

SOIL SURVEY OF THE LYONS AREA, NEW YORK.

By W. EDWARD HEARN.

LOCATION AND BOUNDARIES OF THE AREA.

The Lyons area, lying largely within Wayne County, in the western part of New York, about midway between Rochester and Syracuse, covers an area of approximately 515 square miles, or 339,664 acres. It is comprehended between the parallels 43° and $43^{\circ} 20'$ north latitude and the meridians $77^{\circ} 15'$ and $76^{\circ} 45'$ west longitude.

The area borders upon Lake Ontario for a distance of 26 miles and extends south for about 22 miles. It is crossed by the Erie Canal and the New York Central Railroad. Lake Ontario is the most eastern of the great inland seas which divide the United States from Canada. The part of the lake bordering this survey has only one embayment, namely, Sodus Bay, which is quite a good harbor.

Newark is the largest town in the area surveyed, while Lyons, Clyde, and Palmyra are enterprising places and of some importance as markets for the farm produce of the region. (See fig. 1.)

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The Indians of the Iroquois Confederacy, or what is known as the Six Nations, were the first inhabitants of this area in historic times. They lived in a rude manner, depending for sustenance chiefly upon hunting and fishing. Their main crops were corn, potatoes, and vegetables. With the exception of a few scattered fields and occasional swamps and meadows the land was covered by dense forests, consisting of beech, elm, hickory, oak, ash, hemlock, white pine, and sugar maple. Of all this thick forest very little is left to-day.

The first white settlers entered this area about 1790, coming chiefly from the New England States, although some were from Scotland. During the period of 1809–1815 a few Quakers came in from Pennsylvania. The tide of immigration continued almost constant, and was only slightly checked by the war of 1812.

The inducements to settlement were cheap lands, extended in area, and the prospective increase in value by reason of situation on a waterway and not distant from the eastern markets. There were two classes of settlers—those who were purchasers of land and those who were simply squatters. The latter found employment, but rarely

became landowners by prescription. The land at first was cleared by cutting out the brush and deadening the trees by girdling, and later by felling and burning the timber. Even the choicest timber had no value in those days except for the ashes left upon the fields after the fires. The great labor required to clear the primeval forests of this part of the country, even in this wasteful way, can hardly be appreciated.

The first crops were corn, potatoes, wheat, rye, oats, the common vegetables, and a little tobacco for home use. All these crops yielded well on the fertile virgin soils. On the hills by the streams the pioneer settlements were first made. The streams at that time were the only highways, and here gristmills and sawmills were soon built.

Prior to the completion of the Erie Canal produce was taken to Albany on sleds in winter and by boats in summer. Sheep raising was practiced considerably up to 1850, but since that time there has been a gradual but constant decline in this industry. The Merino has been the principal breed. Dairying also had an early beginning and this interest has continually increased to the present time.

The Erie Canal, connecting Lake Erie with the Hudson River, greatly benefited the farming class, causing freight rates to decrease about 90 per cent. In 1853 the New York Central Railroad was built from Rochester to Syracuse.

By this time the agriculture in this area had become more diversified. Fruit growing had come to be one of the main industries. A little later peppermint became a quite important money crop. At that time peppermint oil brought a good price and had a ready sale at Lyons, but in recent years the price has been low, and at the present time only a little is produced in the area surveyed. A few years ago barley was also considered a staple crop in the northern portion of the area, but now almost none is grown.

Agricultural societies and fairs have long been important institutions in this region and have done much to stimulate the farming classes to activity and progress. Step by step needs have been met and advances made. Changes in methods of cultivation, a greater variety of crops, and improved machinery have given the farmer command of his fields, and to-day in its dwellings, barns, home conveniences, and improvements generally the area stands out as one of great agricultural progress and prosperity.

CLIMATE.

The following table, compiled from the records of the Weather Bureau stations at Lyons, Rochester, and Oswego, shows the normal monthly and annual temperature and rainfall, based on observations covering periods of eleven, thirty, and thirty years, respectively. Lyons, situated in the center of the southern portion, and Rochester, only 21 miles from the western boundary of the area, represent quite

well the conditions in the central and southern part of the survey. Oswego, situated on Lake Ontario, about 20 miles east from the eastern boundary of the survey, is believed to indicate fairly well the climatological conditions of that portion of the area bordering Lake Ontario.

Mean monthly and annual temperature and precipitation.

Month.	Lyons.		Rochester.		Oswego.	
	Tempera- ture.	Precipi- tation.	Tempera- ture.	Precipi- tation.	Tempera- ture.	Precipi- tation.
	°F.	Inches.	°F.	Inches.	°F.	Inches.
January	26.5	2.61	23.9	3.14	24.3	2.97
February	25.6	2.36	24.4	2.73	24.6	2.54
March	32.5	2.62	30.3	2.86	30.4	2.62
April	46.3	1.49	43.5	2.48	42.3	2.08
May	57.5	3.15	56.3	3.34	54.0	2.83
June	67.5	3.21	66.4	3.22	64.0	3.40
July	70.5	3.27	70.4	2.97	69.0	3.12
August	69.4	3.57	68.4	3.06	68.2	2.64
September	62.7	2.77	62.0	2.34	61.7	2.80
October	51.1	2.40	49.9	2.92	50.0	3.26
November	40.1	2.92	37.4	2.85	38.5	3.37
December	31.1	2.76	28.6	2.91	29.4	3.39
Year	48.4	33.13	46.8	34.82	46.4	35.02

An examination of this table shows that the rainfall is fairly uniformly distributed throughout the year, the greatest amount of precipitation, however, occurring during May, June, July, and August.

PHYSIOGRAPHY AND GEOLOGY.

The surface features of the Lyons area are greatly diversified, being composed of a succession of hills and valleys. The elevation ranges from 250 to 700 feet above sea level. The southern and central parts of the area are broken by hills and ridges running north and south. As a rule these terminate in abrupt slopes to the north, while to the south the slope is more gradual. The ridges rise some 100 to 160 feet above the intervening valleys. The northern part of the area possesses a more rolling surface, which inclines northward to the lake. There are, however, some prominent ridges in the northeastern corner of this part of the area.

Only a few of the hills and ridges are so precipitous as to prevent cultivation. There is in the northwestern part of the area, about 5 or 6 miles distant from the lake, a stony and gravelly ridge that has the appearance of an ancient beach, being composed in part of waterworn gravel and boulders. This ridge forms a part of the drainage divide separating the waters entering Clyde River and those running into Lake Ontario. An arm of the Montezuma Marsh, covering about 10 square miles, occurs in the southeastern part of the area.

The central and southern parts of the Lyons area are drained by the Clyde River and its tributaries, while the waters of the northern part run into Lake Ontario. The drainage divide is not well marked, the land being practically level where the small streams head.

Clyde River, formed by the junction of Ganargua Creek and Canandaigua Outlet at Lyons, is the principal stream in the survey. The valley along this river is generally narrow and is flanked by hills and ridges on each side. A few of the smaller streams which have sufficient fall afford water power, which is utilized by gristmills. Many of the small streams have cut deep and very narrow channels. Some terracelike formations occur in places along these streams, and in the vicinity of the New York Central Railroad such terraces furnish an excellent gravel for road ballast.

The soils in this area are derived from glacial drift composed, at least in part, of material brought from the country to the north by the great ice sheet which during the Ice Age covered this part of the American continent. The depth of this drift over the bed rock ranges from a few feet to about 100 feet. The upland soils of the area contain a large percentage of rounded stones and gravel, and in many places large, erratic boulders, chiefly granite and retaining signs of glacial action, are scattered through the drift. The valley soils, after considerable modification by stream action, have been redeposited, and are free from stones and gravel.

The rocks that underlie this glacial material at varying depths are of Silurian age, and are chiefly sandstones and shales.

All the central and southern part of this area is underlain by the Salina shale. This is seen outcropping at the base of the hills in a few places. The strip of country from Marion to Sodus Center and thence east to Wolcott and south to Butler Center is underlain by the Niagara limestone, which also outcrops in several places. It has, however, but little influence upon the soils in this survey. Some of the limestone rock is quarried and manufactured into lime.

The remaining part of the area is underlain by the Clinton and Medina formations. The former consists of limestone and shale; the latter is a red sandstone and is confined to the lake front.

SOILS.

There were mapped in the Lyons area seven types of soil, exclusive of Meadow and Muck. The distribution of these types, while following certain broad, general laws, is very intricate, and the accurate tracing of the boundaries was a labor of more than ordinary difficulty. The predominant soil is the Miami stony loam, occupying a little less than one-half the area. The extent of none of the other types exceeds 12 per cent of the area.

An interesting feature of the soil map is the graphic way in which it illustrates the action of the glacial ice, the areas lying in the majority of cases with their longer axis parallel with the direction of the motion of the ice. The soil is thus seen to occur in grooves or hollows scoured out by the great ice mass, or in ridges between these grooves, filled in or built up by glacial drift, by detritus, and by washed and transported material.

The following table gives the total area of each type of soil and the proportion which each bears to the entire survey:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Miami stony loam.....	158,400	48.4	Miami fine sand.....	14,656	4.4
Alton stony loam.....	38,208	11.6	Miami loam.....	5,184	1.5
Meadow.....	35,008	10.6	Muck.....	3,840	1.1
Miami fine sandy loam.....	29,824	9.0	Total.....	329,664	
Elmira silt loam.....	28,096	8.5			
Alloway clay.....	16,448	4.9			

MIAMI STONY LOAM.

The surface soil of the Miami stony loam is a light-brown sandy loam, having a depth of 7 to 10 inches and containing occasional streaks of gravel, the proportion of which ranges from 5 to 40 per cent of the soil mass. The subsoil is a yellowish or brown sandy loam to a depth of 3 feet, containing from 5 to 50 per cent of gravel and stones. In a few instances the clay content increases with the depth of the soil. There are scattered areas of this type which are underlain by a consolidated mass of gravel forming substantially a hardpan. In most cases this hardpan is not sufficiently near the surface to interfere with cultivation or to exert any influence on the crops. The stones and gravel are composed chiefly of granite with a less quantity of sandstone fragments, generally small and well rounded. This material occurs in the greatest abundance in the more rolling areas of this soil, while as a rule the proportion is comparatively insignificant on the steepest slopes and hills. This peculiar distribution may in part be due to the alternate freezing and thawing of the land in winter and to the cultivation of the soil, both of which would have a tendency to move the stones from the steep to the more level areas. The stones in some cases have been picked off and piled in heaps, or, where they occur in sufficient quantity, used in fencing the fields.

The Miami stony loam is the most important type found in the present survey, both in extent and agricultural value. Its most important development is found in the southern and central parts of the area surveyed, where it occurs in broad and extended areas of irregular

outline. Quite a number of small bodies of this soil are found in the northeastern part of the area, and scattered areas occur in other localities.

The Miami stony loam has a very much broken and diversified surface. It occupies the hills, knolls, ridges, and, occasionally, the gently rolling country. This soil has the highest elevation in the area, the altitude ranging from 450 to 700 feet above sea level. A great number of the ridges occupied by this soil have quite abrupt slopes and are cultivated with difficulty.

The natural drainage of this type is good. Scarcely any part of it has to be ditched, and underdrainage is unnecessary. It is a comparatively warm soil and one that can be tilled shortly after a rain.

The origin of the Miami stony loam may be traced to the weathering of the glacial drift material. The hills and ridges occupied by this type are the immense deposits left by the ice as it receded, or by the glacial streams swollen by the waters from the melting ice.

At least 90 per cent of this soil is under cultivation. Excepting the more stony fields and steep places, it is easily tilled. The stones and the declivities interfere considerably with the use of modern farm machinery.

Upon this soil is grown to some extent every farm crop known to the area. The principal crops are the grasses, corn, oats, wheat, sugar beets, and potatoes; while relatively less important are cabbages, beans, green peas, peppermint, tobacco, and berries. Timothy and clover are the main grass crops, and these yield from 1 to 2½ tons per acre. Corn gives about 25 bushels, wheat 12 bushels, oats 25 bushels, and potatoes about 75 bushels per acre. The yield per acre of sugar beets averages between 8 and 11 tons. The beet contains a high percentage of sugar with a satisfactory purity of juice. The cultivation of green peas and of cabbages is found quite profitable. The peas yield from three-fourths to 1½ tons per acre and are grown for canning purposes. Cabbages average from 4 to 12 tons per acre. (See Pl. IV, fig. 6) A few fields of tobacco were seen north of Savannah. The peppermint is grown for the most part at the base of the hills, where the soil is more moist and slightly finer textured than in the more elevated areas. Patches of raspberries and blackberries were seen, and these fruits are profitably grown. The growing of tree fruits forms a very important part of the agricultural practice and many large apple orchards and a few cherry, pear, plum, and peach orchards occur on this soil.

The Miami stony loam is not especially adapted to any one crop in preference to others, but can be relied upon as a good, safe soil for general farming.

The table on page 149 gives the mechanical analyses of typical samples of Miami stony loam.

Mechanical analyses of Miami stony loam.

[Fine earth.]

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.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7426	1½ miles NE. of Marion.	Brown sandy loam, 0 to 9 inches.	1.90	1.22	3.36	3.84	16.26	24.40	41.02	9.14
7424	1½ miles N. of Lyons.	Brown sandy loam, 0 to 10 inches.	1.67	2.58	3.74	3.44	16.26	24.70	37.90	10.98
7428	2½ miles S. of Palmyra.	Brown sandy loam, 0 to 9 inches.	2.32	3.08	5.30	4.62	16.44	19.56	38.64	11.84
7427	Subsoil of 7426.....	Yellowish sandy loam, 9 to 36 inches.	.94	1.82	3.71	3.96	17.42	25.54	38.54	8.72
7429	Subsoil of 7428.....	Brown sandy loam, 9 to 36 inches.	1.74	4.62	7.34	5.90	18.76	18.92	31.16	13.30
7425	Subsoil of 7424.....	Yellow sandy loam, 10 to 40 inches.	.71	1.90	3.06	3.52	17.82	24.14	34.54	14.84

ELMIRA SILT LOAM.

The Elmira silt loam is a pale-yellow to light-brown silt loam, carrying a relatively high percentage of very fine sand. The soil has a depth ranging from 6 to 12 inches. Below this is found a brown or chocolate loam, slightly heavier in texture and extending to a depth of 36 inches. Road cuts and stream banks show the subsoil to be several feet in thickness. In a few instances the subsoil has streaks or layers of very fine sandy loam scattered through it.

This soil type is confined to the northern and northeastern part of the area surveyed. Excepting the smaller patches scattered along Lake Ontario, the soil occurs in broad and extended areas.

There is a great diversity in the surface features of the Elmira silt loam. It occupies the rolling forelands of Lake Ontario and the tablelands, ridges, and steep slopes bordering Sodus Bay and the several small streams that empty into the lake. Some areas of this soil on the steepest slopes are badly gullied.

The soil generally has good natural drainage, but in some of the more level parts and depressed areas it is inclined to be cold and heavy, and these places would be benefited by underdrainage.

The uniformity in the texture of this soil and the position it occupies are evidences that it was laid down in comparatively quiet water, and that since that time it has undergone but little change. The surface, however, has weathered to some extent, having become slightly lighter in color and of a more mellow nature. It gives soft, smooth roads, a characteristic of this soil easily detected in traversing the area.

The Elmira silt loam is a light and mellow soil, easily tilled and free from stones or gravel, except the few scattering stones occurring where this soil joins the Miami stony loam. It is subject to quite heavy erosion, but this can in great measure be prevented by proper cultivation. Most of the silt loam is under cultivation and produces good crops. The yield per acre of wheat is from 10 to 20 bushels, of oats from 20 to 40 bushels, of corn from 15 to 30 bushels, of potatoes from 60 to 150 bushels, and of timothy hay from 1½ to 2½ tons. Raspberries and blackberries do well. Some of the finest apple orchards in the area were observed on this soil around Sodus Bay, where also are smaller orchards of peaches, pears, plums, and cherries. (See Pl. III, fig. 2.) A few years ago large crops of barley were raised on this soil, but this crop has now been abandoned.

The silt loam has the power of retaining large quantities of water, and hence it can withstand drought exceedingly well—much better than any of the other upland soils in the survey. It holds fertility fairly well and can be easily improved.

The following table shows the texture of typical samples of the Elmira silt loam:

Mechanical analyses of Elmira silt 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.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7420	3 miles N., ¼ mile E. of North Wolcott.	Yellow silty loam, 0 to 8 inches.	0.78	0.16	0.88	0.72	3.86	21.32	63.66	9.06
7418	1½ miles N., ¼ mile E. of Alton.	Yellowish silty loam, 0 to 10 inches.	2.43	.10	1.04	.78	2.98	21.62	60.14	12.76
7422	¼ mile W. of Resort.	Light brown silty loam, 0 to 9 inches.	1.11	.00	1.14	.92	1.80	13.10	69.86	12.82
7419	Subsoil of 7418.....	Yellowish silty loam, 10 to 40 inches.	.18	.26	1.12	.84	1.56	22.36	63.18	10.08
7423	Subsoil of 7422.....	Light brown silty loam, 9 to 36 inches.	.30	.02	.64	.78	1.76	10.04	72.78	12.92
7421	Subsoil of 7420.....	Yellow silt loam, 8 to 36 inches.	.47	.00	.42	.36	2.80	13.64	68.34	13.70

MIAMI FINE SAND.

The Miami fine sand is a fine yellow or light-brown sand, with an average depth of about 8 inches, underlain by a subsoil of fine orange or yellow sand extending to a depth of 40 inches. Both soil and subsoil are generally free from stones, although a little gravel is scattered over the surface in a few localities. The light-brown color of the soil is due to the organic matter that has been incorporated with the mineral particles. From sections in road cuts the Miami fine sand is seen to be several feet deep, the material being quite uniform throughout.

Areas of this soil type occur in the north central and northwestern parts of the survey and along the Rome, Watertown, and Ogdensburg division of the New York Central and Hudson River Railroad, in the vicinity of Williamson. Smaller scattered areas occur in other parts of the survey.

There is but little uniformity in the surface features of the Miami fine sand. It occupies the rolling upland, level areas, knolls, and ridges indiscriminately, and is usually found near the courses of the small streams emptying into Lake Ontario or Sodus Bay.

Owing to its texture and the rolling position it occupies this soil has good natural drainage. Both the surface and seepage waters are quickly carried away. Indeed, so thoroughly and rapidly is the water removed that cultivation can be carried on immediately after a rain, when all the surrounding soils are too wet to be tilled.

The Miami fine sand consists, originally, of glacial material. This has been partly reworked, and in many cases redeposited, by the streams, to the sorting action of which is due its uniformity of texture.

This soil is very early and is easily tilled. The principal crops are corn, potatoes, and berries. Some wheat, oats, hay, and cabbages are produced. One or two fields of tobacco were seen. Corn yields moderately. Potatoes do well, averaging from 50 to 130 bushels per acre. The tubers are of medium size, smooth and clean, keep well, and possess a fine texture and flavor. The culture of raspberries is quite extensively practiced on this soil and a good yield is obtained. Several young orchards of peaches, pears, cherries, and plums, as well as larger and older orchards of apples, were seen on this soil.

The Miami fine sand is adapted to truck, potatoes, and small fruits. All these crops do well and can be more profitably raised than the ordinary farm products. The soil is leachy, does not retain fertilizer well, and consequently it can not reach a high state of productiveness. It can, however, be much improved by applications of well-rotted barnyard manure and by turning under some leguminous crop. These methods would increase the humus in the soil and make it more retentive of moisture.

The following table shows the texture of the Miami fine sand:

Mechanical analyses of Miami fine sand.

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 0.06 mm.	Silt, 0.06 to 0.005 mm.	Clay, 0.005 to 0.001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7399	2½ miles NW. of Sodus.	Light brown fine sand, 0 to 7 inches.	2.35	0.20	0.84	0.68	9.18	67.36	19.24	1.10
7395	1½ miles SE. of Alton.	Light brown fine sand, 0 to 9 inches.	2.43	.38	.48	1.38	36.32	47.34	11.32	2.54
7397	2 miles SW. of Marengo.	Yellowish sand, 0 to 8 inches.	1.66	.20	9.90	13.94	41.70	17.16	10.52	5.24
7400	Subsoil of 7399.....	Yellowish fine sand, 7 to 40 inches.	.47	.18	.48	.40	5.80	76.70	14.94	.78
7396	Subsoil of 7395.....	Yellowish fine sand, 9 to 40 inches.	.28	.02	.04	.06	40.40	52.84	5.00	1.64
7398	Subsoil of 7397.....	Yellowish sand, 8 to 40 inches.	.38	.50	8.20	11.46	46.70	21.70	7.72	3.36

MIAMI LOAM.

The Miami loam to a depth of 10 inches consists of a dark-brown silty loam. The subsoil is either a silty or clay loam of brown color, extending to a depth of 36 inches. Both soil and subsoil are free from stones or gravel. It is an easily tilled soil.

Areas of this soil occur in the central southern portion of the survey along Clyde River, in the vicinity of Alloway, and in a few scattered patches along Ganargua Creek to Palmyra.

The Miami loam occupies the level river and stream bottoms and has the same general surface features throughout. It is never over a few feet above the water level. By reason of this low position the drainage is naturally poor. Artificial drainage can be advantageously applied to a part of the areas.

The soil consists of glacial material, worked over by the smaller streams and finally deposited by Clyde River and the larger creeks. Each year this soil is being built up and enriched by fresh deposits left by the streams at times of flood.

The Miami loam is a strong, fertile soil. It is recognized as one of the best soils for the ordinary farm crops in the area surveyed, though liability to flooding during the growing season considerably lessens its value. Sugar beets do well on this soil, producing as high as 18 tons per acre, with an average yield of from 12 to 14 tons. Corn and oats yield from 30 to 60 bushels per acre. Wheat and the grasses also do well. Some peppermint is also grown, and the soil seems well fitted to the production of this crop. All these yields are dependent

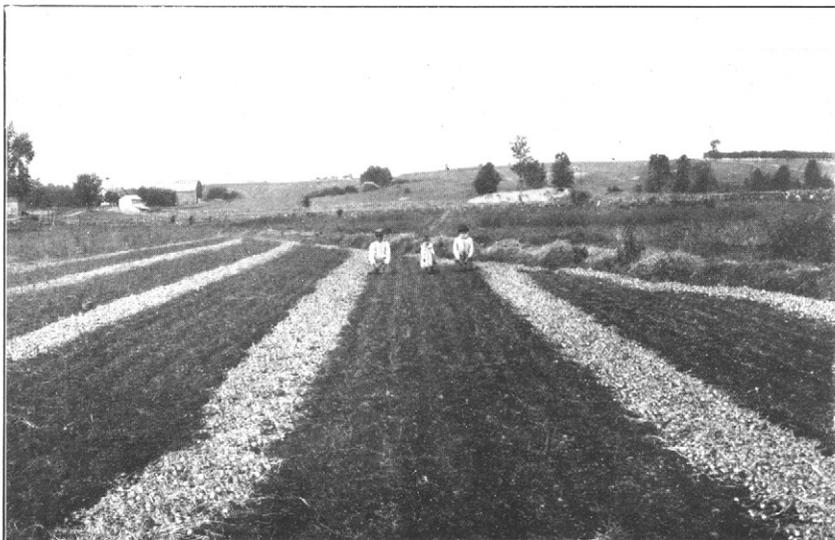


FIG. 1.--HARVESTING A CROP OF ONIONS ON SMALL MUCK AREA, LYONS AREA, NEW YORK.

This represents one of the large special industries, and shows a peculiar adaptation of a soil to a crop.

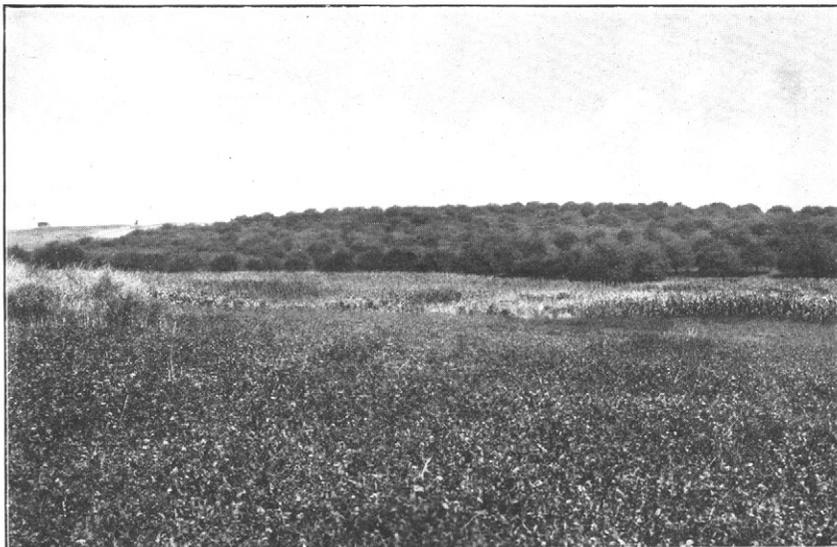


FIG. 2.—AN APPLE ORCHARD ON THE ELMIRA SILT LOAM, LYONS AREA, NEW YORK.

Wayne County is one of the five large apple counties of New York. The principal apple soils are Lyons silt loam and Lyons stony loam.



FIG. 1.—A CROP OF NAVY BEANS ON THE ALTON STONY LOAM, LYONS AREA, NEW YORK.

The illustration shows the very stony character of the soil. This is a far less productive soil than the Lyons stony loam, although the reason for this is not apparent.



FIG. 2.—CABBAGES ON THE MIAMI STONY LOAM, LYONS AREA, NEW YORK.

This is one of the important crops of the area, and this is one of the most important soils, adapted to vegetables, apples, and dairying.

upon a favorable season and freedom from overflow during the growing of the crops.

The natural fertility of the Miami loam is such that little or no fertilization is needed to produce good crops. This fertility is annually added to by the overflows taking place during winter and early spring. The soil is best adapted to wheat, corn, oats, grass, and sugar beets.

The following table shows the texture of the soil and subsoil of this type:

Mechanical analyses of Miami 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 0.06 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7432	3¼ miles SE. of Lyons.	Dark brown loam, 0 to 12 inches.	4.47	0.00	1.04	1.50	6.26	11.64	61.08	18.40
7430	1¼ miles S., 3¼ miles E. of Lyons.	Brown silty loam, 0 to 9 inches.	2.25	Tr.	.94	1.44	5.14	12.98	56.36	22.38
7431	Subsoil of 7430.....	Brown silty loam, 9 to 40 inches.	1.21	.00	.62	1.26	6.28	36.44	40.20	14.92
7433	Subsoil of 7432.....	Brown clay loam, 12 to 36 inches.	2.33	Tr.	1.94	3.24	6.62	6.04	54.30	27.72

MIAMI FINE SANDY LOAM.

The surface soil of the Miami fine sandy loam consists of a brown or black, mellow, fine sandy loam with a depth ranging from 5 to 10 inches and containing in many cases a high percentage of organic matter. The subsoil is a fine to medium, yellow, gray, or white sand with a depth of 3 feet or more. Occasionally strata of sandy loam a few inches thick are found in the subsoil. Both the soil and subsoil are free from stones and gravel, except in a few places adjacent to the stony loams, where a comparatively small proportion of such material is found mixed with the soil. A few small areas of this type are more nearly a silt loam.

This soil type occurs in broad extended areas in the eastern central part of the survey, just west of Clyde and Rose, in small areas in the vicinity of North Rose, Alton, Sodus, and Newark, and in many smaller patches scattered throughout the survey. In the central areas the soil occurs in strips between the Miami stony loam and the Alton stony loam.

There is considerable uniformity in the surface characteristics of the Miami fine sandy loam. It occupies the very gently rolling, level, and low-lying areas bordering the smaller stream courses. The elevation is generally below the surrounding soil areas.

This soil has for the most part very poor natural drainage, and the largest and most typically developed areas badly need underdrainage. This can be had by the use of terra cotta tiles. In its present condition the soil is late and cold, but with proper drainage this disadvantage would be largely overcome. Not only would a larger yield of the crops now grown be secured in this way, but the soil would become adapted to a greater variety of crops, and its value would be enhanced accordingly.

The Miami fine sandy loam consists of glacial material which has been greatly modified by stream action. Part of it is probably the finer material which has been washed from the surrounding stony loams and sands.

On this soil are grown chiefly corn, wheat, oats, grasses, sugar beets, potatoes, peppermint, onions, and osiers. Sugar beets do only fairly well on this soil, producing a moderate yield, ranging between 8 and 10 tons to the acre, although the sugar content and purity are quite high. The culture of osiers is said to be profitable on the wetter areas of this soil. Some fields were noticed just northeast of Lyons. Onions do fairly well where the soil has a high proportion of organic matter. Small patches of peppermint were also noted. This yields from 15 to 20 pounds of oil per acre. Few fruit trees were seen on this soil.

The Miami fine sandy loam is too light to give the best results in growing the grains and grasses. When drained it should be used for potatoes, sugar beets, onions, and other like specialties, while the wetter areas, particularly those difficult and expensive to drain, must continue to be best adapted to osier willow and peppermint production.

The following table shows the texture of samples of the soil and subsoil of this type:

Mechanical analyses of Miami fine 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.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7405	1 mile NW. of Rose.	Dark fine sandy loam, 0. to 10 inches.	1.62	0.02	0.32	0.30	10.34	51.72	32.96	4.20
7403	¾ mile NE. of Newark.	Black fine sandy loam, 0 to 8 inches.	7.54	.60	2.68	6.86	38.02	20.78	26.18	4.82
7401	¼ mile NW. of Alton.	Brown fine sandy loam, 0 to 8 inches.	2.17	.10	.90	.62	4.00	54.30	32.02	6.84
7402	Subsoil of 7401.....	Yellowish sand, 8 to 40 inches.	.70	.56	1.04	.62	1.46	52.30	40.50	3.44
7404	Subsoil of 7403.....	Yellowish fine sand, 8 to 36 inches.	.41	.40	1.94	8.58	54.20	24.46	5.56	4.34
7406	Subsoil of 7405.....	Yellow sandy loam, 10 to 40 inches.	.71	Tr.	.60	.40	19.28	53.34	19.78	6.46

ALLOWAY CLAY.

The Alloway clay is a silty or clay loam of grayish or dark-brown color, 4 to 8 inches deep, underlain by a subsoil of mottled-yellow or grayish clay, having a depth of 3 feet or more. In a few instances the subsoil is underlain by quicksand at a depth of 30 inches. Both soil and subsoil are free from stones.

The only large area of this soil lies just northwest of Clyde. There are, however, many small areas, or patches, scattered over the southern part of the area surveyed.

In this area the Alloway clay is always found in low, level, or depressed areas, and in many cases it borders the small streams. The similarity of position produces quite uniform surface features.

This soil, owing to its low position and the close, impervious nature of the subsoil, has very imperfect natural drainage. Underdrainage would considerably improve its mechanical condition and at the same time make it warmer and more easily tilled.

The Alloway clay is sedimentary in origin, being derived by deposition in very quiet water of the finest material which has been washed out of the surrounding soil formations.

This soil produces good crops of wheat, oats, corn, and hay. Sugar beets and cabbages are also grown to some extent. It is said that the sugar beets have no trouble in penetrating the clay subsoil of this formation, and fairly good yields are secured, but the sugar content is not quite so high as in the beets grown on Miami stony loam. Very few fruit trees are seen on the Alloway clay.

In adaptation this type is an excellent grain and grass soil. It also makes good pasture land.

The following table gives the mechanical analyses of typical samples of the soil and subsoil:

Mechanical analyses of Alloway 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.
			<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
7407	1½ mile NW. of Clyde.	Dark-gray silty loam, 0 to 7 inches.	5.34	0.04	0.44	0.48	2.72	9.80	65.12	20.98
7409	½ mile N., 1½ miles E. of Newark.	Dark brown clay loam, 0 to 7 inches.	5.41	.20	.78	.98	4.50	9.98	47.98	35.10
7408	Subsoil of 7407.....	Clay loam, 7 to 30 inches.	.48	.34	1.24	.94	6.40	11.88	55.18	23.68
7410	Subsoil of 7409.....	Clay, 7 to 36 inches.	.65	.32	1.06	.90	2.84	6.70	36.26	51.74

ALTON STONY LOAM.

The surface soil of the Alton stony loam is a silty or sandy loam of grayish or brown color, having a depth of 6 to 10 inches and containing from 25 to 50 per cent of stones and gravel. The subsoil is either a sandy loam of brown color or a clayey sandy loam of reddish color, each containing from 20 to 60 per cent of stones and gravel. The stones and gravel found in this soil type are chiefly fragments of granite, brown sandstone, and limestone. The fragments are of all sizes, but are generally from 3 to 6 inches in diameter. There are, however, many large, erratic granite boulders scattered over the surface of this soil, some fields being so covered by them that cultivation is impossible. Some of the stones have been picked up and piled in heaps, built into fences—a characteristic feature of the farms on this soil—or even used in the construction of buildings. (See Pl. IV, fig. 1.)

This soil is confined to the northern part of the area surveyed, occurring in the largest and most typically developed areas around Wolcott and Williamson. Many smaller, scattered areas lie between these places, especially along the line of the New York Central and Hudson River Railroad.

There is a somewhat general uniformity in the surface features of this soil. It occupies chiefly the rolling and the practically level uplands, but now and then an area is found on a hill. It occurs for the most part at elevations ranging from 290 to 450 feet above sea level—a much lower position than that occupied by the Miami stony loam.

The more rolling areas of this soil have good natural drainage. Generally it is in the more level areas that the subsoil is the heaviest, and these would be benefited by underdrainage.

This soil consists chiefly of superficially weathered glacial material, but a very small proportion of the area is residual in origin, being derived from the decomposition of outcrops of the Clinton and Niagara limestones. The residual phase of this type is quite rich in lime.

The Alton stony loam, as a rule, is the poorest soil in the area. The more gravelly portions are leachy, can not withstand drought, and are tilled with considerable difficulty. Some areas, however, produce fairly good crops. Beans, corn, wheat, oats, and hay are the main products, with potatoes, cabbage, buckwheat, berries, and grapes as secondary productions. Beans are quite extensively grown on this soil, giving yields ranging from 12 to 25 bushels per acre. Apples do well; also peaches, pears, plums, and cherries. Grapes do fairly well, but are not grown to any great extent. This soil is adapted to fruit, especially apples, and should be devoted exclusively to its culture.

The table following gives mechanical analyses of soil and subsoil of this type.

Mechanical analyses of Alton stony loam.

[Fine earth.]

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.
7411	3 miles SW. of Pultneyville.	Grayish sandy loam, 0 to 8 inches.	4.70	0.66	2.20	1.46	6.34	44.70	33.24	11.06
7415	1½ miles SE. of North Wolcott.	Dark loam, 0 to 7 inches.	3.94	2.24	4.80	3.58	18.06	24.50	34.74	11.76
7413	2 miles NW. of Sodus.	Brown loam, 0 to 10 inches.	3.03	1.34	3.78	2.62	16.58	39.50	21.04	14.82
7414	Subsoil of 7413	Brown sandy loam, 10 to 36 inches.	.59	1.60	3.84	3.38	18.00	30.50	24.00	18.12
7416	Subsoil of 7415	Reddish clay loam, 7 to 36 inches.	.84	.64	2.78	2.68	17.56	23.88	32.98	19.40
7412	Subsoil of 7411	Reddish sandy loam, 8 to 36 inches.	.40	.14	1.38	.68	3.08	39.58	34.98	20.16

MEADOW.

The Meadow in the present survey includes all the flat, low-lying land occurring along the banks of streams and in springy places, which is too wet for cultivation. The soil is either a fine sandy loam or a clay, having scattered through it a few patches of muck. The area comprised in the arm of the Montezuma Marsh contains some muck, which is underlain in a few places by marl. The largest area of the Meadow is found in the southeastern part of the area surveyed, while many smaller areas and strips are found in other localities, especially near Wolcott, in the vicinity of Joy, and on each side of the Clyde River. The low position this land occupies makes it impracticable for it to be drained, either by open ditches or underground drains.

Part of the Meadow is forested with a growth of elms, while the remainder is used chiefly as pasture, affording good grazing for the cattle during the drier months. Some of the areas produce a coarse hay, and the only part that is cultivated is planted to osiers. These do well on this land and are a profitable crop.

During wet seasons a large part of the Montezuma Marsh area is covered with a luxuriant growth of flags, while in dry seasons the same area produces hay. During the last two years a number of tons of these flags have been cut, cured, bundled, and sold, bringing from \$20 to \$25 per ton loaded on cars at the nearest railroad station. The flags grow from 4 to 8 feet high, and the stems are quite uniform in size. They are cut by hand, as the land is partly covered by water and too mucky to support horses and machinery. One man can cut, cure, bundle, and market about 1 ton a week. The chief use made of

these flags is for the bottoms and backs of fine chairs. Should this industry continue, a very handsome profit can be had from land heretofore considere practically worthless.

MUCK.

The Muck consists of vegetable matter more or less thoroughly decomposed, mixed with a small proportion of very fine sand and clay. It is of a dark brown or black color, and has a depth of 40 inches or more, except in a few narrow strips along the edges, where the soil is from 15 to 40 inches deep, underlain by a subsoil of fine sand or clay. In many places the Muck is from 6 to 10 feet deep.

This soil type occurs in small bodies and long strips in the central western portion of the area surveyed, in the vicinity of Minstead, and in a few patches in other parts of the area. It occupies the level, low-lying land along the small, slow-moving streams, and the inclosed, depressed areas between the hills and ridges where drainage outlets are insufficient or altogether lacking.

On account of its position the soil has scarcely any drainage. Before it can be cultivated it is necessary in every case to cut ditches through the areas sufficiently deep to collect and hold, even if they can not rapidly remove, the water drawn from the upper part of the soil. Fortunately, the nature of the soil is such that ditches are easily constructed and are of considerable permanence.

The Muck soil is due to lack of drainage. The soil is formed through the filling in of ponds or shallow lakes by the accumulation of decayed vegetation, particularly the remains of tules, flags, and other water-loving plants. The soil is therefore naturally rich in nitrogen, to such an extent even as to make it profitable to add it to the hill soils commonly deficient in organic matter.

About two-thirds of the area of Muck is under cultivation and produces large crops. The remainder is covered with a growth of trees or thick grass and is too wet for farming. The area unreclaimed, when cleared, ditched, and exposed to the sun, can be cropped profitably. The yield of onions from this soil ranges from 150 to 700 bushels per acre, with the average yield not far from 400 bushels. Potatoes grow very large, but they are apt to be hollow or to be attacked by black heart. The keeping quality is also poor. Some celery is also grown with fair results.

In this area the Muck is especially adapted to onions and celery, and its cultivation can be most profitably carried on if exclusive attention be given to the production of these two crops. (See Pl. III, fig. 1.)

AGRICULTURAL METHODS.

Compared with methods in the West and South, agricultural practices in this area are intensive. Most of the cultivable areas are con-

stantly cropped, even the steepest slopes and the roadside areas being utilized. The usual rotation is corn or potatoes, oats or barley, winter wheat, and clover. This scheme, however, is not very closely followed.

Corn and potatoes are planted in checks and cultivated both ways, generally with a fine-toothed cultivator drawn by one horse. Oats are usually sown broadcast; wheat and barley with drills. Clover, alone or mixed with timothy, is sown in the wheat in the spring. Permanent meadows of timothy are also seen. Chiefly red clover is grown, but crimson clover is used to some extent.

Stable manure is highly valued, and is carefully saved and spread on the fields. Usually this is done by hand, but it would seem that the machine spreader would probably prove a paying investment to the farmers of large tracts.

Hay, an important product of the Lyons area, is cut in most instances with horse mowers and manipulated by horse tedders and rakes. The partly cured grass is thrown into small cocks overnight, or during wet weather spread again in windrows, recocked, and so on until a perfect cure is effected. Handled in this way, the hay preserves a fresh, sweet smell and a bright, clean color.

A great part of the oats, wheat, and barley raised is harvested with sweep reapers, many hillsides being too steep for successful operation of the more cumbersome binder. Moreover, many of the farms are too small to make it economical to own so expensive a machine.

Green peas are sometimes sown broadcast, but more often drilled, mowed like hay when at the right state of maturity, and hauled to the canning factory, where they are shelled by machinery. The vines are often returned to the farm and preserved in silos. Beans are planted in rows and cultivated with horse cultivators. When mature they are pulled up by the roots, dried, and shelled by machinery.

Peppermint is grown from the roots of the preceding crop. These are dug out in the spring, laid in rows in the field, and covered. Shoots soon appear, which are cultivated as any other crop. At maturity the mint is cut, wilted, and the oil distilled from the plants by passing steam through them. The steam, carrying with it the oil, is then condensed, and the oil, which rises to the top, is easily separated.

The heavier soils are found best for sugar beets. The fields are usually subsoiled for this crop. The seed is sown from May 1 to June 20, using not less than 12 pounds to the acre. It is sown with drills in rows 20 to 24 inches apart. When young the seedlings require a great deal of hand labor. They are usually bunched with a narrow hoe when about 1 inch high, and are later thinned by hand. Afterwards the crop is cultivated with horse implements, the large fields with specially constructed sugar-beet cultivators. Those commonly in use are one-horse machines, which scrape the ground between two rows of beets at one time. The beets are harvested by loosening

the ground near the roots with a subsoil plow, and pulling and topping by hand. Practically all the beets are grown under contract, and are delivered at the factory in Lyons or at some convenient shipping point.

Orchards are sometimes cultivated, especially when young, but are generally kept in grass.

Cabbages are started in beds. When of the proper size the plants are set in the field with transplanters, very similar to those used for tobacco, drawn by horses. Cultivation of this crop is also done with horse implements. The plants are usually set in rows 3 feet apart and about 18 inches apart in the row, making 7,000 to 9,000 plants per acre.

Onions are usually raised from sets planted in rows about 1 foot apart and tilled with hand cultivators.

AGRICULTURAL CONDITIONS.

Throughout the Lyons area the farming class is, as a rule, in a prosperous condition. The dwellings, for the most part, are well-constructed frame buildings, neatly painted, while a few more substantial brick and stone buildings are seen. The last are made of smooth, rounded stones about 4 or 5 inches in diameter, and are a characteristic feature of the northern part of the area.

Many large, roomy barns, capable of housing all the live stock and with room in addition for storing hay and grain crops, are seen on the larger and more valuable farms. These barns are generally painted red. On most farms are also evaporator houses, corneribs, onion and potato bins, and shelters for farm implements and carriages. The fences are board, wire, and stone, with occasionally an osage-orange or thorn hedge. Nearly every farm is supplied with good horses, several milch cows, and a few hogs. Here and there a flock of sheep is kept, but the industry is declining.

The land is so closely cultivated and pastured that scarcely any forest exists, except on the areas of meadow. Over three-fourths of the farmers heat their houses with coal, and all the evaporating of fruit is done with that fuel.

About 75 per cent of the farms covered by this survey are owned and tilled by the farmers themselves. The rest are cultivated by two classes of tenants, one of whom pays a cash rental, or a stated amount of labor or farm produce for the use of the land, the other a stated proportion of the crops produced. In the hands of tenants the farms are apt to decline in fertility, for the tenants as a rule make little or no attempt to improve the land, or even to maintain its natural productiveness.

The farms vary in size from 20 acres to over 200 acres, the average size being 70 acres. Around the towns and villages the areas are

smaller and the price per acre very much higher. The Miami stony loam brings from \$20 to \$100 per acre. The Miami loam also brings a good price, while the Muck is the most valuable land in the area.

One great difficulty in operating the farms in this area arises from the scarcity of labor. The foreign classes, chiefly Italians, are about the only kind of labor that can be secured. Some of them are good workers, but the majority do not understand the work or take much interest in the welfare of their employers. The great demand for farm help naturally makes wages high, and the farmers frequently must pay \$1.50 per day for ordinary field labor, and at times it can not be had at any price. A great variety of crops is grown in this area, but the mainstay of agriculture is fruit, especially apples (the money crop), grass, corn, oats, wheat, sugar beets, potatoes, onions, and cabbages, while the less important crops are green peas, beans, peppermint, celery, tobacco, buckwheat, raspberries, grapes, and blackberries. The cultivation of these has been outlined and yields given in the description of the several soil types and in the chapter on agricultural methods.

The sugar-beet industry is comparatively new, but is growing and deserves more particular mention. The beets are grown on all the soils in the central and southern portion of the area, and good yields are secured, being especially good on the Miami loam and Miami stony loam. The Miami loam gives the largest yields, while the beets grown on the Miami stony loam contain the highest percentage of sugar. The sugar-beet company contracts with the farmers to buy the beets, paying up to this time \$5 per ton delivered at the factory.

The area included in the present survey lies within the apple belt of western New York, and is probably, in quantity and quality of the fruit produced, as important as any area of equal size in this region. Many large orchards occur throughout the area, but the industry centers in the northern part, within the zone of the lake influence. There are in the aggregate about 700,000 apple trees in the orchards of the Lyons area. The trees bear a full crop every other year and a partial crop in the intervening years. All the choice fruit is sold green; the inferior is dried, or made into cider and sold as cider or as vinegar. Houses for evaporating the fruit are seen near every large orchard. Here the fruit is peeled, cored, and sliced by machinery and dried on trays by artificial heat.

The Lyons area also ranks high as a producer of small fruit. In addition to the apple orchards many smaller and generally younger orchards of peaches, pears, plums, and cherries are to be found. These fruits also find a ready sale for cash. Several large fruit-tree nurseries are located in the area, important ones being found in the country south of Newark.

Dairying is carried on to a considerable extent. There are no very

large herds of dairy cattle, yet nearly every farm keeps milch cows, and the milk in excess of home demands is sold either to the creameries located here and there in the area or is shipped to the cities.

Some commercial fertilizer is used, but not to any great extent. The great renewer of fertility is barnyard manure, immense quantities of which are made and carefully preserved and added to the fields.

The Elmira silt loam, the Miami stony loam, and Alton stony loam are generally recognized as the best soils for fruits. The Miami stony loam and Miami loam are considered fairly good land for sugar beets. The Miami fine sand is an ideal soil for truck and small fruits, but as yet is not generally recognized as such. It is used to a great extent for potatoes. Muck soil is especially adapted to onions and celery and should be devoted entirely to their culture.

The New York Central Railroad, the West Shore Railroad, and the Erie Canal pass through the southern part of the area, while the Rome, Ogdensburg and Watertown Division of the New York Central and Hudson River Railroad crosses the northern part. There is also the Northern Central Railway, from Sodus Bay southward through the area. All of these furnish good facilities for transportation of the produce of the area, and are a great stimulus to its industries and an important factor in its prosperity. There is also one trolley line in operation, which carries freight. In addition to the railroad transportation facilities, good dirt roads lead out in every direction from the chief market towns. These roads are in fair condition the greater part of the year, and are easily traveled except on the steepest hills and the more sandy places. They are built and maintained at the expense of the county.

Another great convenience to the farmers is the free delivery of mail in rural districts, which system is in operation throughout the survey. Many grocery wagons cover the country, supplying the people with needed articles of food.

There are no large cities in the area, but the towns of Newark, Lyons, Clyde, Palmyra, Wolcott, and Sodus offer some market for farm produce. Creameries are located at all of these places and handle most of the milk produced within the area. Some of these points have canning factories for green peas and corn. Apples and pears are mostly sold directly to purchasing agents of firms in large cities, who come into the territory and buy the product prepared for shipment and delivered at the railroad station. Berries and small fruits that are not consumed within the area are shipped by express to the large cities, some railroads even running special trains for this purpose. The sugar-beet factory is located at Lyons and at this time handles all the beets produced. There is also a firm there which buys peppermint oil. In general this area is so well supplied with railroads that all the surplus products can be easily and quickly placed in the important markets of the large Eastern cities,

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