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Costs and Returns in Producing Apples in the Newfane-Olcott Area, Niagara County, New York, 1926 to 1928

T. E. La Mont

YIELD AND COST OF GROWING APPLES		
	Barrels of apples per acre	Cost per barrel
On poorly drained soil.	21	\$3.55
On well-drained soil...	46	2.17

A WELL-DRAINED SOIL IS NECESSARY FOR PROFIT-
 ABLE APPLE PRODUCTION

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COSTS AND RETURNS IN PRODUCING APPLES IN THE NEWFANE-OLCOTT AREA, NIAGARA COUNTY, NEW YORK, 1926 TO 1928¹

T. E. LA MONT

Farm-management studies of the farms in the Newfane-Olcott area, Newfane Township, Niagara County, have been made by the Department of Agricultural Economics and Farm Management at Cornell University every year since 1913. The smallest number of records taken was 81 in 1915, and the largest number 202 in 1924. As far as possible, records were obtained on the same farms each year. From 1913 to 1926 this work was carried on under the supervision of Professor G. P. Scoville. From 1926 to 1930 it was under the supervision of the writer.

In 1926 it was decided to make a study of the cost of producing apples in addition to the labor-income records, and a blank was prepared by the writer with the assistance of Professor Scoville. This increased the amount of information requested from the farmer. However, most of the farmers gave a cost record on their most important apple orchard, in addition to the usual farm-management-survey data. When a farmer had two or more blocks of approximately the same age they were considered as one block for the purpose of the cost study. When a farmer had an old and a young orchard, a cost record was usually obtained on the old orchard and, if possible, one or more cost records were also obtained on the young orchards. In this way, 177 cost-of-production records were obtained from 162 farmers for the crop year 1926, 175 cost records from 155 farmers for 1927, and 179 cost records from 136 farmers for 1928. Since 1928 only labor-income records have been taken in the Newfane-Olcott area.

LOCATION AND DESCRIPTION OF THE AREA STUDIED

The location of the area studied is shown in figure 1. Almost all of the northern three-quarters of Newfane Township was included in the study. No selection of farms within the area has ever been made.

The Dunkirk soils along Lake Ontario make the northern part of the township one of the largest good fruit sections in western New York. No other community in Niagara County has so large a proportion of the better Dunkirk soils as has Newfane Township.

¹ Also presented to the Faculty of the Graduate School of Cornell University, June, 1932, as a thesis in partial fulfillment of the requirements for the degree of doctor of philosophy.

AUTHOR'S ACKNOWLEDGMENTS: Farmers in the Newfane-Olcott area furnished data on the cost of growing apples from 1926 to 1928 and on receipts and expenses on their farms from 1913 to 1931.

Professors G. P. Scoville, G. F. Warren, and W. I. Myers of the Agricultural Economics and Farm Management Department, and Professor A. J. Heinicke of the Pomology Department gave constructive criticisms and suggestions. Professor Scoville also contributed his data for the Newfane-Olcott area for the years 1913 to 1925.

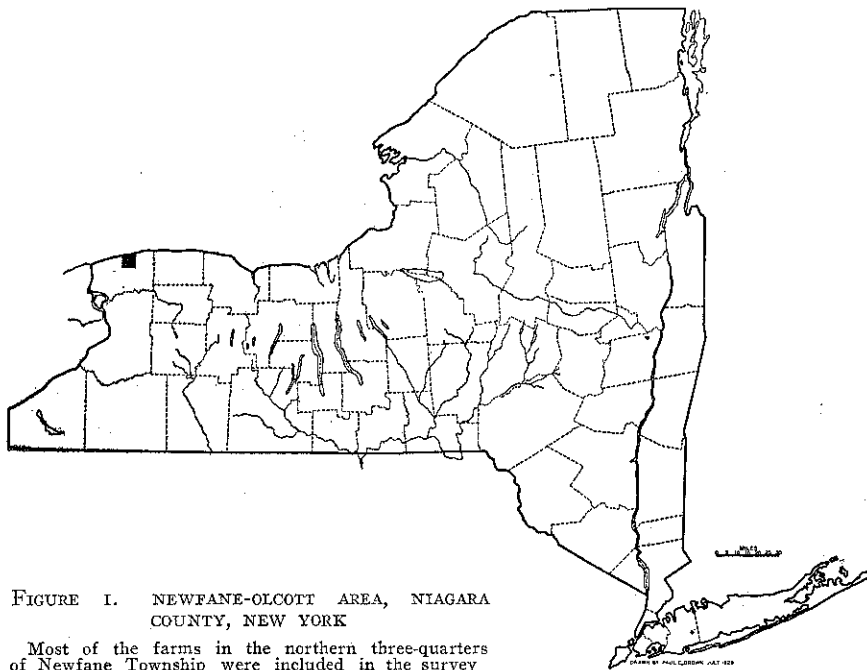


FIGURE 1. NEWFANE-OLCOTT AREA, NIAGARA COUNTY, NEW YORK

Most of the farms in the northern three-quarters of Newfane Township were included in the survey

CLIMATE

The average length of growing season at Appleton, Newfane Township, is 162 days, extending from May 5 to October 14.

The lowest minimum temperature ever recorded at Appleton was -13° F. in 1905. Appleton has an elevation of 300 feet above sea level and is 54 feet above Lake Ontario. It is one-half mile south of the lake.

The mean annual precipitation at Appleton is 30.36 inches. For the crop-growing season (April to August) it is 14 inches. Newfane Township receives as little rainfall as any part of the fruit areas in New York State except the Champlain Valley. In the other fruit counties along Lake Ontario the average annual rainfall ranges from 31 to 35 inches, and for the crop-growing season from 14 to 16 inches.

SOILS

According to the soil survey of Niagara County the soils of this region have been formed under glacial lake influence.² Two main soil series, the Dunkirk and the Clyde, occupy nearly all of the township. The Dunkirk includes all light-colored and moderately well drained materials, while the Clyde represents soils which were originally laid down in the same way as the Dunkirk, but which have been modified by poor drainage conditions. The accumulations of organic matter and wash in the Clyde soils give them a dark or black color.

² Soil survey of Niagara County, New York, by E. O. Fippin and others. U. S. Agr. Dept. 1908.

For convenience in this study the soils in Newfane Township have been grouped into six main soil groups. Three of these groups belong to the Dunkirk series and three to the Clyde. The location of the house on each farm on which cost records were taken for 1926 is marked by a symbol which indicates the predominating soil group of the farm (figure 2).

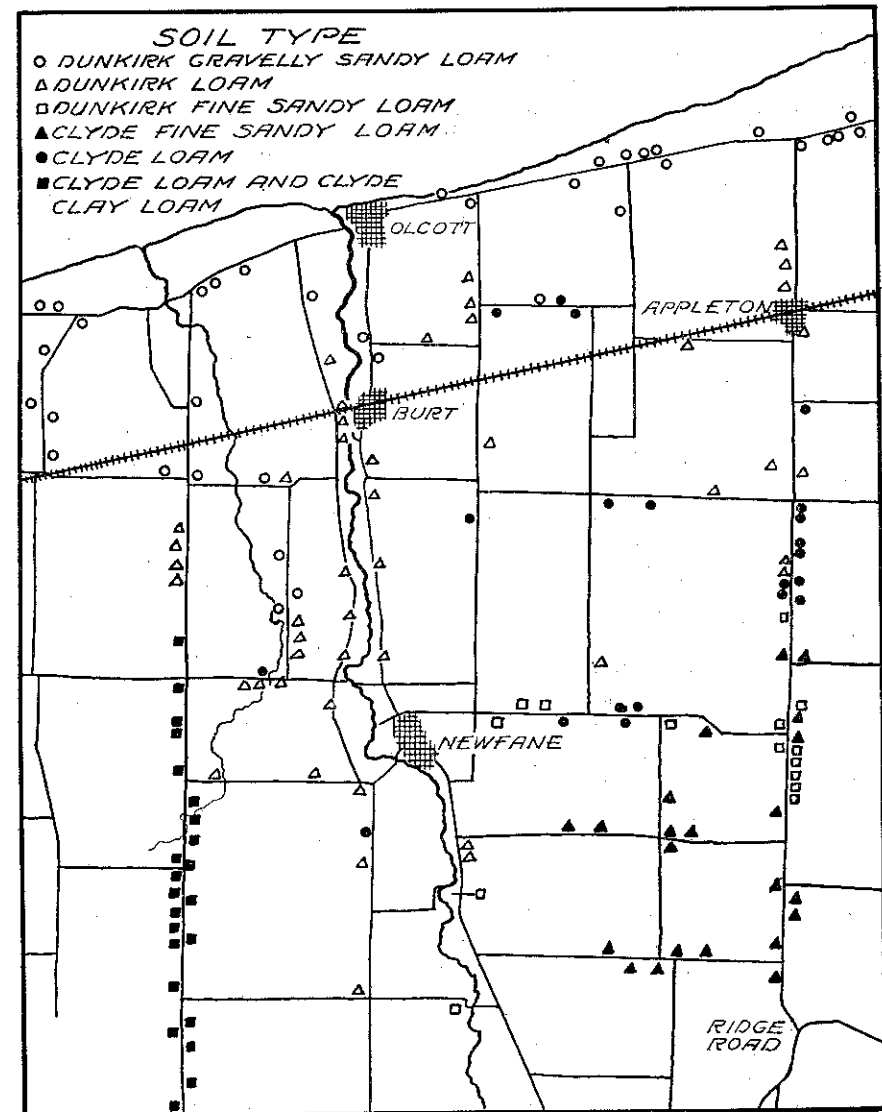


FIGURE 2. FARM HOUSES WHERE COST RECORDS WERE TAKEN, 1926

The symbols indicate the predominating soil type on the farms

A soil map does not show changes that occur in less than 10-acre blocks. Also the changes between one type and another are not so abrupt as indicated by the soil map. Farmers generally set orchards on their best soil, and in some cases the orchard is on a better soil than the predominating soil type of the farm. Therefore an accurate classification of orchards according to soil type would make a still greater difference between the Dunkirk and Clyde soils than is indicated by this study.

The six soil groups in which the farms were classified are:

Dunkirk gravelly sandy loam group includes the Dunkirk sandy loam and the Dunkirk silt loam soils as well as the Dunkirk gravelly sandy loam. The subsoil is a light brown sandy loam of a coarser texture than the surface soil. It is porous, friable, and thoroughly drained. This soil is along the lake shore and is very well adapted to peaches. All the farms along the lake road and most of the farms around Coomer Station were included in this group. On the average, from 1913 to 1930, the farms in this group have been more profitable than those in any other group.

Dunkirk loam is farther from the lake than the Dunkirk gravelly sandy loam. The subsoil has the general texture of a loam. Dunkirk loam is the best general-purpose soil of the region. Drainage is fairly good, but not so good as on the soils in the Dunkirk gravelly sandy loam group. The farms around Appleton and most of the farms on either side of Eighteen Mile Creek were classed in this group. The average apple yields and average profits on the Dunkirk loam have been nearly as large as on the Dunkirk gravelly sandy loam.

Dunkirk fine sandy loam is loose and loamy. It is composed of the finer grades of sand and silt and is naturally well drained. Most of the farms in this group are on the Hess road about two miles south of Appleton and on the road running east of Newfane. The average apple yields on this soil were less than on the other Dunkirk soils. Farms located on this soil have not paid so well as the farms on the Dunkirk loam or Dunkirk gravelly sandy loam.

Clyde fine sandy loam is southeast of Newfane and is closely associated with the Dunkirk fine sandy loam. The chief difference is one of drainage. The Clyde fine sandy loam contains a high percentage of organic matter which renders it loamy, mellow, and easy to cultivate, and imparts to it a characteristic dark color. The average apple yields from 1926 to 1928 were ten barrels less per acre than those on the adjacent Dunkirk fine sandy loam soils. The average labor income for the farmers on each of the Clyde soils was practically nothing during these eighteen years, 1913 to 1930.

Clyde loam soil possesses decidedly clayey properties and occupies low, level, poorly drained positions. It is free from stone or gravel. This soil is a heavy black loam and in some instances a clay loam, with an accumulation of organic matter on the surface. The farms on this soil are scattered and are found east of Newfane and Newfane Station. The apple yields on this soil from 1926 to 1928 were lower than those on the other Clyde soils.

Clyde loam and clay loam consists of Clyde loam, Dunkirk loam and clay loam, and some Dunkirk fine sandy loam. The Dunkirk loam in this group is heavier than that previously described. The soils are heavy

and are not well drained. All of the farms on the southern half of the Coomer road were included in this group. The average yield of apples in this group from 1926 to 1928 was three barrels per acre higher than those on the Clyde loam. The average labor income of farmers in this group was — \$89 for 1913 to 1930.

RAILROADS

The Newfane-Olcott area is served by the Rome, Watertown and Ogdensburg railroad which is a branch of the New York Central. This railroad runs east and west through the township about one and one-half miles from the lake. Burt and Appleton are the two shipping points on this railroad in this area. Also, the International Railway operates an electric line running north and south through the center of the township. The two shipping points on this road are Newfane and Olcott.

The three cold storage plants in the area are at Burt, Newfane, and Olcott.

LOCAL MARKETS

This area is within trucking distance of a number of fairly large local markets. Buffalo is within about 40 miles, Niagara Falls 35, and Lockport 10 miles from the center of the township. The populations of these cities in 1930 were: Buffalo, 573,076; Niagara Falls, 75,460; and Lockport, 23,160. On the average, from 1922 to 1926, farmers in this area sold about 10 per cent of their packed and tree run apples on local markets.³

SIZE OF FARMS

AVERAGE ACREAGE OF FARMS, 1928

The average size of farms on the Dunkirk soils was 74.4 acres, which was about 7 acres larger than on the Clyde soils (table 1). There was about the same difference in the acreage of crop land per farm.

TABLE 1. UTILIZATION OF LAND ON 96 FARMS ON DUNKIRK SOILS AND 53 FARMS ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1928

	Dunkirk soils	Clyde soils	All soils
	Average area per farm		
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>
Cropland.....	57.9	50.6	55.3
Woods.....	4.6	5.2	4.8
Permanent pasture.....	4.9	3.1	4.3
Other land pastured through season.....	0.7	2.5	1.3
Farmstead, roads, and fence rows.....	5.8	4.6	5.4
Other land.....	0.5	1.0	0.7
Total.....	74.4	67.0	71.8

AVERAGE CAPITAL PER FARM, 1928

The average investment per farm in land and buildings on the Dunkirk soils was 73 per cent higher than on the Clyde soils (table 2). The

³ Apple varieties: prices, yields, and acreage, by G. P. Scoville and T. E. La Mont. Cornell Univ. Agr. Exp. Sta. Bul. 495:21. 1929.

average value of land and buildings per acre was \$230 on the Dunkirk soils and \$148 on the Clyde soils. About 88 per cent of the total capital invested in these farms was in land and buildings.

The average investment in livestock per farm was about the same on the two soil series.

TABLE 2. AVERAGE CAPITAL PER FARM ON 96 FARMS ON DUNKIRK SOILS AND 53 FARMS ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1928

	Dunkirk soils	Clyde soils	All soils	Dunkirk soils	Clyde soils	All soils
	Value per farm			Proportion of total		
	Dollars	Dollars	Dollars	Per cent	Per cent	Per cent
Land and buildings.....	17,139	9,898	14,563	88.7	84.6	87.7
Machinery.....	1,193	827	1,063	6.2	7.1	6.4
Livestock.....	840	803	826	4.3	6.9	5.0
Feed.....	152	161	156	0.8	1.4	0.9
Total.....	19,324	11,689	16,608	100.0	100.0	100.0

AVERAGE NUMBER OF LIVESTOCK PER FARM, 1928

Livestock is of minor importance on these farms. The average number of cows per farm for the area was 2.8 and the average number of poultry 97 (table 3). The average number of livestock per farm was about the same on the Clyde as on the Dunkirk soils.

The average number of horses per farm was slightly higher on the Clyde than on the Dunkirk soils. A smaller percentage of the farmers on the Clyde soils had tractors than did farmers on the Dunkirk soils.

TABLE 3. AVERAGE NUMBER OF LIVESTOCK PER FARM ON 96 FARMS ON DUNKIRK SOILS AND 53 FARMS ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1928

	Dunkirk soils	Clyde soils	All soils
	Number	Number	Number
Cows.....	2.8	2.7	2.8
Heifers.....	1.0	1.0	1.0
Sheep.....	1.3	0.5	1.0
Brood sows.....	0.3	0.4	0.3
Other hogs.....	0.6	0.7	0.6
Poultry.....	99.0	93.0	96.9
Horses.....	2.3	2.6	2.4

TYPE OF BUSINESS

ACREAGE OF CROPS GROWN, 1928

The percentage of farmers who grew each crop and the average acreage for these farms are shown in table 4. Apple trees of bearing age were found on 145 of the 149 farms. The four farmers that did not grow apples were all on the Dunkirk soils and each grew peaches. The average acreage of bearing apples per farm growing this fruit was 56 per cent higher on the Dunkirk soils than on Clyde soils.

Peaches of bearing age were found on 84 per cent of the farms on the Dunkirk soils, as compared to only 49 per cent on the Clyde soils. Also,

the average acreage of bearing peaches per farm growing peaches was more than three and one-half times as large on the Dunkirk soils as on the Clyde soils. Only about 30 per cent of the farms on the Clyde soils had non-bearing apples, as compared to more than 50 per cent of the farms on the Dunkirk soils. This was true also of peaches.

Alfalfa was not grown on any of the farms on Clyde soils in 1928, while it was grown on 15 per cent of the farms on the Dunkirk soils. In most cases the Clyde soils are not sufficiently well drained to grow alfalfa.

TABLE 4. AVERAGE ACRES OF CROPS ON 96 FARMS ON DUNKIRK SOILS AND 53 FARMS ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1928*

	Dunkirk soils	Clyde soils	All soils	Dunkirk soils	Clyde soils	All soils
	Farms growing			Average acreage per farm growing		
	Per cent	Per cent	Per cent	Acres	Acres	Acres
Bearing fruit:						
Apples.....	96	100	97	13.6	8.7	11.8
Peaches.....	84	49	72	6.1	1.7	5.1
Sour cherries.....	62	49	58	0.5	0.7	0.6
Sweet cherries.....	46	25	38	0.3	0.2	0.2
Pears.....	84	92	87	2.3	1.8	2.1
Prunes.....	62	66	64	1.1	0.7	0.9
Quinces.....	46	58	50	0.6	0.3	0.5
Non-bearing fruit:						
Apples.....	51	28	43	4.7	3.6	4.4
Peaches.....	58	36	50	3.2	2.4	3.0
Other cash crops:						
Cabbage.....	60	49	56	3.2	3.8	3.4
Tomatoes.....	47	60	52	2.6	2.5	2.6
Melons.....	22	11	18	1.2	0.6	1.0
Cucumbers.....	30	42	34	1.1	0.7	0.9
Peppers.....	22	8	17	0.6	0.2	0.6
Sweet corn.....	25	25	25	0.8	0.8	0.8
Wheat.....	58	75	64	7.6	7.6	7.6
Beans.....	12	21	15	2.8	1.2	2.1
Feed crops:						
Oats.....	69	83	74	6.8	6.8	6.8
Barley.....	5	6	5	4.1	2.9	3.7
Oats and barley.....	4	8	5	6.5	8.2	7.4
Oats, barley and peas.....	4	4	4	9.2	8.5	9.0
Buckwheat.....	18	23	19	2.7	4.2	3.3
Corn for grain.....	60	58	60	4.4	4.2	4.3
Corn for fodder.....	11	19	14	3.7	5.7	4.7
Corn silage.....	14	11	13	7.8	7.3	7.6
Potatoes.....	90	96	92	1.1	1.0	1.1
Alfalfa.....	15	0	9	3.6	0.0	3.6
Other hay.....	78	96	85	13.6	12.2	13.1

* The average yields of the more important crops in this area by soil types are given in *Fruit-Farm Management*, by T. E. La Mont. Cornell Extension Bulletin 219:10-11, 53. 1932.

IMPORTANCE OF APPLES AND PEACHES

Apples are the most important source of income on these farms, and constituted 36 per cent of the total receipts during the 18-years period 1913 to 1930 (table 5). During this period the average acreage of apples per farm increased 52 per cent.

Peaches, the second most important source of income on these farms, averaged 21 per cent of the total receipts during this 18-years period (table 6.) The average acreage of peaches per farm in 1930 was about one-third of the acreage in 1913. From 1926 to 1930 peaches made up only 13 per cent of total receipts on these farms, as compared to 27 per cent from 1913 to 1920.

Apples and peaches constituted 57 per cent of the total receipts for the period 1913 to 1930.

TABLE 5. AVERAGE APPLE PRODUCTION AND SALES, NEWFANE-OLCOTT AREA, 1913 TO 1931

Year	Farms	Apple acreage per farm		Apples harvested per acre		Price received		Apple sales per farm	Proportion that apple sales were of total receipts
		Bearing age	Non-bearing age	Packed barrels	Ciders	Per barrel	Per hundred-weight		
1913.....	89	7.2	3.0	56	18	3.08	0.42	1,309	32
1914.....	98	7.6	4.0	77	34	1.58	0.30	994	52
1915.....	81	8.5	4.4	37	11	2.58	0.40	841	35
1916.....	88	7.6	3.1	35	15	2.45	0.46	717	29
1917.....	113	7.6	2.5	9	4	3.93	1.12	293	9
1918.....	159	8.0	2.1	54	16	3.87	0.58	1,739	47
1919.....	156	8.3	2.1	27	11	5.84	1.46	1,429	43
1920.....	178	9.2	1.8	68	12	2.81	0.26	1,726	35
1921.....	171	9.1	1.8	24	10	5.11	0.90	1,186	36
1922.....	178	9.6	1.8	53	17	2.78	0.35	1,437	35
1923.....	194	9.2	1.5	37	11	2.83	0.40	1,005	36
1924.....	202	10.1	1.9	32	19	3.79	0.51	1,286	37
1925.....	172	11.0	2.4	52	15	2.81	0.38	1,651	34
1926.....	187	10.9	2.5	48	12	2.36	0.29	1,261	37
1927.....	170	11.8	2.2	14	5	4.75	0.78	821	30
1928.....	149	11.4	2.2	25	7	3.45	0.77	1,038	36
1929.....	156	12.8	1.9	29	8	4.26	0.50	1,593	43
1930.....	140	13.6	1.9	46	10	2.79	0.27	1,746	44
1931.....	156	13.1	1.9	38	7	1.65	0.17	831	37
Averages:									
1913-1920....	120	8.0	2.9	45	15	3.27	0.62	1,131	35
1921-1930....	172	11.0	2.0	36	11	3.49	0.52	1,302	37
1913-1930....	149	9.6	2.4	40	13	3.39	0.56	1,226	36

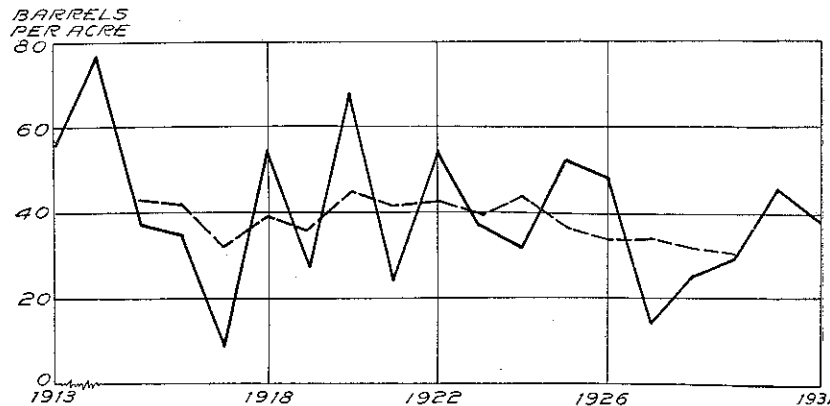


FIGURE 3. BARRELS OF APPLES PACKED PER ACRE, NEWFANE-OLCOTT AREA, 1913 TO 1931

During each of the years 1927 to 1929, the average yield of apples was low, but in 1930 the yield was above average. During the latter part of this 19-year period, a higher percentage of the bearing trees had just come into bearing. The dotted line represents the five-years moving average

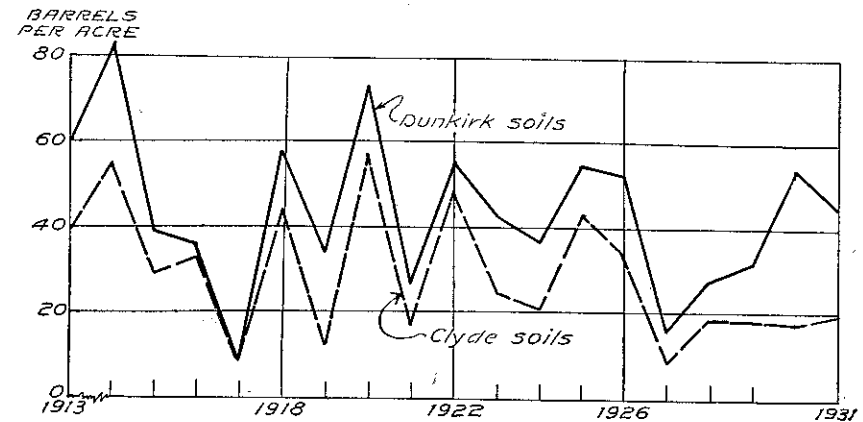


FIGURE 4. AVERAGE BARRELS OF APPLES PACKED PER ACRE ON DUNKIRK AND ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1913 TO 1931

In 1930 and 1931, the apple orchards on the Dunkirk soils apparently had recovered from the wet falls of 1925, 1926, and 1927, while those on the Clyde soils had not. For data on rainfall for falls of 1925 to 1927, see *Fruit-Farm Management*, by T. E. La Mont (Cornell Ext. Bul. 219:70. 1932)

TABLE 6. AVERAGE PEACH PRODUCTION AND SALES, NEWFANE-OLCOTT AREA, 1913 TO 1931

Year	Farms	Peach acreage per farm		Quantity per acre	Price per bushel	Peach sales per farm	Proportion peach sales were of total receipts	Proportion that peach and apple sales were of total receipts
		Bearing age	Non-bearing age					
1913.....	89	11.4	3.4	142	1.01	1,632	40	72
1914.....	98	12.0	2.9	4	1.36	70	4	56
1915.....	81	13.4	2.8	128	0.46	714	30	65
1916.....	88	10.8	3.1	94	0.96	973	40	69
1917.....	113	11.4	1.4	151	1.03	1,769	54	63
1918.....	159	9.0	1.5	18	2.48	393	11	58
1919.....	156	7.2	1.1	14	2.35	241	7	50
1920.....	178	8.2	1.1	130	1.37	1,409	29	64
1921.....	171	7.0	1.2	53	2.26	835	26	62
1922.....	178	6.4	1.6	162	0.78	807	19	54
1923.....	194	4.8	1.8	72	1.28	447	16	52
1924.....	202	4.6	2.1	94	1.42	619	18	55
1925.....	172	4.4	2.3	133	1.45	841	17	51
1926.....	187	4.1	2.3	92	0.73	275	8	45
1927.....	170	4.1	1.7	56	1.65	381	14	44
1928.....	149	3.6	1.4	87	1.04	331	12	48
1929.....	156	4.0	1.5	77	1.64	502	14	57
1930.....	140	4.0	1.0	149	1.23	727	18	61
1931.....	156	3.8	1.0	111*	0.47	200	9	46
Averages:								
1913-1920....	120	10.4	2.2	85	1.38	900	27	62
1921-1930....	172	4.7	1.7	98	1.35	576	16	53
1913-1930....	149	7.2	1.9	92	1.36	720	21	57

* In 1931 not all the peaches were harvested. When the farmers' estimates of the bushels not harvested were included, the yield was 175 bushels per acre.

AGE OF APPLE TREES *

The periods when the trees living in 1926 were set in the Newfane-Olcott area are shown in figure 5. The peaks of planting occurred from 1868 to 1887 and from 1908 to 1912. Very few trees were set from 1888 to 1902.

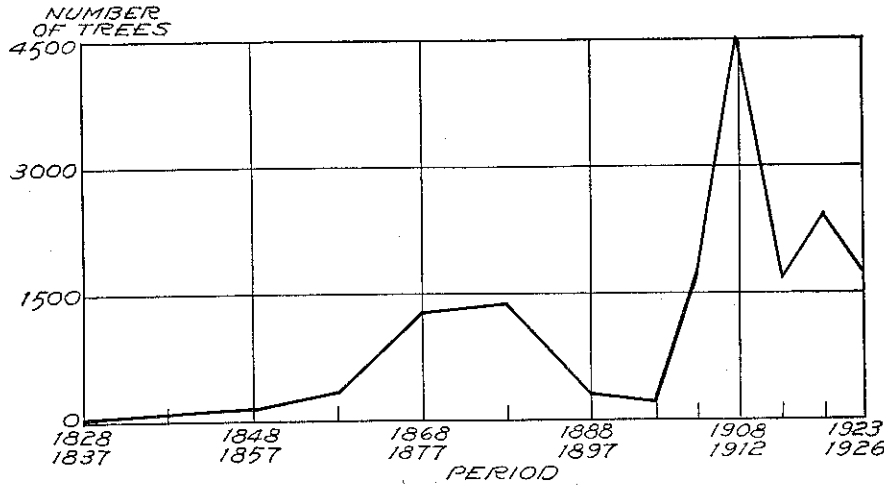


FIGURE 5. AVERAGE NUMBER OF APPLE TREES SET PER YEAR FOR TREES LIVING IN 1926, ON 192 NEWFANE-OLCOTT FARMS

The periods of heaviest planting were from 1868 to 1887 and from 1908 to 1912

APPLE VARIETIES

Baldwin and Rhode Island Greening are by far the most important varieties in this area; 46 per cent of the total trees and 72 per cent of the apples sold from 1922 to 1926 were of these two varieties (table 7).

Wealthy and Duchess were the next most important varieties and each one amounted to about 5 per cent of the total apples sold from 1922 to 1926. Most of the McIntosh trees were too young to bear large crops. Nearly all of the Wealthy, Duchess, and McIntosh trees have been set since 1900.

TABLE 7. APPLE VARIETIES ON 192 NEWFANE-OLCOTT FARMS, 1926

Variety	Proportion of total number of trees	Proportion of total bushels sold from 1922 to 1926
	Per cent	Per cent
Baldwin	28.7	45.5
Rhode Island Greening	17.3	27.0
Wealthy	13.0	5.5
Duchess	9.2	4.3
McIntosh	8.0	1.3
Other varieties	23.8	16.4
Total	100.0	100.0

* A more detailed discussion of age and varieties of apple trees on the Newfane-Olcott farms is given in *Apple Varieties, Prices, Yields, and Acreages*, by G. P. Scoville and T. E. La Mont. Cornell Univ. Agr. Sta. Bul. 495:51-54 and 66-69. 1929.

AVERAGE RECEIPTS PER FARM, 1928

The average receipts per farm on the Dunkirk soils were slightly more than double those on the Clyde soils in 1928 (table 8). About 58 per cent of the total receipts on the Dunkirk soils was from fruit, as compared to only 41 per cent on the Clyde soils.

The most important cash crops in this area, next to fruit, were cabbage and tomatoes. The total income from crops other than fruit was 19.8 per cent on the Dunkirk soils, as compared to 15.4 per cent on the Clyde soils.

Returns from livestock made up a higher percentage of the total receipts, but were smaller in dollars per farm, on the Clyde than on the Dunkirk soils. Also, miscellaneous receipts, which are largely work off the farm, were higher on the Clyde soils.

TABLE 8. AVERAGE RECEIPTS PER FARM ON 96 FARMS ON DUNKIRK SOILS AND 53 FARMS ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1928

	Dunkirk soils	Clyde soils	All soils	Dunkirk soils	Clyde soils	All soils
	Average per farm			Proportion of total		
	Dollars	Dollars	Dollars	Per cent	Per cent	Per cent
Fruit:						
Apples	1,306	551	1,038	37.6	31.8	36.3
Peaches	488	45	331	14.0	2.6	11.6
Sour cherries	65	38	55	1.9	2.2	1.9
Sweet cherries	14	7	12	0.4	0.4	0.4
Pears	65	19	49	1.9	1.1	1.7
Prunes	43	29	38	1.2	1.6	1.3
Other fruit	29	24	27	0.8	1.4	1.0
Total	2,010	713	1,550	57.8	41.1	54.2
Other crops:						
Cabbage	209	110	174	6.0	6.3	6.1
Tomatoes	157	67	125	4.5	3.9	4.4
Melons	44	2	29	1.3	0.1	1.0
Cucumbers	34	17	28	1.0	1.0	1.0
Peppers	37	1	24	1.1	0.1	0.8
Wheat	28	20	25	0.8	1.2	0.9
Other crops	178	49	130	5.1	2.8	4.5
Total	687	266	535	19.8	15.4	18.7
Livestock:						
Dairy products	261	174	230	7.5	10.0	8.1
Eggs	216	217	216	6.2	12.5	7.6
Other livestock products	4	2	4	0.1	0.1	0.1
Net livestock increase	167	164	167	4.8	9.5	5.8
Total	648	557	617	18.6	32.1	21.6
Miscellaneous	132	198	156	3.8	11.4	5.5
Total receipts	3,477	1,734	2,858	100.0	100.0	100.0

AVERAGE EXPENSES PER FARM, 1928

The most important item of expense on these farms was labor. The total value of all labor except that of the operator was approximately 33 per cent of the total expenses on each soil series (table 9). However, unpaid family labor made up a higher percentage of the total labor on Clyde than on Dunkirk soils.

The average amount paid for taxes was \$2.16 per acre on the Dunkirk soils and \$1.52 on the Clyde. On the basis of the value that the farmers placed on their farms, taxes averaged \$9.39 per \$1000 valuation on the Dunkirk soils, as compared to \$10.31 on the Clyde soils.

TABLE 9. AVERAGE EXPENSES PER FARM ON 96 FARMS ON DUNKIRK SOILS AND 53 FARMS ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1928

	Dunkirk soils	Clyde soils	All soils	Dunkirk soils	Clyde soils	All soils
	Average per farm			Per cent of total		
Hired help:						
Number of months.....	4.4	3.6	4.1	.....	.....	.....
Number of days.....	55.7	8.8	39.1	.....	.....	.....
Month help.....	\$241	\$150	\$208	9.9	10.1	9.9
Day help and piece work...	200	28	139	8.2	1.9	6.6
Board, month help.....	76	85	79	3.1	5.7	3.8
Board, day help.....	27	6	20	1.1	0.4	0.9
Unpaid family labor*.....	253	221	242	10.4	14.9	11.5
Total labor.....	797	490	688	32.7	33.0	32.7
Barrels and baskets.....	253	73	189	10.4	4.9	9.0
Feed.....	195	165	184	8.0	11.1	8.7
Taxes.....	161	102	140	6.6	6.9	6.7
Spray and dust.....	168	64	131	6.9	4.3	6.2
Fertilizers.....	89	84	87	3.7	5.7	4.1
Farm share of auto cost.....	91	76	86	3.7	5.1	4.1
New machinery and equipment	118	21	83	4.8	1.4	4.0
Machinery and equipment de-						
crease.....	12	67	32	0.5	4.5	1.5
Tractor expense†.....	84	55	74	3.4	3.7	3.5
Truck expense†.....	79	30	61	3.2	2.0	2.9
Seeds, plants and trees.....	91	67	83	3.7	4.5	4.0
Other expenses.....	303	192	264	12.4	12.9	12.6
Total expenses.....	\$2,441	\$1,486	\$2,102	100.0	100.0	100.0

* Unpaid family labor does not include the operator.

† In tractor and truck expenses only cash costs, such as gas, oil, repairs, license, and insurance are included. Depreciation is shown in machinery and equipment decrease.

The expenses for spray and dust, and for barrels and baskets were more than two and one-half times as large per farm on the Dunkirk as on the Clyde soils. The farmers on the Dunkirk soils had a larger acreage of fruit per farm and obtained higher yields per acre than did those on the Clyde soils.

The average amount paid out for new machinery and equipment was \$118 per farm on the Dunkirk soils and \$21 on the Clyde. This expense lacked \$12 per farm of maintaining the value of machinery and equipment on the Dunkirk soils and \$67 on the Clyde soils. Because of low returns, the farmers on the Clyde soils did not maintain the value of their machinery and equipment.

LABOR INCOMES, 1913 TO 1930

FINANCIAL SUMMARIES, 1913 TO 1920 AND 1921 TO 1930

During the 18-years period 1913 to 1930, the average labor income of all farms studied in the Newfane-Olcott area was \$263 (table 10). Labor income is what a farmer receives for his year's work and management after all farm expenses, and interest on his investment, have been deducted from farm receipts. The value of unpaid family labor other than that of the operator is deducted from farm receipts the same as cash expenses. In addition to his labor income the farmer has a house in which to live and farm products for home consumption. In this area in 1928 the average annual value of house rental was \$306 and the average value of

farm products used in the operators' households was \$329 (table 11). Labor income is comparable to the cash wages paid to a year man when house, garden, fruit, milk, fuel and so forth are furnished. The cash wages paid to year men on these farms averaged \$640 per year from 1913 to 1930. After making interest on the capital invested, farmers in this area received for their labor during this 18-years period about 40 per cent as much as was paid to the year men. However, as will be discussed later, the farmers who had large farms on well-drained soils made good returns for their labor and management.

TABLE 10. FINANCIAL SUMMARIES FOR NEWFANE-OLCOTT FARMS, 1913 TO 1931

Year	Farms	Average per farm							
		Total capital	Receipts	Cash expenses	Unpaid family labor	Returns on capital and farmer's labor	Labor income	Cash wages paid to year men	Return on capital*
1913.....	Number	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Per cent
1913.....	89	18,279	4,095	1,860	106	2,129	1,215	407	9.4
1914.....	98	18,597	1,905	1,371	184	350	-580	427	-0.4
1915.....	87	18,311	2,376	1,499	137	739	-177	447	1.6
1916.....	81	15,322	2,460	1,290	119	1,051	285	439	4.0
1917.....	113	15,058	3,295	1,875	133	1,287	534	448	5.6
1918.....	159	14,962	3,698	2,008	118	1,572	823	508	7.1
1919.....	156	14,994	3,355	1,904	133	1,318	569	629	4.6
1920.....	178	17,474	4,916	3,550	226	1,141	267	750	2.2
1921.....	171	16,722	3,257	2,114	168	975	138	651	1.9
1922.....	178	17,664	4,158	2,851	180	1,127	244	656	2.7
1923.....	194	16,441	2,828	2,127	152	549	-273	680	-0.8
1924.....	202	17,104	3,492	2,070	166	1,256	401	718	3.1
1925.....	172	18,629	4,809	2,779	179	1,851	920	768	5.8
1926.....	187	17,987	3,439	2,531	188	720	-178	768	-0.3
1927.....	170	18,181	2,736	1,968	200	568	-341	792	-1.2
1928.....	149	16,608	2,858	1,860	242	756	-75	819	-0.4
1929.....	156	16,943	3,673	2,104	265	1,304	458	807	2.9
1930.....	140	16,429	3,980	2,450	211	1,319	497	809	3.1
1931.....	156	12,369	2,223	2,025	166	18	-600	557†	-4.4
Averages:									
1913-1920.....	120	16,625	3,262	1,920	144	1,198	367	507	4.2
1921-1930.....	172	17,271	3,523	2,286	195	1,042	179	747	1.7
1913-1930.....	149	16,984	3,407	2,123	172	1,112	263	640	2.8

* In calculating percentage return on capital the value of the farmer's labor was considered the same as the cash wages paid to year men.

† Only a small number of year men were hired in 1931. From 1928 to 1931 the wages of month men with board declined 32 per cent. The figure for 1931 was obtained by multiplying the cash wage paid to year men in 1928 by 68.

The average labor income for the period 1913 to 1920 was \$188 higher than for the period 1921 to 1930. The lower income during 1921 to 1930 was due in part to a lower yield of apples (table 5). However, a more important fact is that since 1920 farm wages have been high relative to the price of apples and other farm products. For the period 1921 to 1930 it required 59 more barrels of apples or 186 more bushels of peaches to hire a man for a year than for the period 1913 to 1920 (table 12). This situation has been true with most other farm products. Since the drop in the general price level, beginning in 1920, an increasingly larger quantity of farm products has been required to pay the wages of a hired man. This has made it more difficult for farmers to make good incomes.

TABLE 11. FARM PRODUCTS USED IN THE OPERATORS' HOUSEHOLDS AND VALUE OF HOUSE RENTAL, 96 FARMS ON DUNKIRK SOILS AND 53 FARMS ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1928

Item	Unit	Dunkirk soils	Clyde soils	All soils	Dunkirk soils	Clyde soils	All soils
		Quantity per farm			Average value per farm (farm prices)		
Milk	Quarts	708	710	709	\$53.76	\$56.19	\$54.62
Cream			0		0.21	0	0.13
Butter	Pounds	115	108	112	55.39	51.77	54.10
Eggs	Dozens	131	127	130	47.51	42.19	45.62
Poultry	Pounds	74	64	70	20.99	17.43	19.72
Pork	Pounds	196	176	189	25.32	21.26	23.88
Veal		0			0.57	0.20	0.20
Beef					0.26	2.17	0.94
Apples	Bushels	10	11	11	10.38	10.85	10.54
Other fruit					9.25	8.17	8.87
Cider			0		0.26	0	0.17
Potatoes	Bushels	21	23	22	18.42	21.60	19.55
Beans					0.03	0.45	0.18
Corn			0		0.10	0	0.07
Wheat flour			0		0.53	0	0.34
Garden					34.19	24.81	30.85
Wood	Cords	17	15	16	60.37	57.62	59.40
Miscellaneous			0		0.12	0	0.08
Total farm products					\$337.09	\$315.08	\$329.26
Use of house*					342.66	238.87	305.74
Total					\$679.75	\$553.95	\$635.00

* Use of house was calculated at 10 per cent of the value of the house. In 1928 the average cost of operators' houses on 34 farms keeping cost accounts in cooperation with the Department of Agricultural Economics and Farm Management was 11.7 per cent of the value of the houses.

Because of lower incomes from 1921 to 1930 the amount of unpaid family labor has been increased. During each of the four years 1927 to 1930, the average value of unpaid family labor was more than \$200 per farm. In only one other year, 1920, did the value of unpaid family labor average more than \$200 a farm.

TABLE 12. COMPARISON OF THE AVERAGE WAGES PAID YEAR MEN AND THE AVERAGE PRICE OF APPLES AND PEACHES, NEWFANE-OLCOTT AREA, 1913 TO 1931

Year	Cash wages paid year men	Price of apples per barrel	Barrels of apples required to pay a man for a year	Price of peaches per bushel	Bushels of peaches required to pay a man for a year
1913 to 1915	Dollars 427	Dollars 2.41	Number 177	Dollars 0.94	Number 454
1916 to 1920	555	3.78	147	1.64	338
1921 to 1924	676	3.63	186	1.44	469
1925 to 1929	791	3.53	224	1.30	608
1930	809	2.79	290	1.23	658
1931	557*	1.65	338	0.47	1,185

* See footnote to table 10.

LABOR INCOME BY SOIL TYPES, 1913 to 1930

The average labor income on each of six soil types in the Newfane-Olcott area is shown for each year in table 13. The farmers on the Dunkirk gravelly sandy loam soil have obtained higher average labor incomes than have the farmers on any of the other soil types.

For the period 1921 to 1930, the average labor income on each of the Clyde soils was minus. A minus labor income means that a farmer lacked

that much of paying interest on his investment and received nothing for his own labor and management. In only two of the ten years did the farmers on all Clyde soils receive anything, on the average, for their own time after paying farm expenses and interest on their investment.

TABLE 13. AVERAGE LABOR INCOME ON EACH SOIL TYPE, NEWFANE-OLCOTT AREA, 1913 TO 1931

Year	Dunkirk				Clyde			
	Gravelly sandy loam soil	Loam soil	Fine sandy loam soil	All Dunkirk soils	Fine sandy loam soil	Loam soil	Loam clay loam soil	All Clyde soils
	Dollars							
1913	2,060	1,066	1,085	1,442	723	751	8	623
1914	-1,573	-213	-370	-732	-196	-286	-312	-234
1915	-838	98	-112	-304	-7	296	136	82
1916	435	313	555	425	101	9	-66	64
1917	1,516	699	256	806	-31	519	85	148
1918	1,140	1,494	615	1,119	362	515	408	419
1919	1,442	763	611	1,021	168	150	-38	77
1920	945	256	370	538	-203	-174	7	-114
1921	197	445	527	366	-171	-108	-377	-241
1922	545	363	194	385	-107	184	118	41
1923	-645	35	191	-168	-229	-710	-389	-398
1924	1,046	599	486	766	-74	-268	18	-93
1925	1,144	975	1,201	1,078	413	1,095	665	705
1926	-562	159	-147	-189	-65	-135	-290	-163
1927	-87	-317	-531	-269	-216	-319	-785	-465
1928	228	141	-531	69	-420	-425	-205	-336
1929	1,297	567	109	786	29	-111	-233	-128
1930	1,478	828	197	973	-281	-562	-356	-414
1931	-709	-347	-704	-624	-106	-872	-567	-536
Averages:								
1913-1920	641	560	376	539	115	222	28	133
1921-1930	464	380	170	380	-112	-136	-183	-149
1913-1930	543	460	261	451	-11	23	-89	-24

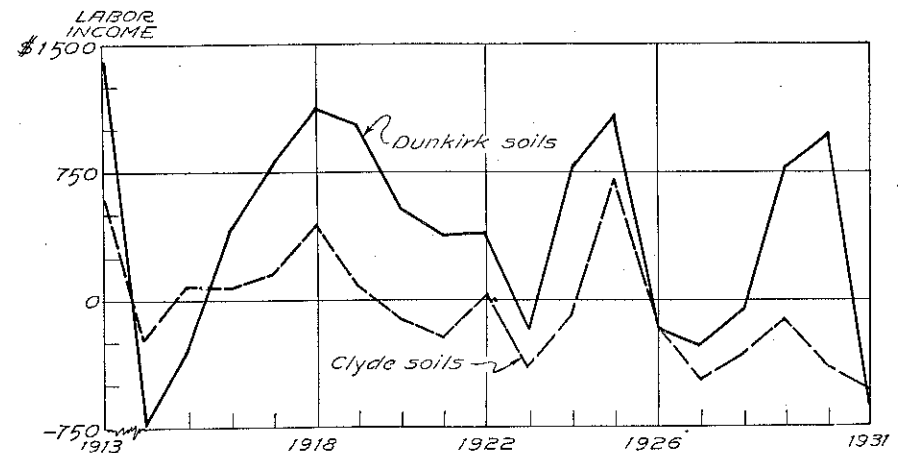


FIGURE 6. AVERAGE LABOR INCOME OF FARMERS ON DUNKIRK AND ON CLYDE SOILS, NEWFANE-OLCOTT AREA, 1913 TO 1931

During the period 1929 and 1930, the difference between the average labor income of farmers on Dunkirk and those on Clyde soils was greater than in any previous two-year period during the 19 years 1913 to 1931

For the entire period 1921 to 1930, there was a greater difference than formerly between the average labor income of farmers on the Dunkirk soils and those on Clyde soils. For the period 1913 to 1920, farmers on the Dunkirk soils made, on the average, \$406 more per year for their own time than farmers on the Clyde soils. For the period 1921 to 1930, the difference was \$529. During 1929 and 1930, which were favorable years for apples and peaches, the farmers on the Dunkirk soils made, on the average, \$1150 per year more for their own time than did the farmers on the Clyde soils.

TABLE 14. FARMS BY SOIL TYPE, NEWFANE-OLCOTT AREA, 1913 TO 1931

Year	Dunkirk				Clyde			
	Gravelly sandy loam soil	Loam soil	Fine sandy loam soil	All Dunkirk soils	Fine sandy loam soil	Loam soil	Loam clay loam soil	All Clyde soils
	<i>Number</i>							
1913.....	24	29	11	64	8	13	4	25
1914.....	24	27	17	68	19	5	6	30
1915.....	22	25	9	56	15	5	5	25
1916.....	16	20	16	52	23	11	2	36
1917.....	19	28	19	66	27	14	6	47
1918.....	33	33	26	92	28	19	20	67
1919.....	34	35	13	82	29	14	32	75
1920.....	39	44	21	104	27	18	29	74
1921.....	37	43	18	98	30	14	29	73
1922.....	35	46	24	105	30	17	26	73
1923.....	37	46	23	106	33	19	36	88
1924.....	48	50	18	116	29	24	33	86
1925.....	39	44	16	99	26	22	25	73
1926.....	45	46	19	110	27	24	26	77
1927.....	42	45	21	108	16	23	23	62
1928.....	36	45	15	96	11	21	21	53
1929.....	40	44	16	100	14	18	24	56
1930.....	37	38	17	92	19	14	15	48
1931.....	38	38	14	90*	16	19	17	52*
Averages:								
1913-1920.....	26	30	16	73	22	12	13	47
1921-1930.....	40	45	19	103	24	20	26	69
1913-1930.....	34	38	18	90	23	16	20	59

* In 1931, in addition to the 90 farms on Dunkirk soils and the 52 farms on Clyde soils, 14 new farms adjoining the old area were included for the first time. In order to make the years for a soil comparable these 14 farms were not included in table 13, but were included in table 10.

RETURNS ON DUNKIRK GRAVELLY SANDY LOAM AND CLYDE FINE SANDY LOAM SOILS, 1913 TO 1929

The average farm receipts per farm on the Dunkirk gravelly sandy loam soil were more than three times as large as those on the Clyde fine sandy loam for the period 1913 to 1929 (table 15). After subtracting all farm expenses, except interest, from farm receipts there was left \$1947 per farm on the Dunkirk soil and \$585 on the Clyde soil. This is the average return on the capital invested and for the farmer's own labor. After subtracting interest at 5 per cent on the average capital invested, there was left, on the average, \$488 per year for the farmer's own time on the Dunkirk gravelly sandy loam soil and \$5 per year on the Clyde fine sandy loam. Despite this difference in earning power, the farms on the Clyde soil were valued at about one-half as much as those of the same size on

the Dunkirk soil. The poor fruit land was valued at high prices because it was associated with good fruit land.

TABLE 15. FINANCIAL RETURNS ON DUNKIRK AND CLYDE SOILS, 1913 TO 1929, NEWFANE-OLCOTT AREA

	Dunkirk gravelly sandy loam soil	Clyde fine sandy loam soil
Number of records.....	570	392
Average number of farms per year.....	34	23
Average per farm:		
Total acres.....	89	55
Total capital.....	\$29,193	\$11,606
Value of real estate.....	\$26,299	\$9,892
Farm receipts.....	\$6,028	\$2,006
Farm expenses.....	\$4,081	\$1,421
Return on capital and operator's labor.....	\$1,947	\$585
Interest at 5 per cent on average capital.....	1,459	580
Labor income.....	\$488	\$5
Average value of real estate per acre.....	\$295	\$183

The average returns for the period 1921 to 1929, were less than for the period 1913 to 1920, on both the Dunkirk gravelly sandy loam soil and on the Clyde fine sandy loam (table 16). Farm expenses were higher from 1921 to 1929 and there was not a corresponding increase in farm receipts. On the average, from 1921 to 1929 the farmers on the Clyde fine sandy loam soil lacked \$93 of paying interest on their investment and received nothing for their own labor.

TABLE 16. FINANCIAL RETURNS ON DUNKIRK AND CLYDE SOILS, 1913 TO 1920 AND 1921 TO 1929, NEWFANE-OLCOTT AREA

	Dunkirk gravelly sandy loam soil		Clyde fine sandy loam soil	
	1913 to 1920	1921 to 1929	1913 to 1920	1921 to 1929
Number of records.....	211	359	176	216
Average number of farms per year.....	26	40	22	24
Average per farm:				
Total capital.....	\$28,775	\$29,564	\$11,168	\$11,995
Farm receipts.....	\$6,001	\$6,052	\$1,861	\$2,134
Farm expenses.....	\$3,922	\$4,222	\$1,188	\$1,627
Return on capital and operator's labor.....	\$2,079	\$1,830	\$673	\$507
Interest at 5 per cent on average capital.....	1,438	1,479	558	600
Labor income.....	\$641	\$351	\$115	-\$93

SIZE OF FARM AND LABOR INCOME, 1913 TO 1929

On the Dunkirk gravelly sandy loam soil the farmers who had less than 60 acres in their farms made an average labor income of \$428 per year during the 17-years period 1913 to 1929 (table 17). The farmers who had from 100 to 199 acres averaged \$544 and those with 200 acres or more made an average labor income of \$1092 per year. The Dunkirk gravelly sandy loam soil is well drained and well adapted to fruit.

TABLE 17. AVERAGE LABOR INCOMES OF LARGE AND SMALL FARMS ON DUNKIRK AND CLYDE SOILS, NEWFANE-OLCOTT AREA, 1913 TO 1929

Acres per farm	Records	Average acreage per farm	Average area of bearing apples	Value of real estate		Average labor income
				Per farm	Per acre	
	Number	Acres	Acres	Dollars	Dollars	Dollars
Dunkirk gravelly sandy loam:						
Less than 60.....	168	37	8	16,082	431	428
60 to 99.....	220	77	14	22,912	298	524
100 to 199.....	150	126	24	35,651	285	544
200 or more.....	32	272	31	59,112	217	1,092
Clyde fine sandy loam:						
Less than 60.....	227	33	3	6,883	213	114
60 to 99.....	118	77	7	12,752	170	-75
100 to 199.....	47	108	13	17,100	160	-281

Even during an agricultural and fruit depression larger farms on good fruit soil have paid better than have the smaller ones. For the period 1921 to 1929, farmers who had 100 acres or more made \$683 more per year for their time than did those who had less than 60 acres (table 18).

On the Clyde fine sandy loam soil, which in most cases is poorly drained, the farmers who had less than 60 acres made an average labor income of \$114 per year for the period 1913 to 1929. On this poor fruit soil, the farmers with larger farms did not receive anything for their own time after paying farm expenses and interest on their investment. In general, the Clyde soils are not well adapted to apples, so that the more apple trees these farmers had, the more money they lost.

TABLE 18. AVERAGE LABOR INCOME OF LARGE AND SMALL FARMS ON DUNKIRK GRAVELLY SANDY LOAM SOIL, NEWFANE-OLCOTT AREA, 1921 TO 1929

Acres per farm	Records	Average acreage per farm	Value of real estate		Average labor income
			Per farm	Per acre	
	Number	Acres	Dollars	Dollars	Dollars
Less than 60.....	109	35	16,384	464	82
60 to 99.....	140	78	24,807	320	213
100 or more.....	110	145	39,950	276	765

The handicap of operating a farm on Clyde soil has been greater since 1920 than before this date. From 1913 to 1920 the average difference in labor income between large and small farms on the Clyde fine sandy loam soil was \$139, as compared to a difference of \$595 from 1921 to 1929 (table 19). In both periods the average labor income of farmers with 100 acres or more was minus, but from 1913 to 1920 it was -\$27 as compared to -\$478 from 1921 to 1929.

Since 1920, labor has been high relative to the prices of farm products. When labor is high it is not profitable to work land that gives low yields. In such periods farmers operating large farms on poorly drained soils are much worse off than those operating smaller farms.

TABLE 19. AVERAGE LABOR INCOMES OF LARGE AND SMALL FARMS ON CLYDE FINE SANDY LOAM SOIL, 1913 TO 1920 AND 1921 TO 1929, NEWFANE-OLCOTT AREA

Acres per farm	Records	Average acreage per farm	Value of real estate		Average labor income
			Per farm	Per acre	
	Number	Acres	Dollars	Dollars	Dollars
1913 to 1920:					
Less than 60.....	107	36	6,340	180	112
60 to 99.....	49	80	12,764	161	204
100 to 199.....	20	110	16,525	150	-27
1921 to 1929:					
Less than 60.....	120	30	7,366	248	117
60 to 99.....	69	74	12,743	177	-323
100 to 199.....	27	107	17,526	167	-478

APPLE YIELDS AND PRODUCTION IN 1926, 1927, AND 1928

In 1926 the United States crop and the New York crop and the yield in the Newfane-Olcott area were from 22 to 37 per cent above the 1924-1930 average (table 20). The year 1927 was one of low production and the yield in the Newfane-Olcott area was only 40 per cent of the 1924-1930 average for this region. In 1928 the United States crop was 11 per cent above the 1924-1930 average, but the yield in the Newfane-Olcott area was only 71 per cent of the average. The yield of apples in the Newfane-Olcott area for the three-years period 1926 to 1928, was 83 per cent of the average from 1924 to 1930, while the United States commercial production was 5 per cent above the average for the same period.

TABLE 20. COMMERCIAL APPLE PRODUCTION IN UNITED STATES, NEW YORK, AND NEWFANE-OLCOTT AREA, 1916 TO 1932

Year	United States (thousands of barrels)†	New York (thousands of barrels)†	Newfane-Olcott area (barrels packed per acre)	Index numbers (1924 to 1930 = 100)		
				United States	New York	Newfane-Olcott area
1916.....	26,747	5,544	35	83	122	100
1917.....	22,341	2,058	9	70	45	26
1918.....	24,743	5,950	54	77	131	154
1919.....	26,159	2,975	27	82	66	77
1920.....	33,905	6,500	68	106	143	194
1921.....	21,557	3,300	24	67	73	68
1922.....	31,945	6,000	53	100	132	151
1923.....	35,936	4,200	37	112	93	105
1924.....	28,013	3,738	32	87	82	91
1925.....	33,246	6,250	52	104	138	148
1926.....	39,128	6,000	48	122	132	137
1927.....	26,017	2,721	14	81	60	40
1928.....	35,461	4,230	25	111	93	71
1929.....	28,843	3,404	29	90	75	83
1930.....	33,529	5,330	46	105	119	131
1931.....	34,592	3,900	38	108	86	109
1932.....	28,273	4,550	*	88	101	*
Average.....	30,026	4,509	37	.....	.....	.....

* Records in the Newfane-Olcott area for 1932 had not been taken in May, 1933.
 † Sources of data: For United States and New York production for 1916, from *Yearbook of Agriculture*, 1920, p. 653. U. S. Agr. Dept. 1921.
 For 1917 to 1928, from *Statistics Relative to the Apple Industry* p. 3 and 4. U. S. Agr. Dept., Bur. Agr. Econ. Mimeographed report, 1931.
 For 1929 to 1932, from *Crops and Markets*, U. S. Agr. Dept., 8th: 513. 1931; and 9th: 466. 1932.

The average price per barrel including package⁵ received by farmers in this area was \$2.36 in 1926, \$4.75 in 1927, and \$3.45 in 1928 (table 5). The average price for the period 1921 to 1930, was \$3.49 per barrel.

RELATION OF SOIL TO YIELD OF APPLES

The yields of apple trees in orchards set before 1900 on each of the six soil groups are shown for each year from 1926 to 1928 in table 21. The yields were for packed fruit and did not include culls. For all varieties combined, culls averaged 15 per cent of the tree-run fruit packed in the Newfane Cooperative Association from 1918 to 1926. The average yield of orchards on Dunkirk gravelly sandy loam and the Dunkirk loam was 46 barrels per acre for the period 1926 to 1928. The difference in average yield between these two soils was only 3 barrels per acre.

TABLE 21. RELATION OF SOIL TO YIELD OF APPLES PER ACRE ON ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

Soils	1926	1927	1928	Average, 1926-28
	Barrels packed per acre			
	Number	Number	Number	Number
Dunkirk gravelly sandy loam.....	79	24	39	47
Dunkirk loam.....	79	17	36	44
Average.....	79	21	38	46
Dunkirk fine sandy loam.....	70	16	24	37
Clyde fine sandy loam.....	36	17	29	27
Average.....	52	16	26	31
Clyde loam.....	34	9	15	19
Clyde loam and clay loam.....	39	6	22	22
Average.....	37	8	18	21
Average barrels packed per acre for all soils.	66	18	32	39
	Orchards			
	Number	Number	Number	Number
Dunkirk gravelly sandy loam.....	29	30	27	28
Dunkirk loam.....	36	34	37	36
Total.....	65	64	64	64
Dunkirk fine sandy loam.....	10	13	9	11
Clyde fine sandy loam.....	20	15	10	15
Total.....	30	28	19	26
Clyde loam.....	13	15	16	16
Clyde loam and clay loam.....	21	19	16	17
Total.....	34	34	32	33
Total of all soils.....	129	126	115	123

The average yield of orchards on the Dunkirk fine sandy loam and the Clyde fine sandy loam soils for the periods 1926 to 1928 was 31 barrels per acre. The orchards on Dunkirk fine sandy loam soil yielded 10 barrels more per acre than those on the Clyde fine sandy loam soils during this three-years period. However, in two of the three years the yields of orchards on Clyde fine sandy loam were higher than those on the Dunkirk fine sandy

⁵ In some cases the buyer furnished the package, and under these conditions the package was not included in the price.

loam. These two soils are very closely associated. The chief difference is one of drainage. Since orchards are generally set on the best soil on the farm, it is probable that many orchards on farms classified as on Clyde fine sandy loam are planted on Dunkirk fine sandy loam soil.

The average yield of orchards on the Clyde loam and Clyde clay loam soils was 21 barrels per acre for the same three-years period. The difference in yield between these two soils was only 3 barrels per acre.

On the basis of drainage and yield these six soil groups were combined into three groups. The first group is made up of the two best-drained soils of the Dunkirk series, the Dunkirk gravelly sandy loam and the Dunkirk loam soils. The second group includes the Dunkirk fine sandy loam and the best-drained soil type of the Clyde series, the Clyde fine sandy loam. In the third group are the Clyde loam soil and the Clyde loam and clay loam.

In nearly all of the cost data presented on the following pages these three groups are shown wherever the figures are given by soil groups. In some cases the second and third groups, the Dunkirk fine sandy loam and the Clyde soils, are shown together.

RELATION OF AGE OF TREES TO YIELD OF APPLES

In the Dunkirk gravelly sandy loam and Dunkirk loam soil group the highest yield was on orchards set from 1870 to 1879 (table 22). This

TABLE 22. RELATION OF AGE OF APPLE TREES TO YIELD, NEWFANE-OLCOTT AREA, 1926 TO 1928

Orchards set	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils
	Barrels packed per acre		
	Number	Number	Number
Before 1870.....	46	31	18
1870 to 1879.....	54	34	18
1880 to 1889.....	42	27	29
1900 to 1909.....	27	27	31
1910 to 1918.....	15	16	5
	Records		
Before 1850.....	7	6	0
1850 to 1859.....	22	6	8
1860 to 1869.....	39	18	21
Total.....	68	30	29
1870 to 1879.....	72	28	49
1880 to 1889.....	48	13	15
1890 to 1899.....	5	6	7
Total.....	53	19	22
1900 to 1904.....	12	6	7
1905 to 1909.....	38	8	5
Total.....	50	14	12
1910 to 1914.....	37	17	17
1915 to 1918.....	9	2	3
Total.....	46	19	20
Total number of records.....	289	110	132

was also true of orchards on the Dunkirk and Clyde fine-sandy-loam soils. These orchards were between 47 and 56 years old in 1926. In both of these two soil groups the average yield of orchards set before 1870 was 4 barrels per acre higher than the yield of orchards set from 1880 to 1889.

In the Clyde-loam and Clyde-clay-loam group the highest yield was on orchards set since 1880. Apparently, on such poorly drained soils the trees more than 45 years old have become injured so they are not capable of bearing such large crops as they did between 35 and 45 years of age. On these two poorly drained soils no orchards that had been set before 1850 were standing in 1926.

The same relationship between age of trees and yield was found twenty-five years earlier in Wayne, Orleans, and Niagara Counties by Dr. G. F. Warren and Dr. M. B. Cummings. Their studies showed that trees about 50 years old had the highest yields.⁶

In the Dunkirk gravelly sandy loam and Dunkirk loam group the yield on orchards set after 1900 was considerably lower than on orchards set before 1900. On the other two soil groups the yield on orchards set from 1900 to 1909 was relatively high, but the number of orchards in these two groups was small.

In this area very few orchards were set from 1890 to 1904 (figure 5 and table 22). Because of this break in planting and because of the difference in yield between the young and old trees the orchards have been divided into two groups, those set before 1900 and those set after 1900. In nearly all of the cost data on the following pages where yield and cost-per-barrel figures are shown these two groups are shown separately.

Nearly all orchards set after 1900 have been divided into two groups, those set from 1900 to 1909 and those set from 1910 to 1918. In the latter group all except two of the records were for orchards set from 1910 to 1916. Because of the few orchards set after 1900 on the Dunkirk and Clyde fine sandy loam soils and on the Clyde loam and Clyde clay loam soils most of the data on the young orchards set after 1900 on these soils have not been shown. The data on young orchards are largely for the group of best-drained soils, the Dunkirk gravelly sandy loam and Dunkirk loam.

COST OF GROWING APPLES TO PICKING TIME

HUMAN LABOR

On the average, on orchards set before 1900 it took about 43 hours of man labor annually to take care of an acre of apples to picking time in 1927 and 1928 (table 23). In 1926 it required about 50 hours. About one-half of this time was spent in pruning, about 20 per cent for spraying, and 20 per cent for cultivating. The other 10 per cent was used for applying manure and fertilizer, for dusting and for miscellaneous work.

⁶ Warren, G. F. An apple orchard survey of Wayne County, New York. Cornell Univ. Agr. Exp. Sta. Bul. 226:311. 1905.
Warren, G. F. An apple orchard survey of Orleans County. Cornell Univ. Agr. Exp. Sta. Bul. 229:484. 1905.
Cummings, M. B. Apple orchard survey of Niagara County. Cornell Univ. Agr. Exp. Sta. Bul. 262:289. 1909.

TABLE 23. HOURS OF MAN LABOR PER ACRE TO PICKING TIME ON APPLE ORCHARDS SET BEFORE 1900, BY SOIL GROUPS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
	Hours	Hours	Hours	Hours
Pruning.....	21.6	26.2	25.4	23.0
Spraying.....	8.6	9.2	9.8	8.9
Cultivating.....	8.0	8.8	10.4	8.6
Manuring.....	1.4	2.2	1.9	1.6
Fertilizing.....	0.4	0.3	0.1	0.2
Other labor.....	0.8	0.1	1.9	1.0
Total.....	40.8	46.8	49.5	43.3

The average hours spent per acre were less on the Dunkirk gravelly sandy loam and Dunkirk loam group than on the other soil types. This is owing to the fact that a smaller percentage of the orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils were pruned each year. Also, on these better-drained soils a higher percentage of the orchards were cultivated with tractors, and sprayed with larger sprayers. This enabled the growers on these soils to reduce the time required to cultivate and spray their orchards.

To determine the value of the operator's time the farmers were asked, "What would it cost per hour to hire a man who boards himself to do the work on apples that you do?" The number of farmers who valued their time at each rate is shown in table 24; 84 per cent of the farmers valued their time between 40 and 50 cents an hour.

The value of unpaid family labor was valued at what it would cost per hour to hire a man who boards himself to do the same amount of work.

TABLE 24. DISTRIBUTION OF FARMS ACCORDING TO VALUE OF OPERATOR'S TIME, NEWFANE-OLCOTT AREA, 1926 TO 1928

Value per hour	Records	Proportion of total
Cents	Number	Per cent
Less than 40.....	41	9
40.....	185	42
43 to 47.....	24	5
50.....	164	37
More than 50.....	32	7
Total.....	446*	100

* The operators themselves did not do any work on their apple orchards on 3 farms in 1927 and 4 farms in 1928.

The cost per hour of hired labor was calculated for each type of labor on each farm by dividing the cash wages paid, plus board or privileges, by the number of hours worked.

The average monthly wages paid year and month help in 1926 are shown in table 25. Since the farms on Dunkirk soils are larger, on the average, the farmers on these soils hired about two and one-half times

as much year and month help per farm as did the farmers on the Clyde soils. The average cash wage per month where board was furnished was \$50 on the Dunkirk soils, as compared to \$41 on the Clyde soils. Because of the better returns on the Dunkirk soils, the farmers on these soils hired better men and paid them more.

TABLE 25. MONTHLY WAGES PAID YEAR AND MONTH MEN, 187 NEWFANE-OLCOTT FARMS, 1926

	Year and month men with board			Year and month men without board		
	Dunkirk soils	Clyde soils	All soils	Dunkirk soils	Clyde soils	All soils
Number of farms hiring.....	40	15	55	16	3	19
Per cent of farms hiring.....	36	19	29	15	4	10
Months hired per farm:						
For farms hiring.....	9.3	10.5	9.6	14.4	8.8	13.5
For all farms.....	3.4	2.0	2.8	2.1	0.3	1.4
Rate per month:						
Cash.....	\$50	\$41	\$47	\$68	\$44	\$66
Board.....	\$31	\$27	\$30	.....	.....	.....
Total rate per month.....	\$81	\$68	\$77	\$68	\$44	\$66

The average value or cost per hour for each type of labor on the different soil groups for 1927 and 1928 is given in table 26. On the better-drained soils the cost for hired labor was higher and the operators valued their own time higher than on the poorly drained soils.

About one-half of the labor spent on old and young apple orchards to picking time was done by the operator and about one-quarter by his regular hired men (table 27). In many cases the operator's son was not paid a definite cash wage. If the time of all the operators' sons were included, unpaid family labor would account for 7.2 per cent of the total labor on apple orchards to picking time.

The average cost of all labor on apples to picking time was 41 cents an hour for the two-years period 1927 and 1928 (table 27).

TABLE 26. AVERAGE COST OF LABOR PER HOUR ON APPLE ORCHARDS TO PICKING TIME, BY SOIL GROUPS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
	Average cost per hour			
	Cents	Cents	Cents	Cents
Operator.....	47	45	42	46
Year and month men.....	36	33	28	34
Day men.....	38	36	38	38
Piecework trimming.....	44	42	44*	44
All labor.....	42	41	38	41

* Piecework trimming trees was only 115 hours on the Clyde loam and Clyde clay loam soils, as compared to 3,943 hours on the Dunkirk gravelly sandy loam and Dunkirk loam soils.

TABLE 27. NUMBER OF HOURS SPENT ANNUALLY BY DIFFERENT WORKERS ON APPLE ORCHARDS TO PICKING TIME, 343 COST RECORDS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Total hours	Average time per acre	Proportion of total hours	Average cost per hour
	Number	Hours	Per cent	Cents
Operator.....	50,968	19.7	52.3	46
Year and month men.....	25,279	9.8	25.9	34
Day men.....	8,715	3.4	9.0	38
Piecework trimming.....	4,421	1.7	4.5	44
Operator's son.....	5,693	2.2	5.9	35
Landlord.....	383	0.1	0.4	40
Exchange labor.....	593	0.2	0.6	43
Operator's father.....	510	0.2	0.5	39
Operator's brother.....	119	0.1	0.1	34
Operator's wife.....	440	0.2	0.5	33
Operator's daughter.....	175	0.1	0.2	29
Operator's mother.....	15	.....	.....	30
Boys hired.....	100	.....	0.1	25
Total.....	97,411	37.7	100.0	41

HORSE LABOR

On the average, on orchards set before 1900, it required about 25 hours of horse labor annually to take care of an acre of apples to picking time for the period 1927 and 1928 (table 28). In 1926 it took about 30 hours. On the average, 43 per cent of this time was for spraying and 35 per cent for cultivating the orchards. The other 22 per cent was spent for removing brush, spreading manure, and for other horse labor.

TABLE 28. AVERAGE HOURS OF HORSE LABOR PER ACRE TO PICKING TIME ON APPLE ORCHARDS SET BEFORE 1900, BY SOIL GROUPS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
	Hours	Hours	Hours	Hours
Spraying.....	10.0	12.6	11.6	10.6
Cultivating.....	6.4	11.2	14.1	8.6
Removing brush.....	2.0	5.2	5.0	3.0
Manuring.....	1.4	3.4	2.8	2.0
Other horse labor.....	0.8	0.5	0.6	0.6
Total.....	20.6	32.9	34.1	24.8

The number of hours of horse labor in cultivating was less on the Dunkirk gravelly sandy loam and Dunkirk loam group than on the other soil types. On these better-drained soils the farms were larger, on the average, and a higher percentage of the orchards were worked with tractors.

On all farms, horse labor was charged at 18 cents per horse hour. This was the average cost per hour of horse labor in 1926 on farms which kept cost accounts in New York State.⁷ Since the farmers who keep cost

⁷ Results of cost accounts on New York farms, by J. F. Harriott. A mimeographed report by the Department of Agricultural Economics and Farm Management, New York State College of Agriculture, 1927.

accounts are selected and have businesses much larger than average, it is probable that more than one-half of the fruit farms studied had higher costs for horse labor than the rate of 18 cents, which was used in this study.

USE OF EQUIPMENT

The costs of operating tractors and tractor tools, trucks, sprayers, and dusters were calculated for each farm. The use of other equipment was charged at 11.5 cents per hour of horse labor.⁷

TRACTOR COSTS

Of the farms in the Newfane-Olcott area, 61 per cent had one or more tractors in 1928 (table 29). In this area 76 per cent of the tractors in use at that time were Fordsons and 18 per cent McCormick-Deerings.

TABLE 29. NUMBER OF FARMS HAVING ONE OR MORE TRACTORS, 136 NEWFANE-OLCOTT FARMS, 1928

Tractors	Farms	Proportion of total
	Number	Per cent
None.....	53	39.0
One.....	78	57.3
Two.....	3	2.2
Three.....	2	1.5
Total.....	136	100.0

The farmers who had tractors had more than twice as much fruit and 50 per cent more acres of cultivated crops than did the farmers without tractors (table 30).

TABLE 30. AVERAGE SIZE OF FARMS WITH AND WITHOUT TRACTORS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Farms with tractors	Farms without tractors
Number of records.....	260	185
Average per farm:		
Acres of fruit.....	29	13
Acres of cultivated crops.....	12	8
Acres of hay and grain.....	22	19
Number of horses.....	2.4	2.5
Number of tractors.....	1.1	0.0

Of the farmers on the Dunkirk gravelly sandy loam and Dunkirk loam soils, 69 per cent had one or more tractors, as compared to less than 50 per cent on the other soil types (table 31). The farms on these Dunkirk soils were larger, and the farmers used their tractors 103 hours more per year than those on the Clyde loam and Clyde clay loam soils. This greater amount of use resulted in an average cost per hour of 76 cents as compared to 84 cents on the Clyde loam and Clyde clay loam soils. These costs are for tractors and tractor tools and do not include any charge for

the operator's time. Probably because they had less work to be done, the farmers on the Clyde soils had older tractors. The farms on the Dunkirk and Clyde fine sandy loam soils had the highest number of hours of annual use per tractor and the lowest cost per hour.

TABLE 31. PERCENTAGE OF FARMS HAVING TRACTORS ON DIFFERENT SOIL GROUPS AND COSTS OF OPERATING TRACTORS AND TRACTOR TOOLS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
Number of records.....	234	95	116	445
Number of tractors*.....	178	48	54	280
Per cent with one tractor.....	65	41	47	55
Per cent with two tractors.....	3	0	0	2
Per cent with three tractors.....	1	3	0	1
Number of farms per tractor.....	1.3	2.0	2.2	1.6
Average per farm:				
Acres of fruit.....	29	18	13	22
Acres of cultivated crops.....	11	10	9	10
Acres of hay and grain.....	19	19	25	21
Number of horses.....	2.5	2.3	2.6	2.5
Hours per tractor per year.....	312	347	209	298
Cost of tractor and tractor tools per year.....	\$238	\$236	\$176	\$226
Cost of tractor and tractor tools per hour.....	\$0.76	\$0.68	\$0.84	\$0.76

*A tractor was counted each year a record was taken on it.

Size of farm and cost of operating tractors.⁸

COST BY OPERATIONS

Cultivating

In this area nearly all of the orchards were cultivated. Only 6 per cent of the orchards set before 1900 were in sod during the period 1926 to 1928. Of the orchards set from 1900 to 1918, 10 per cent were in sod.

In this area clean cultivation was the common practice; in fact 99 per cent of the orchards cultivated were worked within two feet of the tree trunks, and 93 per cent within one foot. Most of the orchards that were not cultivated closer than two feet to the tree trunks were orchards set after 1900.

Times the soil was worked

The orchards that were cultivated oftenest were also sprayed and pruned more than the other orchards (table 32). Because of this association the effect of times the soil was worked could not be determined from the number of records available. When the orchards were sorted according to number of times the soil was worked, those that were cultivated six or seven times had higher yields than those that were worked less than six times or more than seven times. This probably was owing to the fact that those who cultivated six or seven times applied more sprays than did those who cultivated less than six times. Also, those who cultivated more times probably started cultivation earlier in the spring. Data on the rela-

⁸The relation of size of farm to the cost of operating tractors is discussed in *Fruit-Farm Management*, by T. E. La Mont. Cornell Ext. Bul. 219:38-40. 1932.

TABLE 32. RELATION OF NUMBER OF TIMES THE SOIL WAS WORKED TO NUMBER OF SPRAYS AND PER CENT OF ACREAGE PRUNED, NEWFANE-OLCOTT AREA, 1927 AND 1928 (ORCHARDS SET BEFORE 1900)

Times soil was worked	Dunkirk gravelly sandy loam and Dunkirk loam soils		Clyde soils and Dunkirk fine sandy loam soil					
	Sprays		Proportion of acreage pruned		Sprays		Proportion of acreage pruned	
	1927	1928	1927	1928	1927	1928	1927	1928
<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Number</i>	<i>Number</i>	<i>Per cent</i>	<i>Per cent</i>
0.....	2.0	2.7	5	37	3.4	3.0	33	0
1 to 5.....	3.5	3.8	30	34	3.1	3.9	35	52
6 to 7.....	3.5	4.5	48	55	4.1	3.5	72	71
8 or more.....	4.1	4.6	47	66	3.8	4.1	76	74

tion of the number of times the soil was worked to the date cultivation was started in the spring were not obtained for the years 1926 to 1928. These data were obtained for the year 1929 and probably give some indication of what the same farmers did in the previous years. The date that cultivation was started in the spring was asked in reference to the calyx spray. Along Lake Ontario this spray usually is applied the last week in May. Each farmer was asked whether he began to cultivate his orchards before or after the calyx spray, and how many weeks before or after. Of the orchards worked one to five times, 13 per cent were not cultivated until after the calyx spray, while in none of the orchards cultivated six or more times was cultivation started as late as this date (table 33).

TABLE 33. RELATION OF NUMBER OF TIMES THE SOIL WAS WORKED TO DATE CULTIVATION WAS STARTED ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1929

Times soil was worked	Orchards	Date cultivation was started			
		Average weeks before calyx spray	4 or more weeks before calyx spray	1 to 3 weeks before calyx spray	After calyx spray
<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
1 to 5.....	24	2.4	33	54	13
6 to 7.....	14	3.1	36	64	0
8 or more.....	26	4.4	77	23	0
Total or average.....	64	3.4	51	44	5

Cultivation was started somewhat earlier on the Dunkirk gravelly sandy loam and the Dunkirk loam soils than on the other soil types.

The number of times that the orchards were worked decreased during this three-years period. On the Dunkirk gravelly sandy loam and the Dunkirk loam soils, 51 per cent of the cultivated orchards were worked eight or more times in 1926, as compared to 34 per cent in 1928. On the other soils, 33 per cent of the cultivated orchards were worked eight or more times in 1926, as compared to 27 per cent in 1928.

For the period 1927 to 1928, 16 per cent of the orchards were cultivated eight or nine times and 11 per cent were worked ten or more times (table 34).

TABLE 34. DISTRIBUTION OF ORCHARDS ACCORDING TO NUMBER OF TIMES SOIL WAS WORKED, NEWFANE-OLCOTT AREA, 1927 AND 1928 (ORCHARDS SET BEFORE 1900)

Times soil was worked	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
		<i>Per cent of records</i>		
0.....	10	4	8	8
1 to 3.....	3	4	9	5
4 or 5.....	27	28	32	29
6 or 7.....	32	38	25	31
8 or 9.....	17	13	15	16
10 or 11.....	7	2	3	5
12 or 13.....	2	9	2	3
14 or more.....	2	2	6	3
Total.....	100	100	100	100
	<i>Number of records</i>			
	128	47	65	240

The apple orchards set after 1900 were cultivated less than the older orchards (table 35).

TABLE 35. AVERAGE NUMBER OF TIMES SOIL WAS WORKED IN CULTIVATED ORCHARDS SET BEFORE OR AFTER 1900, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

Date orchard set	1927		1928	
	Orchards cultivated	Average times soil was worked	Orchards cultivated	Average times soil was worked
Before 1900.....	<i>Number</i> 57	<i>Number</i> 7.1	<i>Number</i> 58	<i>Number</i> 6.7
1900 to 1909.....	17	5.5	15	5.7
1910 to 1918.....	15	6.6	16	5.9

Size of orchard and cost of cultivation

The size of the orchard block has an important effect on the cost of tilling. On the Dunkirk gravelly sandy loam and Dunkirk loam soils the average cost of tilling orchards decreased from \$13.70 per acre to \$7.71 as the average size of orchard increased from approximately three to twenty acres (table 36). On the other soils similar results were found. This decrease in cost was due in part to the fact that a higher percentage of the larger orchards were worked with tractors.

Factors affecting the cost of plowing, disking, and harrowing⁹

The average cost of plowing orchards with horses was \$4.72 an acre, as compared to \$2.81 where tractors were used (table 37). As was previously explained, the horse labor was charged at 18 cents an hour, and use of equipment was charged at 11.5 cents an hour of horse labor on

⁹ Only the average cost of plowing, disking, and harrowing with tractors and with horses is presented in this bulletin. For the factors affecting the cost, such as size of orchard, size of farm, size of tool, and number of trees per acre, see *Fruit-Farm Management* by T. E. La Mont. Cornell Ext. Bul. 219:29-38. 1932.

TABLE 36. RELATION OF SIZE OF ORCHARD TO COST OF CULTIVATION IN ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils			Clyde soils and Dunkirk fine sandy loam soil	
	Size of orchard			Size of orchard	
	Less than 4.5 acres	4.5 to 9.4 acres	9.5 or more acres	Less than 4.5 acres	4.5 or more acres
Number of orchards.....	35	40	40	49	57
Acres per orchard.....	3.1	6.3	19.5	2.6	7.8
Acres of bearing fruit per farm.....	16.5	19.4	43.4	9.2	17.8
Average number of times soil was worked.....	7.7	6.2	6.9	6.2	7.0
Cultivation per acre:*					
Man hours.....	13.7	8.7	7.6	14.1	9.1
Horse hours.....	17.2	7.8	5.1	19.8	11.5
Tractor hours.....	3.2	4.2	4.0	2.4	2.8
Cost per acre.....	\$13.70	\$9.96	\$7.71	\$14.65	\$9.26

* Cultivation, in this table, includes a small amount of mowing, hoeing around trees, and ditching the orchard.

TABLE 37. AVERAGE COSTS OF PLOWING APPLE ORCHARDS WITH HORSES AND WITH TRACTORS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Orchards plowed with		All orchards plowed
	Horses	Tractors	
Number of records.....	237	100	413
Acres per orchard.....	5.8	7.7	7.0
Acres of fruit and other crops except hay per farm.....	20	34	26
Plowing per acre:			
Man hours.....	4.6	2.2	3.6
Horse hours.....	9.3	.....	5.2
Cost of man labor.....	\$1.84	\$0.95	\$1.46
Cost of horse labor*.....	1.67	.....	0.94
Cost for use of equipment.....	1.07	.....	0.60
Cost for tractor and tractor tools.....	.....	1.78	0.89
Interest on costs†.....	0.14	0.08	0.12
Total cost per acre.....	\$4.72	\$2.81	\$4.01

* In this and subsequent tables, horse labor was charged at 18 cents per hour and use of equipment at 11.5 cents per hour of horse labor. These are the average rates on farms keeping cost-account records in New York State for 1926.

† Interest was charged on the cost of plowing for 6 months at the rate of 6 per cent annually.

all farms. The average cost of all farm equipment, except tractors, tractor tools, and trucks, on the farms which kept cost accounts was 11.5 cents an hour of horse labor. This rate is probably too high for the use of equipment for plowing. The cost for the use of a two-horse plow is probably considerably less than 23 cents per hour. However, if no charge were made for the use of the plow, the average cost of plowing with horses would still be about 80 cents an acre higher than the average cost with tractors. The tractor cost was calculated for each farm. The lower cost with tractors is largely due to the saving in man labor. However, on a small farm the overhead cost of the tractor may more than off-set the saving in man labor.

Of the orchards that were cultivated in this area, 86 per cent were plowed (table 38). Of the cultivated orchards that were not plowed only

about one-half were disked. Where it is possible to do a thorough job with a tractor disk this method is one way of reducing the cost of cultivation. The average cost of plowing with tractors was \$2.81 per acre as compared to 91 cents for diskings.

TABLE 38. METHOD OF CULTIVATION OF APPLE ORCHARDS, 521 RECORDS IN THE NEWFANE-OLCOTT AREA, 1926 TO 1928

	Number of records
Orchards plowed.....	413
Orchards not plowed:	
Disked and harrowed.....	36
Harrowed but not disked.....	31
Not cultivated.....	41
Total.....	521

About 57 per cent more hours of man labor was required, on the average, to disk an acre with horses than with tractors (table 39). The average cost of diskings an acre once with horses was \$1.34 as compared to 91 cents where tractors were used. On about 80 per cent of all the orchards that were disked, a tractor disk was used.

The average cost of harrowing an acre of orchard once with horses was \$1.24 as compared to 80 cents where tractors were used (table 39). The cheaper cost with tractors is largely due to the saving of man labor. On the average, it required only about one-half as much time to harrow an acre with a tractor as it did with horses.

TABLE 39. AVERAGE COSTS OF DISKING AND HARROWING APPLE ORCHARDS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Disking		Harrowing	
	With horses	With tractors	With horses	With tractors
Number of records.....	21	91	194	270
Acres per orchard.....	4.7	10.9	5.2	9.1
Acres of fruit and other crops except hay per farm.....	34	60	32	57
Average times disked.....	2.4	2.4	0.3	0.7
Average times harrowed.....	4.2	4.4	5.6	5.3
Hours per acre per time:				
Man hours.....	1.27	0.81	1.1	0.6
Horse hours.....	2.69	.....	2.5	.....
Cost per acre per time over:				
Man labor.....	\$0.51	\$0.32	\$0.47	\$0.27
Horse labor.....	0.48	.....	0.45	.....
Use of equipment.....	0.31	.....	0.28	.....
Tractor and tractor tools.....	.....	0.56	.....	0.51
Interest on costs.....	0.04	0.03	0.04	0.02
Total cost per acre per time over.....	\$1.34	\$0.91	\$1.24	\$0.80

The total cost of harrowing with horses in orchards that were harrowed seven or more times was \$11.03 per acre, as compared to \$4.09 on orchards harrowed less than five times (table 40). With tractors the cost of harrowing was \$5.98 per acre in orchards that were harrowed seven or more times and \$2.83 in orchards harrowed less than five times.

TABLE 40. RELATION OF NUMBER OF TIMES HARROWED TO AVERAGE COST OF HARROWING, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Farms using horses			Farms using tractors		
	Times harrowed			Times harrowed		
	Less than 5	5 to 6	7 or more	Less than 5	5 to 6	7 or more
Number of records.....	80	60	54	121	87	62
Average times harrowed.....	3.2	5.5	9.4	3.1	5.5	9.3
Acres per orchard.....	4.6	4.7	5.3	7.9	9.0	11.4
Harrowing per acre:						
Man hours.....	3.9	6.0	10.1	2.1	3.2	5.2
Horse hours.....	8.3	13.5	22.0	.....	.....	.....
Cost of man labor.....	\$1.53	\$2.45	\$4.23	\$0.84	\$1.43	\$2.24
Cost of horse labor.....	\$1.49	\$2.43	\$3.95	.....	.....	.....
Cost for use of equipment.....	\$0.95	\$1.55	\$2.53	.....	.....	.....
Cost of tractor and tractor tools.....	.....	.....	.....	\$1.91	\$2.98	\$3.57
Interest on costs.....	\$0.12	\$0.19	\$0.32	\$0.08	\$0.13	\$0.17
Total cost per acre.....	\$4.09	\$6.62	\$11.03	\$2.83	\$4.54	\$5.98

Date cultivation was stopped

About 75 per cent of the farmers in this area stopped cultivating their orchards between July 1 and 15, in 1929 (table 41). The percentage which stopped cultivation at each date was about the same in each soil group.

TABLE 41. NUMBER OF ORCHARDS ACCORDING TO DATE ON WHICH CULTIVATION WAS STOPPED, NEWFANE-OLCOTT AREA, 1929

	Number of orchards
Before June 15.....	2
June 15 to 30.....	14
July 1 to 15.....	74
After July 15.....	10
Total.....	100

Cover crops

Weeds were usually used as a cover crop in this area. A cover crop was sowed in only 14 per cent of the mature bearing orchards in 1927 and in only 5 per cent in 1928 (table 42). Buckwheat was used on about two-thirds of the orchards on which a cover crop was sowed. The cost for cover-crop seed was included under miscellaneous expenses.

TABLE 42. APPLE ORCHARDS IN WHICH COVER CROPS WERE SOWED, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Orchards set before 1900		Orchards set 1900 to 1919	
	1927	1928	1927	1928
Total number of orchards.....	126	115	38	64
Number of orchards in which cover crops were sowed.....	18	6	3	4
Per cent of orchards in which cover crops were sowed.....	14	5	8	6

Spraying

Number of applications and amount of spray

On the better-drained soils, the commonest number of applications of spray on orchards set before 1900 was 4 or 5, and on the poorer-drained soils 3 or 4, in the years 1926, 1927, and 1928 (table 43). On orchards set from 1900 to 1918 on the Dunkirk gravelly sandy loam and Dunkirk loam soils the usual number of applications was four (table 44).

TABLE 43. PERCENTAGE OF ORCHARDS SET BEFORE 1900 THAT WERE SPRAYED THE INDICATED NUMBER OF TIMES, BY SOIL GROUPS, NEWFANE-OLCOTT AREA, 1926 TO 1928

Number of sprays	Dunkirk gravelly sandy loam and Dunkirk loam soils			Dunkirk and Clyde fine sandy loam soils			Clyde loam and Clyde clay loam soils			All soils		
	1926	1927	1928	1926	1927	1928	1926	1927	1928	1926	1927	1928
	<i>Per cent of orchards</i>											
0.....	5	8	6	3	0	0	9	3	0	5	5	4
1.....	9	8	5	7	7	0	6	0	0	8	6	3
2.....	3	8	3	17	4	5	9	12	9	8	8	5
3.....	15	20	19	23	25	42	26	29	31	20	24	26
4.....	35	23	14	27	32	27	41	47	41	35	32	23
5.....	28	28	34	23	32	16	9	3	16	22	22	26
6.....	3	3	17	0	0	5	0	3	3	2	2	11
7.....	2	2	2	0	0	5	0	3	0	0	1	2
Total.....	100	100	100	100	100	100	100	100	100	100	100	100
	<i>Number of orchards</i>											
	65	64	64	30	28	19	34	34	32	129	126	115
	<i>Average number of sprays</i>											
	3.7	3.5	4.1	3.3	3.8	3.9	3.1	3.5	3.7	3.5	3.6	4.0

TABLE 44. NUMBER OF ORCHARDS SET AFTER 1900 THAT WERE SPRAYED THE INDICATED NUMBER OF TIMES, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928

Sprays	Orchards set 1900 to 1909			Orchards set 1910 to 1918		
	1926	1927	1928	1926	1927	1928
	<i>Number</i>					
0.....	1	1	1	0	0	1
1.....	1	0	0	1	3	1
2.....	1	1	3	1	1	1
3.....	1	1	3	2	5	5
4.....	3	10	4	3	2	2
5.....	7	4	2	3	3	7
6.....	1	0	3	0	1	1
7 or more.....	0	0	0	2	1	0
Total.....	15	17	18	12	16	18

In 1905, the most frequent number of applications of spray in Niagara County was two, and 26 per cent of the orchards were not sprayed at all (table 45).

In 1926 the average number of sprays applied on trees of all ages in western New York was about the same as in the intensive fruit areas of Virginia (table 46). However, growers in the Wenatchee and Yakima districts of Washington applied, on the average, from one to one and one-

TABLE 45. DISTRIBUTION OF ORCHARDS ACCORDING TO NUMBER OF SPRAYS, NIAGARA COUNTY, 1905*

Sprays	Orchards	Acres	Orchards
Number	Number	Number	Per cent
Seldom or never sprayed.....	98	864	19.1
None in 1905†.....	35	409	6.8
One.....	104	1,105	20.3
Two.....	203	2,156	39.6
Three.....	68	675	13.3
Four.....	4	49	0.8
Five.....	1	7	0.2
Total.....	513	5,265	100.0

*Apple orchard survey of Niagara County, by Dr. M. B. Cummings. Cornell Univ. Agr. Exp. Sta. Bul. 262:305. 1909.

† Usually sprayed in other years.

half more sprays than did the growers in western New York. Because of the warmer temperature during the growing season in the Washington fruit districts, codling moth is a more serious pest than in western New York.

TABLE 46. NUMBER OF SPRAYS APPLIED ON APPLE TREES OF ALL AGES IN DIFFERENT FRUIT AREAS IN THE UNITED STATES, 1926 (FARMS WITH 100 OR MORE TREES)*

Area	Average number of sprays	Per cent applying		
		Less than 4 sprays	4 or 5 sprays	6 or more sprays
New York:				
4 Lake Ontario counties.....	4.2	31	51	18
Virginia:				
North Valley district†.....	3.9	40	50	10
Piedmont district‡.....	4.6	17	59	24
West Virginia:				
Berkley County.....	3.6	41	50	9
Michigan:				
Southern lake district §.....	4.9	26	39	35
Washington:				
Wenatchee district ¶.....	5.1	22	34	44
Yakima district ¶.....	5.8	7	33	60

* Adapted from mimeographed reports on estimated number of apple trees by varieties and ages in commercial and farm orchards in New York, Virginia, West Virginia, Michigan, and Washington, January 1, 1928, by W. H. Youngman and J. B. Shepard. United States Department of Agriculture, Bureau of Agricultural Economics, in cooperation with the State Departments of Agriculture, October, 1930 to April, 1931.

† Includes the counties of Frederick, Clarke, Page, Rockingham, Shenandoah, and Warren.

‡ Includes the counties of Albemarle, Amherst, Greene, Nelson, and Orange.

§ Includes the counties of Allegan, Berrien, Kent, Van Buren, Muskegon, and Ottawa.

¶ Wenatchee district includes the counties of Chelan, Okanogan, Douglas, and Grant.

¶ Yakima district includes the counties of Yakima, Kittitas, Benton, and Franklin.

In the Newfane-Olcott area the farmers who sprayed their trees a greater number of times had higher average yields per acre than did those who made fewer applications (tables 47 and 48). The higher yields were due in part to better control of insects and diseases. The control of such troubles as scab, leaf roller, and bud moth is very important in obtaining a good set of fruit. Thorough spraying is also essential to the production of fruit of high quality. The growers who had the most apples to protect from insects and diseases sprayed more often than did those who had small yields. On the average, growers applied more spray in 1928 than in 1927 because they had more apples to protect from insects and diseases.

In 1927, the total cost of producing apples for those growers who sprayed three or four times was \$5.00 a barrel, as compared to \$2.90 where five or more sprays were applied (table 47). In 1928, the cost was \$2.54 where three or four sprays were applied and \$1.97 for those who sprayed six or seven times (table 48).

TABLE 47. RELATION OF NUMBER OF SPRAYS TO THE COST OF PRODUCING APPLES ON ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927

	Number of sprays			
	0	1 or 2	3 or 4	5 to 7
Number of orchards.....	5	10	28	21
Average number of sprays.....	0	1.5	3.5	5.2
Gallons per tree per application.....	0	8.3	7.0	6.9
Average number of dusts.....	3.6	1.9	0.4	.....
Man hours spraying per acre.....	0	3.8	8.5	11.6
Cost of spraying per acre.....	0	\$9.69	\$20.77	\$27.58
Cost of dusting per acre.....	\$21.81	\$17.15	\$3.30	\$0.85
Barrels packed per acre.....	17.7	14.1	15.9	30.9
Average cost per barrel packed:				
Spraying.....	0	\$0.69	\$1.31	\$0.89
Dusting.....	\$1.23	\$1.22	\$0.21	0
Total growing.....	\$3.18	\$4.76	\$4.07	\$2.12
Harvesting and marketing.....	\$0.87	\$0.83	\$0.93	\$0.78
Total.....	\$4.05	\$5.59	\$5.00	\$2.90

TABLE 48. RELATION OF NUMBER OF SPRAYS TO THE COST OF PRODUCING APPLES ON ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1928

	Number of sprays				
	0	1 or 2	3 or 4	5	6 or 7
Number of orchards.....	4	5	21	22	12
Average number of sprays.....	0	1.4	3.4	5.0	6.1
Gallons per tree per application.....	0	8.4	7.5	8.2	7.9
Average number of dusts.....	2.0	2.0	0.4	0.1	0
Man hours spraying per acre.....	0	3.3	8.1	11.4	15.1
Cost of spraying per acre.....	0	\$9.36	\$20.65	\$30.81	\$31.82
Cost of dusting per acre.....	\$17.73	\$18.97	\$2.91	\$0.91	0
Barrels packed per acre.....	22.9	26.2	32.9	44.2	50.2
Average cost per barrel packed:					
Spraying.....	0	\$0.36	\$0.63	\$0.70	\$0.63
Dusting.....	\$0.77	\$0.73	\$0.09	\$0.02	0
Total growing.....	\$2.25	\$2.32	\$1.69	\$1.52	\$1.32
Harvesting and marketing.....	\$0.75	\$0.44*	\$0.85	\$0.70	\$0.65
Total.....	\$3.00	\$2.76	\$2.54	\$2.22	\$1.97

* One grower who sprayed only once had a large acreage of fruit, and in 1928 he sold his apples tree-run, so the harvesting and marketing costs are low for this group.

The year 1926 was an unfavorable one for insects and diseases, and a very high percentage of the fruit was packed in the No. 1 grade. In this year the relation between number of sprays and yield was not so striking as in 1927 or in 1928. However, the growers who applied five or more sprays in 1926 had a higher average yield per acre and a lower cost per barrel than those who put on less than five sprays (table 49).

TABLE 49. RELATION OF NUMBER OF SPRAYS TO THE COST OF PRODUCING APPLES ON ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926

	Number of sprays		
	Less than 4	4	5 or more
Number of orchards.....	21	23	21
Average number of sprays.....	1.9	4.0	5.2
Average number of dusts.....	2.0	0.3	0
Barrels packed per acre.....	74	73	94
Average cost per barrel packed:			
Growing cost.....	\$0.90	\$1.02	\$0.79
Harvesting and marketing.....	\$0.72	\$0.76	\$0.71
Total.....	\$1.62	\$1.78	\$1.50

The quantity of spray applied most frequently per tree per application on mature bearing apple orchards on Dunkirk gravelly sandy loam and Dunkirk loam soils was about 6.5 gallons (table 50). On the other soils it was about 4.5 gallons. On the Dunkirk gravelly sandy loam and Dunkirk loam soils, 25 per cent of the growers applied 9.5 gallons or more of spray per tree per application. Of the orchards set on these soils after 1900, 55 per cent received less than 3.5 gallons of spray per tree per application (table 51).

TABLE 50. PERCENTAGE DISTRIBUTION OF ORCHARDS SET BEFORE 1900 ACCORDING TO GALLONS OF SPRAY APPLIED PER TREE PER APPLICATION, NEWFANE-OLCOTT AREA, 1927 AND 1928

Gallons per tree per application	Dunkirk gravelly sandy loam and Dunkirk loam soils		Dunkirk and Clyde fine sandy loam soils		Clyde loam and Clyde clay loam soils		All soils	
	1927	1928	1927	1928	1927	1928	1927	1928
	<i>Per cent of orchards</i>							
Less than 3.5.....	17	7	21	11	46	28	26	13
3.5 to 5.4.....	19	22	43	31	33	47	28	31
5.5 to 7.4.....	24	25	21	11	11	16	23	20
7.5 to 9.4.....	19	18	7	26	0	6	11	16
9.5 to 11.4.....	8	8	4	21	0	0	5	8
11.5 to 13.4.....	5	15	0	0	0	0	2	8
13.5 to 15.4.....	3	0	0	0	0	3	2	1
15.5 or more.....	5	5	4	0	0	0	3	3
Total.....	100	100	100	100	100	100	100	100
	<i>Number of orchards</i>							
	59	60	28	19	33	32	120	111
	<i>Average gallons</i>							
	7.2	7.9	5.5	6.7	4.0	4.7	5.9	6.8

Growers who applied more gallons of spray per tree per application had higher yields per acre than did those who used less spray (table 52). In general, the cost of spraying per barrel of packed fruit was higher where more spray was applied, but the total cost of producing apples was lower. In 1927, the growers who applied less than five sprays and less than seven gallons of spray per tree per application had a total cost of

\$5.74 per barrel, while those who applied five or more sprays and seven or more gallons of spray per tree per application had a total cost of \$2.86

TABLE 51. DISTRIBUTION OF ORCHARDS SET AFTER 1900 ACCORDING TO GALLONS OF SPRAY APPLIED PER TREE PER APPLICATION, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

Gallons per tree per application	1927			1928		
	Orchards set					
	1900 to 1909	1910 to 1918	1900 to 1918	1900 to 1909	1910 to 1918	1900 to 1918
	<i>Number</i>					
Less than 1.5.....	3	5	8	1	2	3
1.5 to 2.4.....	5	4	9	4	5	9
2.5 to 3.4.....	0	0	0	4	3	7
3.5 to 4.4.....	3	3	6	2	3	5
4.5 to 5.4.....	3	1	4	0	3	3
5.5 to 6.4.....	0	1	1	5	1	6
6.5 or more.....	2	2	4	1	0	1
Total.....	16	16	32	17	17	34

TABLE 52. RELATION OF NUMBER OF SPRAYS AND GALLONS APPLIED PER TREE PER APPLICATION TO THE AVERAGE COST OF PRODUCING APPLES ON ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Less than 5 sprays		5 or more sprays	
	Less than 7 gallons per tree per application	7 or more gallons per tree per application	Less than 7 gallons per tree per application	7 or more gallons per tree per application
	1927			
Number of orchards.....	21	17	11	10
Number of sprays.....	3.3	2.6	5.3	5.1
Gallons per tree per application.....	4.4	10.9	4.7	9.2
Number of dusts.....	0.2	1.5	0	0.1
Man hours of spraying per acre.....	8.2	5.4	10.3	12.4
Cost of spraying per acre.....	\$18.04	\$15.70	\$22.89	\$30.54
Barrels packed per acre.....	12.6	18.0	31.2	30.7
Cost of spraying per barrel.....	\$1.43	\$0.87	\$0.73	\$0.99
Growing cost per barrel.....	\$4.82	\$3.91	\$2.09	\$2.14
Harvesting and marketing cost per barrel.....	\$0.92	\$0.89	\$0.87	\$0.72
Total cost per barrel.....	\$5.74	\$4.80	\$2.96	\$2.86
Net receipts per barrel.....	\$4.23	\$4.14	\$4.08	\$4.89
Profit or loss per barrel.....	-\$1.51	-\$0.66	\$1.12	\$2.03
	1928			
Number of orchards.....	11	15	14	20
Number of sprays.....	3.5	2.7	5.4	5.4
Gallons per tree per application.....	4.5	9.9	4.6	10.5
Number of dusts.....	0	1.3	0.1	0.1
Man hours of spraying per acre.....	8.5	5.7	8.9	18.1
Cost of spraying per acre.....	\$17.99	\$16.35	\$23.44	\$43.19
Barrels packed per acre.....	29.4	31.1	36.8	60.2
Cost of spraying per barrel.....	\$0.61	\$0.53	\$0.64	\$0.72
Growing cost per barrel.....	\$1.91	\$1.86	\$1.62	\$1.30
Harvesting and marketing cost per barrel.....	\$0.95	\$0.65	\$0.78	\$0.60
Total cost per barrel.....	\$2.86	\$2.51	\$2.40	\$1.90
Net receipts per barrel.....	\$2.82	\$3.30	\$3.17	\$3.09
Profit or loss per barrel.....	-\$0.04	\$0.79	\$0.77	\$1.19

per barrel. In 1928, the total cost for growers who used a small quantity of spray was \$2.86 per barrel as compared to \$1.90 for those who applied a large quantity of spray.

In 1928 the average yields were nearly double those of 1927 and consequently a higher percentage of the growers applied five or more sprays and seven or more gallons of spray per tree per application in that year.

Cost of spraying on different soil groups

The cost of spraying on the different soil groups in 1927 and in 1928 is shown in table 53. Growers on the Dunkirk gravelly sandy loam and Dunkirk loam soils put on a larger number of sprays and more spray per tree per application than did the growers on the other soil types. Because the growers on the Dunkirk gravelly sandy loam and Dunkirk loam soils had larger sprayers that carried a greater pressure, they were able to apply the larger amount of spray in about the same length of time as did the growers on the other soil types.

TABLE 53. COST OF SPRAYING ORCHARDS SET BEFORE 1900, BY SOIL GROUPS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils		Dunkirk and Clyde fine sandy loam soils		Clyde loam and Clyde clay loam soils	
	1927	1928	1927	1928	1927	1928
Number of orchards.....	59	60	28	19	33	32
Acres of bearing fruit per farm....	28	23	16	19	11	11
Average capacity of sprayers in gallons.....	*	202	*	184	*	192
Average pounds of pressure.....	*	296	*	255	*	237
Number of sprays.....	3.8	4.4	3.8	3.9	3.6	3.7
Gallons per tree per application...	7.2	7.9	5.5	6.7	4.0	4.7
Hours spraying per acre:						
Man labor.....	8.7	9.8	8.0	10.5	8.8	10.7
Horse labor.....	9.4	12.2	10.5	14.6	10.4	13.0
Tractor.....	0.7	0.7	0	0	0.2	0.1
Sprayer.....	5.4	6.8	5.2	7.3	5.4	6.6
Cost of sprayer per hour.....	\$0.71	\$0.72	\$0.71	\$0.83	\$1.02	\$0.89
Cost of spraying per acre:						
Man labor.....	\$3.76	\$4.11	\$3.28	\$4.98	\$3.29	\$4.30
Horse labor.....	\$1.71	\$2.20	\$1.89	\$2.62	\$1.87	\$2.34
Tractor.....	\$0.39	\$0.61	0	0	\$0.13	\$0.09
Sprayer.....	\$3.86	\$4.93	\$3.69	\$6.06	\$5.49	\$5.87
Spray material.....	\$10.73	\$12.26	\$7.12	\$9.93	\$6.03	\$7.65
Interest on costs †.....	\$0.61	\$0.72	\$0.48	\$0.71	\$0.50	\$0.61
Total cost.....	\$21.06	\$24.83	\$16.46	\$24.30	\$17.31	\$20.86
Barrels packed per acre.....	21.1	37.9	16.3	25.8	7.7	18.4
Cost of spraying per barrel packed	\$1.00	\$0.66	\$1.01	\$0.94	\$2.25	\$1.13

* Data on size of sprayer and pounds of pressure carried were not obtained on the 1927 records.

† Interest was charged on the cost of spraying for six months at the rate of 6 per cent annually.

Although the growers on the better-drained soils had better sprayers and applied more spray, they had a lower sprayer cost per hour and per acre than did the growers on the other soil types. This is because the growers on the better-drained soils had larger acreages of bearing fruit over which to distribute the overhead cost of the sprayer.

The cost of spraying per barrel of packed fruit on the Clyde loam and Clyde clay loam soils was about twice as high as on the Dunkirk gravelly

sandy loam and Dunkirk loam soils. The most important factor in this difference was the fact that the average yield of packed fruit on the Clyde loam and Clyde clay loam soils was less than half that on the Dunkirk gravelly sandy loam and Dunkirk loam soils.

The average yield of all bearing apple orchards in the Newfane-Olcott area was 68 per cent below the 1913-1926 average in 1927, and 43 per cent below in 1928. These low yields resulted in high average spraying costs per barrel of packed apples.

Changes in the cost of spraying from 1910-1915¹⁰ to 1927-1928

About 1916, the "spray gun" for applying liquid material was introduced; practically all of the fruit growers in western New York now use this method of spraying their trees. In 1919, after the introduction of the spray gun, the amount of material applied per tree was reduced (table 54). However, in 1927 and 1928 the amount of spray material applied per tree per application was about the same as that applied during the period 1910 to 1915, but, on the average, approximately one more spray was applied in 1927 and 1928 than during 1910 to 1915.

TABLE 54. COMPARISON OF THE COST OF SPRAYING MATURE BEARING APPLE ORCHARDS IN 1910 TO 1915, IN 1919, AND IN 1927 AND 1928

	Western New York *		Newfane-Olcott area, 1927 and 1928†
	1910 to 1915	1919	
Number of records.....	218	‡	119
Method of spraying.....	Pole and nozzle	Spray gun	Spray gun
Trees per acre.....	35	35	31
Average number of sprays.....	3.2	5.4	4.1
Gallons per tree per application.....	7.7	5.3	7.6
Gallons per tree per season.....	24.7	18.2	31.2
Hours spraying per acre:			
Man labor.....	20.5	13.3	9.2
Horse labor.....	18.0	13.3	10.8
Tractor.....	0	0	0.7
Sprayer.....	9.0	6.6	6.1
Cost of spraying per acre:			
Man labor.....	\$4.10	\$3.99	\$3.94
Horse labor.....	\$2.70	\$2.66	\$1.95
Tractor.....	0	0	\$0.50
Sprayer.....	‡	‡	\$4.40
Spray material.....	\$8.66	\$10.94	\$11.49
Interest on costs.....	‡	‡	\$0.66
Total cost.....	.....	.....	\$22.94

* Adapted from data in *Cost of Producing Apples in Five Counties in Western New York, 1910 to 1915*, by G. H. Miller. United States Agr. Dept. Bul. 851:27-28. 1920.

† Data for the Newfane-Olcott area are for the Dunkirk gravelly sandy loam and Dunkirk loam soils.

‡ Data on the cost of the sprayer were not given.

§ Number of records for 1919 was not given.

When the pole and nozzle were used, the crew generally consisted of two men and two horses or three men and two horses. In 1919, where the gun was used practically all of the spray crews comprised two men and a team. One man did the driving and the other applied the material

¹⁰ Data for western New York from 1910 to 1915 and for 1919 were adapted from *Cost of Producing Apples in Five Counties in Western New York, 1910 to 1915* by G. H. Miller. U. S. Agr. Dept. Bul. 851:27-28. 1920.

with the gun. In the period 1927 to 1928 about one-half of the spraying was done by a crew of one man and a team and the other half with two men and a team. The second man either drove, or both drove and sprayed.

The number of man hours required to spray an acre has been reduced in recent years in spite of the larger number of sprays applied. Sprayers with greater capacity, with larger pumps, and more powerful engines have been introduced. This has greatly reduced the time required for spraying. This change has been due in part to the increasing cost of labor. Man labor was figured at 20 cents an hour from 1910 to 1915, and 30 cents in 1919. For 1927 and 1928 the average cost of man labor was 41 cents an hour.

The cost of spray material was higher in 1927 and 1928 than from 1910 to 1915, largely owing to the fact that more sprays have been applied in recent years than formerly. The average cost of commercial lime-sulfur was 14 cents a gallon in 1915, 18 cents in 1919, and 15.5 cents in 1928. Arsenate-of-lead paste cost, on the average, 8 cents a pound in 1915 and 15 cents in 1919. In 1928, the average cost of arsenate-of-lead in the powder form was 15.7 cents, which was approximately equivalent to 8 cents a pound in the paste form.

In the earlier studies the cost of the sprayer was put in with the general-equipment account so the sprayer cost was not figured.

Age of orchards and cost of spraying

The orchards set before 1870 had larger-sized trees and received more spray per tree per application than did the orchards set after 1870 (table 55). The average circumference of trees set after 1900 was about one-half that of trees set before 1900.

TABLE 55. RELATION OF AGE AND SIZE OF TREES TO AMOUNT OF SPRAY APPLIED, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

Date orchard set	Average circumference of trees	1927			1928		
		Orchards	Average sprays	Average quantity per tree per application	Orchards	Average sprays	Average quantity per tree per application
Before 1870.....	Inches 68.2	Number 20	Number 3.8	Gallons 8.3	Number 24	Number 4.4	Gallons 8.8
1870 to 1879.....	65.9	22	3.8	7.8	22	4.2	7.7
1880 to 1899.....	63.3	17	3.8	5.1	14	4.6	6.7
1900 to 1909.....	33.5	16	3.8	3.7	17	3.6	4.2
1910 to 1918.....	28.7	16	3.6	3.0	17	3.7	3.2

The average cost of spraying per acre on orchards set from 1900 to 1918 was about two-thirds the cost on orchards set before 1900 (table 56).

Size of sprayers and pounds of pressure carried

Of the sprayers in this area 66 per cent had a capacity of 200 gallons (table 57). Only 2 per cent held as much as 300 gallons.

TABLE 56. AVERAGE COST OF SPRAYING YOUNG AND OLD ORCHARDS ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Before 1900		1900 to 1909		1910 to 1918	
	Time per acre	Cost per acre	Time per acre	Cost per acre	Time per acre	Cost per acre
1927:	<i>Hours</i>	<i>Dollars</i>	<i>Hours</i>	<i>Dollars</i>	<i>Hours</i>	<i>Dollars</i>
Man labor.....	8.7	3.76	7.1	2.71	5.6	2.07
Horse labor.....	9.4	1.71	7.6	1.36	8.1	1.46
Tractor.....	0.7	0.39	0.7	0.46	0.4	0.28
Sprayer.....	5.4	3.86	4.5	3.42	4.4	2.79
Spray material.....	.....	10.73	.....	6.22	.....	6.18
Interest on costs.....	.....	0.61	.....	0.43	.....	0.38
Total cost per acre.....	.....	21.06	.....	14.60	.....	13.16
1928:						
Man labor.....	9.8	4.11	7.7	3.16	6.1	3.09
Horse labor.....	12.2	2.20	8.0	1.44	6.2	1.11
Tractor.....	0.7	0.61	0.9	1.23	1.2	0.72
Sprayer.....	6.8	4.93	4.9	3.10	4.3	3.60
Spray material.....	.....	12.26	.....	7.79	.....	7.49
Interest on costs.....	.....	0.72	.....	0.50	.....	0.48
Total cost per acre.....	.....	24.83	.....	17.22	.....	16.49

TABLE 57. NUMBER OF SPRAYERS OF DIFFERENT SIZES ON NEWFANE-OLCOTT FARMS, 1928

Capacity of sprayer	Dunkirk gravelly sandy loam and Dunkirk loam soils		Clyde soils and Dunkirk fine sandy loam soil	Total
	Number of sprayers			
Gallons				
50.....	1	0		1
100.....	6	4		10
150.....	9	6		15
200.....	41	47		88
250.....	13	3		16
300.....	3	0		3
Total.....	73	60		133

As many as 63 per cent of the sprayers usually carried between 240 and 339 pounds of pressure (table 58). On the Dunkirk gravelly sandy loam and Dunkirk loam soils, 27 per cent of the sprayers carried 340 pounds or more of pressure, while none of the sprayers on the other soil types carried as much as 340 pounds.

From 1910 to 1915, when the pole-and-nozzle method of spraying was used the usual amount of pressure carried was between 125 and 250 pounds.¹¹

In 1928 there was a slight relation between the size of the sprayer and the pounds of pressure carried. The larger sprayers, in general, carried more pounds of pressure than the smaller sprayers (table 58).

Acres of bearing orchard and cost of spraying apple trees

Growers who had less than 15 acres of bearing orchard spent, on the average, about 14 hours spraying an acre, while those who had 30 or more

¹¹ Cost of producing apples in five counties in western New York, 1910 to 1915, by G. H. Miller. U. S. Agr. Dept. Bul. 851:27-28. 1920.

TABLE 58. DISTRIBUTION OF SPRAYERS ACCORDING TO CAPACITY AND POUNDS OF PRESSURE CARRIED, NEWFANE-OLCOTT AREA, 1928

Pounds of pressure	Size of sprayer in gallons						Total
	50	100	150	200	250	300	
Less than 190.....	0	0	4	0	3	0	7
190 to 239.....	0	1	9	1	2	0	13
240 to 289.....	0	3	24	6	2	0	35
290 to 339.....	0	4	17	2	1	0	24
340 to 389.....	1	3	2	2	1	1	10
390 or more.....	2	1	2	0	0	0	5
	3	12	58	11	9	1	94*

* The amount of pressure was obtained on only 94 of the 133 sprayers on the farms studied in 1928.

acres, spent about 7 hours per acre (table 59). The average number of sprays applied was 4.4 in both cases. The total spraying cost, including man and horse labor, sprayer and spray material, for the growers with the larger acreage of bearing orchard, was about \$14 less per acre than the total spraying cost of growers with a small acreage.

The lower cost of spraying on the farms with the larger acreage of bearing orchard was due in part to the greater efficiency in the use of labor. Larger sprayers that carried more pounds of pressure were used, and thus the growers were able to apply more gallons of spray per hour than those with smaller sprayers.

The growers with a large acreage of orchard could afford to buy better spray outfits and still have a much lower sprayer cost per acre than those with a small acreage, because the overhead cost of the sprayer was distributed over more acres. Larger sprayers are necessary in order to save labor in spraying. In order to use a large sprayer efficiently it is necessary to have a large acreage of bearing orchard.

The average cost of spraying per 100 gallons of spray applied was \$3.43 for the growers with less than 15 acres of bearing orchard, as compared to \$2.54 for those who had 30 or more acres (table 59).

Farmers who had the larger acreages of fruit trees obtained their spray material at lower prices than did those with smaller acreages, because they bought it in larger quantities and often at wholesale prices. On farms with less than 15 acres of bearing orchard, lime-sulfur cost, on the average, 14.8 cents per gallon, as compared to 13.2 cents on farms with 30 or more acres of bearing orchard (table 60). This is a difference of 1.6 cents per gallon, or about 11 per cent.

Since the decline in the general price level in 1920, there has been a large spread between retail and wholesale prices of farm products. Retail prices are high as compared with wholesale prices. This makes it important for farmers to buy feed, seed, fertilizer, and spray materials in large quantities at wholesale prices and to pay cash. Buying in this way means a considerable saving over buying in small quantities at retail prices.

Quantity and cost of spray material

The quantity of each kind of spray material used and its cost are shown in table 61 for the year 1928. The growers on the Dunkirk gravelly

TABLE 59. RELATION OF ACRES OF BEARING ORCHARD TO AVERAGE COST OF SPRAYING APPLE TREES ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1928 (60 ORCHARDS SET BEFORE 1900)

	Acres of bearing orchard		
	Less than 15	15 to 29	30 or more
Number of orchards.....	23	24	13
Average acres of bearing orchard per farm.....	10	22	50
Average capacity of sprayers, in gallons.....	183	198	242
Average pounds of pressure.....	267	286	364
Average number of sprays.....	4.4	4.3	4.4
Gallons per tree per application.....	6.7	6.7	6.4
Hours spraying per acre.....	35.5	29.7	29.4
Hours spraying per acre:			
Man labor.....	14.1	10.4	7.5
Horse labor.....	18.4	14.0	8.2
Tractor.....	0.8	0.7	0.7
Sprayer.....	10.0	7.7	4.8
Cost of spraying per acre:			
Man labor.....	\$5.50	\$4.23	\$3.42
Horse labor.....	\$3.32	\$2.51	\$1.49
Tractor.....	\$0.80	\$0.84	\$0.36
Sprayer.....	\$8.97	\$4.67	\$3.44
Spray material.....	\$16.03	\$11.09	\$11.59
Interest on costs.....	\$1.04	\$0.70	\$0.61
Total cost per acre.....	\$35.66	\$24.04	\$20.91
Hours spraying per 100 gallons of spray applied:			
Man labor.....	1.36	1.21	0.91
Horse labor.....	1.77	1.63	1.00
Sprayer.....	0.96	0.90	0.58
Cost of spraying per 100 gallons of spray applied:			
Man labor.....	\$0.53	\$0.49	\$0.42
Horse labor.....	\$0.32	\$0.29	\$0.18
Tractor.....	\$0.08	\$0.10	\$0.04
Sprayer.....	\$0.86	\$0.55	\$0.42
Spray material.....	\$1.54	\$1.29	\$1.41
Interest on costs.....	\$0.10	\$0.08	\$0.07
Total cost per 100 gallons.....	\$3.43	\$2.80	\$2.54

TABLE 60. RELATION OF ACRES OF BEARING ORCHARD TO PRICE OF SPRAY MATERIAL USED ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1928 (60 ORCHARDS SET BEFORE 1900)

Kind of material	Unit	Acres of bearing orchard		
		Less than 15	15 to 29	30 or more
		Average price per unit		
		Dollars	Dollars	Dollars
Lime-sulfur solution.....	Gallons.....	0.148	0.159	0.132
Dry lime-sulfur.....	Pounds.....	0.107	0.084	0.110
Sodium-sulfur compounds.....	Pounds.....	0.096	0.090	0.090
Dry-mix sulfur-lime.....	Pounds.....	0.107	0.059	0.050
Lead arsenate.....	Pounds.....	0.166	0.165	0.141
Nicotine sulfate.....	Gallons.....	12.20	12.20	11.20
Oil.....	Gallons.....	0.500	0.500	0.310

sandy loam and Dunkirk loam soils obtained their liquid lime-sulfur and arsenate of lead at prices 8 per cent lower than did those on the other soil types. The growers on the better-drained soils had larger acreages of orchard so they bought their spray material in larger quantities and obtained lower average prices.

TABLE 61. AMOUNT AND PRICE OF DIFFERENT SPRAY MATERIALS USED PER ORCHARD, NEWFANE-OLCOTT AREA, 1928

Kind of material	Unit	Average quantity per orchard	Average price per unit
Lime-sulfur solution.....	Gallons	82	<i>Dollars</i> 0.155
Lime-sulfur solution (made on farms) *.....	Gallons	9	0.059
Dry lime-sulfur.....	Pounds	31	0.094
Sodium-sulfur compounds.....	Pounds	58	0.088
Dry-mix sulfur-lime.....	Pounds	85	0.070
Lead arsenate.....	Pounds	157	0.157
Nicotine sulfate.....	Quarts	1	2.94
Oil.....	Gallons	11	0.451
Copper sulfate.....	Pounds	22	0.078
Bordeaux.....	Pounds	1	0.158
Kayso.....	Pounds	7	0.161
Lime.....	Pounds	100	0.010
Number of orchards.....		179	
Acres per orchard.....		7.2	

* The price of the lime-sulfur solution made on the farms includes the cost of the lime-sulfur, labor, and fuel for boiling.

The test of the home-made lime-sulfur was not obtained. If the test had averaged 30° Baumé the cost to make enough lime-sulfur to equal 1 gallon testing 32° was 6.3 cents. If the test averaged 28° the cost was 6.7 cents.

Of the liquid lime-sulfur used in this area in 1928, 90 per cent was bought already made. Only 7 growers out of 136 made their own lime-sulfur; four of these were on the Clyde soils and two on the Dunkirk fine sandy loam soil.

A study made in western New York in 1914 showed that 28 per cent of the farmers used home-made lime-sulfur.¹² In 1928, in the Newfane-Olcott area, only 5 per cent of the farmers made lime-sulfur.

Dusting

Percentage of farmers dusting

On the Dunkirk gravelly sandy loam and Dunkirk loam soils, 29 per cent of the farmers did some dusting in 1926, 25 per cent in 1927, and 17 per cent in 1928. On the other soils only one farmer did any dusting in 1926, only two in 1927, and none in 1928.

In each year about one-half of the farmers who dusted did not apply any spray or sprayed only once (table 62). The other one-half who dusted used dust as a supplement to their spray schedule.

The farmers who had a large acreage of bearing orchard did more dusting than the other growers. About one-half of the growers who had 40 acres or more of bearing orchard did some dusting, as compared to 15 per cent of the farmers who had less than 40 acres. Dusting enables a farmer to apply a fungicide and insecticide to a large acreage of orchard in a short period of time.

Cost of dusting

The most common rates of applying dust on mature bearing orchards were between 1 and 2.9 pounds of material per tree per application (table 63).

¹²Cost of producing apples in five counties in western New York, 1910 to 1915, by G. H. Miller. U. S. Agr. Dept. Bul. 851:26. 1920.

TABLE 62. DISTRIBUTION OF ORCHARDS THAT WERE DUSTED, ACCORDING TO NUMBER OF SPRAYS AND DUSTS APPLIED, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928* (ORCHARDS SET BEFORE 1900)

Number of sprays	Number of dusts					Total
	1	2	3	4	5 or more	
Number of orchards, 1926						
0.....	..	1	1	..	1	3
1.....	..	1	4	1	..	6
2.....	..	..	..	..	..	0
3.....	1	..	2	1	..	5
4.....	4	1	..	..	..	5
5.....	..	..	..	..	..	0
Total.....	5	4	7	2	1	19
Number of orchards, 1927						
0.....	..	1	1	1	1	4
1.....	..	1	1	2	..	4
2.....	1	..	..	..	1	2
3.....	1	1	2	..	..	4
4.....	1	..	..	..	..	1
5.....	1	..	..	..	..	1
Total.....	4	3	4	3	2	16
Number of orchards, 1928						
0.....	..	..	..	2	..	2
1.....	..	1	..	2	..	3
2.....	..	..	..	..	..	0
3.....	1	..	1	1	..	3
4.....	1	..	..	..	..	1
5.....	1	1	..	..	..	2
Total.....	3	2	1	5	..	11

* On the Clyde soils and Dunkirk fine sandy loam the orchards that were dusted are not included in the above table. On these soils one farmer dusted in 1926, 2 in 1927, and none in 1928.

TABLE 63. DISTRIBUTION OF ORCHARDS THAT WERE DUSTED, ACCORDING TO POUNDS OF DUST APPLIED PER TREE PER APPLICATION, NEWFANE-OLCOTT AREA, 1927 AND 1928 (ORCHARDS SET BEFORE 1900)

Pounds per tree per application	Orchards		Orchards	
	1927	1928	1927	1928
0.1 to 0.9.....	<i>Number</i> 0	<i>Number</i> 1	<i>Per cent</i> 0	<i>Per cent</i> 9
1.0 to 1.9.....	6	4	38	37
2.0 to 2.9.....	5	3	31	27
3.0 to 3.9.....	1	2	6	18
4.0 to 4.9.....	4	1	25	9
Total.....	16	11	100	100

The most important cost in dusting was for the dust material, which amounted to 79 per cent of the cost of dusting (table 64). The average cost of operating dusters was \$1.71 per hour in 1927 and \$2.47 in 1928. The cost per hour was higher in 1928 because the dusters were used for fewer hours than in 1927; 69 per cent of the dust material used in this area during 1928 was 85-15 sulfur-lead-arsenate dust (table 65).

TABLE 64. AVERAGE COST OF DUSTING ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	1927	1928
Number of orchards.....	16	11
Average number of dusts.....	3.0	2.7
Average pounds per tree per application.....	2.3	2.0
Hours per acre:		
Man labor.....	1.79	1.27
Horse labor.....	1.60	1.04
Tractor.....	0.05	0.01
Duster.....	0.91	0.66
Cost of duster per hour.....	\$1.71	\$2.47
Cost per acre:		
Man labor.....	\$0.73	\$0.51
Horse labor.....	\$0.29	\$0.19
Tractor.....	\$0.04	\$0.14
Duster.....	\$1.56	\$1.63
Dust material.....	\$11.83	\$10.25
Interest on costs*.....	\$0.43	\$0.38
Total costs.....	\$14.88	\$13.10

* Interest was charged on the cost of dusting for six months at the rate of 6 per cent annually.

TABLE 65. AMOUNT AND PRICE OF DIFFERENT DUST MATERIALS USED ON THE 18 APPLE ORCHARDS THAT WERE DUSTED, NEWFANE-OLCOTT AREA, 1928

Kind of dust	Quantity	Average price per pound	
	<i>Pounds</i>	<i>Cents</i>	<i>Dollars</i>
85-15 sulfur-lead-arsenate.....	25,300	8.0	2,015
90-10 sulfur-lead-arsenate.....	2,650	6.0	159
Sulfur.....	2,400	4.0	97
Sodium-sulfur compounds.....	1,800	8.2	147
Sulfur and lime.....	2,400	5.5	132
Lead-arsenate and lime.....	1,200	9.5	114
Copper-lime.....	1,100	6.5	71
Nicotine-lime.....	70	14.3	10
Total.....	36,920	.....	2,745

Comparison of the costs of spraying and dusting

It required about four times as long to make one application of spray as it did to make one application of dust on mature bearing apple orchards (table 66). However, the cost of the dust material for one application of dust was 38 per cent higher than the cost of the spray material for one application of spray. The average cost of making one application of dust including man and horse labor, use of equipment, and material was \$4.90 cents per acre in the period 1927 and 1928, while the average cost of making one application of spray was \$5.59. Thus, the cost of applying eight dusts was about the same as the cost of seven applications of spray.

There was a greater incentive for tenant farmers to dust than where the owner operated his own farm, because the landlord usually furnished the sprayer or duster and paid for the spray and dust material; while the tenant furnished the man and horse labor. On all except one of the 13 records on share-rented farms where the tenant and landlord were not related the landlord paid for all of the dust material. About 25 per cent

TABLE 66. COMPARISON OF THE AVERAGE COST OF SPRAYING AND DUSTING ON ORCHARDS SET BEFORE 1900, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Spraying		Dusting	
	1927	1928	1927	1928
Number of orchards.....	59	60	16	11
Average number of applications.....	3.8	4.4	3.0	2.7
Amount per tree per application.....	7.2	7.9	2.3	2.0
Hours per acre per application:				
Man labor.....	2.29	2.22	0.60	0.47
Horse labor.....	2.48	2.77	0.53	0.39
Tractor.....	0.19	0.16	0.02	0.05
Sprayer or duster.....	1.43	1.54	0.30	0.24
Cost per acre per application:				
Man labor.....	\$0.99	\$0.93	\$0.24	\$0.19
Horse labor.....	\$0.45	\$0.50	\$0.10	\$0.07
Tractor.....	\$0.10	\$0.14	\$0.02	\$0.05
Sprayer or duster.....	\$1.02	\$1.12	\$0.52	\$0.60
Material.....	\$2.82	\$2.79	\$3.94	\$3.80
Interest on costs.....	\$0.16	\$0.16	\$0.14	\$0.14
Total costs.....	\$5.54	\$5.64	\$4.96	\$4.85

of the tenant farmers who were not related to the landlord dusted their orchards, as compared to only 5 per cent of the other farmers.

The yield and growing cost per barrel on orchards that were dusted and orchards that were not dusted is shown in table 67. The number of orchards that were dusted is too small to justify definite conclusions, but the average yields on the orchards that were dusted were lower than those on the other orchards. The growing cost per acre and per barrel was higher on the orchards that were dusted.

TABLE 67. AVERAGE YIELD AND COST OF GROWING APPLES ON ORCHARDS THAT WERE DUSTED AND ON ORCHARDS NOT DUSTED, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928 (ORCHARDS SET BEFORE 1900)

	1927		1928	
	Orchards dusted	Orchards not dusted	Orchards dusted	Orchards not dusted
Number of orchards.....	16	48	11	53
Average number of dusts.....	3.0	0	2.7	0
Pounds of dust per tree per application.....	2.3	0	2.0	0
Average number of sprays.....	1.8	4.0	2.4	4.5
Gallons of spray per tree per application.....	9.9	6.5	10.4	7.3
Cost of dusting per acre.....	\$14.91	0	\$13.08	0
Cost of spraying per acre.....	\$15.05	\$23.12	\$16.61	\$26.91
Total growing cost per acre*.....	\$68.82	\$61.79	\$61.99	\$61.63
Barrels packed per acre.....	17.9	23.5	36.7	38.7
Total growing cost per barrel*.....	\$3.85	\$2.63	\$1.69	\$1.59

* Cost to picking time.

Pruning

In this area about 75 per cent of the apple orchards set before 1900 were pruned each year (table 68). A slightly smaller percentage of the orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils were pruned each year, because the average acreage of orchard per farm on these well-drained soils was larger than on the other soil types.

TABLE 68. PERCENTAGE OF APPLE ORCHARDS PRUNED AND AVERAGE HOURS PRUNING PER ACRE, NEWFANE-OLCOTT AREA, 1926 TO 1928 (ORCHARDS SET BEFORE 1900)

	Proportion of orchards receiving some pruning				Average pruning per acre in orchards pruned*			
	1926	1927	1928	Average	1926	1927	1928	Average
	<i>Per cent</i>				<i>Hours</i>			
Dunkirk gravelly sandy loam and Dunkirk loam soils.....	78	66	73	72	33.1	30.5	39.8	34.5
Dunkirk and Clyde fine sandy loam soils.....	87	82	79	83	46.8	38.5	34.1	39.8
Clyde loam and Clyde clay loam soils.....	76	82	75	78	32.3	33.5	30.7	32.2
All soils.....	80	74	75	76	36.3	33.4	36.3	35.3

* In each orchard that received some pruning the total hours pruning was divided by the number of acres in the orchard, whether all of it was pruned or not. These figures were averaged with each orchard given equal weight.

In orchards that received some pruning, the average hours spent pruning per acre of orchard was 35 (table 68). This time includes cutting the branches out of the trees (in this bulletin this work is called *trimming*); cutting, hauling, and buzzing the wood; and hauling and burning the brush. Not all of the trees in these orchards were pruned. Therefore, the average number of hours per acre pruned was somewhat higher than 35.

Relation of soil to cost of pruning

The total net cost of pruning per acre pruned was higher on the Dunkirk gravelly sandy loam and Dunkirk loam soils than on the other soil types (table 69). On these better-drained soils the trees were larger and more time was required to trim a tree.

On the average, it required about one hour per tree to trim the branches out of the trees in orchards set before 1900 and about one-third of an hour per acre to cut the wood and remove the brush. The average net cost per tree pruned was 58 cents in 1927 and 53 cents in 1928.

TABLE 69. RELATION OF SOIL TO THE AVERAGE NET COST OF PRUNING APPLE TREES, ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1928*

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
Total acres in cost orchards.....	564	97	174	835
Per cent of acreage pruned.....	52	58	64	55
Pruning per acre pruned:				
Hours trimming out of trees.....	36	28	27	33
Hours cutting wood and removing brush.....	12	13	10	11
Total hours.....	48	41	37	44
Total net cost.....	\$18.08	\$15.36	\$13.66	\$16.67
Average number of trees per acre.....	31	31	32	32
Average circumference of trees, inches.....	67	62	57	63
Pruning per tree pruned:				
Hours trimming out of trees.....	1.16	0.90	0.84	1.04
Hours cutting wood and removing brush.....	0.39	0.42	0.31	0.36
Total hours.....	1.55	1.32	1.15	1.40
Net cost.....	\$0.58	\$0.50	\$0.43	\$0.53

* The cost of pruning in 1927 was about the same as in 1928.

Relation of age of orchard to cost of pruning

It took longer to trim orchards set before 1900 than it did those set after that date. Also more time was required to cut the wood and remove the brush in the older orchards than in the younger ones (table 70). Probably this was owing to the fact that more large branches were cut out of the trees in the older orchards.

The average net cost of pruning trees set from 1900 to 1909 was 24 cents per tree, as compared to more than 50 cents in orchards set before 1900.

The detailed costs for pruning apple trees are shown for orchards of different ages on the Dunkirk gravelly sandy loam and Dunkirk loam soils in table 71. Man labor made up more than 80 per cent of the cost in each

TABLE 70. RELATION OF AGE OF APPLE ORCHARDS TO AVERAGE NET COST OF PRUNING, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Orchard set				
	1840 to 1869	1870 to 1879	1880 to 1899	1900 to 1909	1910 to 1918
Number of records.....	86	97	58	44	53
Acres pruned.....	322	342	262	183	260
Pruning per acre pruned:					
Hours trimming out of trees.....	35	32	33	16	10
Cutting wood and removing brush.....	13	12	9	5	4
Total hours.....	48	44	42	21	14
Net cost.....	\$18.73	\$16.46	\$18.24	\$10.11	\$6.62
Trees per acre.....	30	32	34	42	43
Average circumference of trees, inches.....	66	62	60	33	27
Pruning per tree pruned:					
Hours trimming out of trees.....	1.18	0.99	0.96	0.39	0.22
Hours cutting wood and removing brush.....	0.42	0.38	0.28	0.11	0.10
Total hours.....	1.60	1.37	1.24	0.50	0.32
Net cost.....	\$0.62	\$0.52	\$0.54	\$0.24	\$0.15

TABLE 71. AVERAGE COST OF PRUNING OLD AND YOUNG APPLE TREES ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Orchards set before 1900		Orchards set 1900 to 1909		Orchards set 1910 to 1918	
	1927	1928	1927	1928	1927	1928
Acres pruned.....	271	291	83	58	100	113
Hours per acre pruned:						
Man labor.....	44.3	47.9	19.0	20.3	14.5	11.6
Horse labor.....	4.0	4.2	1.7	4.8	1.4	2.4
Tractor.....	1.1	1.0	0.4	0.6	0.6	0.4
Cords of wood per acre pruned.....	0.85	1.04	0.10	0.24	0.09	0.13
Cost per acre pruned:						
Man labor.....	\$19.39	\$18.97	\$8.32	\$7.91	\$6.02	\$5.17
Horse labor.....	\$0.73	\$0.77	\$0.31	\$0.86	\$0.25	\$0.44
Tractor.....	\$0.98	\$0.85	\$0.56	\$0.65	\$0.41	\$0.22
Other equipment.....	\$0.48	\$0.52	\$0.20	\$0.55	\$0.16	\$0.28
Interest on costs*.....	\$0.65	\$0.63	\$0.28	\$0.30	\$0.20	\$0.18
Total cost.....	\$22.23	\$21.74	\$9.67	\$10.27	\$7.04	\$6.29
Credit for wood per acre.....	\$2.79	\$3.66	\$0.35	\$0.79	\$0.26	\$0.51
Net cost per acre.....	\$19.44	\$18.08	\$9.32	\$9.48	\$6.78	\$5.78

* Interest was charged on the cost of pruning for six months at the rate of 6 per cent annually.

age group. The costs under pruning include trimming the branches out of the trees, cutting out the limbs that were saved for fire wood, hauling and buzzing this wood, and hauling and burning the brush. The limbs saved for fire wood were credited at what the farmer estimated they were worth. The average value placed on apple wood after it was buzzed was \$3.40 per cord. On the average, in orchards set before 1900 slightly less than one cord of wood was obtained per acre pruned. In orchards set after 1900 very little wood was obtained.

Manuring

Percentage of orchards manured and rates of application

About one-quarter of the acreage in the mature bearing orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils were manured each year, while 44 per cent of the acreage on the Dunkirk and Clyde fine sandy loam soils and 35 per cent on the Clyde loam and Clyde clay loam soils were manured (table 72). The farmers on the Dunkirk gravelly sandy loam and Dunkirk loam soils have more orchard and less manure than the farmers on the other soil types.

The average rate of applying manure on these mature bearing orchards on each of the soil groups was approximately four and one-half tons per acre. On apple orchards set after 1900 manure was applied less frequently than on orchards set before 1900. In each of the soil groups about one-half as large a percentage of the acreage in the young orchards was manured as in the older orchards (table 73).

TABLE 72. NUMBER OF ORCHARDS SET BEFORE 1900 THAT WERE MANURED, AND RATES OF APPLICATION, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
Number of records.....	128	47	66	241
Per cent of orchards receiving manure.....	33	60	44	41
Acres in cost orchards.....	1,214	241	356	1,811
Per cent of acreage manured.....	23	44	35	28
Average tons of manure per acre covered.....	4.5	4.4	4.4	4.4

TABLE 73. ACRES OF ORCHARD SET FROM 1900 TO 1918 THAT WERE MANURED, AND RATES OF APPLICATION, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils		Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils
	1927	1928	1928	1928
Number of orchards.....	33	36	17	11
Per cent of orchards receiving manure.....	15	22	53	36
Acres in cost orchards.....	291	296	82	78
Per cent of acreage manured.....	6	18	24	21
Tons of manure per acre covered.....	3.7	5.8	6.2	4.0

Cost of applying manure

Of the manure applied to the orchards in this area, 94 per cent was produced on the farm in 1928 and 69 per cent in 1927. In 1927 one grower with a large acreage of orchard bought 250 tons of manure in carload lots, but has not purchased any since that date.

The average cost of hauling and applying manure was \$1.44 per ton in 1927 and 98 cents in 1928 (table 74). The higher average cost in 1927 was due to the fact that the cost of hauling the 250 tons purchased, from the railroad station to the orchard, was included in the cost. Hence, the data for 1928 are more representative of the cost of hauling the manure from the barn to the orchard than the figures for 1927.

TABLE 74. AVERAGE COST OF APPLYING MANURE ON ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1927 AND 1928

	1927 (1,237 tons)		1928 (1,020 tons)	
	Time per ton	Cost or value per ton	Time per ton	Cost or value per ton
	<i>Hours</i>	<i>Dollars</i>	<i>Hours</i>	<i>Dollars</i>
Man labor.....	1.5	0.60	1.1	0.45
Horse labor.....	1.7	0.31	1.4	0.25
Equipment use.....	1.7	0.20	1.4	0.16
Truck cost.....	.....	0.24	.....	0.03
Manure *.....	.....	1.79	.....	2.03
Interest on costs †.....	.....	0.09	.....	0.09
Total cost.....	.....	3.23	.....	3.01

* Manure at the barn was valued at \$2 a ton. This was the median estimate of the farmers in 1927. Some manure was bought. In 1927, one grower with a large acreage of fruit purchased 250 tons at \$1 a ton, and another grower purchased 15 tons at \$1 per ton. In 1928, one grower bought 50 tons at \$3 a ton and another grower bought 15 tons at \$1 a ton.

† Interest on the value of the manure and the costs of applying it was charged for six months at the rate of 6 per cent annually.

All of the manure applied in any one season was charged to the following crop.

Fertilizing

Percentage of orchards fertilized and rates of application

About one-fourth of the mature bearing orchards on the Dunkirk soils and the Clyde fine sandy loam soil were fertilized each year, while only 8 per cent of the orchards on the Clyde loam and Clyde clay loam soils received any fertilizer (table 75). Because poor drainage is probably the

TABLE 75. NUMBER OF ORCHARDS SET BEFORE 1900 THAT WERE FERTILIZED, AND RATES OF APPLICATION, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
	Number of records.....	128	47	66	241
Per cent of orchards receiving fertilizer.....	27	26	8	21
Per cent of acreage fertilized.....	20	26	3	17
Per cent of acreage fertilized or manured.....	38	54	37	40
Average pounds of fertilizer per acre fertilized.....	278	195	500	270
Average number of trees per acre.....	29	34	60	31
Average pounds of fertilizer per tree fertilized.....	9.6	5.7	8.3	8.7

limiting factor in yield on the Clyde loam and Clyde clay loam soils, the farmers on these soils apparently have found that it does not pay to apply fertilizer.

None of the orchards set from 1900 to 1918 on the Clyde loam and Clyde clay loam soils were fertilized. On the Dunkirk gravelly sandy loam and Dunkirk loam soils 12 per cent of the acreage was fertilized at an average rate of 2.9 pounds per tree.

Cost of applying fertilizer

The average cost of fertilizer was approximately \$61 per ton in 1927 and \$60 in 1928 (table 76). The average cost of applying the fertilizer, including interest at the rate of 6 per cent annually for six months on the fertilizer, labor, and equipment costs, was \$7.07 in 1927 and \$8.11 in 1928. This included the cost of hauling the fertilizer from the barn and of applying it to the orchard, but did not include the cost of hauling the fertilizer from the railroad station to the farm. This latter cost should have been obtained from the farmers and included as an expense when the fertilizer was not delivered by the dealer. More horse labor per ton was used in 1928 than in 1927. The greater amount of horse labor in 1928 reduced the amount of man labor required to apply the fertilizer.

All of the fertilizer applied each spring was charged to the crop of the same year.

TABLE 76. AVERAGE COST OF APPLYING FERTILIZER ON ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1927 AND 1928

	1927 (25.39 tons)		1928 (17.24 tons)	
	Time per ton	Cost per ton	Time per ton	Cost per ton
	<i>Hours</i>	<i>Dollars</i>	<i>Hours</i>	<i>Dollars</i>
Man labor.....	11.3	4.51	10.6	4.01
Horse labor.....	1.9	0.35	7.2	1.29
Equipment use.....	1.9	0.22	7.2	0.83
Fertilizer.....		61.19		59.76
Interest on costs*.....		1.99		1.98
Total cost per ton.....		68.26		67.87

* Interest on costs was charged for six months on the cost of the fertilizer, labor, and equipment at the rate of 6 per cent annually.

Quantity and cost of fertilizers used

Of the fertilizers used on apple orchards in this area from 1926 to 1928, 85 per cent were nitrate of soda and sulfate of ammonia (table 77). Most of the other 15 per cent were complete fertilizers. During this three-years period, 1926 to 1928, growers used more than twice as much nitrate of soda as sulfate of ammonia. During this period the price of sulfate of ammonia decreased relative to the price of nitrate of soda. In 1926 sulfate of ammonia cost \$2.56 more per ton than nitrate of soda, but in 1928 sulfate cost \$5.84 per ton less than nitrate (table 77). The spread in price between nitrate of soda and sulfate of ammonia has increased since 1928, and in some communities in 1932 sulfate could be bought for \$13 per ton less than nitrate.

TABLE 77. AMOUNT AND COST OF EACH KIND OF FERTILIZER USED ON APPLE ORCHARDS, NEWFANE-OLCOTT AREA, 1926 TO 1928

Kind	Tons				Average cost per ton			
	1926	1927	1928	1926 to 1928	1926	1927	1928	1926 to 1928
	<i>Number</i>				<i>Dollars</i>			
Nitrate of soda.....	16.3	9.6	16.4	42.3	64.76	67.96	62.76	65.16
Sulfate of ammonia.....	2.8	13.6	3.2	19.6	67.32	66.34	56.92	63.53
2-8-10.....	2.6	1.0	0	3.6	39.80	33.50	.....	36.65
2-8-16.....	0	3.0	0	3.0	.....	38.00	.....	38.00
4-12-4.....	0	1.0	1.5	2.5	.....	35.00	36.66	35.83
Potash.....	0.6	0.2	0.2	1.0	54.62	52.00	55.00	53.87
Unknown.....	0	0.1	0.2	0.3	.....	72.00	60.00	66.00
Total.....	22.3	28.5	21.5	72.3				

INTEREST ON THE ORCHARDS

Value of cost orchards per acre

Interest was charged at 5 per cent of the value of each apple orchard as it was estimated by the farmer. The farmer was asked how much he would be willing to sell his orchard for, or what he would pay for a block of orchard just like his if the new block adjoined his present orchard.

The average of these estimates is shown by soil groups in table 78.

TABLE 78. AVERAGE VALUE PER ACRE OF APPLE ORCHARDS SET BEFORE 1900 BY SOIL GROUPS, NEWFANE-OLCOTT AREA, 1926 TO 1928*

Year	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
1926.....	406	355	290	363
1927.....	395	371	295	363
1928.....	356	388	280	340
Average, 1926 to 1928.....	386	371	288	355

* In this and subsequent tables the average value per acre was obtained by giving each orchard equal weight regardless of its size. This average is approximately the same as an average weighted by acres in each orchard. Thus, the small orchards were valued at nearly the same amount per acre as the large orchards.

Orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils were valued, on the average, at about \$100 more per acre than orchards on the Clyde loam and Clyde clay loam soils. The average values per acre were lower in 1928 than in 1926 except on the Dunkirk and Clyde fine sandy loam soils. The greatest decrease in value as estimated by the farmers was on the two better-drained soil types. However, on the basis of yields and returns, the other soil types should have decreased in value more than the Dunkirk gravelly sandy loam and Dunkirk loam soils.

Studies made from 1910 to 1915 showed that the estimated average value of apple orchards at that time in Niagara County was \$475, and in

Wayne, Monroe, Orleans, Niagara, and Ontario Counties \$514.¹⁸ These orchards were somewhat selected and the average is probably comparable with the average on the Dunkirk gravelly sandy loam and Dunkirk loam soils in the Newfane-Olcott area. The average value of mature bearing orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils from 1926 to 1928 was \$89 less than the average value of orchards in Niagara County from 1910 to 1915.

On the Dunkirk gravelly sandy loam, 29 per cent of the orchards were valued at \$500 or more for the period 1927 and 1928, as compared to 3 per cent on the Clyde loam and Clyde clay loam soils (table 79).

The average value of the land without trees in old and young apple orchards was \$139 per acre in 1928 (table 84). This is the value of the bare land in the orchards and does not include the value of buildings on the farm. Orchards are generally set on the best soil on the farm.

TABLE 79. PERCENTAGE OF ORCHARDS SET BEFORE 1900 WITH INDICATED VALUES PER ACRE, NEWFANE-OLCOTT AREA, 1927 AND 1928

Value of orchards per acre	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils
	Per cent	Per cent	Per cent
<i>Dollars</i>			
Less than 200.....	5	8	21
200 to 299.....	29	34	24
300 to 399.....	20	17	21
400 to 499.....	17	21	31
500 to 599.....	19	8	3
600 to 699.....	3	4	0
700 to 799.....	2	0	0
800 to 899.....	2	0	0
900 to 999.....	3	8	0
	100	100	100
	Number of orchards		
	64	24	33

Age of orchards and value per acre

Orchards set from 1880 to 1899 were valued higher, on the average, than the orchards set before or after that period (table 80). Most of the

TABLE 80. RELATION OF AGE OF ORCHARD TO AVERAGE VALUE PER ACRE, NEWFANE-OLCOTT AREA, 1926 TO 1928*

Date orchard set	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Before 1870.....	383	368	273
1870 to 1879.....	364	357	276
1880 to 1899.....	414	402	335
1900 to 1909.....	350	270	375
1910 to 1918.....	323	334	182
Before 1900.....	386	371	288
After 1900.....	337	302	256

* For number of records in each group, see table 22.

¹⁸ Cost of producing apples in five counties in western New York 1910-1915, by G. H. Miller. U. S. Agri. Dept. Bul. 851:3, 6. 1920.

orchards in this age group were between 40 and 45 years old in 1927. Orchards set before 1880 were valued, on the average, at about \$50 less per acre than those set from 1880 to 1899. However, on all the soils except the Clyde loam and Clyde clay loam the highest average yields were obtained on orchards set from 1870 to 1879 (table 22).

Orchards set after 1900 were valued slightly lower, on the average, than orchards set before 1900. The average value of orchards set from 1910 to 1918 on Clyde loam and Clyde clay loam soils was \$182 per acre. This was \$88 less per acre than the average value of the orchards in any other group.

Relation of value of orchards per acre to yield and cost

The average yields on the higher-valued orchards were larger than those on the other orchards (tables 81 and 82). On the Dunkirk gravelly sandy loam and Dunkirk loam soils the higher-valued orchards had a lower cost per barrel in 1927 than the other orchards and about the same cost per barrel in 1928. Apparently, on these two better-drained soils if any of the orchards were overvalued on the basis of their earning power it was those orchards that were valued at less than \$300 per acre. However, on the other soil types the higher-valued orchards had a higher cost per barrel than the other orchards. On these soils the larger yields on the higher-valued orchards were not sufficient to pay for the extra charge for interest and the extra care in obtaining these better yields. Apparently, on these soils if any of the orchards were overvalued it was those that were valued the highest.

TABLE 81. RELATION OF VALUE PER ACRE OF APPLE ORCHARDS SET BEFORE 1900 TO YIELD PER ACRE AND COST PER BARREL, NEWFANE-OLCOTT AREA, 1927

Value per acre	Orchards	Average value per acre	Cost per acre to picking time	Barrels packed per acre	Cost per barrel to picking time
		<i>Dollars</i>	<i>Dollars</i>	<i>Number</i>	<i>Dollars</i>
<i>Dollars</i>	<i>Number</i>				
Dunkirk gravelly sandy loam and Dunkirk loam soils:					
Less than 300.....	18	213	58	16	3.73
300 to 400.....	25	360	63	20	3.11
401 or more.....	21	594	74	27	2.73
Dunkirk and Clyde fine sandy loam soils:					
Less than 400.....	16	235	40	16	2.55
400 or more.....	12	552	60	17	3.55
Clyde loam and Clyde clay loam soils:					
Less than 300.....	14	168	39	6	6.02
300 or more.....	20	384	60	8	7.11

The average value of orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils was higher than on the other soil types. However, after paying interest on the higher-valued orchards, the growers on the Dunkirk gravelly sandy loam and Dunkirk loam soils had a lower cost per barrel than the growers on the other soil types. Small differences in yield make a large difference in what one can afford to pay for the right kind of soil. Apparently farmers do not fully appreciate the difference in productive value for apple production between well-drained and poorly-drained soils.

TABLE 82. RELATION OF VALUE PER ACRE OF APPLE ORCHARDS SET BEFORE 1900 TO YIELD PER ACRE AND COST PER BARREL, NEWFANE-OLCOTT AREA, 1928

Value per acre	Orchards	Average value per acre	Cost per acre to picking time	Barrels packed per acre	Cost per barrel to picking time
<i>Dollars</i>	<i>Number</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Number</i>	<i>Dollars</i>
Dunkirk gravelly sandy loam and Dunkirk loam soils:					
Less than 300.....	26	210	49	30	1.65
300 to 400.....	19	343	64	40	1.60
401 or more.....	19	569	75	46	1.65
Dunkirk and Clyde fine sandy loam soils:					
Less than 400.....	10	215	50	22	2.26
400 or more.....	9	581	73	29	2.57
Clyde loam and Clyde clay loam soils:					
Less than 300.....	16	181	49	17	2.84
300 or more.....	16	379	59	19	3.07

INTEREST ON COSTS

Interest was charged at the rate of 6 per cent annually for six months on all costs to picking time, except interest and taxes on the orchards. Most of the costs of growing apples to picking time are incurred during the winter and spring months and no return is received until after the apples are harvested.

TAXES ON THE ORCHARDS

Taxes were charged to each orchard on the basis of the proportion that the value of the orchard was of the total farm value. The average amount charged for taxes was \$3.49 per acre of apple orchard set before 1900 (table 83). This was about one per cent of the average value of the orchards.

TABLE 83. AVERAGE AMOUNT PAID FOR TAXES PER ACRE OF APPLE ORCHARD SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Taxes per acre of orchard	Estimated value of apple orchards per acre	Proportion taxes were of estimated value of orchards
	<i>Dollars</i>	<i>Dollars</i>	<i>Per cent</i>
Dunkirk gravelly sandy loam and Dunkirk loam soils.....	3.66	386	0.95
Dunkirk and Clyde fine sandy loam soils.....	3.24	371	0.87
Clyde loam and Clyde clay loam soils.....	3.09	288	1.07
Average.....	3.49	355	0.98

The taxes on the Clyde loam and Clyde clay loam soils were higher in proportion to their estimated value than the taxes on the Dunkirk gravelly sandy loam and Dunkirk loam soils. The difference in returns on these two soil groups indicates that if the orchards were capitalized according to their earning power there would be more than \$100 difference in their value per acre. Because of the over-assessment and over-valuation of the Clyde loam and Clyde clay loam soils the farmers on these soils paid relatively higher taxes than the farmers on the better-drained soils.

DEPRECIATION ON THE ORCHARDS

No charge was made for depreciation on orchards, because no satisfactory basis could be found. On the better-drained soils the orchards set before 1870 yielded better, on the average, than the orchards set from 1880 to 1899 (table 22). Most of the orchards set before 1870 were between 57 and 80 years old in 1926. However, on the Clyde loam and Clyde clay loam soils the orchards set before 1880 did not yield so well as the orchards set from 1880 to 1899. These yields indicate that there is no definite age limit beyond which apple trees become unprofitable. On well-drained soils apple trees will remain in profitable production longer than on poorly drained soils. The amount of care given an orchard also influences the length of time the trees live.

An estimate of the amount of depreciation on his orchard was obtained from each of the farmers in 1927, but the results were very unsatisfactory. Whether any depreciation was allowed depended chiefly on the enumerator. The farmers knew very little about the question, and consequently when an estimate could be obtained the figure was usually excessive.

Orchards will not live forever; if orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils come into full bearing at about 30 to 40 years of age and cease to be profitable at 70 to 80 years of age, it might be assumed that they had depreciated 100 per cent in 40 years. If this were distributed over the 40 years, it would be 2.5 per cent per year. Orchards on the Clyde loam and Clyde clay loam soils probably will not be cared for after they are 55 to 65 years old. If orchards on these soils come into bearing between 30 and 40 years of age, it might be assumed that they had depreciated 100 per cent in 25 years. If this were distributed over the 25 years it would be 4 per cent per year. Orchards on the Dunkirk and the Clyde fine sandy loam soils are midway between the Dunkirk gravelly sandy loam and Dunkirk loam soils, and the Clyde loam and Clyde clay loam soils in yield and returns. Depreciation on orchards on these soils might be assumed to be about 3.25 per cent per year.

Applying these percentages to the value of the orchard less the value of the land without trees, the depreciation on the Dunkirk gravelly sandy loam and Dunkirk loam soils would be \$5.80 per acre annually and on the other soils between \$7 and \$8 (table 84). Because of the higher yields

TABLE 84. ESTIMATED ANNUAL DEPRECIATION OF ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

Soil	Value of land and trees per acre	Value of land without trees per acre	Value of trees per acre	Assumed rate of depreciation	Depreciation per acre annually	Average barrels packed per acre	Depreciation per barrel
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Per cent</i>	<i>Dollars</i>	<i>Number</i>	<i>Cents</i>
Dunkirk gravelly sandy loam and Dunkirk loam soils.....	386	154	232	2.50	5.80	46	13
Dunkirk and Clyde fine sandy loam soils.....	371	130	241	3.25	7.83	31	25
Clyde loam and Clyde clay loam soils.....	288	111	177	4.00	7.08	21	34
All soils.....	355	139	216	2.90	6.26	39	16

on the better-drained soils the depreciation would be 13 cents per barrel on the Dunkirk gravelly sandy loam and Dunkirk loam soils and 34 cents on the Clyde loam and Clyde clay loam soils.

This method of calculating depreciation does not include the cost of removing the trees and stumps. The value of the fire wood obtained is probably equal to the cost of cutting down the old trees. If the orchard is on good soil a new orchard can be set next to the old stumps so the stumps will not have to be pulled out.

SUMMARY OF COSTS TO PICKING TIME

The three-years average net cost of growing apples to picking time on orchards set before 1900 was approximately \$66 per acre on the Dunkirk gravelly sandy loam and Dunkirk loam soils and \$54 per acre on the Clyde loam and Clyde clay loam (table 85). This \$12 difference in cost is due principally to the larger expenditure for spray and dust material and

TABLE 85. RELATION OF SOIL TO AVERAGE COSTS AND RETURNS IN PRODUCING APPLES ON ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
Number of orchards.....	64	26	33	123
Average acres per orchard.....	9.3	4.7	5.5	7.3
Hours per acre to picking time:				
Man labor.....	43	53	47	45
Horse labor.....	22	34	35	27
Tractor.....	4.9	3.8	2.6	4.3
Cost per acre to picking time:				
Labor:				
Man.....	\$18.19	\$21.54	\$18.66	\$18.74
Horse.....	\$4.06	\$6.16	\$6.25	\$4.79
Equipment:				
Tractor.....	\$3.84	\$2.58	\$1.99	\$3.29
Truck.....	\$0.20	\$0.02	\$0.01	\$0.14
Sprayer.....	\$4.12	\$5.27	\$5.19	\$4.49
Duster.....	\$0.59	\$0.02	\$0.01	\$0.39
Other equipment.....	\$1.28	\$2.47	\$2.63	\$1.71
Fertilizer and spray:				
Manure.....	\$1.85	\$4.21	\$3.09	\$2.42
Fertilizer.....	\$1.74	\$1.50	\$0.32	\$1.42
Spray.....	\$10.61	\$8.77	\$7.14	\$9.66
Dust.....	\$4.38	\$0.05	\$0.13	\$2.93
Taxes and interest:				
Taxes.....	\$3.66	\$3.24	\$3.09	\$3.49
Interest on value of orchards.....	\$19.02	\$18.43	\$15.10	\$18.15
Interest on costs.....	\$1.35	\$1.33	\$1.16	\$1.31
Other expenses.....	\$0.18	\$0.11	\$0.07	\$0.16
Total cost *.....	\$75.07	\$75.70	\$64.84	\$73.09
Credits per acre:				
Wood.....	\$1.63	\$2.21	\$2.59	\$1.91
Culls and home use.....	\$7.52	\$12.42	\$8.08	\$8.30
Net cost per acre to picking time.....	\$65.92	\$61.07	\$54.17	\$62.88
Barrels packed per acre.....	46	31	21	39
Cost per barrel to picking time.....	\$1.43	\$1.95	\$2.57	\$1.61
Harvesting and marketing.....	\$0.74	\$0.98	\$0.98	\$0.80
Total cost per barrel †.....	\$2.17	\$2.93	\$3.55	\$2.41
Receipts per barrel †.....	\$2.55	\$2.44	\$2.20	\$2.51
Profit or loss per barrel.....	\$0.38	\$-0.49	\$-1.35	\$0.10
Return per hour of labor ‡.....	\$0.65	\$0.25	\$0.04	\$0.46

* Depreciation on orchards was not included. For estimated depreciation costs see table 84.

† The total cost or receipts per barrel does not include any cost for package, storage, or commission.

‡ For method of calculating returns per hour of labor see table 94.

to a larger charge for interest for the orchards on the Dunkirk gravelly sandy loam and the Dunkirk loam than for those on the other soil types.

Neither the Dunkirk fine sandy loam nor the Clyde fine sandy loam is so well drained as are the Dunkirk gravelly sandy loam and Dunkirk loam soils, but in most cases they are better drained than the Clyde loam and Clyde clay loam soils.

The average yield per acre on the Dunkirk gravelly sandy loam and Dunkirk loam soils was 50 per cent higher than on the Dunkirk and Clyde fine sandy loam soils, and more than twice as high as on the Clyde loam and Clyde clay loam soils. Thus, the average cost of growing apples to picking time for the three-years period 1926 to 1928, was \$1.43 per barrel on the Dunkirk gravelly sandy loam and Dunkirk loam soils, \$1.95 on the Dunkirk and Clyde fine sandy soils, and \$2.57 on the Clyde loam and Clyde clay loam soils.

The returns per hour of man labor spent on apples were 65 cents on the Dunkirk gravelly sandy loam and Dunkirk loam, 25 cents on the Dunkirk and Clyde fine sandy loam, and 4 cents on the Clyde loam and Clyde clay loam soils.

Labor, equipment, and spray materials are the major items in the cost of producing apples. For the three-years period 1926 to 1928, the cost of man labor on these farms was 42 per cent of the total cost of producing apples.¹⁴ Interest on the value of the orchard is a minor item in the cost of producing apples. On the Dunkirk gravelly sandy loam and Dunkirk loam soils, interest on the orchards made up 19 per cent of the total cost during the period 1926 to 1928. Formerly, when labor was cheaper, interest on the orchards was a more important item in the cost than at the present time. From 1910 to 1915, interest on the orchards amounted to 29 per cent of the cost of producing apples in western New York.¹⁵ At that time labor was charged at 20 cents per hour and the average value of the bearing apple orchards was \$514 per acre. For the period 1926 to 1928 the average cost of labor was 41 cents an hour and the average value of orchards more than 30 years old on the Dunkirk gravelly sandy loam and Dunkirk loam soils was \$386. Interest on the value of the orchard is not only a minor item in the cost but is becoming even less important. This means that a few bushels difference in the average yield per acre will make a very great difference in the amount one can afford to pay for the right kind of soil.

The cost of growing apples on old and young orchards on Dunkirk gravelly sandy loam and Dunkirk loam soils is shown in table 86. The net cost per acre to picking time on orchards set from 1900 to 1918 was about 75 per cent of the cost on orchards set before 1900. However, the yield on the young orchards was low. Orchards set from 1900 to 1909 yielded, on the average, about 27 barrels per acre, as compared to 46 barrels on orchards set before 1900. The lower yield on the younger orchards increased the net cost per barrel to picking time from \$1.43 to \$1.82. Harvesting and marketing costs were slightly lower on the younger orchards.

¹⁴ On these farms 39 per cent of the apples were packed at a custom packing house. On farms that packed their apples at home, labor made up about 45 per cent of the total cost of producing apples.

¹⁵ Cost of producing apples in five counties in western New York, 1910 to 1915, by G. H. Miller. U. S. Agr. Dept. Bul. 851:43-45. 1920.

TABLE 86. AVERAGE COST OF GROWING APPLES ON OLD AND YOUNG ORCHARDS ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Orchards set —		
	Before 1900	1900 to 1909	1910 to 1918
Number of records.....	193	50	46
Average acres per cost orchard.....	9.3	8.6	8.6
Hours per acre to picking time:			
Man labor.....	43	25	26
Horse labor.....	22	14	17
Tractor.....	4.9	5.1	5.1
Cost per acre to picking time:			
Labor:			
Man.....	\$18.19	\$10.40	\$11.60
Horse.....	\$4.06	\$2.54	\$3.14
Equipment:			
Tractor.....	\$3.84	\$4.77	\$3.51
Truck.....	\$0.20	\$0.01	
Sprayer.....	\$4.12	\$2.90	\$3.26
Duster.....	\$0.59	\$0.23	\$0.14
Other equipment.....	\$1.28	\$0.81	\$1.33
Fertilizer and spray:			
Manure.....	\$1.85	\$1.61	\$1.35
Fertilizer.....	\$1.74	\$0.42	\$0.18
Spray.....	\$10.61	\$5.98	\$6.30
Dust.....	\$4.38	\$1.81	\$0.75
Taxes and interest:			
Taxes.....	\$3.66	\$3.69	\$3.22
Interest on value of orchards.....	\$19.02	\$17.87	\$16.37
Interest on costs.....	\$1.35	\$0.81	\$0.80
Other expenses.....	\$0.18	\$0.25	\$0.05
Total cost.....	\$75.07	\$54.10	\$52.00
Credits per acre:			
Wood.....	\$1.63	\$0.30	\$0.31
Culls and home use.....	\$7.52	\$4.99	\$1.85
Net cost per acre to picking time.....	\$65.92	\$48.81	\$49.84
Barrels packed per acre.....	46.0	26.8	14.6
Cost per barrel to picking time.....	\$1.43	\$1.82	\$3.41
Harvesting and marketing cost per barrel.....	0.74	0.68	0.60
Total cost per barrel.....	\$2.17	\$2.50	\$4.01
Returns per hour of labor.....	\$0.65	\$0.54	\$0.02

Depreciation on the orchards set before 1900 was not included in the cost. If depreciation was considered as 2.5 per cent per year this would increase the cost 13 cents per barrel. Also, on the orchards set from 1900 to 1918 no appreciation on the orchards was included. The average value of these orchards on Dunkirk gravelly sandy loam and Dunkirk loam soils was from \$64 to \$91 less than the value of the orchards set from 1880 to 1899 (table 80).

The average cost of growing apples to picking time on orchards set before 1900 is shown by operations for the period 1927 and 1928 in table 87. The cost of each operation includes labor, equipment, and materials. Spraying was the most important cost in each soil group and amounted to about 30 per cent of the total cost to picking time.

A comparison of the cost of growing apples on old and young orchards on Dunkirk gravelly sandy loam and Dunkirk loam soils is shown by operations in table 88. The lower cost on the younger orchards is largely due to the lower cost for spraying, dusting, and pruning.

TABLE 87. AVERAGE COST OF GROWING APPLES, BY OPERATIONS, NEWFANE-OLCOTT AREA, 1927 AND 1928 (ORCHARDS SET BEFORE 1900)

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
	Number of orchards.....	64	24	33	121
Average acres per orchard.....	9.5	5.1	5.4	7.5
Cost per acre to picking time:				
Cultivating.....	\$8.28	\$9.01	\$10.24	\$8.76
Spraying.....	\$21.21	\$20.12	\$18.74	\$20.55
Dusting.....	\$5.77	\$0.12	\$0.01	\$3.88
Pruning.....	\$8.69	\$10.02	\$9.40	\$9.03
Manuring.....	\$3.24	\$6.02	\$4.65	\$3.86
Fertilizing.....	\$1.86	\$1.98	\$0.40	\$1.58
Taxes.....	\$3.46	\$3.30	\$3.07	\$3.36
Interest on value of orchard.....	\$18.43	\$18.87	\$15.25	\$17.84
Other expenses.....	\$0.30	\$0.16	\$0.46	\$0.31
Total cost.....	\$71.24	\$69.60	\$62.22	\$69.17
Credit for culls per acre.....	\$6.64	\$11.24	\$6.99	\$7.33
Credit for home use per acre.....	\$1.45	\$2.45	\$2.21	\$1.75
Net cost per acre to picking time.....	\$63.15	\$55.91	\$53.02	\$60.09
Barrels packed per acre.....	29.5	21.0	13.0	25.2
Net cost per barrel to picking time.....	\$2.14	\$2.66	\$4.08	\$2.38

TABLE 88. AVERAGE COST OF GROWING APPLES ON OLD AND YOUNG ORCHARDS ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, BY OPERATIONS, NEWFANE-OLCOTT AREA, 1927 AND 1928

	Date orchard set		
	Before 1900	1900 to 1909	1910 to 1918
Number of orchards.....	64	18	17
Average acres per orchard.....	9.5	8.3	8.7
Cost per acre to picking time:			
Cultivating.....	\$ 8.28	\$ 7.65	\$ 8.36
Spraying.....	\$21.21	\$13.72	\$14.62
Dusting.....	\$5.77	\$2.06	\$0.88
Pruning.....	\$8.69	\$4.49	\$4.54
Manuring.....	\$3.24	\$2.28	\$1.52
Fertilizing.....	\$1.86	\$0.72	\$0.32
Taxes.....	\$3.46	\$3.60	\$3.17
Interest on value of orchard.....	\$18.43	\$17.78	\$16.82
Other expenses.....	\$0.30	\$0.60	\$0.08
Total cost.....	\$71.24	\$52.90	\$50.31
Credit for culls per acre.....	\$6.64	\$5.14	\$1.72
Credit for home use per acre.....	\$1.45	\$0.92	\$0.58
Net cost per acre to picking time.....	\$63.15	\$46.84	\$48.01
Barrels packed per acre.....	29.5	19.4	13.8
Net cost per barrel to picking time.....	\$2.14	\$2.41	\$3.48

COSTS OF HARVESTING AND MARKETING APPLES

COST OF PICKING

On the Dunkirk gravelly sandy loam and Dunkirk loam soils 56 per cent of the apples were picked by the barrel or bushel as compared to less than 24 per cent on the other soil types (table 89). Growers on the better-drained soils had more apples per farm. Also, on these soils the yields per tree were higher and there was more opportunity for men picking by the barrel or bushel to make a large return per day.

In 1927, 29 per cent of the apples were picked by the barrel or bushel as compared to 43 per cent in 1928 and 54 per cent in 1926, because the crop was very short in 1927 and not so much extra help was needed.

TABLE 89. AVERAGE YIELD PER TREE AND COST OF PICKING APPLES, BY SOIL GROUPS, ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils	All soils
Number of bearing trees.....	18,970	3,884	6,263	29,117
Barrels picked per tree.....	1.6	1.2	0.8	1.3
Per cent picked by the barrel or bushel.....	56	21	23	48
Barrels picked per hour:				
Picked by barrel or bushel.....	2.6	2.1	2.8	2.5
Not picked by barrel or bushel.....	1.7	1.6	1.3	1.6
Labor cost per barrel picked:				
Picked by barrel or bushel.....	\$0.27	\$0.23	\$0.28	\$0.27
Not picked by barrel or bushel.....	\$0.24	\$0.26	\$0.32	\$0.26

When apples were picked by the barrel or bushel the average number of barrels picked per hour was 2.5 as compared to 1.6 barrels per hour when they were picked by the operator or help other than piece workers (table 89). When apples are hired picked at so much a barrel or bushel there is greater incentive to pick more barrels per day than when they are picked by month or day help. However, part of the difference between 2.5 and 1.6 barrels per hour is due to the fact that where the yields per tree were higher a larger percentage of the apples were picked by the barrel or bushel (table 92). The average number of barrels picked per hour was higher in 1926 than in 1927 or in 1928 because the yields per tree were larger.

The average labor cost of picking apples by the barrel or bushel during the period 1926 to 1928 was 27 cents per barrel (table 89). This cost included not only the cash cost of the piece work labor but also the cost of board where this was furnished. It did not include any charge for picking equipment. When apples were picked by the operator or help other than piece workers the average cost was 26 cents per barrel. On the Dunkirk gravelly sandy loam and Dunkirk loam soils the difference in labor cost of picking per barrel between 1926 and 1927 was 2 cents where the apples were picked by the barrel or bushel and 7 cents where they were not picked by the barrel or bushel. In a short crop year a smaller percentage of the apples were picked by piece workers, but the men that did pick by the barrel or bushel apparently were willing to work for less per day in a short crop year such as 1927 than in a large crop year such as 1926.

The average total cost of picking all apples was 30 cents per barrel in 1927 and 26 cents in 1928 (table 90). This cost includes the cost for picking equipment, such as ladders and picking bags, which averaged 2 cents per barrel.

TABLE 90. AVERAGE COST OF PICKING APPLES, NEWFANE-OLCOTT AREA, 1927 AND 1928

	1927			1928		
	Orchards set before 1900	Orchards set from 1900 to 1918	All orchards	Orchards set before 1900	Orchards set from 1900 to 1918	All orchards
Number of orchards.....	126	38	164	115	64	179
Total barrels picked.....	19,580	4,490	24,070	30,080	9,910	39,990
Barrels picked per tree.....	0.6	0.3	0.5	1.1	0.5	0.9
Average for all apples picked:						
Hours per barrel.....	0.68	0.56	0.65	0.57	0.48	0.55
Cost per hour:						
Piece work.....	\$0.62	.....	\$0.62	\$0.59	\$0.68	\$0.60
Other labor.....	\$0.39	\$0.39	\$0.39	\$0.40	\$0.38	\$0.39
Cost per barrel picked:						
Labor.....	\$0.29	\$0.22	\$0.28	\$0.26	\$0.20	\$0.24
Picking equipment.....	\$0.02	\$0.02	\$0.02	\$0.02	\$0.02	\$0.02
Total.....	\$0.31	\$0.24	\$0.30	\$0.28	\$0.22	\$0.26

Cost of picking apples on old and young trees

When apples were picked by the barrel or bushel there was no definite relation between age of trees and the labor cost of picking per barrel (table 91). Except for trees set from 1910 to 1918, on which the average yield was very low, more barrels were picked per hour on the younger than on the older trees, but this was not reflected in the cost. This may be owing to the fact that when a farmer hired this labor by the piece he agreed to pay a flat price per barrel for the season with the understanding that they would pick both the old and young orchards.

When apples were not picked by the barrel or bushel the labor cost of picking decreased from 25 cents a barrel in orchards set before 1870 to 19 cents in orchards set from 1910 to 1918.

TABLE 91. RELATION OF AGE OF ORCHARD TO BARRELS OF APPLES PICKED PER HOUR AND LABOR COST OF PICKING PER BARREL, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928

Date orchard was set	Trees per acre	Apples picked per tree	Picked by the barrel or bushel		Not picked by the barrel or bushel	
			Barrels picked per hour	Labor cost per barrel picked	Barrels picked per hour	Labor cost per barrel picked
Before 1870.....	30	1.7	2.4	26	1.7	25
1870 to 1879.....	31	1.9	2.4	26	1.9	23
1880 to 1899.....	34	1.3	2.8	28	1.7	24
1900 to 1909.....	41	0.7	3.4	23	1.9	21
1910 to 1918.....	41	0.4	1.9	41	2.1	19
Average.....	35	1.3	2.6	27	1.8	23

Yield per tree as well as the size and height of the trees was an important factor affecting the number of barrels picked per hour (table 92). However, in orchards set before 1900 where the apples were picked by the barrel or bushel the labor cost of picking was only 3 cents

more per barrel in orchards with low yields per tree than in orchards with high yields. Apparently in a community there is a tendency to pay a flat rate per barrel for piece-work picking regardless of the yield per tree. When apples were not picked by the barrel or bushel the average labor cost of picking decreased from 43 cents a barrel in orchards with less than 0.5 barrels per tree to 20 cents in orchards with 3 barrels or more per tree.

TABLE 92. COMPARISON OF THE AVERAGE LABOR COST OF PICKING APPLES ON YOUNG AND OLD TREES, NEWFANE-OLCOTT AREA, 1926 TO 1928

Barrels of apples packed per tree	Total barrels picked		Barrels picked per hour		Labor cost of picking per barrel	
	Orchards set before 1900	Orchards set from 1900 to 1918	Orchards set before 1900	Orchards set from 1900 to 1918	Orchards set before 1900	Orchards set from 1900 to 1918
	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Cents</i>	<i>Cents</i>
Picked by the barrel or bushel:						
0.1 to 0.4.....	1,000	550	1.9	2.0	27	40
0.5 to 0.9.....	4,630	960	2.1	2.5	28	25
1.0 to 1.9.....	15,220	1,280	2.3	2.4	28	26
2.0 to 2.9.....	14,220	2,100	2.4	3.8	27	21
3.0 or more.....	21,370	.....	3.1	.....	25	.....
Total or average.....	56,440	4,890	2.5	2.8	27	25
Not picked by the barrel or bushel:						
0.1 to 0.4.....	5,310	4,890	1.0	1.5	43	26
0.5 to 0.9.....	11,020	9,400	1.3	2.2	31	19
1.0 to 1.9.....	23,530	4,290	1.8	2.1	23	19
2.0 to 2.9.....	15,010	3,240	2.0	2.4	22	18
3.0 or more.....	7,620	.....	2.1	.....	20	.....
Total or average.....	62,490	21,820	1.6	2.0	26	20

In orchards that yielded from 0.1 to 0.4 barrels per tree the average labor cost of picking apples in orchards set before 1900 was 43 cents per barrel as compared with 26 cents in orchards set from 1900 to 1918 (table 92). With yields between 2 and 2.9 barrels per tree, the average labor costs of picking on old and young trees were 22 and 18 cents per barrel, respectively. Both of these comparisons relate to orchards on which the apples were not picked by the barrel or bushel.

With the same yield per tree, more barrels were picked per hour on the young than on the old trees. For both old and young trees in the orchards with higher yields per tree more barrels were picked per hour than in those orchards with low yields.

COST OF PACKING AND MARKETING¹⁶

Cost of packing apples on farms and at custom packing houses

For all the soil groups 61 per cent of the apples were packed on farms from 1926 to 1928. In 1927, a short crop year, only 50 per cent of the apples were packed on farms (table 93).

¹⁶ Because of the shortage of funds available for printing, nearly all of the section on packing and marketing has been omitted from this publication. This section of the thesis is available in a mimeographed report entitled "Cost of Packing and Marketing Apples, Newfane-Olcott Area, Niagara County, New York, 1926 to 1928." This may be obtained from the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York.

TABLE 93. AVERAGE COST OF PACKING APPLES ON FARMS AND AT CUSTOM PACKING HOUSES, NEWFANE-OLCOTT AREA, 1926 TO 1928

Year	Barrels packed at custom packing houses	Barrels packed on farms	Proportion packed on farms	Average cost per barrel packed —	
				At custom packing houses	On farms
	<i>Number</i>	<i>Number</i>	<i>Per cent</i>	<i>Cents</i>	<i>Cents</i>
1926.....	25,930	40,270	61	30	25
1927.....	9,180	9,220	50	23	32
1928.....	9,430	19,520	67	22	22
Total or average.....	44,540	69,010	61	27	25

For the period 1926 to 1928 the average cost of packing apples at custom packing houses was 27 cents per barrel and on farms 25 cents. The average cost of packing at custom packing houses decreased from 30 cents per barrel in 1926 to 22 cents in 1928. In 1926, the two cooperative packing houses had high overhead costs. The larger one of these associations charged 27 cents per barrel packed plus a flat general expense charge per member which averaged 10 cents a barrel in 1926. In 1927 this association was taken over by a private dealer and because of the larger volume packed the packing charge was reduced to 23.3 cents per barrel.

The cost of packing apples on farms was not entirely a cash cost. In most cases apples were packed in buildings that were used mainly for other purposes. The cost of maintaining these buildings would be about the same whether apples were packed in them or not. The charge for use of buildings averaged 5 cents a barrel in 1927 and 2 cents in 1928. Use of packing equipment amounted to 3 cents a barrel in 1927 and 1 cent in 1928. About 30 per cent of the labor used in packing apples was unpaid family labor (not including the operator). The charge for family labor averaged about 6 cents a barrel for the period 1927 and 1928.

SUMMARY OF COSTS AND RETURNS IN PRODUCING APPLES

In the Newfane-Olcott area the average cost of producing apples on orchards set before 1900 was \$2.41 a barrel for the period 1926 to 1928 (table 94). This cost does not include packing, storage, or commission, or any charge for depreciation on the orchards. The average cost per barrel varied from \$1.81 in 1926, with an average yield per acre of 66 barrels, to \$4.28 in 1927, with an average yield per acre of 18 barrels.

The average net receipts per barrel during this three-years period were \$2.51. Therefore, on the average, the growers in this area paid all costs, except depreciation, on their orchards set before 1900, and in addition received a profit of 10 cents a barrel. This profit of 10 cents a barrel would cover about two-thirds of the estimated charge for depreciation on the orchards (table 84).

For the period 1926 to 1928 the average time spent growing apples to picking time on orchards set before 1900 was approximately 45 man hours per acre, and about 45 more hours was required to harvest and market the crop (table 94). With a large crop, as in 1926, about 116 hours was required to care for an acre of apples as compared with only 66 hours in

TABLE 94. SUMMARY OF COSTS AND RETURNS ON ALL SOILS, ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

	1926	1927	1928	Average 1926 to 1928
Number of orchards.....	129	126	115	123
Number of acres.....	892	976	835	901
Hours of man labor per acre:				
Growing.....	49.5	41.2	45.4	45.4
Picking.....				
By the barrel or bushel.....	15.8	2.7	6.6	8.4
Other labor.....	18.8	10.8	13.9	14.5
Packing.....	18.8	4.7	8.5	10.7
Hauling and marketing tree run and packed apples.....	10.2	3.4	5.1	6.2
Picking up and hauling culls.....	3.3	3.1	4.7	3.7
Total.....	116.4	65.9	84.2	88.9
Barrels packed per acre.....	66.3	17.9	32.4	38.9
Hours of man labor per barrel packed:				
Growing.....	0.75	2.30	1.40	1.17
Picking.....	0.52	0.75	0.63	0.59
Packing.....	0.28	0.26	0.26	0.27
Hauling and marketing tree run and packed apples.....	0.16	0.19	0.16	0.16
Picking up and hauling culls.....	0.05	0.18	0.15	0.09
Total.....	1.76	3.68	2.60	2.28
Cost per barrel packed:				
Growing*.....	\$1.03	\$3.37	\$1.87	\$1.62
Picking.....	\$0.30	\$0.33	\$0.30	\$0.30
Packing.....	\$0.26	\$0.25	\$0.18	\$0.24
Hauling and marketing tree run and packed apples.....	\$0.18	\$0.21	\$0.18	\$0.19
Picking up and hauling culls.....	\$0.04	\$0.12	\$0.08	\$0.06
Total.....	\$1.81	\$4.28	\$2.61	\$2.41
Net receipts per barrel †.....	\$1.72	\$4.34	\$3.11	\$2.51
Profit or loss per barrel.....	\$-0.09	\$0.06	\$0.50	\$0.10
Returns per hour of labor ‡.....	\$0.37	\$0.42	\$0.61	\$0.46

* Growing cost per barrel packed in all tables where harvesting and marketing costs are shown is the cost to picking time less the value of wood, cull apples, and home use, divided by the number of barrels packed.

† Net receipts per barrel do not include any cost for package, storage or commission.

‡ In calculating returns per hour of labor all costs including the cost of labor that picked by the barrel or bushel but not the cost of other labor were subtracted from total receipts. This figure was divided by the number of hours spent on apples by labor other than the labor that picked by the barrel or bushel. This applies to all tables where returns per hour of labor are shown.

1927, a short crop year. The average yield from 1926 to 1928 was 22 per cent below the 1916 to 1930 average (table 20). An average yield on orchards set before 1900 would be about 50 barrels per acre. To grow, harvest, and market this sized crop would require, on the average, about 100 man hours per acre.

The average hours of man labor per barrel to grow apples to picking time varied from 0.75 in 1926 to 2.30 in 1927 and averaged 1.17 for the three years 1926 to 1928. The hours to harvest and market apples are more closely associated with yield than the hours to grow the crop. However, in a year of small crops, as in 1927, 37 per cent more labor was required per barrel packed to harvest and market the crop than in 1926, a large crop year.

Less man labor per acre was required to grow apples to picking time on the Dunkirk gravelly sandy loam and Dunkirk loam soils than on the other soil types (table 95). On these soils a higher percentage of the farmers used tractors to cultivate their orchards. Also, the growers on these soils used larger sprayers and pruned a smaller percentage of their orchards each year.

TABLE 95. TOTAL HOURS OF MAN LABOR REQUIRED TO PRODUCE APPLES IN ORCHARDS SET BEFORE 1900, BY SOIL GROUPS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils
Man hours per acre:			
Growing.....	43	53	47
Picking.....			
By the barrel or bushel.....	11	4	2
Other labor.....	13	20	15
Packing.....	10	16	10
Hauling and marketing tree run and packed apples.....	7	8	5
Picking up and hauling culls.....	4	4	3
Total.....	88	105	82
Barrels packed per acre.....	46.1	31.3	21.1
Man hours per barrel packed:			
Growing.....	0.94	1.69	2.23
Picking.....	0.53	0.78	0.83
Packing.....	0.21	0.50	0.46
Hauling and marketing tree-run and packed apples.....	0.14	0.25	0.22
Picking up and hauling culls.....	.08	0.14	0.16
Total.....	1.90	3.36	3.90

Because of the higher yields on the better-drained soils the man hours per barrel packed that were used in producing apples on the Dunkirk gravelly sandy loam and Dunkirk loam soils was 58 per cent less than on the Clyde loam and Clyde clay loam soils. The hours picking per barrel on the Dunkirk gravelly sandy loam and Dunkirk loam soils was 36 per cent less than on the Clyde loam and Clyde clay loam soils.

The hours of packing per barrel were fewer on the Dunkirk gravelly sandy loam and Dunkirk loam soils than on the other types, in part because on these two better-drained soils one-half of the apples were packed at custom packing houses. On the other soils, 97 per cent of the apples were packed on the farms.

The hours hauling and marketing per barrel packed on the Dunkirk gravelly sandy loam and Dunkirk loam soils were 43 per cent less than on the other soil types. This is largely owing to the fact that growers on the better-drained soils did less trucking to local city markets.

A summary of costs and returns for each soil group for 1926 to 1928 is shown in table 96.

The average net receipts per barrel for the period 1926 to 1928 were \$2.55 on the Dunkirk gravelly sand loam and Dunkirk loam soils, \$2.44 on the Dunkirk and Clyde fine sandy loam soils, and \$2.20 on the Clyde loam and Clyde clay loam soils. A higher percentage of the apples on the Dunkirk gravelly sandy loam and Dunkirk loam soils were packed in the No. 1 grade than on the other soil types.

For the period 1926 to 1928 the total cost of producing apples was \$2.17 per barrel on the Dunkirk gravelly sandy loam and Dunkirk loam soils, \$2.93 on the Dunkirk and Clyde fine sandy loam soils, and \$3.55 on the Clyde loam and Clyde clay loam soils.

The growers on the Dunkirk gravelly sandy loam and Dunkirk loam soils had higher average net receipts per barrel and lower average costs

TABLE 96. AVERAGE COSTS AND RETURNS BY SOIL GROUPS, ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils	Dunkirk and Clyde fine sandy loam soils	Clyde loam and Clyde clay loam soils
Number of orchards.....	64	26	33
Number of acres.....	597	121	183
Barrels packed per acre.....	46	31	21
Costs per barrel packed:			
Growing.....	\$1.43	\$1.97	\$2.60
Picking.....	\$0.29	\$0.32	\$0.38
Packing.....	\$0.23	\$0.26	\$0.23
Hauling and marketing tree run and packed apples.....	\$0.16	\$0.29	\$0.24
Picking up and hauling culls.....	\$0.06	\$0.09	\$0.10
Total cost.....	\$2.17	\$2.93	\$3.55
Net receipts per barrel *.....	\$2.55	\$2.44	\$2.20
Profit per barrel.....	\$0.38	\$-0.49	\$-1.35
Returns per hour of labor.....	\$0.65	\$0.25	\$0.04

* Net receipts per barrel do not include any cost for package, storage, or commission.

of production per barrel than did growers on the other soil groups. For the period 1926 to 1928 the average returns on the Dunkirk gravelly sandy loam and Dunkirk loam soils were 65 cents per hour of labor, as compared to 25 cents on the Dunkirk and Clyde fine sandy loam soils, and 4 cents on the Clyde loam and Clyde clay loam soils. Similar relationships held true in each of the three years.

The average number of hours required per acre to grow apples to picking time was about 70 per cent higher on the orchards set before 1900 than it was on orchards set from 1900 to 1918 (table 97). However, the average yield per acre on the young orchards was considerably lower, so that the average number of man hours per barrel packed required to grow apples to picking time was about the same for orchards set before 1900 as for orchards set from 1900 to 1909. Because of the very low yield on the orchards set from 1910 to 1918, the average hours required per barrel on these orchards were nearly twice as high as on the older orchards.

On Dunkirk gravelly sandy loam and Dunkirk loam soils the average cost of producing apples on the orchards set before 1900 was \$2.17 per barrel packed, the cost on orchards set from 1900 to 1909 was \$2.50, and on those set from 1910 to 1918 it was \$4.01. The cost on orchards set before 1900 does not include depreciation on the orchards. Depreciation at 2.5 per cent per year would amount to 13 cents a barrel (table 84). For the orchards set after 1900 no appreciation has been included in figuring the cost of growing apples.

In spite of the large difference in average yields per acre on the orchards set from 1900 to 1909 and the orchards set before 1900, the returns per hour of labor were 54 and 65 cents, respectively. The average costs per acre were lower on the orchards set from 1900 to 1909, so that the return for man labor was \$26.84 an acre on these orchards, as compared to \$49.61 on orchards set before 1900. Because of the fewer hours per acre on orchards set from 1900 to 1909 there was only 11 cents difference

TABLE 97. SUMMARY OF AVERAGE COSTS AND RETURNS ON OLD AND YOUNG ORCHARDS ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS AND ALL ORCHARDS SET BEFORE 1919 ON ALL SOILS, 1926 TO 1928

	Dunkirk gravelly sandy loam and Dunkirk loam soils				All soils
	Orchards set				
	Before 1900	1900 to 1909	1910 to 1918	Before 1919	
Number of orchards per year.....	64	17	15	96	177
Number of acres per year.....	597	143	131	871	1,307
Hours of man labor per acre:					
Growing.....	43	25	26	38	40
Picking:					
By barrel or bushel.....	11	2	1	8	6
Other labor.....	13	12	7	12	13
Packing.....	10	8	3	8	9
Hauling and marketing tree-run and packed apples.....	7	4	2	5	5
Picking up and hauling culls.....	4	1	.....	3	3
Total.....	88	52	39	74	76
Barrels packed per acre.....	46.1	26.8	14.5	38.5	33.1
Man hours per barrel packed:					
Growing.....	0.94	0.93	1.83	0.98	1.20
Harvesting and marketing.....	0.96	1.00	0.86	0.95	1.11
Total.....	1.90	1.93	2.69	1.93	2.31
Cost per barrel packed:					
Growing.....	\$1.43	\$1.83	\$3.42	\$1.58	\$1.75
Picking.....	\$0.29	\$0.24	\$0.23	\$0.28	\$0.29
Packing.....	\$0.23	\$0.22	\$0.14	\$0.23	\$0.23
Hauling and marketing tree run and packed fruit.....	\$0.16	\$0.17	\$0.19	\$0.16	\$0.19
Picking up and hauling culls.....	\$0.06	\$0.04	\$0.03	\$0.05	\$0.08
Total.....	\$2.17	\$2.50	\$4.01	\$2.30	\$2.54
Net receipts per barrel *.....	\$2.55	\$2.74	\$2.92	\$2.58	\$2.53
Profit or loss per barrel.....	\$0.38	\$0.24	\$-1.09	\$0.28	\$-0.01
Returns per hour of labor.....	\$0.65	0.54	\$0.02	\$0.58	\$0.42

* Net receipts per barrel do not include any cost for package, storage, or commission.

in the returns per hour of labor. For bearing orchards set on Dunkirk gravelly sandy loam and Dunkirk loam soils from 1910 to 1918, the average return for labor, not including appreciation, was only 2 cents an hour during the three-years period 1926 to 1928. Nearly all of the orchards in this group were set before 1916.

On the Dunkirk gravelly sandy loam and the Dunkirk loam soils the average yield on all orchards on which cost records were taken was 38.5 barrels per acre for the period 1926 to 1928 (table 97). On these soils the average yield of all bearing apple orchards on the farms on which labor income records were taken was 33.4 barrels per acre for the same three years, 1926 to 1928.

On all soil types the average yield of all orchards on which cost records were taken was 33.1 barrels per acre. The average yield of all bearing apple orchards on farms on which labor income records were taken was 29 barrels per acre during this three-years period (table 5). Probably cost records were taken on a smaller proportion of the younger trees than of the older trees in the area. On all soil types in the area 47 per cent

of the trees set before 1918 were set before 1898.¹⁷ Not all of these orchards set before 1918 were of bearing age from 1926 to 1928. In the bearing orchards for which cost records were obtained, 63 per cent of the trees were set before 1900. Also the older orchards on which cost records were obtained may have been higher-yielding orchards than those on which no cost records were taken. If a grower had two blocks of orchard and one was somewhat neglected, usually no cost record was taken on the neglected orchard.

EFFECT OF VARIOUS FACTORS ON COSTS AND RETURNS

YIELD PER TREE

The yield of apples per tree or per acre is a very important factor affecting the cost of producing apples. On the Dunkirk gravelly sandy loam and Dunkirk loam soils orchards that yielded less than one barrel per tree had a growing cost to picking time of \$2.15 per barrel packed, as compared to 54 cents on orchards that yielded 4 or more barrels per tree in 1926 (table 98). On the average, the farmers with the lowest-yielding orchards lost 18 cents an hour on the labor used in raising apples, while the growers with orchards yielding 4 or more barrels per tree received \$1.12 an hour for the time spent on apples in 1926. This striking effect of yield on costs and returns was found on all soil groups and in all years covered by this study (tables 98 and 99, and figures 7 to 13). Small differences in yield were very important in reducing or increasing the returns per hour of labor in each year, but were more important when prices were high, as in 1927, than when prices were low, as in 1926 (figure 14).

TABLE 98. RELATION OF YIELD TO THE AVERAGE COST OF PRODUCING APPLES, ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926

Barrels of apples packed per tree	Orchards	Average barrels packed per tree	Average cost per barrel packed *		Returns per hour of labor
			Growing	Harvesting and marketing*	
	Number	Number	Dollars	Dollars	Dollars
Dunkirk gravelly sandy loam and Dunkirk loam soils:					
Less than 1.0.....	7	0.7	2.15	1.32	-0.18
1.0 to 1.9.....	21	1.4	1.24	0.74	0.21
2.0 to 2.9.....	16	2.3	1.01	0.73	0.54
3.0 to 3.9.....	10	3.4	0.74	0.71	0.56
4.0 to 7.1.....	11	5.0	0.54	0.69	1.12
Dunkirk and Clyde fine sandy loam soils:					
Less than 1.0.....	9	0.6	4.02	1.45	-0.30
1.0 to 1.9.....	13	1.4	1.47	1.09	0.18
2.0 to 2.8.....	8	2.4	0.90	0.82	0.40
Clyde loam and Clyde clay loam soils:					
Less than 0.5.....	12	0.2	5.92	2.08	-0.43
0.5 to 0.9.....	9	0.7	2.31	1.04	-0.24
1.0 to 1.9.....	8	1.3	1.39	0.78	0.20
2.0 to 4.5.....	5	2.8	0.73	0.76	0.50

* Harvesting and marketing cost does not include any cost for package, storage, or commission.

¹⁷ Apple varieties: price, yields, and acreages, by G. P. Scoville and T. E. La Mont. Cornell University Agr. Exp. Sta. Bul. 495:67. 1929.

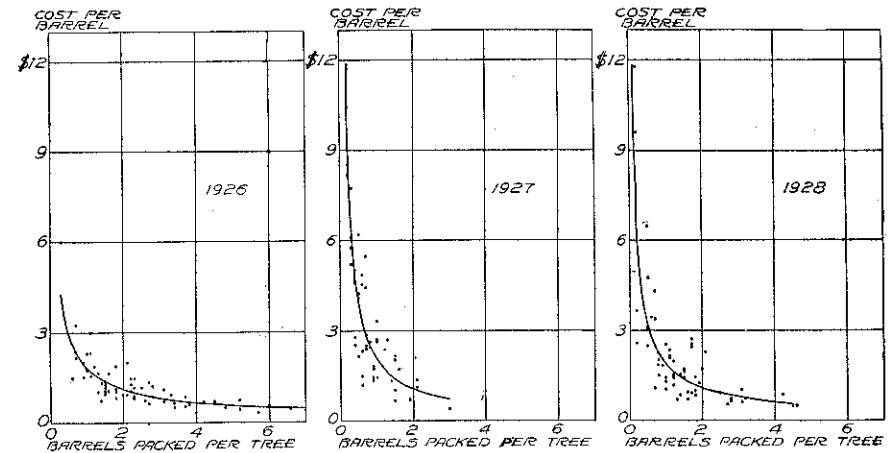


FIGURE 7. RELATION OF BARRELS OF APPLES PACKED PER TREE TO THE COST PER BARREL TO PICKING TIME, ORCHARDS SET BEFORE 1900, ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, 1926, 1927, AND 1928

As the yield increased there was a marked decrease in the cost per barrel. The shape of the curves for the different years is nearly the same. (Eight orchards in 1927 and two in 1928 were omitted because of no yield, and five orchards in 1927 and one in 1928 were not plotted because the cost was more than \$13 per barrel.) The equations for curves in figures 7 to 13 are given in *Cost of Packing and Marketing Apples, in the Newfane-Olcott Area, Niagara County, New York, 1926 to 1928*, p 18-19. (Mimeographed report by T. E. La Mont, Department of Agricultural Economics and Farm Management, Cornell University, 1933)

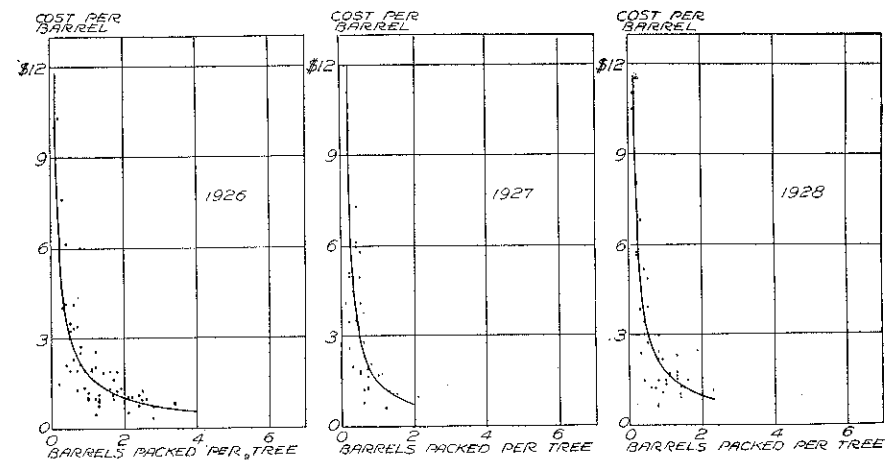


FIGURE 8. RELATION OF BARRELS OF APPLES PACKED PER TREE TO THE COST PER BARREL TO PICKING TIME, ORCHARDS SET BEFORE 1900, ON CLYDE SOILS AND DUNKIRK FINE SANDY LOAM SOIL, 1926, 1927, AND 1928

The yields per tree on these soils were lower than those on the well-drained soils shown in figure 7. However, the shape of the curves for the two soil groups was nearly the same. (Four orchards in 1926, twelve in 1927, and eight in 1928 were omitted because of no yield. One orchard in 1926, eleven in 1927, and one in 1928 were not plotted because the cost was more than \$13 per barrel)

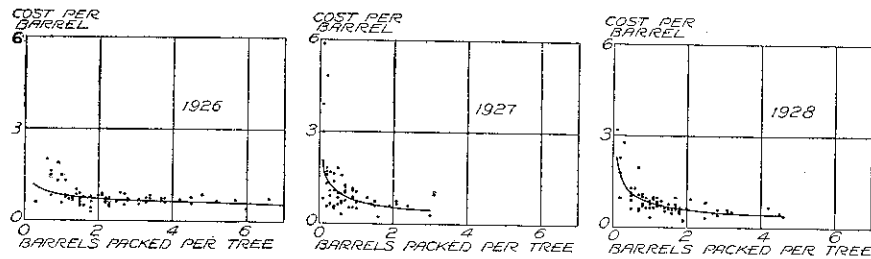


FIGURE 9. RELATION OF BARRELS OF APPLES PACKED PER TREE TO THE COST OF HARVESTING AND MARKETING PER BARREL ON ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, 1926, 1927, AND 1928

As the yield increased, the harvesting and marketing costs decreased, but the decrease was not so marked as for the growing costs shown in figures 7 and 8

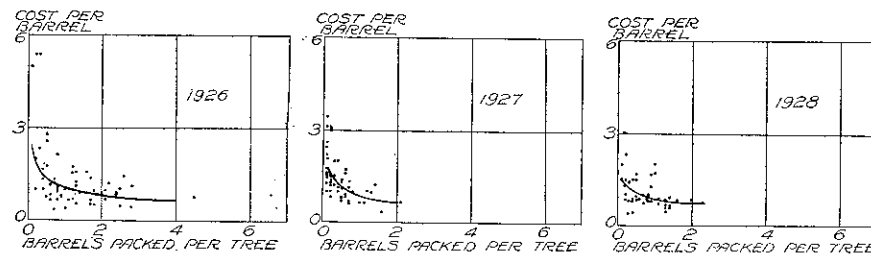


FIGURE 10. RELATION OF BARRELS OF APPLES PACKED PER TREE TO THE COST OF HARVESTING AND MARKETING PER BARREL ON ORCHARDS SET BEFORE 1900 ON CLYDE SOILS AND ON DUNKIRK FINE SANDY LOAM SOIL, 1926, 1927, AND 1928

The yields per tree on those soils were lower than those on the well-drained soils shown in figure 9. However, the shape of the curves for the two soil groups was nearly the same

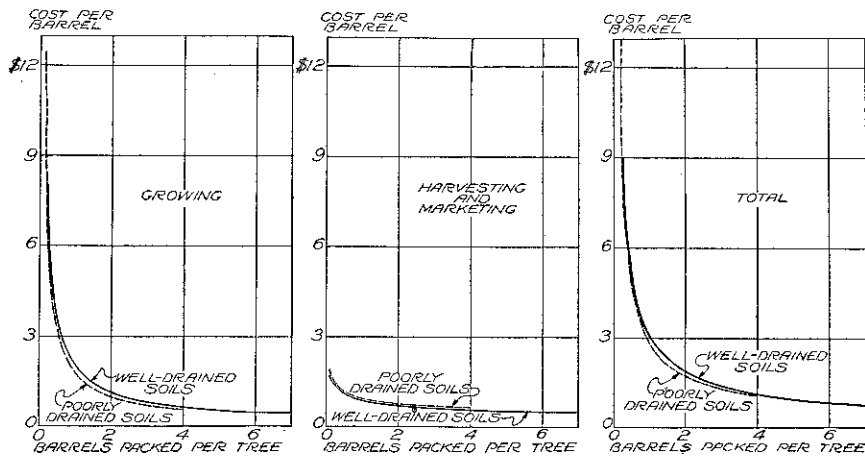


FIGURE 11. RELATION OF BARRELS OF APPLES PACKED PER TREE TO THE COST PER BARREL FOR GROWING, HARVESTING, AND MARKETING, AND TOTAL COST OF PRODUCING APPLES, 193 RECORDS ON WELL-DRAINED SOILS, AND 177 RECORDS ON POORLY DRAINED SOILS, ORCHARDS SET BEFORE 1900, 1926 TO 1928

As the yield increased, harvesting and marketing costs decreased less than the growing cost to picking time. The shape of the curves for the two soil groups was nearly the same

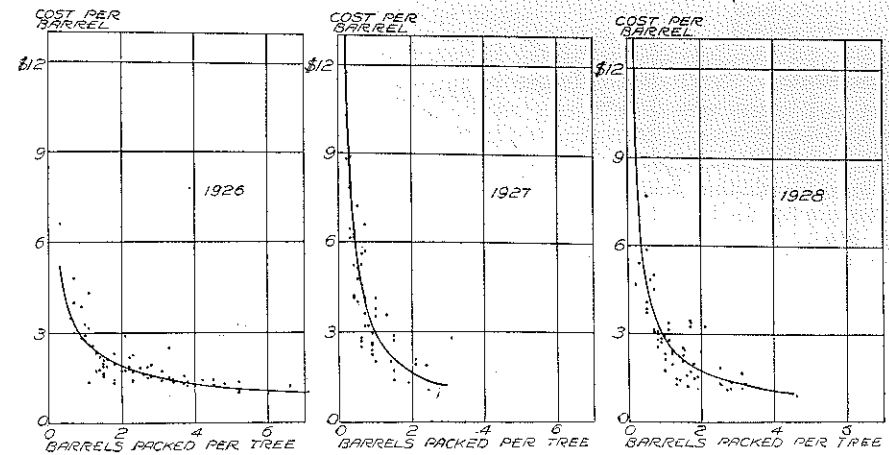


FIGURE 12. RELATION OF BARRELS OF APPLES PACKED PER TREE TO THE TOTAL COST OF PRODUCING APPLES, ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND ON DUNKIRK LOAM SOILS, 1926, 1927, AND 1928

In 1926, ten orchards yielded more than 4 barrels per tree, while only three orchards in 1928 and none in 1927 yielded this much. (Eight orchards in 1927 and two in 1928 were omitted because of no yield, and seven orchards in 1927 and two in 1928 were not plotted because the cost was more than \$13 per barrel)

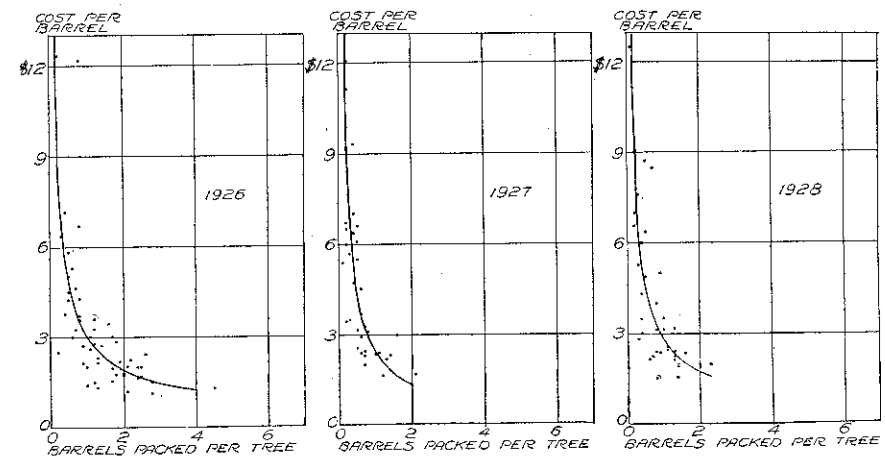


FIGURE 13. RELATION OF BARRELS OF APPLES PACKED PER TREE TO THE TOTAL COST OF PRODUCING APPLES, ORCHARDS SET BEFORE 1900 ON CLYDE SOILS AND ON DUNKIRK FINE SANDY LOAM SOIL, 1926, 1927, AND 1928

On these soils, less than one per cent of the records showed yields of more than 3 barrels per tree, as compared to 15 per cent of the records on the well-drained soils. (Four orchards in 1926, twelve in 1927, and eight in 1928 were omitted because of no yield. Two orchards in 1926, eleven in 1927, and two in 1928 were not plotted because the cost was more than \$13 per barrel)

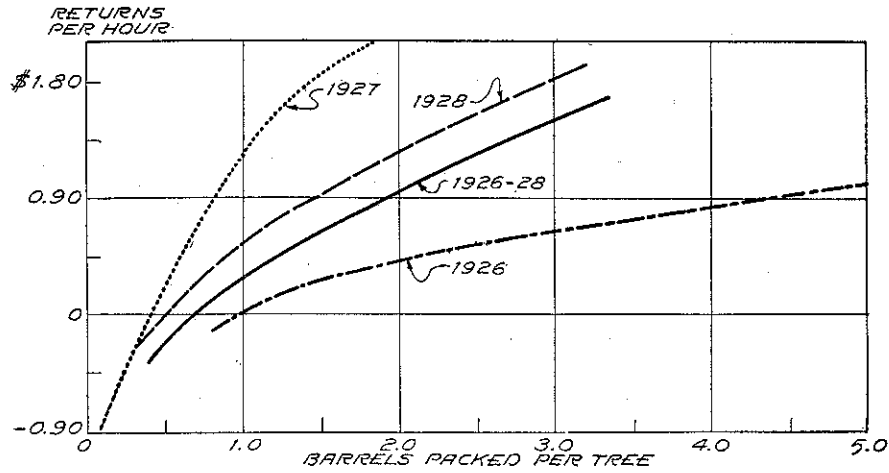


FIGURE 14. RELATION OF BARRELS OF APPLES PACKED PER TREE TO RETURNS PER HOUR OF LABOR, ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND ON DUNKIRK LOAM SOILS, 1926 TO 1928, NEWFANE-OLCOTT AREA

In each year as the yield increased there was a marked increase in the returns per hour of labor. However, the relation was most striking in 1927 when apple prices were high

As the yield increased the cost per barrel of harvesting and marketing decreased (tables 98 and 99, and figures 9 and 10). Where the yields per tree were high, the cost of picking per barrel was less than where the yields were low (table 92). Also the growers who had higher yields per tree had a larger quantity of apples per farm. Because of this larger volume their packing and marketing costs per barrel were lower than those of farmers who had a small volume.

TABLE 99. RELATION OF YIELD TO THE AVERAGE COST OF PRODUCING APPLES IN ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1927*

Barrels of apples packed per tree	Orchards	Average barrels packed per tree	Growing	Harvesting and marketing†	Returns per hour of labor
			Average cost per barrel packed †		
	Number	Number	Dollars	Dollars	Dollars
Dunkirk gravelly sandy loam and Dunkirk loam soils:					
Less than 0.4.....	22	0.2	10.16	1.61	-0.44
0.4 to 0.8.....	20	0.5	4.20	0.88	0.28
0.9 to 3.1.....	22	1.4	1.57	0.71	1.84
Dunkirk and Clyde fine sandy loam soils:					
Less than 0.6.....	14	0.2	7.84	1.23	-0.16
0.6 to 2.1.....	14	0.9	1.52	0.95	0.75
Clyde loam and Clyde clay loam soils:					
Less than 0.2.....	17	0.1	19.32	2.04	-0.40
0.2 to 0.8.....	17	0.3	4.48	1.33	0.05

* The same data for 1928 were presented in *Fruit-Farm Management*, by T. E. LaMont. Cornell Ext. Bul. 219:16, 1932

† Harvesting and marketing cost does not include any cost for package, storage, or commission.

AGE OF TREES

The total net cost of producing apples per barrel on orchards set from 1900 to 1918 was higher than on orchards set before 1900 (table 100). The reason for this is that the yield on the young trees was lower than on the old trees. As previously stated, neither appreciation nor depreciation was included in computing costs. However, if depreciation on orchards on the Dunkirk gravelly sandy loam and Dunkirk loam soils were calculated at 2.5 per cent per year the depreciation cost per barrel would amount to only 13 cents (table 84). Yield was a more important factor affecting the cost of producing apples per barrel than was the age of the trees.

TABLE 100. RELATION OF AGE OF ORCHARD TO AVERAGE COSTS AND RETURNS, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Orchards set				
	Before 1870	1870 to 1879	1880 to 1899	1900 to 1909	1910 to 1918
Number of records.....	68	72	53	50	46
Average acres per orchard.....	9.2	6.8	12.6	8.6	8.6
Barrels packed per acre.....	46	54	42	27	15
Net receipts per barrel *.....	\$2.50	\$2.45	\$2.72	\$2.74	\$2.92
Net cost per barrel †.....	\$2.18	\$1.93	\$2.38	\$2.50	\$4.01
Profit or loss per barrel.....	\$0.32	\$0.52	\$0.34	\$0.24	-\$1.09
Returns per hour of labor.....	\$0.60	\$0.75	\$0.64	\$0.54	\$0.02

* Net receipts per barrel do not include any cost for package, storage, or commission.

† Net cost per barrel includes all costs except depreciation on the orchards less the value of wood and cull apples and those used for home consumption.

The higher average price of apples on orchards set after 1900 was due to the fact that a higher percentage of the apples produced in the young orchards during this three-years period were grown in 1927, the year when apple prices were high. When each year is given equal weight the average price of apples in orchards set after 1900 was approximately the same as that in orchards set before 1900.

On the Dunkirk and Clyde fine sandy loam soils the best returns were received on orchards set from 1870 to 1879 (table 101). In this age group the average yields were higher than in orchards set before 1870 or after 1879.

On the Clyde loam and Clyde clay loam soils the yields and returns on the orchards set from 1880 to 1899 were better than those on the older orchards.

TREES PER ACRE

"One of the greatest enemies of the apple orchard is the apple tree¹⁸." Dr. G. F. Warren made this statement in 1905 as a result of his study of a large number of orchards in Wayne County for the period 1900 to 1904. He found that orchards with less than 35 trees per acre

¹⁸ Apple orchard survey of Wayne County New York, by G. F. Warren. Cornell Univ. Agr. Exp. Sta. Bul. 226:299, 1905.

TABLE 101. RELATION OF AGE OF ORCHARD TO COSTS AND RETURNS ON DUNKIRK FINE SANDY LOAM AND CLYDE SOILS, ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Dunkirk and Clyde fine sandy loam soils			Clyde loam and Clyde clay loam soils		
	Orchards set			Orchards set		
	Before 1870	1870 to 1879	1880 to 1899	Before 1870	1870 to 1879	1880 to 1899
Number of records.....	30	28	19	29	49	22
Average acres per orchard.....	3.4	6.7	3.9	5.1	5.5	5.8
Barrels packed per acre.....	31	34	27	18	18	29
Net receipts per barrel*.....	\$2.44	\$2.44	\$2.33	\$2.45	\$2.11	\$2.19
Net cost per barrel†.....	\$3.30	\$2.57	\$3.37	\$4.70	\$3.98	\$2.68
Profit or loss per barrel.....	-\$0.86	-\$0.13	-\$1.04	-\$2.25	-\$1.87	-\$0.49
Returns per hour of labor.....	\$0.17	\$0.38	\$0.09	-\$0.05	-\$0.07	\$0.26

* Net receipts per barrel do not include any cost for package, storage, or commission.

† Net cost per barrel includes all costs except depreciation on the orchards, less the value of wood and cull apples and those used for home consumption.

yielded 76 barrels per acre as compared to only 62 barrels in orchards with 48 or more trees per acre.

The effect of number of trees per acre on yield was just as striking in the Newfane-Olcott area of Niagara County for the period 1926 to 1928 as it was in Wayne County 25 years earlier. In the Newfane-Olcott area orchards with less than 30 trees per acre had an average yield of 54 barrels packed per acre as compared to 41 barrels for orchards with 40 or more trees per acre from 1926 to 1928 (table 102). In orchards that had the larger number of trees per acre the number of hours spent and the costs of growing apples to picking time were higher than in the orchards with fewer trees per acre. It cost 40 per cent more to prune an acre where there was an average of 40 trees per acre than in orchards that had an average of about 26 trees per acre (table 103). The costs of plowing and harrowing were also higher where there were more trees per acre.

The average cost per barrel to picking time was \$1.94 in orchards with 40 or more trees per acre, as compared to \$1.12 in orchards with less than 30 trees per acre, for the period 1926 to 1928. This relationship held true in each of the three years.

TABLE 102. RELATION OF PLACES FOR TREES PER ACRE TO THE AVERAGE COST OF GROWING APPLES IN CULTIVATED ORCHARDS SET BEFORE 1900, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928

Places for trees per acre	Records	Trees per acre	Acreage per cost orchard	Growing to picking time		Yield of packed apples per acre	Cost per barrel to picking time
				Man hours per acre	Cost per acre		
				Number	Dollars		
Less than 30.....	57	26	9	38	60	54	1.12
30 to 39.....	64	32	13	41	66	44	1.50
40 or more.....	59	41	6	60	80	41	1.94

TABLE 103. RELATION OF PLACES FOR TREES PER ACRE TO THE AVERAGE COST OF PRUNING APPLE ORCHARDS SET BEFORE 1900 ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1927 AND 1928

Places for trees per acre	Orchards	Trees per acre	Acres pruned	Hours pruning per acre pruned	Net cost of pruning per acre pruned*
Less than 30.....	Number 35	Number 26	Number 144	Number 40	Dollars 16.08
30 to 39.....	39	31	267	38	18.52
40 or more.....	41	40	136	57	22.58

* Net cost of pruning is the total cost less the value of the wood.

SIZE OF TREES

On the better-drained soils the average size of trees in orchards set before 1900 was larger than on the other soil types. On the Dunkirk gravelly sandy loam and Dunkirk loam soils, the average area of a cross section of the trunks of the trees about one foot above the ground was 17 per cent larger than those on the Dunkirk and Clyde fine sandy loam soils and 27 per cent larger than those on Clyde loam and Clyde clay loam soils. The trees on the better-drained soils grow faster and live longer.

There probably is a close relation between the area of a cross section of the trunk and the size of the tree. Collison and Harlan¹⁹ reported on a study of 21 McIntosh trees that were cut down when they were 16 years old. The correlation between the circumference of the trunks just above the roots and the total tree weight above the roots was $+0.963 \pm 0.011$. The correlation between the area of a cross section of the trunks just above the roots and the total tree weight was $+0.960$. These correlations are nearly the same, because the area of a cross section of the trunk = $\frac{(\text{Circumference})^2}{4\pi}$, and the variation in the circumference of the trees

was small (from 27 to 34 inches), so that squaring the circumference and dividing by a constant, 4π , did not materially change the correlation. However, they found that the percentage difference in total tree weight above the roots between large and small trees was greater than the percentage difference in the area of a cross section of the tree trunks. This indicates that in the Newfane-Olcott area there probably was greater difference in the size of the trees, as measured by total tree weight above the roots, than that shown by the areas of cross sections of the tree trunks.

Even within each soil group there was a marked difference in the size of the trees in orchards set before 1900 (table 104.) This probably was owing in part to soil variation within the group. Also part of it probably was caused by the number of trees per acre, the age of trees, and by factors of care such as cultivating, fertilizing, pruning, and spraying.

On the Dunkirk gravelly sandy loam and Dunkirk loam soils the one-third of the orchards with the largest-sized trees had an average yield of 45 barrels per acre, as compared to 34 barrels in the one-third of the orchards with the smallest-sized trees. The average area of the cross

¹⁹ Collison, R. C. and Harlan, J. D. Variability and size relations in apple trees. New York Agr. Exp. Sta. Technical bul. 164:33. 1930.

sections of the tree trunks in the former group was 62 per cent larger than the area of those in the latter group.

TABLE 104. RELATION OF SIZE OF TREES TO THE AVERAGE YIELD OF APPLE ORCHARDS SET BEFORE 1900, NEWFANE-OLCOTT AREA, 1928

Circumference of trees	Orchards	Average circum- ference of tree trunks*	Average area of cross section of trunks	Places for trees per acre	Trees per acre	Spray per tree per ap- plica- tion	Yield of packed apples per acre
		Inches	Square inches	Number	Number	Gallons	Barrels
<i>Inches</i>							
Dunkirk gravelly sandy loam and Dunkirk loam soils:							
Less than 63.....	22	59	277	40	32	6.9	34
63 to 67.....	20	65	336	36	33	7.9	36
68 or more.....	22	75	448	33	29	9.3	45
Dunkirk and Clyde fine sandy loam soils:							
Less than 60.....	7	54	232	34	32	6.1	26
60 to 63.....	6	62	306	36	35	6.8	28
64 or more.....	6	69	379	32	29	6.0	25
Clyde loam and Clyde clay loam soils:							
Less than 56.....	11	50	199	47	39	4.1	8
56 to 59.....	10	57	259	35	31	4.6	15
60 or more.....	11	69	379	36	32	5.4	34

* The average circumference of the trees in an orchard was obtained by measuring the trunks of 10 trees about one foot above the surface of the ground. A row that was fairly representative of the orchard was selected and 10 consecutive trees were measured unless a tree was a replant. No tree at the end of a row was measured.

On the Clyde loam and Clyde clay loam soils the difference in yield between the orchards with large and those with small trees was 26 barrels per acre. The average area of the cross sections of the trunks in the orchards with large trees was nearly double that in the orchards with small trees. The orchards with the largest-sized trees probably were on better soils than the other orchards.

On the Dunkirk and Clyde fine sandy loam soils the number of orchards is too small to draw any definite conclusions.

In general, those orchards with the largest-sized trees had fewer trees per acre than the other orchards. Since the trees were larger more spray was applied per tree per application. However, there was not so great a difference in the quantities of spray applied per tree as there was in the areas of the cross section of the tree trunks.

CONDITION OF ORCHARDS

The author discusses condition of orchards in a previous bulletin. This is Cornell Extension Bulletin 219, *Fruit-Farm Management*, pages 20 to 24.

SIZE OF ORCHARDS

Growers with the larger-sized orchards produced apples with fewer hours of labor and at a lower cost per acre than did the growers with the smaller orchards. On the Dunkirk gravelly sandy loam and Dunkirk loam soils, 48 per cent more man labor was required to grow apples to picking time in orchards of less than five acres in size than in orchards of 10 acres or more (table 105). The same relationship held true on the other soil types.

TABLE 105. RELATION OF SIZE OF ORCHARD TO THE AVERAGE COST OF PRODUCING APPLES ON DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Acres per orchard		
	Less than 5	5 to 9.9	10 or more
Number of records.....	56	80	57
Average acres per orchard.....	3.1	6.5	19.2
Barrels packed per acre.....	46	48	45
Growing to picking time:			
Man hours per acre.....	59	44	40
Cost per acre.....	\$69.55	\$65.83	\$64.96
Costs per barrel packed:			
Growing.....	\$1.50	\$1.38	\$1.44
Picking.....	\$0.29	\$0.28	\$0.29
Packing.....	\$0.26	\$0.22	\$0.24
Hauling and marketing tree run and packed fruit.....	\$0.18	\$0.15	\$0.17
Picking up and hauling culls.....	\$0.09	\$0.06	\$0.04
Total cost per barrel.....	\$2.32	\$2.09	\$2.18
Net receipts per barrel*.....	\$2.56	\$2.42	\$2.64
Profit per barrel.....	\$0.24	\$0.33	\$0.46
Returns per hour of labor.....	\$0.49	\$0.59	\$0.75

* Net receipts per barrel do not include any cost for package, storage, or commission.

The average yield per acre for the different-sized orchards showed only slight variation. Thus, in general, the growing cost per barrel to picking time was lower for the large than for the small orchards.

The hauling and marketing cost per barrel was also higher for the small orchards. This is owing in part to the fact that the growers with a small amount of orchard had more time to truck their apples to local city markets than did the growers with large orchards.

SIZE OF ORCHARDS AND YIELD PER TREE

Both size of orchard and yield per tree are important factors which affect the cost of growing apples. The effect of yield per tree was shown in tables 98 and 99, and the effect of size of orchard was shown in table 105. To make the best returns it is usually necessary to have more than one factor above average. The combined effect of yield per tree and size of orchard on the Dunkirk gravelly sandy loam and Dunkirk loam soils for the three-years period is shown in table 106. In the orchards of seven or more acres in size, the man hours per acre to picking time were considerably less than in the smaller-sized orchards. Also the cost per acre to picking time was less in the large orchards.

For those growers who had yields above average, the yield per acre in the orchards of seven or more acres in size was less, on the average, than in the smaller orchards. For those who had yields below average, the yield per acre was higher in the orchards of seven or more acres than in those of less than seven acres. As was shown in table 105 there was no definite relation between size of orchard and yield per acre on the Dunkirk gravelly sandy loam and Dunkirk loam soils during this three-years period.

The average number of man hours required per barrel to grow apples to picking time was less in the larger orchards that had yields above

TABLE 106. RELATION OF YIELD PER TREE AND SIZE OF ORCHARD TO AVERAGE COSTS AND RETURNS IN PRODUCING APPLES, DUNKIRK GRAVELLY SANDY LOAM AND DUNKIRK LOAM SOILS, NEWFANE-OLCOTT AREA, 1926 TO 1928

	Yield below average		Yield above average	
	Less than 7 acres in orchard	7 or more acres in orchard	Less than 7 acres in orchard	7 or more acres in orchard
Number of records.....	46	53	51	43
Barrels packed per acre.....	28.3	31.4	80.7	58.9
Average acres per orchard.....	4.0	15.3	4.3	13.5
Growing to picking time:				
Man hours per acre.....	51.7	39.7	61.0	38.7
Cost per acre.....	\$66.26	\$62.17	\$80.68	\$64.08
Man hours per barrel:				
Growing.....	1.8	1.3	0.8	0.7
Harvesting and marketing.....	1.7	1.0	0.9	0.8
Total.....	3.5	2.3	1.7	1.5
Cost per barrel:				
Growing.....	\$2.34	\$1.98	\$1.00	\$1.09
Harvesting and marketing.....	\$0.99	\$0.83	\$0.65	\$0.68
Total.....	\$3.33	\$2.81	\$1.65	\$1.77
Net receipts per barrel*.....	\$2.38	\$2.51	\$2.48	\$2.67
Profit or loss per barrel.....	\$-0.95	\$-0.30	\$0.83	\$0.90
Returns per hour of labor.....	\$0.13	\$0.28	\$0.97	\$1.15

* Net receipts per barrel do not include any cost for package, storage, or commission.

average than in the other orchards. The man hours per barrel necessary to harvest and market the crop, were considerably less where the yields per tree were above average. Also, the total number of man hours per barrel was less in the larger orchards, even where the yields were less than the yields in the smaller orchards.

Where the yields were above average, the total cost per barrel in orchards of less than seven acres was 12 cents less than in the larger orchards for the period 1926 to 1928. The reason for this is that the average yield per acre was higher in the smaller orchards. However, the average price of apples from the larger orchards was 19 cents per barrel higher than those from the small orchards. Thus, the greatest profit per barrel and returns per hour of labor were made by those growers who had large orchards with yields above average. The lowest returns were made by those who had small orchards with less than the average amount per tree.

SUMMARY

Soil is one of the most important factors which affect the cost of growing apples and the labor income of fruit growers. In the Newfane-Olcott area there are two important soil series, the Dunkirk and the Clyde. In most cases the Dunkirk are well-drained and the Clyde poorly drained.

From 1913 to 1930 the average labor income of farmers on the Dunkirk soils was \$451, as compared to —\$24 on the Clyde soils. On each soil series the average labor income from 1913 to 1920 was higher than from 1921 to 1930, because from 1920 to 1930 farm wages were high relative to the price of apples, peaches, and other farm products.

On the well-drained soils, the operators of the large farms obtained higher average labor incomes than the operators of small farms. On poorly drained soils the larger farms returned smaller average labor incomes.

For the period 1926 to 1928 the average yield of apple orchards set before 1900 on Dunkirk gravelly sandy loam and Dunkirk loam soils was 46 barrels per acre, on the Dunkirk and Clyde fine sandy loam soils 31 barrels, and on the Clyde loam and Clyde clay loam soils 21 barrels. Because of this great difference in yield the total cost of producing apples per barrel on the different soil groups varied widely, averaging \$2.17, \$2.93, and \$3.55, respectively.

Man labor made up 42 per cent of the cost of producing apples, and interest on the orchard 19 per cent. Since interest on the orchard is a relatively small item in the total cost, small differences in yield make a large difference in what one can afford to pay for the better-drained soils.

The average cost of plowing apple orchards with horses was \$4.72 per acre, as compared to \$2.81 where tractors were used. The average cost of disking an acre once with horses was \$1.34, and with tractors 91 cents. The average cost of harrowing an acre once with horses was \$1.24 as compared to 80 cents where tractors were used. The important factors affecting the cost of plowing and harrowing whether horses or tractors were used were size of orchard, size of farm, size of tillage tool used, and the number of trees per acre.

On the Dunkirk gravelly sandy loam and Dunkirk loam soils the orchards that received a larger number of sprays and a larger quantity of spray per tree per application, had higher average yields of packed apples per acre and lower costs per barrel than the orchards that received less spray.

The growers who had less than 15 acres of bearing orchard had a spraying cost of \$36 per acre as compared to \$21 for those with 30 or more acres of bearing orchard. Each group applied an average of 4.4 sprays. The growers who had larger acreages had larger sprayers that carried more pounds of pressure. Hence, they were able to apply the same quantity of spray in less time than could the growers with a small acreage of orchard. The growers with a large acreage of orchard had lower average sprayer costs because the overhead cost of the better sprayers was spread over more acres. They also obtained their spray material at lower average prices because they bought it in larger quantities and often at wholesale prices. Large sprayers are necessary to save labor. This requires a large acreage of orchard per farm.

The average cost of one application of dust on apples was \$4.90 and of one application of spray \$5.59; 79 per cent of the cost of dusting was for the dust material. The average yield of apples on the orchards that were dusted one or more times was about 12 per cent less than on the orchards that were not dusted. The total cost of producing apples per acre and per barrel on the orchards that were dusted was higher than on the other orchards.

About one-half of the man labor to picking time on apple orchards set before 1900 was for pruning. The average net cost of pruning per acre pruned was \$17.70 on orchards set before 1900 and \$7.12 on orchards set after 1900.

On the well-drained soils 23 per cent of the acreage in orchards set before 1900 was manured each year, as compared to 39 per cent on the other soil types. Commercial fertilizers were used on 20 per cent of the acreage in orchards on the well-drained soils each year, as compared to 13 per cent on the other soil types. The farmers on the well-drained soils had more orchard per farm and less manure.

On the Dunkirk gravelly sandy loam and Dunkirk loam soils, 56 per cent of the apples were picked by the barrel or bushel, as compared to less than 24 per cent on the other soil types, for the period 1926 to 1928. During this period the average labor cost of picking apples by the barrel or bushel was 27 cents and by the operator or other labor 26 cents. The average cost of ladders and picking bags was 2 cents per barrel. The number of barrels of apples per tree was a more important factor affecting the cost of picking than the age of the trees.

During 1927 and 1928 a higher percentage of the apples were packed unclassified or sold tree-run than in any of the years from 1922 to 1926. A higher percentage of the apples from the Dunkirk gravelly sandy loam and Dunkirk loam soils were packed in the No. 1 grade than from the other soil types. Also on the better-drained soils the percentage sold to the evaporators or cider mill was less. For the period 1922 to 1926, 67 per cent of the tree-run or packed apples were sold in barrels, as compared to 47 per cent for the period 1927 to 1930.

The average cost of packing apples at custom packing houses decreased from 30 cents per barrel in 1926 to 22 cents in 1928. The average cost of packing apples on farms in 1928 was 22 cents. Of the cost on farms, 2 cents was for use of buildings, 1 cent for packing equipment, and 19 cents for labor. Of the labor for packing on farms 30 per cent was unpaid family labor. During this three-years period, 1926 to 1928, 61 per cent of all the apples sold were packed on farms. The percentage packed on farms varied from 50 per cent on the Dunkirk gravelly sandy loam and Dunkirk loam soils to about 97 per cent on the other soil types.

When less than 75 barrels of apples were packed per orchard, the average cost of packing on farms was 34 cents per barrel, as compared to 23 cents where 175 or more barrels of apples were packed per orchard. Where more barrels were packed per orchard a higher percentage were packed in the No. 1 grade.

The average cost of hauling and marketing the tree-run and packed fruit was 21 cents per barrel in 1927 and 20 cents in 1928. This cost was lower on the Dunkirk gravelly sandy loam and Dunkirk loam soils than on the other soil types. The farmers on the Clyde soils and the Dunkirk fine sandy loam soil had fewer apples per farm so they had more time to truck their apples to local markets. On farms where few apples were packed per orchard a high percentage of the fruit was packed unclassified. The average net prices per barrel indicate that the farmers with a small quantity of fruit per orchard made up to some extent for the poorer quality of fruit by trucking their apples to local markets.

The average yield of orchards with less than 30 places for trees per acre was 32 per cent higher than the yield in orchards with 40 or more places for trees. The costs per acre of cultivation and pruning were higher in the orchards with more trees on an acre.

Even within the soil groups the average yield of orchards in good condition was higher than the yield of orchards in fair condition and very much higher than the orchards in poor condition.

The growers who had a large acreage of orchard on well-drained soil and who obtained high yields per acre had lower production costs than the other growers had. A large acreage of orchard is especially important in reducing the cost of cultivation, spraying, packing, and marketing.