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

SOIL SURVEY OF THE ASHTABULA AREA, OHIO.

BY

J. O. MARTIN AND E. P. CARR.

[Advance Sheets—Field Operations of the Bureau of Soils, 1903.]

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[PUBLIC RESOLUTION—No. 9.]

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

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

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

Approved, March 14, 1904.

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

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SOIL SURVEY OF THE ASHTABULA AREA, OHIO.

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LOCATION AND BOUNDARIES OF THE AREA.

Ashtabula County occupies the northeast corner of the State of Ohio, as it did also of the original Western Reserve of the State of Connecticut. It is bounded on the north by Lake Erie, on the east by

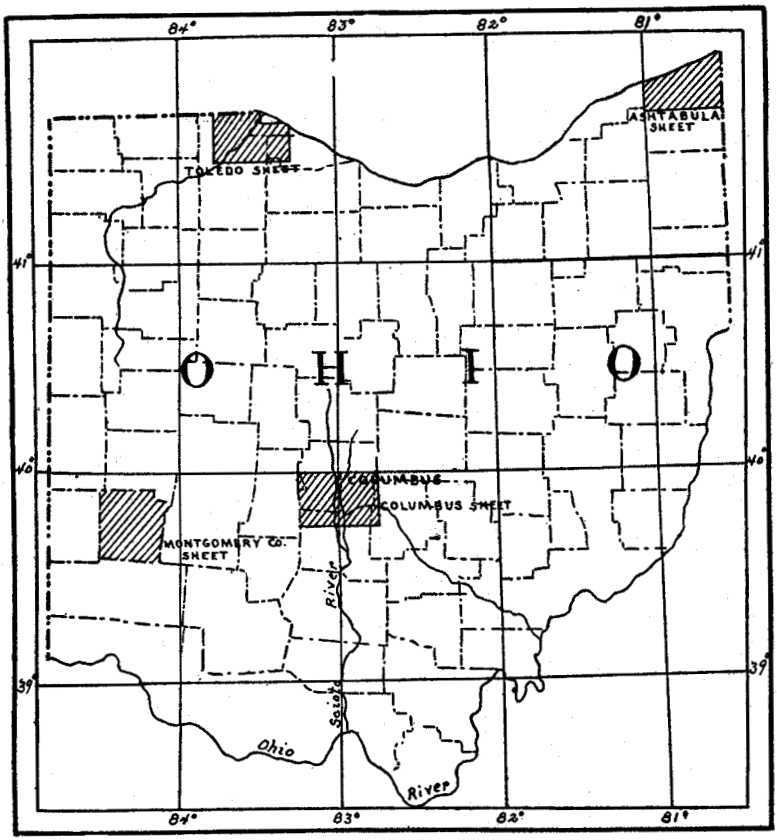

FIG. 1.—Sketch map showing position of the Ashtabula area, Ohio.

the State of Pennsylvania, on the south by Trumbull County, and on the west by Lake and Geauga counties.

The county is divided into 28 townships, but the present survey includes only the 13 lying north of the southern boundary of Pierpont,

Denmark, Jefferson, Austinburg, and Harpersfield townships. The townships included, besides those just named, are Monroe, Sheffield, Plymouth, Saybrook, Geneva, Ashtabula, Kingsville, and Conneaut.

Jefferson, the county seat, lies to the south of the center of Jefferson Township, in 41° 45′ north latitude and 80° 45′ 5″ west longitude.

The county comprises an area of 687 square miles, but the area surveyed is less than half that of the county, having an extent of approximately 340 square miles.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

Ashtabula County was originally heavily forested with a considerable variety of trees. Hemlock and pine were found on the sandier hillsides, while the clay soils of the interior gave dense forests of beech, maple, oak, ash, elm, and basswood, and the swampy areas supported red elm, rock maple, and black ash.

In 1811 Ashtabula County was given independent organization, and in 1823 the Ashtabula County Agricultural Society held its first fair and cattle show in Austinburg. The dairy business, on account of the suitability of the heavy soils for the growth of hay, became the main industry. The methods of dairying at the time were probably crude, for Ohio butter did not have the best of reputations in the markets. One of the chief efforts of the local agricultural society has been to introduce improvements in dairy practices.

The first railroads in the county were the Cleveland, Painesville and Ashtabula Railroad, chartered in 1848, and the Ashtabula and New Lisbon Railroad, chartered in 1853. With the advent of better transportation, creameries and cheese factories were established, and most of the dairy products have come to be made at these centers instead of on the farms. Much milk is also shipped from the county to the large cities. The Northeastern Ohio Dairymen's Association was organized in 1877, and there has since been established in the county a farmers' institute. Ashtabula has been for many years the leading county of the State in the production of butter and cheese, while it ranks low in the production of wheat, corn, and oats. The population of the county in 1890 was about 43,000, and in 1900, 51,448.

CLIMATE.

Ashtabula County, in common with other parts of the country bordering on the Great Lakes, is believed to have a somewhat more equable climate than interior areas in approximately the same latitude. The occurrences of frost are less erratic, and the differences in day and night temperatures are not so great as in areas removed from the influence of large bodies of water. For this reason the area surveyed may be considered superior to others for the cultivation of cer-

tain crops, though as far as its chief industry—dairying—is concerned, the mere matter of a few days more or less in the growing season can have but little effect.

The following table of temperatures and precipitations is drawn from records of the Weather Bureau stations at Hillhouse and Orangeville. The figures given represent the monthly and annual normals, or the average of the means over a series of years, and show in a general way the distribution of rainfall and the prevailing temperature through the year:

Normal monthly and annual temperature and precipitation.

Month.	Hillhouse.		Orangeville.		Month.	Hillhouse.		Orangeville.	
	Temperature.	Precipitation.	Temperature.	Precipitation.		Temperature.	Precipitation.	Temperature.	Precipitation.
	°F.	*Inches.*	°F.	*Inches.*		°F.	*Inches.*	°F.	*Inches.*
January	25.8	2.97	26.8	2.66	August	67.8	3.24	68.6	2.74
February	24.4	3.11	25.2	2.99	September	63.3	3.61	61.6	3.48
March	33.5	3.20	36.1	2.73	October	51.3	3.53	50.7	1.67
April	46.0	2.02	47.9	1.76	November	39.3	3.99	38.6	2.48
May	57.2	4.38	58.3	4.34	December	30.7	3.11	29.8	2.52
June	66.1	3.11	66.6	4.35	Year	48.1	40.88	48.3	35.01
July	71.3	4.61	71.0	3.29					

PHYSIOGRAPHY AND GEOLOGY.

The part of Ashtabula County surveyed may be divided into two distinct topographic areas—a foreland area bordering the lake, with an average width of about 3 miles, and an upland area, including all of the territory south of the foreland. These two areas are separated by a distinct east-and-west escarpment, known as the South Ridge, and by a sudden rise from the lake foreland to the upland area.

The foreland, but for stream erosion, would be a fairly level plain, lying at an elevation of from 40 to 80 feet above Lake Erie. The surface of this foreland is very gently rolling, except for the stream valleys crossing it, which, as they near the lake, have frequently, by their cutting, produced steep-sided valleys. The larger streams, like Conneaut and Ashtabula creeks, enter the lake through distinct gorges.

The upland area is a gently rolling plain, with a gradual rise to the south. The most pronounced irregularities of topography on this upland are the valleys produced by stream erosion. Frequently these valleys reach the gorge condition in various parts of their courses, where they have been forced to cut through obstructions.

The drainage of the northern part of Ashtabula County finds its way into Lake Erie, the main systems being those of Ashtabula Creek, Conneaut Creek, and Grand River. All of these streams have remarkably tortuous channels, flowing long distances to reach the lake.

These three streams carry nearly all of the upland drainage, while that of the foreland is through a series of short creeks flowing directly into the lake.

The geology of this part of Ashtabula County is comparatively simple. The foundation consists of a soft shale, the strata of which lie nearly horizontal. Most cuts show, lying directly above this shale, a hard, blue bowlder clay, and above the clay a more weathered form of apparently the same material. Both the blue clay and the overlying material belong without doubt to the till sheet deposited during the Ice Age by the great American continental glacier. This till sheet overlies the shale rock everywhere in the area except where removed by the streams, as in most of the valleys.

Parallel to the shore of Lake Erie and crossing the townships of Geneva, Saybrook, Ashtabula, Kingsville, and Conneaut is a zone of sandy and gravelly materials, representing the ancient beach and offshore deposits of a great glacial lake. This lake was formed, it is thought, during the existence of ice dams blocking the present outlets of the Great Lake System.

These deposits begin at the South Ridge, which is composed for the most part of the material making up the till sheet, though on its northern slope deposits of sandy and gravelly material are found.

About 1 mile north of the South Ridge and roughly parallel to it lies the North Ridge, which is made up entirely of stratified and water-worn beach deposits. These deposits extend from this ridge in places to the present lake shore and represent both beach and offshore bars and deposits. The North and South ridges have been cut here and there by the streams, but they are generally continuous and well defined, and are followed by two important roads, known as the "ridge roads."

The present lake shore consists of a sea cliff cut in the till sheet and varying from 10 to 90 feet in height.

The shales which underlie the area belong to the Devonian Age and are known as the Erie shales, which are correlated with the Chemung and Portage. All of the soils of the area are derived in large measure from these shales, reduced by glacial action. They have mixed with them a greater or less proportion of fragments of rocks that are not found within the area, but were brought from the north by the ice.

The present drainage system is a result of the glacial period. When the ice advanced over the region it filled with glacial deposits all of the then existing valleys, and on its retreat the drainage was forced to readjust itself to the new conditions, flowing miles to avoid obstructions, and to find the lowest outlets to Lake Erie.

SOILS.

The soils of Ashtabula County all owe their origin, directly or indirectly, to glaciation, and are therefore transported soils. They may

be divided into two groups—those laid down directly from the ice and not stratified, and those deposited in or assorted by water, which are in most cases well stratified. Both of these groups are in this area derived largely from the underlying shale rock, ground up by ice action, the shale furnishing probably from 75 to 90 per cent of the soil body.

The following table gives the extent of each of the six types established for the Ashtabula area:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Volusia loam	173,440	79.7	Dunkirk gravelly loam	6,528	3.0
Dunkirk sandy loam	14,720	6.8	Dunkirk gravel	2,880	1.3
Meadow	12,160	5.6	Total	217,920	.....
Dunkirk clay	8,192	3.5			

VOLUSIA LOAM.

The soil of the Volusia loam, which varies in depth from 6 to 10 inches, is usually brown or dark-brown loam, though in wet, poorly drained areas the color varies from gray to black, the latter being due to accumulations of organic matter.

The subsoil, to a depth of 36 inches, consists of a yellow or mottled gray and yellow silt loam, very compact in texture, and when very wet resembling a clay. This subsoil frequently reaches a depth of 30 feet, where it is underlain by blue bowlder clay or shale. Frequently, however, the shale comes to within 3 or 4 feet of the surface, in which cases the bowlder clay is absent, the loam subsoil resting directly upon the shale.

This soil type covers about three-fourths of the area, being the only type found on the uplands, where it is terminated on the north by the North Ridge. It is also found on the lake foreland, wherever the surface has not been covered by lake deposits.

The surface of the Volusia loam is gently rolling, with the stream valleys lying at from 30 to 100 feet below its general level. In some instances large areas are very flat, and these are liable to be wet and poorly drained, but, as a rule, taking into consideration the rather heavy character of the soil, this type is fairly well drained. Some of the large areas already referred to lie in Denmark Township, where there is a tendency to swampy conditions. These could be brought into good cultural condition by a thorough system of drainage, which is in all cases possible. The subsoil of this type is somewhat impervious, and underdrainage would make the soil lighter and more productive.

The Volusia loam is derived from the Erie shales, ground up and mixed with rock fragments brought from the north by the ice. These fragments consist of a great variety of rock, but are largely sandstone, gneiss, and granite. The fragments range in size from small pebbles to bowlders 6 feet or more in diameter. The latter are not, however, of frequent occurrence. The shale fragments predominate, and indicate that the soil is derived for the most part from the underlying shale. The texture of this soil does not differ in any important degree from the underlying blue clay, and it seems likely that it is derived from the weathering of this bowlder clay or till.

The Volusia loam grows fine crops of timothy, oats, wheat, and rye, being especially adapted to cereals and grass. Timothy hay yields from 2 to 3 tons per acre, and is the principal crop grown on this type, large quantities of hay being shipped out of the county. Corn and potatoes do not yield as well on this as on the lighter soils, but do fairly well when the season is not too wet. Grapes also do well on the Volusia loam, though not an important crop in the area. Wheat yields from 15 to 25 bushels per acre on the average, though 30 or 35 bushels are sometimes obtained, and oats yield from 30 to 40 bushels.

The following table shows the texture of typical samples of fine earth of the soil and subsoil of the Volusia loam:

Mechanical analyses of Volusia loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.35 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9306	4 miles S. of Conneaut.	Yellow heavy loam, 0 to 6 inches.	1.98	2.12	4.06	3.74	12.02	13.76	41.90	21.88
9304	2 miles N. of Geneva.	Brown heavy loam, 0 to 6 inches.	1.70	.80	2.10	1.88	6.70	7.90	50.84	29.54
9302	Jefferson	Brown heavy loam, 0 to 8 inches.	3.65	.48	2.20	1.92	6.92	10.56	46.60	31.78
9305	Subsoil of 9304	Heavy loam, 6 to 36 inches.	.56	1.68	4.30	3.56	12.16	12.80	39.70	25.74
9303	Subsoil of 9302	Heavy loam, 8 to 36 inches.	1.70	1.62	6.00	4.28	10.02	13.58	37.00	27.98
9307	Subsoil of 9306	Yellow clay, 6 to 36 inches.	.26	2.18	5.36	4.68	11.70	11.38	36.40	28.02

DUNKIRK CLAY.

The Dunkirk clay is the heaviest type of soil occurring in the area. The soil consists of from 6 to 10 inches of gray to brown clay loam, containing occasional scattered pebbles or bowlders. This soil is very stiff, and it is impossible to work it in wet weather. On drying it cracks and breaks up into hard lumps.

The subsoil consists of a mottled gray and yellow clay, reaching a depth of 4 or 6 feet, being underlain at that depth by bowlder clay. The subsoil also contains scattered rock fragments.

The Dunkirk clay in this area is found entirely upon the lake foreland and north of the North Ridge. It is very level and in most cases very poorly drained. In wet weather water collects on its surface in pools. Most of the drainage water, as now disposed of, flows into open ditches, which are nearly always wet.

This soil is composed of offshore deposits laid down when the waters of the glacial lake covered this part of the area. The bowlders found scattered through it were undoubtedly dropped from the fragments of floating ice as they slowly melted. Occasionally there are small lenses and pockets of sand in the subsoil.

When well drained the Dunkirk clay has the same crop values and yields as the Volusia loam, but as a rule the yields are lower. Grass, however, gives from 1½ to 3 tons of hay per acre. In the Westfield area, Chautauqua County, N. Y., this soil type has recently been found to be an excellent one for grapes, and a considerable acreage is devoted to their production. The yield ranges from 4 to 5 tons per acre, depending upon the season.

The following table gives the texture of typical samples of fine earth of this soil:

Mechanical analyses of Dunkirk clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9286	4 miles E. of Ashtabula.	Stiff clay loam, 0 to 7 inches.	3.77	0.90	1.84	1.16	5.26	5.92	31.50	52.90
9282	½ mile N. of Saybrook.	Dark clay loam, 0 to 6 inches.	5.06	.90	1.54	1.10	4.70	5.46	32.70	53.50
9284	1 mile NW. of Geneva.	Heavy clay loam, 0 to 6 inches.	4.44	.68	1.76	1.28	5.68	6.40	28.80	53.90
9285	Subsoil of 9284.....	Gray and yellow clay, 6 to 36 inches.	.11	.20	1.20	1.34	8.60	10.46	28.04	50.04
9283	Subsoil of 9282.....	Mottled yellow clay, 6 to 36 inches.	1.09	.08	.60	.90	8.94	10.08	24.20	55.00
9287	Subsoil of 9286.....	Clay, 7 to 36 inches.	2.26	.50	1.32	1.38	10.28	13.08	16.52	56.80

DUNKIRK SANDY LOAM.

The soil of the Dunkirk sandy loam consists of from 6 to 10 inches of sandy loam, underlain by a subsoil of medium or fine sand. Occasional scattered pebbles are present in both soil and subsoil.

The Dunkirk sandy loam is found on both the North and the South

ridges, as a rule in elongated, narrow areas. It is also found north of the North Ridge, where it occurs in hummocky ridges or knolls, frequently quite sandy on their crests.

It is very well drained along the ridges, but in the low-lying areas it is occasionally liable to be wet, owing to the nearness of the underlying till sheet.

The Dunkirk sandy loam is derived from beach deposits, deltas, and offshore bars formed in the glacial lake. It is generally underlain at from 3 to 6 feet by gravel or the bowlder clay of the till sheet. East of Conneaut there is a large area of this type, the subsoil of which is mined and sold as molding sand. Here the subsoil is fine and loamy and well adapted for this purpose.

The Dunkirk sandy loam is a typical truck soil. Good crops of corn and potatoes are produced, but the yields of grass and cereals are much smaller than on the Volusia loam. This soil should grow good peaches, small fruits, and truck crops. In Chautauqua County, N. Y., this soil is considered the best type for growing grapes, on account of the heavy yields rather than quality of the fruit.

The following table shows the texture of typical samples of this soil:

Mechanical analyses of Dunkirk sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9298	2 miles W. of Conneaut.	Yellow sandy loam, 0 to 10 inches.	1.73	0.60	1.06	1.46	28.58	43.06	17.80	7.34
9296	1 mile SW. of Ashtabula.	Sandy loam, 0 to 8 inches.	2.23	.80	3.44	3.90	42.70	26.14	13.02	9.80
9300	Near Geneva.....	Brown sandy loam, 0 to 10 inches.	3.06	1.00	3.36	6.34	32.54	24.56	20.40	12.00
9297	Subsoil of 9296.....	Sand, 8 to 36 inches.	1.07	.40	2.24	5.40	60.50	21.96	5.40	4.02
9299	Subsoil of 9298.....	Fine loamy sand, 10 to 36 inches.	.46	.24	.86	.74	20.14	50.98	16.90	10.00
9301	Subsoil of 9300.....	Sand, 10 to 36 inches.	.80	1.30	4.66	8.44	35.66	20.64	16.20	13.10

DUNKIRK GRAVELLY LOAM.

The soil of the Dunkirk gravelly loam consists of from 6 to 12 inches of gravelly sandy loam, underlain by a subsoil varying from gravel to coarse sand, which extends to a depth of 3 feet or more. The gravel is made up largely of shale fragments rounded by water action. It occurs in long, relatively narrow bands along the ridges, and is in origin a beach or delta deposit. It is, with the Dunkirk gravel, the

best drained soil of the area, and in dry seasons is apt to suffer from drought.

This type is best adapted to growing fruit and truck, though in fairly wet seasons it will produce good crops of corn and potatoes. Grass and wheat require heavy fertilization to produce well on this soil. Grapes form a very important crop on this soil in some other areas along Lake Erie.

The following table shows the texture, as determined by mechanical analyses of typical samples of fine earth of this soil:

Mechanical analyses of Dunkirk gravelly loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9288	½ mile E. of Ashtabula.	Gravelly sandy loam, 0 to 8 inches.	2.69	17.36	18.12	12.62	15.72	9.18	17.40	9.60
9289	Subsoil of 9288	Coarse sand and gravel, 8 to 36 inches.	.27	9.96	25.36	26.10	26.62	4.34	4.00	3.42

DUNKIRK GRAVEL.

The Dunkirk gravel consists of an extremely gravelly soil, with a subsoil of the same material. The size of the gravel varies greatly, as does the proportion of sand present. It is found in bands and small detached areas along the ridges. It is well drained, and in dry seasons is apt to be too droughty for ordinary crops. It represents the most gravelly phase of the old beach deposits, passing so gradually into the Dunkirk sand and the Dunkirk gravelly loam that it is frequently hard to define exact boundaries between these three types.

Grass, corn, and wheat are the crops ordinarily grown on the Dunkirk gravel, but the yields are low compared with those of other types of the area. Judging from results obtained from the cultivation of peaches, plums, and grapes in other areas, this type should be used more largely for these products in Ashtabula County. The soil is especially useful where an early grape is desired, and while the yield would not be quite so large as on other types the quality and early maturity should make up the deficiency.

The following table shows the texture of the fine earth components of this type of soil:

Mechanical analyses of Dunkirk gravel.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
9292	Saybrook.....	Gravel and sand, 0 to 10 inches.	0.49	31.00	27.32	13.38	9.46	4.74	8.20	5.80
9294	2½ miles NE. of Saybrook.	Gravel containing sand, 0 to 12 inches.	1.69	28.44	23.36	8.00	7.70	7.10	15.70	9.48
9295	Subsoil of 9294....	Gravel and coarse sand, 12 to 36 inches.	.35	24.30	33.76	18.38	11.48	3.76	4.40	3.78
9293	Subsoil of 9292....	Gravel containing sand, 10 to 36 inches.	.39	31.38	32.06	13.78	7.66	3.42	6.80	4.90

MEADOW.

The Meadow in the Ashtabula area is found along the streams, by which it has been deposited in times of overflow, and in texture is very variable. It is low-lying, and for the greater part poorly drained, and is seldom cultivated, being liable to overflow during any very heavy rainfall. Its main use in this area is as pasturage, for which purpose it is well adapted, especially during the summer months.

DRAINAGE PROBLEMS.

Probably 75 per cent of the soils of Ashtabula County would be greatly benefited by a thorough system of underdrainage, for the heavy Volusia loam and Dunkirk clay are both very retentive of moisture. Heavy showers leave the fields saturated with water, which is slow to drain off. This not only makes early cultivation difficult, but in wet seasons retards the growth of crops.

In some townships there are quite large areas which in wet seasons become almost swamps. All of these wet lands might be greatly improved by drainage, though in the case of the more extensive tracts such drainage could only be secured by cooperative efforts involving the construction of a common outlet ditch or drain.

At present there are some tile-drained fields, but for the most part open ditches are resorted to. These are far from satisfactory, becoming choked by vegetation and the caving in of the banks.

It is conceded by most of those who have tile-drained fields that such drains soon pay the cost of installation in making the soils earlier and in increasing the yield of crops.

Most of the cultivable land lies at a sufficient elevation above the natural drainage channels to insure easy and complete relief from excess of water, provided properly planned drains are constructed.

AGRICULTURAL CONDITIONS.

The agricultural conditions of Ashtabula County are undoubtedly above the average in prosperity, and evidences of this are noticeable in the buildings and general appearance of the majority of the farms. Many of the agricultural class are wealthy, with investments in railroad and other securities, while another evidence of prosperity is shown in the comparatively small number of mortgaged farms, not more than 25 per cent being encumbered. Many of the farms in freehold are rented by their owners, who have retired from active agricultural pursuits. These rented farms invariably show the lack of interest of the tenant farmer.

The average size of the farm varies from 150 to 200 acres, though a few much larger acreages exist. As a rule the farms contain larger areas of cultivable land than can be readily handled with the present difficulty of securing farm labor.

Labor, especially of the more efficient class, is scarce, and this scarcity is greatest during the harvest season, when such help is almost impossible to obtain. This, however, is at present true of most agricultural communities, where labor is being attracted largely to the industrial centers by the higher wages and more attractive town life.

The principal crop grown in the Ashtabula area is hay, of which large quantities are baled and sold outside of the county. The hay is mostly timothy, or a mixture of timothy and clover, and the yields average from 2 to 3 tons per acre. The fields usually remain in grass for about three years, after which the yield becomes reduced by the increase of several species of plantain (plantago), which covers the ground and chokes out the grass.

Wheat is probably the second in importance of the crops grown in this area, and produces about 25 bushels per acre. The wheat is of a good, firm berry, and of fine quality. Oats is the crop next in importance, with yields of from 35 to 40 bushels per acre on the best handled farms. Considerable corn is grown, though the soils, as a rule, are too heavy for an ideal corn land. A large proportion of the corn grown is used as ensilage. Potatoes are not extensively grown, the Volusia loam, which covers the larger part of the area, being too heavy for this crop. Those produced are chiefly for local use.

At one time the grape industry was very promising in this county, especially along the ridges, but the increase of the grape rot has caused many vineyards to be abandoned, and others are fast following. Only by thorough and frequent spraying can this disease be kept in check. The expense of such spraying is keeping all but the more

wealthy growers from extending their vineyards. The principal varieties grown are the Concord and the Niagara.

Apples do well in this county, and should be more extensively grown than at present. Most farmers now have small orchards, but these are seldom cared for as they should be.

The dairy industry is of considerable importance, though the herds of cattle are probably not as large as formerly. Instead of using the hay to produce butter, cheese, and milk, a larger proportion of the crop is baled and sold outside the area, and commercial fertilizers are bought to take the place of barnyard manure.

The soils of Ashtabula County seem to be well adapted to grass and cereal crops. These crops are especially suited to the Volusia loam and Dunkirk clay, which together cover nearly 76 per cent of the area surveyed. On the well-drained lighter soils of the old beach lines, peaches and small fruits, as well as truck, should do well, though as yet these industries are little developed.

Ashtabula County is well supplied with means of transportation, being crossed in the northern part by the Lake Shore and Michigan Southern Railroad. A branch of this line extends southward through the central part of the county from Ashtabula to Youngstown and on to Pittsburg. The Pittsburg and Lake Erie Railroad and the Pittsburg, Youngstown and Ashtabula branch of the Pennsylvania Railroad also give connection with Pittsburg from Conneaut and Ashtabula, respectively. The New York, Chicago and St. Louis Railroad crosses the northern part of the county, paralleling the Lake Shore and Michigan Southern.

These roads give good transportation facilities to markets, such as Erie and Buffalo on the east, Cleveland on the west, and Pittsburg to the south. With the large towns of Ashtabula and Conneaut within its boundaries, and with its good transportation facilities to large nearby markets in Ohio and other States, it would seem that the Ashtabula area should have a more specialized agriculture than that which exists at present.

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