekalb loam and Dekalb stony loam or between those types and other soil formations.

The topographic features of the type include slopes below the Dekalb stony loam and small hills, ridges, and slopes within the type and also the Dekalb loam.

Surface drainage is thus well established, and the texture of soil and subsoil favors such rapid downward percolation of soil moisture that the type can ill withstand droughty conditions.

The Dekalb fine sandy loam is derived from a fine-grained gray sandstone of Potsdam age.

On account of its position and texture the type can be utilized best for light farming or in some instances for early garden crops. When farmed the Dekalb fine sandy loam is used for regular rotation, but the fields are so small and so associated with other types that no estimate is made of average yields.

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

*Mechanical analyses of Dekalb fine sandy loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14343.....	Soil.....	0.5	1.6	1.5	27.7	31.2	24.0	12.5
14344.....	Subsoil.....	1.2	1.8	2.0	38.7	23.8	18.5	13.4

PENN LOAM.

The surface soil of the largest areas of the Penn loam as it occurs in Chester County consists of loose medium brown loam from 9 to 12 inches deep. The subsoil consists of light-brown, gray-brown, or rarely reddish-brown heavy loam to clay loam. With this occurrence in much smaller areas is a dark Indian-red phase of which the soil consists of red heavy loam or silty loam to an average depth of 8 inches and the subsoil of red heavy silty loam or silty clay loam to a depth of 36 inches. Bits and fragments of sandstone to the extent of from 5 to 15 per cent are frequently found with the soil and subsoil. Along the Schuylkill River and for 1 to 2 miles back therefrom the Penn loam consists of heterogeneous material forming small, yet diverse, areas, not of sufficient extent to appear on the map and which when considered in their entirety may be readily grouped under the following description: Medium brown loam containing enough medium and coarse sand to give the effect of a coarse loam to an average depth of 10 inches. The subsoil consists of light-brown to grayish loam or rarely clay loam containing even more coarse sand than the soil, and in the most exposed topographic positions, such as steep slopes or sharp, narrow little ridges, this material sometimes grades at from 15 to 24 inches into heavy sticky sandy loam, which finally rests upon a mass of sandstone fragments and sandy loam. Areas of a sandy loam, which might be classed as Penn sandy loam, are of occasional occurrence in the northern part of the formation, but these are of importance not from their extent, but because they furnish desirable spots for the production of potatoes in a section where soils well adapted to this purpose are comparatively scarce. The largest areas of this kind are at the northwest corner of the county between Chestnut Hill and the Schuylkill River.

The Penn loam lies in the northern part of the county, forming a belt about 2 miles wide at its eastern extremity between Valleyforge and the Schuylkill River, and thence in its northwesterly course, widening as the distance from the river to the metamorphic rock formations to the southward increases until its general width is about 6 miles.

The topographic features of the Penn loam of Chester County are much more irregular and broken than is the general occurrence with this type. A succession of ridges, usually narrow, but in some cases broad, lie in a position generally parallel to the Schuylkill River. In places near the river these seem much like benches, but with increasing distance hills more or less rounded and sharp ridges between which the streams have cut steep courses make a much more diversified and broken topography. Thus while moderately sloping areas of considerable size are a feature of the Penn loam level areas of any considerable extent are rare, and steeply rolling areas are common, especially with the approach toward the formations of metamorphic rocks.

Drainage is well established on most of the Penn loam. Small depressions sometimes need artificial drainage, whereas steep ridges and hills are more or less susceptible to drought. A pertinent problem is presented in the tendency of the soil to wash on steep slopes. Through careless farming, most common on rented farms, destructive gullies have been allowed to form in some cases, and thus much injury has resulted. Contour plowing and cultivation would be a sufficient preventive where the slope is not too steep, and would be highly beneficial even on the steepest slopes, which can be well controlled only by terracing.

The Penn loam is derived from brown, red, yellow, and gray shales and sandstones. It often happens that a brown loam immediately overlies red shales and sandstones, whereas a red loam would naturally be expected. This is due in part to the fact that the shales are frequently laid down in beds of alternating colors, and as these vary greatly in thickness an upper layer of brown shale has been entirely disintegrated in the formation of the upper layers of soil, which are thus superposed oftentimes on a well-defined Indian-red subsoil in turn resting upon beds of deep red shale and sandstone.

Many other variations in the sandstone rock may be seen, but perhaps the most important is that of a gray or light-brown, coarse-grained sandstone, which in places approaches a conglomerate very similar to that in Montgomery County from which is derived the Dekalb gravelly loam. The coarse material is not coarse enough, however, to give rise to the fine gravel which is a primal characteristic of that type; but it does form the very coarse loam found for some distance back from the Schuylkill River. This loam is quite distinct from a heavy sandy loam which it is locally called, for even though the amount of coarse sand is so prominent as to cause a coarse, gritty feel, the amount of the finer grades of soil present is sufficient to form a medium to heavy loam.

The Penn loam is best adapted to the production of the staple farm crops of the area. The brown Penn loam is in general a deeper soil

than the red, the underlying rock being a greater distance from the surface, and as a natural sequence it is somewhat more productive.

The crops grown and average yields are: Shelled corn, 55 bushels; oats, 30 bushels; wheat, 20 bushels; rye, 25 bushels; hay, 1½ tons, and potatoes on the sandy phase, 150 bushels per acre.

The following table shows the average results of mechanical analyses of the fine earth of soil and subsoil of the Penn loam:

*Mechanical analyses of Penn loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13711,14362.....	Soil.....	1.4	7.2	4.5	10.5	14.1	41.8	20.4
13712,14363.....	Subsoil.....	1.6	7.9	4.4	10.1	13.7	35.3	27.0

LANSDALE SILT LOAM.

The surface soil of the Lansdale silt loam consists of brown or slate-colored medium to heavy silt loam from 10 to 14 inches deep. In local areas the clay content may be sufficient to constitute a clay loam, but in such cases the high silt content keeps the soil very mellow, and in working its physical characteristics are those of a heavy silty loam or silt loam. The subsoil, to a depth of 36 inches or more, consists of silty clay loam, or, in places, of a heavy silty loam grading into a silty clay loam at an average depth of 20 inches. This material is of a pale yellow, light drab, or gray-yellow color, seldom well pronounced, but usually of a lighter shade than the soil of the surface. The texture of the soil is such that it may be kept with comparatively little effort in a fine mellow mechanical condition, and this constitutes a very desirable feature of this type, for although a comparatively heavy soil it is not exacting as to the moisture conditions under which it may be worked.

The Lansdale silt loam is not as typically developed as across the river in Montgomery County, nor is its extent nearly as great. The two principal areas lie south of Spring City and Phoenixville, while small areas are scattered about the Penn loam formation.

The topographic features of the Lansdale silt loam range from gently to moderately rolling, and in general the surface of the type is less dissected than is the Penn loam with which it is associated. The drainage features of the type include a surface sufficiently rolling to secure adequate superficial drainage, while the texture of soil and subsoil is such as to allow a moderate downward percolation of moisture, at the same time retaining enough to afford a favorable supply to growing crops.

The Lansdale silt loam is derived from fine-grained sandstone and shale of Mesozoic age. These rock formations, which are usually brown or gray in color, have weathered more deeply than the coarser-

grained rock from which the Penn loam has been derived and decomposition has been more complete.

The Lansdale silt loam is well adapted to the production of all the general farm crops of the area and is a little more productive than the Penn loam. In Montgomery County, where the type is more extensively developed, it is found to produce a little better quality of wheat than the Penn loam. Where well drained the type is well adapted to potatoes, being surpassed only by the heavy sandy loam spots in the Penn loam.

Corn brings an average yield of 58 bushels, oats 35 bushels, wheat 20 bushels, rye 25 bushels, hay 1 $\frac{3}{4}$  tons, and potatoes 135 bushels per acre.

The following table shows the results of mechanical analyses of the fine earth of soil and subsoil of the Lansdale silt loam:

*Mechanical analyses of Lansdale silt loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13713.....	Soil.....	0.1	1.0	1.1	4.9	5.9	68.1	18.7
13714.....	Subsoil.....	.1	1.1	1.1	4.5	5.3	65.2	22.0

DEKALB SHALE LOAM.

The surface soil of the Dekalb shale loam consists of brown, blue-brown, red-brown, drab, or rarely red, light, or medium silty loam, containing from 5 to 50 per cent of stone in the form of broken bits of shale or sandstone. Where the minimum or only a small amount of shale is present on the surface the soil has been included in this type, because much greater amounts are present in the subsoil or because the area is too small to be mapped separately. The surface soil is for the most part open and easy to work, a characteristic intensified by the presence of the sandstone particles and shale. The subsoil, which, with increased depth, grows gradually heavier in texture, consists of a heavy silty loam which often grades into a silty clay loam. The amount of shale and sandstone fragments increases with depth and is often sufficient to prevent boring at from 6 to 30 inches, the average depth being about 20 inches. The amount of shale and sandstone present depends primarily upon the topography. On steep and exposed places sandstone bed rock lies so near the surface that the plow rides on it and bed rock underlies the entire formation at depths ranging from 6 inches to 6 feet, the average probably not exceeding 4 feet. Immediately overlying the parent rock there is commonly a mass of sandstone fragments with the interstices filled with soil.

The Dekalb shale loam occurs only in small areas, of which the two largest occupy the bluffs along the Schuylkill River north of Phoenix-

ville and a long, narrow ridge extending from thence westward. Other scattered small areas are associated with the more important members of the Penn series.

The topographic features of the Dekalb shale loam are always broken and often steep, as the greater portion of the type occupies river bluffs, narrow ridges, or steep hills.

Drainage is excessive on most of the Kekalb shale loam, as the slopes are so steep that the surface water runs off before the soil has a chance to absorb it, or the shale is so near the surface that little water can be stored for the use of crops. In a few places where the bed rock is arranged horizontally the ground water can not percolate downward, and so causes seepage along the adjoining slopes. Such areas are almost worthless, as crops suffer alternately from excess of moisture and drought. In favorable locations, however, where the soil has accumulated to a considerable depth the type maintains a favorable supply of moisture for growing crops.

The Dekalb shale loam is derived from Mesozoic sandstone and shale. Some of this rock is in place, but much of it has been subjected in some degree to the processes of metamorphism, caused by the elevation of the underlying rock formations which often come within a few feet of the surface.

The Dekalb shale loam is moderately well, or poorly, adapted to the production of the general farm crops of the area, depending upon the position of the underlying rock or mass of shale fragments. Where decomposed to a considerable depth and well drained, potatoes can be grown to advantage. Where subject to seepage it can be used best as permanent pasture.

Crop yields are very variable, as they depend largely upon the proximity of the shale to the surface, and thus, in years of drought, are very low. Corn yields from 30 to 50 bushels, oats 15 to 50 bushels, wheat 8 to 25 bushels, and hay from one-half ton to 1½ tons per acre. Oats seem especially dependent upon the season, and good yields are secured only when the rainfall is well distributed.

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

*Mechanical analyses of Dekalb shale loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14366.....	Soil.....	3.8	5.4	3.3	16.1	19.2	37.4	14.9
14367.....	Subsoil.....	2.1	5.8	3.0	11.4	13.0	40.4	24.3

PENN STONY LOAM.

The surface soil of the Penn stony loam consists of brown-red, Indian-red, brown, or bluish-gray silty loam from 8 to 12 inches deep. The subsoil consists of Indian-red, brown-red, or bluish-gray heavy silty loam, which grades into a silty clay loam at an average depth of 20 inches. In places, however, the surface soil is underlain immediately by silty clay loam. From 10 to 60 per cent of shale and small sandstone fragments are of common occurrence in the Penn stony loam, but this is not a constant feature. The stone content is variable, but on the principal part of the type consists of blue or gray flaggy sandstones, and bowlders of sandstone which are sometimes conglomeritic. In spots igneous bowlders have been intruded through the surface, but where of sufficient extent to affect the soil formation such areas have been mapped as Chester stony loam.

The Penn stony loam is all located in the northwestern part of the county. The principal areas are on or near Chestnut Hill, while small areas are scattered between there and the Schuylkill River.

The topographic features of the Penn stony loam are always hilly and sometimes mountainous, and consequently surface drainage is always rapid. When large amounts of shale are present and the soil is shallow the type is very susceptible to drought, but in other cases at least a fairly good supply of moisture is retained.

The Penn stony loam has been derived from Mesozoic sandstone and shale, which in cases have been metamorphosed in varying degree, but only seldom to an advanced stage.

In adaptation to crops the Penn stony loam depends on the amount of stones present and topographic position. The most level and least stony parts are fairly well suited to the production of general farm crops, but most of the type should be used as pasture or left in forest. Much of the type is now used for forestry purposes, but from the small fields cultivated fair yields of corn, oats, wheat, and grass are obtained in moist seasons.

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

*Mechanical analyses of Penn stony loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
13953.....	Soil.....	2.1	4.4	2.7	9.3	10.7	49.1	21.2
13954.....	Subsoil.....	1.5	3.7	2.6	8.4	8.6	44.2	30.3

## LICKDALE CLAY LOAM.

The surface soil of the Lickdale clay loam, to a depth of from 6 to 8 inches, consists of drab or gray clay loam. As the type owes its origin in most places to the accumulation of fine material which has been very slowly transported by washing from the gently or rarely moderately rolling surroundings, its texture varies. In places the silt content is prominent, but this is not a constant feature, and again the soil may be a very heavy loam. The subsoil consists of drab clay loam, which often is mottled in its lower depths. This material may extend to a depth of several feet, depending chiefly upon topographic position, or it may rest upon the underlying formation at depths ranging from 3 to 4 feet.

The Lickdale clay loam is of small extent, including one area at Westchester, another near Rockville, and a few scattering patches.

Natural drainage is not well established, and most of the type requires artificial drainage if it is to be used to advantage for tilled crops.

The Lickdale clay loam is not especially adapted to any crops, but it can be best used for mowing and pasture lands. Where sufficiently drained fair yields of hay, corn, and oats are obtained.

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

*Mechanical analyses of Lickdale clay loam.*

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	<i>Per cent.</i>
14368.....	Soil.....	1.9	6.5	2.0	3.9	6.0	56.5	23.2
14369.....	Subsoil.....	.6	1.9	.9	2.5	4.5	49.2	40.1

## ROUGH STONY LAND.

The Rough stony land includes parts of four different soil formations, and thus represents similarity of condition rather than likeness of soil texture or derivation. The largest areas are in the northwestern part of the county on or near Chestnut Hill, where the type is associated with the Penn series. There the soil corresponds very closely with the Penn stony loam, but the topography is so broken and the ground so stony that its agricultural value is distinctly inferior to that type. This material is derived from the New Red sandstone formation, and the stones, rocks, and ledges are of sandstone, some of which has been hardened considerably by the processes of metamorphism. Other areas are found with the Manor series on the steep ridge which extends from near Gulf Mills westward for several miles. The type is here derived from the semicrystalline mica schists of the Manor series and

bears a relation to the Manor stony loam similar to that it bears to the Penn stony loam.

Areas associated with the Chester series are widely scattered, but are most numerous north of the Chester Valley, and associated in many cases with the Chester stony loam.

The Dekalb series also includes small areas of this type which occupies steep-sided ravines and sharp, steep slopes, and crests of ridges.

Small areas within the Rough stony land have been kept cleared of forest growth and are utilized as pasture, not without profit when bought after the work of clearing has been done, but most of the type is left in forest, the purpose to which it is best adapted.

#### MEADOW.

Scattered over the county are small areas adjacent to streams which are subject to overflow or kept in a condition too moist to be used for tilled crops. These areas have been mapped as Meadow.

The soil in such areas is largely alluvial, being derived from material washed in from the surrounding slopes or transported from greater distances during flood time.

The largest areas are along the Brandywine Creek, where the type affords excellent pasturage for large herds of cows. Most of the type is used as pasture, a purpose for which it is well and best adapted.

#### AGRICULTURAL METHODS.

Within the memory of the present generation agricultural methods in Chester County were much less intensive than now, and the land was turned reluctantly, the farmers preferring to keep as much of it in grass and pasture as possible. This feeling has gradually disappeared, and methods of farming throughout the county have steadily grown more efficient. The land is well turned, as a rule, with two-horse plows to a depth of 6 to 7 inches, and this is not too deep for all the heavy soils. Some plow to a depth of only 4 inches, which is much too shallow for all types of the area except the fine sandy loams, sandy areas within the Penn loam, and the lighter parts of the Brandywine loam. The plowing is done in the fall for wheat and winter rye and in the spring for corn and oats. Owing to the ravages of cutworms in some sections it is recommended that corn ground also be plowed late in the fall where the topographic features of the field are such that the soil will not be injured by washing. This will not only kill many of the worms, but in the case of the heavy loam and clay loam will subject the ground to the beneficial action of a more thorough freezing and thawing during the late winter and early spring months.

The amount of preparation given fields before planting, and of cultivation of tilled crops during the growing season, varies greatly; but

the degree of financial success attained by farmers bears a very definite relation to the thoroughness with which this is done, and demonstrates conclusively the necessity for intensive preparation and cultivation of the soil, as well as the profit of so doing. For wheat, some of the best farmers roll the land immediately after plowing, then go over it with a spring-tooth or disk harrow three or four times or more, according to the condition of the soil. If still lumpy, the ground is rolled again ahead of the drill. For oats, the land is harrowed only once or twice, and corn receives preparation about half way between this and that given wheat. Corn is planted in check rows  $3\frac{1}{2}$  feet apart so as to allow cultivation both ways, or it is drilled in rows with the hills from 12 to 15 inches apart, 1 kernel to a hill. One of the most efficient practices noted consists of going over the corn twice with a weeder and three times with a double riding cultivator, the last cultivation being in the last part of June, just before harvesting the wheat. Very little hand hoeing is done, and the weeder is probably not used by more than one-fourth of the farmers.

The importance of maintaining land in a productive state is generally recognized in Chester County, and only a small part has been allowed to become depleted. As it has been the custom to keep large numbers of stock, most farmers have been able to apply liberal dressings of homemade manure, and in addition, a great deal is brought from Philadelphia stables. The farmyard manure is cared for better than in many places, but there is still a great deal of waste in the aggregate from the failure to use sufficient absorbents and from exposure in the yards, thus allowing much loss in the drainage therefrom. The manure is variable in quality and not as valuable in many cases as it might just as well be without additional cost, and for this reason it is earnestly recommended that farmers study carefully how to feed balanced rations and how to produce as much clover as possible to feed upon the farm, thus obtaining more economical feed and increasing the value of the manure.

The manure is applied to corn in amounts ranging from 6 to 15 two-horse loads an acre. The large number of manure spreaders in use is exceptional, and thus much of the manure is applied to the best advantage. In addition there is given a dressing of from 150 to 800 pounds of acid phosphate, bone and phosphate, or of a complete commercial fertilizer of grades costing from \$18 to \$28 a ton. When no manure is applied, from 500 to 1,000 pounds of commercial fertilizer is used. Some of the best farmers apply the manure in winter, add 300 pounds of acid phosphate before plowing and from 100 to 150 pounds of complete fertilizers at time of planting.

Potato land receives from 6 to 10 loads of manure and generally from 300 to 1,000 pounds of commercial fertilizers costing about \$30 a ton. Occasionally the amount of the latter is increased to

1,500 or even 2,000 pounds, and then no additional application is made for wheat the following year. The oat and millet crops generally receive no application of fertilizer, but sometimes are given from 100 to 300 pounds of a \$22 brand. To wheat is applied from 100 to 600 pounds of fertilizer costing from \$22 to \$28 a ton and in addition from 6 to 8 loads of manure, when available.

Formerly it was the practice to lime land at least once during the course of a rotation, the amounts applied ranging from 20 to 40 bushels an acre, but this has been largely discontinued. In recent years, too, considerable difficulty has been experienced in getting satisfactory stands of clover. It dies out in spots, and some farmers attribute this to the excessive use of acid phosphate. The land becomes sour, and in some cases better stands of clover have been secured after a liberal application of lime. Such dressing seems to be necessary only once in from three to six years. The experience of others indicates that in some cases at least there is no difficulty in obtaining a good stand of clover if the land is thoroughly prepared for the wheat and so is in a condition of good tilth.

The character of machinery and farming implements of all kinds is so far above the average that as a whole they may be termed excellent. Besides tillage implements farmers are well supplied with grain drills, mowing machines, hay rakes, tedders, and horse forks. Hay loaders and corn harvesters are not uncommon, and self-binding reapers are on nearly every farm. Round silos, which are numerous, are filled by corn-cutting outfits, in which the power is supplied by a traction engine. These outfits are hired in most instances, although some are owned by the farmers on the cooperative plan.

Corn for husking is cut from 1 to 2 feet above the ground, shocked, and husked in the fields. The stubs are cut down either with a heavy hoe or an old mowing machine. This is done usually during the late fall, so as not to retard the next spring's work.

The crop rotation which has been considered the standard is corn, followed by oats or potatoes, wheat, and grass. General change of conditions has led to many adaptations of this rotation to suit different locations, soils, markets, and individual tastes. Of these changes the most common is the replacement of a part of the oats in the second year of rotation by ensilage corn, millet, spring rye, or by increasing the acreage of potatoes. The practice of sowing crimson clover in the corn when it is "laid by" is gaining favor in some parts of the county, but this is usually plowed down the following spring rather than kept for mowing, which has been successfully done elsewhere by cutting the corn stubs close to the ground during the winter. Wheat is almost universally the sole crop in the third year of rotation, though some farmers substitute rye on a part of the ground. Timothy is seeded with the wheat or rye, and clover is sown the following spring.

The land is then mowed as long as it is profitable to do so, which nowadays is from one to three years. Formerly fields were mowed at least three years, but, owing to the spread of noxious weeds, plantain, cinquefoil, daisies, and wild onions, fields are now shorter lived. The second crop of hay is seldom mowed, but the fields are pastured when the grass is well started, after the removal of the first crop, and again for two or three entire seasons when it is no longer considered profitable to harvest the hay.

#### AGRICULTURAL CONDITIONS.

The general appearance of Chester County betokens prosperity to a degree that is rarely attained. The excellence of the farm dwellings, barns, outbuildings, and fences, coupled with extraordinary neatness of surroundings, lends a supreme distinction to the tone of the county, indicative of thrift, vigor, alertness, and prosperity. This outward appearance also makes evident that the agricultural success is not transitory, but that it has been an attainment of many past generations, which, in general, is maintained at the present time. Failure to adapt oneself to the gradual evolution of conditions, and consequent unprofitable farming, is occasionally revealed, but the county is unusually free from illustrations of this kind.

An insight into the working conditions of the farmers discloses an agricultural practice, as already described under the heading "Agricultural methods," an understanding and intelligence which make plain why the external appearances are so indicative of prosperity. The Grange is well organized, and this, with local coteries, constitutes a very attractive feature of farm life which is both profitable and enjoyable.

The hard work attending farm life, contrasted with the seemingly easier life which the farmer sees when he goes to town, proves distracting to those who fail both to estimate correctly the ratio between income and expenses and to realize the possible advantages they may already possess or attain, and it is said that this tendency toward discontentment of condition is slowly increasing, but fortunately it has not yet been strong enough to affect seriously the good tone of the farming class or to impair thrifty agricultural development.

No more crucial test, perhaps, can be applied to the actual conditions of farming within a given area than the promise which it offers to the average young man who has to make his own way and is willing to begin on a small scale the acquirement of a comfortable living for himself and family, a good high-school education for his children, and a sufficient reserve fund to support himself and wife comfortably in old age, as a reward for steady work and intelligent effort. Such inducements Chester County offers, it is believed, in exceptional

degree, and, at the same time, the county is a very attractive section in which to live.

The proportion of farmers who live on and till their own farms varies in different parts of the county, but the range is estimated at from 60 to 75 per cent. Of the farms in the county perhaps three-fourths are encumbered more or less, the encumbrance averaging about one-third of their value. Many, but not all, of these obligations are being steadily reduced.

The greater number of the farms rented are leased on shares, the owner furnishing, by the most common arrangement, one-half the commercial fertilizer and one-half the seed and receiving one-half of the annual products, while the tenant for the other half of the products furnishes the stock, tools, labor, one-half of the fertilizer, and one-half the seed. A few farms are rented outright for a cash sum. Some of the renters make enough money so that in time they are able to own a farm, but others just drift along saving little or nothing above their living expenses. The owner generally, but not always, gets a fair return on the investment.

Farms range in size from 30 to 200 acres, the average for the entire county being, according to the Twelfth Census, 72.1 acres. Farms were originally much larger, many containing from 200 to 500 acres, but they have been much reduced in size, owing to the division of estates among heirs and the development of a more intensive agriculture.

Labor has generally been plentiful at a satisfactory rate of wages, but for the last few years there seems to have been a tendency toward a decrease in the supply, and its character is also deteriorating, owing to the fact that some of the best men buy farms of their own and others leave farm work for something else that they think promises better returns for the work done.

An average price for a good farm hand is \$18 a month and board by the year, or \$22 a month and board for eight months. Many of the men have a horse and arrange to work it enough on the farm to pay for its keeping. Married men are given the use of a tenant house, a garden, the crop grown from 1 bushel of seed potatoes planted usually with the farmer's crop, and from \$25 to \$30 a month. Day help ranges in price from 75 cents to \$1.25 a day with meals, according to the season and the efficiency of the labor. Considerable labor is hired in the fall to husk corn by the shock, the price ranging from 4 to 8 cents, depending upon the supply of labor and the lateness of the season.

Dairy products constitute at present the principal source of income, having largely replaced, within the last few decades, the fat steers and wheat which were formerly the principal products. The pre-eminence of dairying and the converting of so many farm products

into manure is largely accountable for the prosperity of the area, for the soils have thus been maintained in a very productive state. Milk is shipped principally to the wholesale market in Philadelphia or to local creameries, depending largely upon the distance to a railway station. Considerable money has been lost in the former manner by sending to unreliable dealers. Most of the local creameries are proprietary, but a few are run on the cooperative plan. Both purchase milk on the basis of the Babcock test for butter fat, and the skimmed milk is sold back to the farmers as desired. There is a condensed milk factory at Malvern, in the eastern part of the county, which also buys large quantities of milk.

There are few pure-bred cows, and thoroughbred bulls are too scarce, though some attempt is made to use a high-grade bull. Many of the cows are common stock, in which the characteristics of any particular breed are not sufficiently prominent to allow of their classification, but Shorthorn, Jersey, Holstein, and Guernsey grades are all well represented.

Hay is the product of next importance, and with those who do not keep dairies it is the primary money crop. The hay is baled on the farm and sold to local buyers or to local commission men, the city dealers generally declining to buy direct of the farmers. Wheat, which with some is of more importance than hay as a money crop, is of good quality for eastern-grown grain, and is graded locally as No. 1 and No. 2, but if classed on the same basis as the western-grown product it is No. 2 and No. 3. The oat crop is nearly all consumed at home, but potatoes are an important source of income with some, and a secondary money crop with many.

Most of the corn is fed on the farm, but it is sold by those who do not keep dairies or fatten steers. Steer feeding, which was once extensively followed, has assumed an unimportant position and is still declining. Pork has become a more important product than beef. A great many farmers sell from 8 to 25 hogs in a single season. Berkshires and Chester Whites are the most numerous of all breeds, and are sold to local dealers, who ship them. About one-half are dressed at home and one-half shipped alive, the preferred weight being from 150 to 200 pounds. Most of the rye grown is mixed with corn and fed to pigs. Poultry brings to many farmers an income which can not be ignored, and with some it is an important adjunct. In some parts of the county about one-half the horses required for farm use are raised, and in the eastern part of the Chester Valley there is a large farm devoted to the production of choice driving and coach horses by crossing Hackney stallions with Kentucky mares.

The fruit product is not large. There are no commercial orchards, but many farmers have small apple plantings which supply their own needs and furnish some to sell. Pears, peaches, quinces, cherries, and

small fruits are generally grown for a home supply, and small quantities are sold. The San Jose scale is a serious and increasing pest to the fruit interests, and in this connection may be mentioned the Hessian fly, which in some seasons injures the wheat crop, and the cutworm, which sometimes necessitates a replanting of part of the corn fields.

The production of mushrooms and carnations has been extensively developed. For the former the manure is brought from Philadelphia in car lots, placed in piles, shaped, moistened, covered with soil, and then turned just before sufficient heat develops to "burn" the manure. This process is repeated every few days for a period of from four to six weeks. This work is done in the spring, so that the beds may be started from the 1st to the 15th of July. The treatment given is described in publications of this Department, and is not given in detail here. The best growers try to have their mushrooms ready for market as soon as possible after October 1, the picking season extending to about Christmas. Special greenhouses are constructed by the most progressive growers, but combination houses are also used.

The carnation belt extends through the southern part of the county. The carnations are started in the spring from slips or twigs taken from old plants, bedded in sand, and later transplanted in greenhouses into a soil consisting of Chester loam, mixed with pig manure and some lime, or with soil taken from the mushroom beds. The flowers are cut and shipped principally to commission men in Philadelphia. Another special industry is represented at Westgrove by the largest rose growers in the world.

To the adaptation of soils to crops little attention is paid as far as the standard rotation is concerned, and these crops are grown by nearly everyone regardless of the soil types upon which his farm is located. The most attention is paid to the potato crop by the average farmer, who generally tries to select a well-drained area of as light textured soil as he possesses. The fact that one type of soil yields a better quality of wheat than another is occasionally recognized, but is practically never considered of sufficient importance to cause a change in the use made of the soil more poorly adapted to this purpose.

The transportation facilities of the county are extensive. The crossing of the area by the Chester Valley has been of great importance as a general transportation factor, and consequently for the development of numerous towns which have followed the course of transportation. The four tracks of main line of the Pennsylvania Railroad extend across the county along the course of the valley, and numerous branch lines of this and other companies render exceptional service over the area. There is some complaint, however, that freight rates are unreasonably high.

Numerous trolley lines add greatly to the convenience of traveling, and several main roadways constructed on scientific principles, in addition to the good dirt roads which ramify through the county, make all parts of the area easily accessible.

The nearness of the area to Philadelphia causes that city to be the principal market for all farm products. The fact that so good a market is so near at hand is largely accountable for the prosperous agricultural condition. The extent of the markets within the county, however, has much to do with its general welfare, as they consume great quantities of milk, potatoes, garden vegetables, and poultry products. Of these towns the most important are Westchester, Phœnixville, Spring City, Coatesville, Parkesburg, Malvern, Oxford, Downingtown, Kennett Square, Westgrove, and Avondale.

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