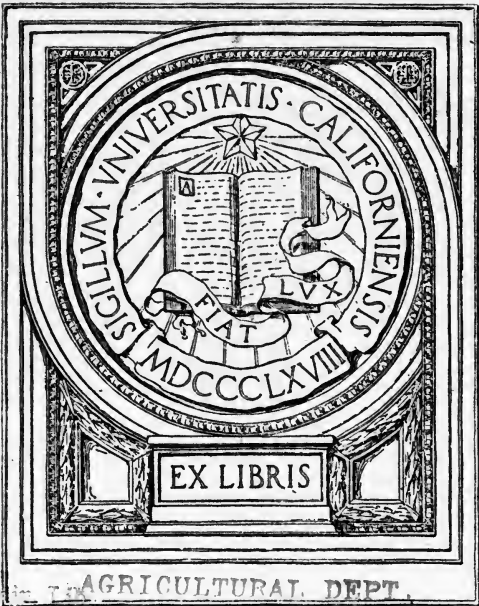


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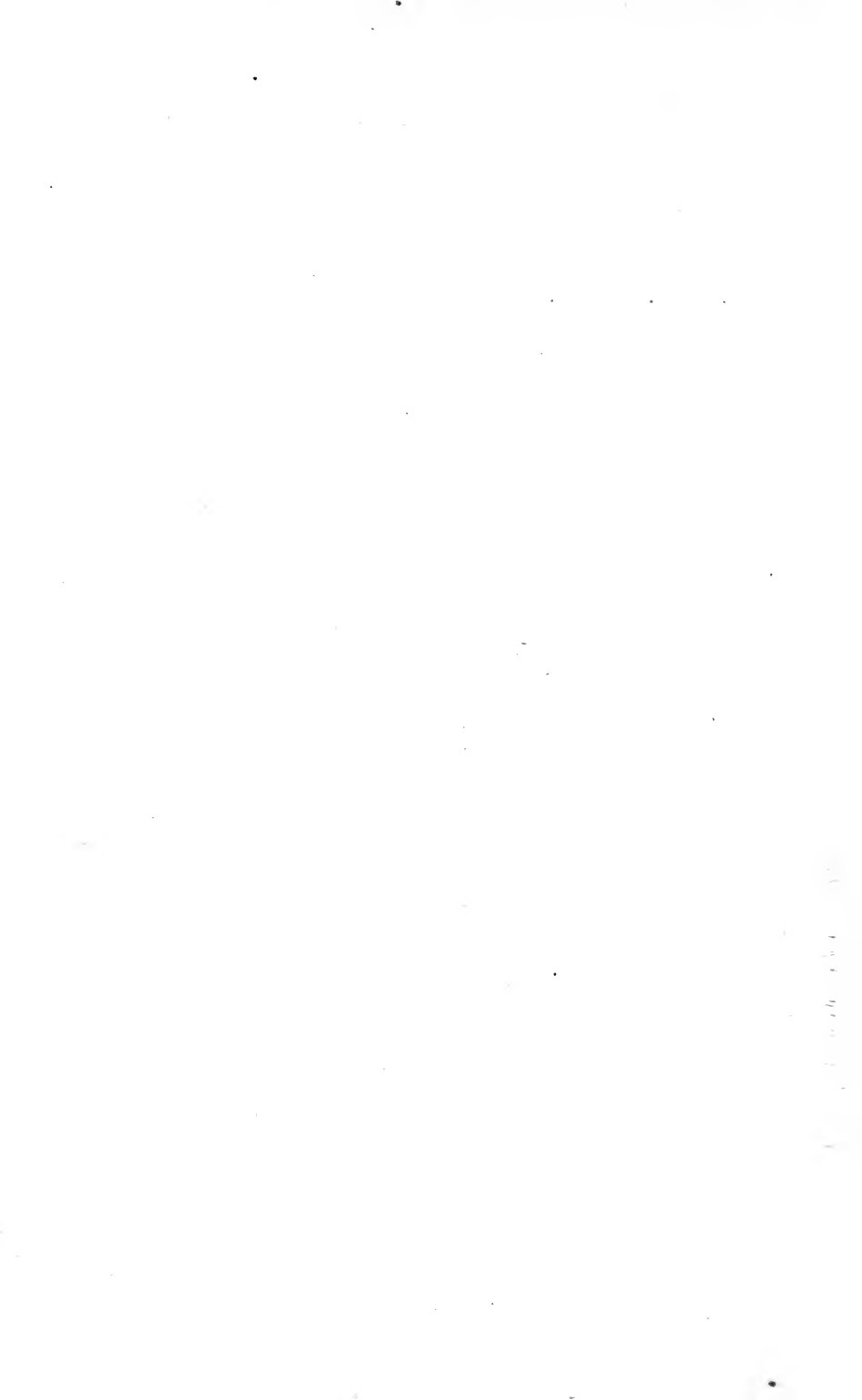


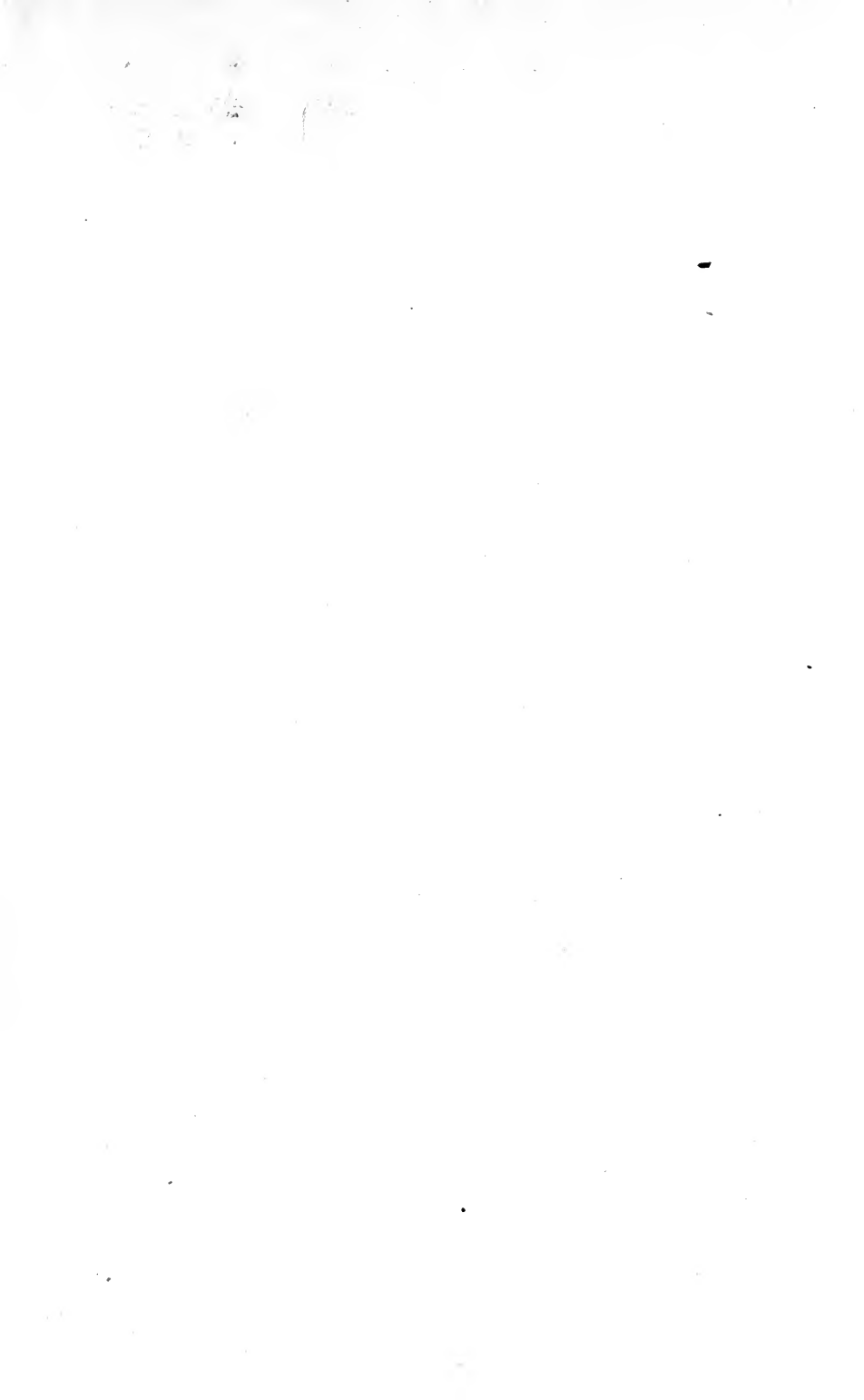
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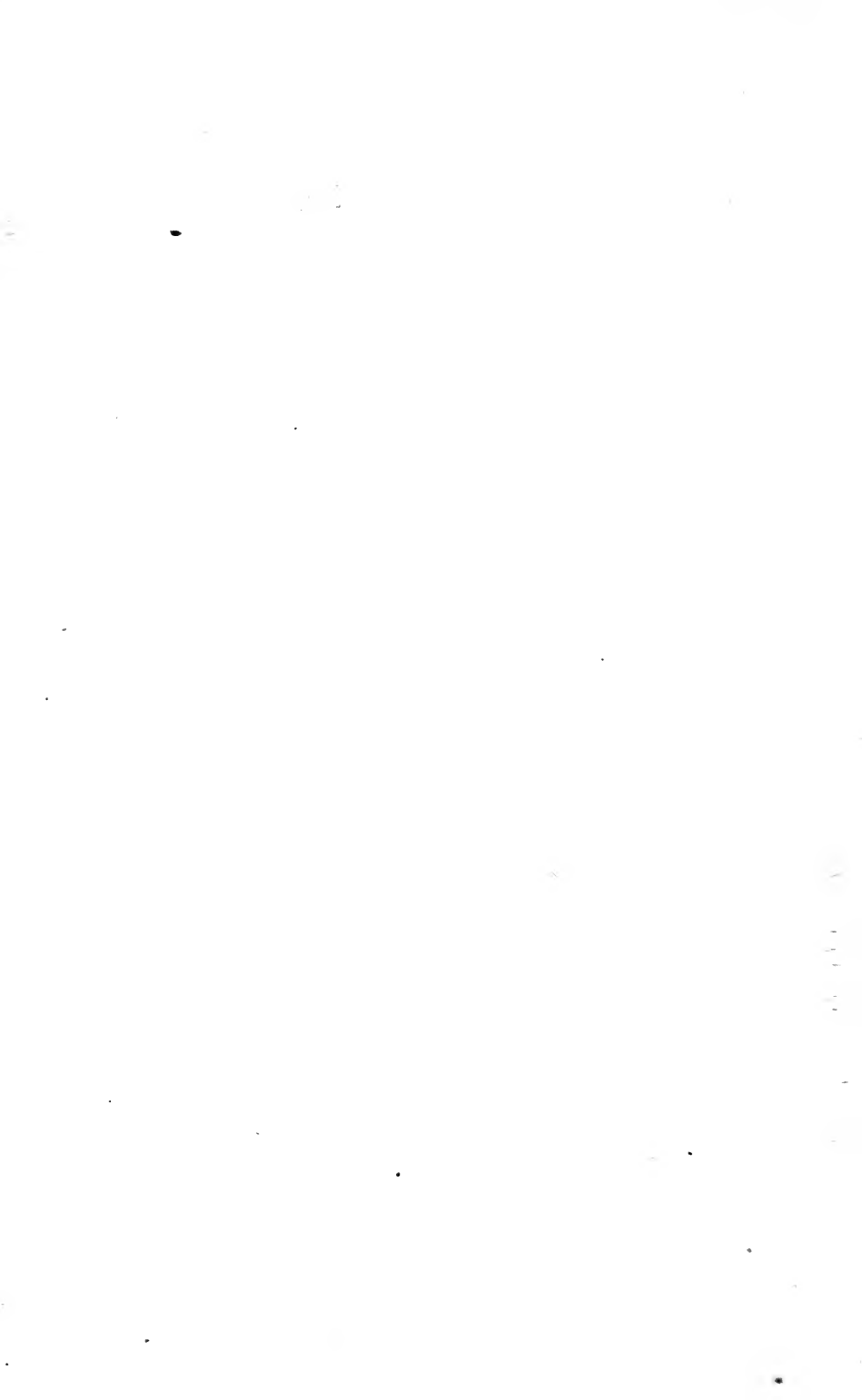


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THE APPLE INDUSTRY

OF

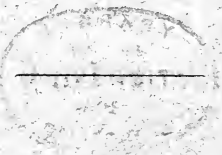
Wayne and of Orleans Counties,
New York

A THESIS

SUBMITTED TO THE UNIVERSITY FACULTY OF CORNELL UNI-
VERSITY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

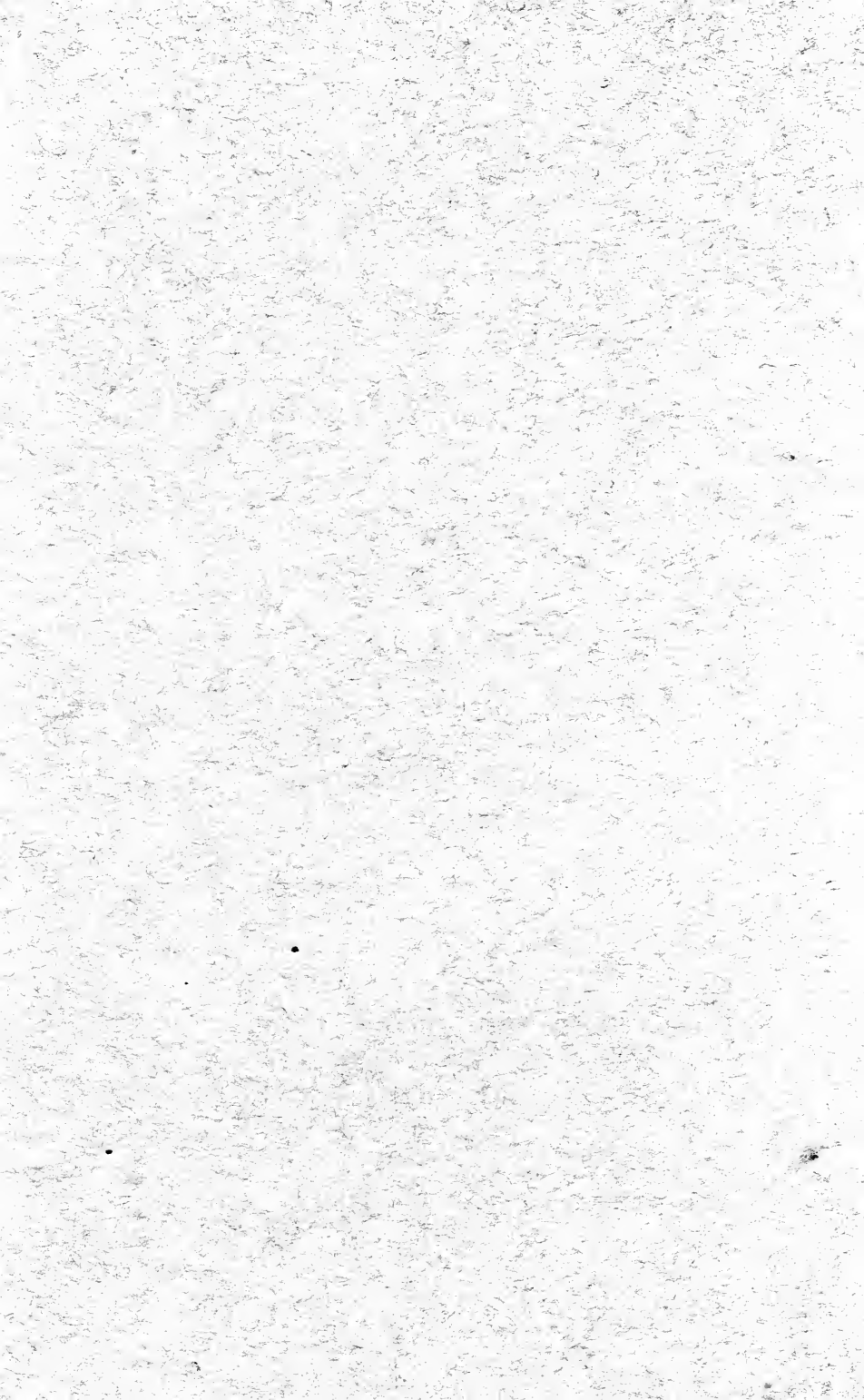
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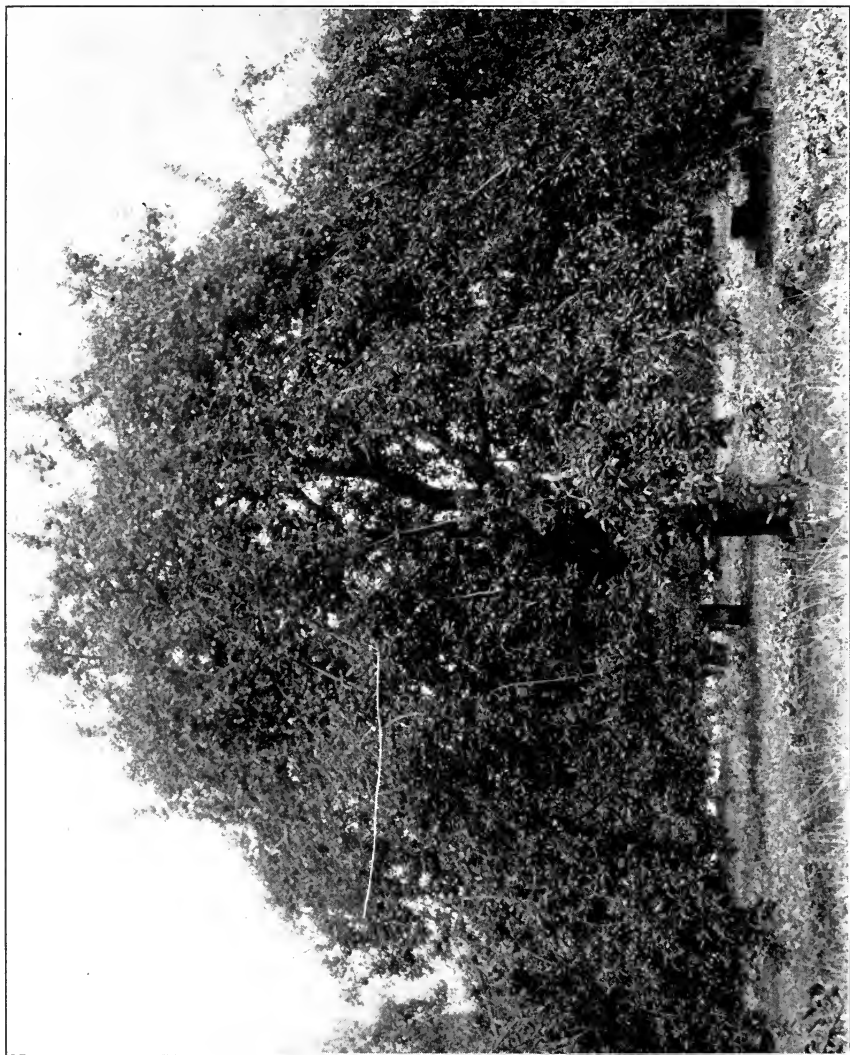


ITHACA, NEW YORK

1905







An ideal Baldwin apple-tree for Western New York.

THE APPLE INDUSTRY

OF

Wayne and of Orleans Counties,
New York

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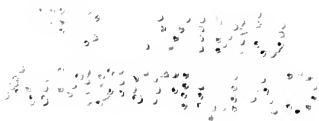
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ITHACA, NEW YORK

1905

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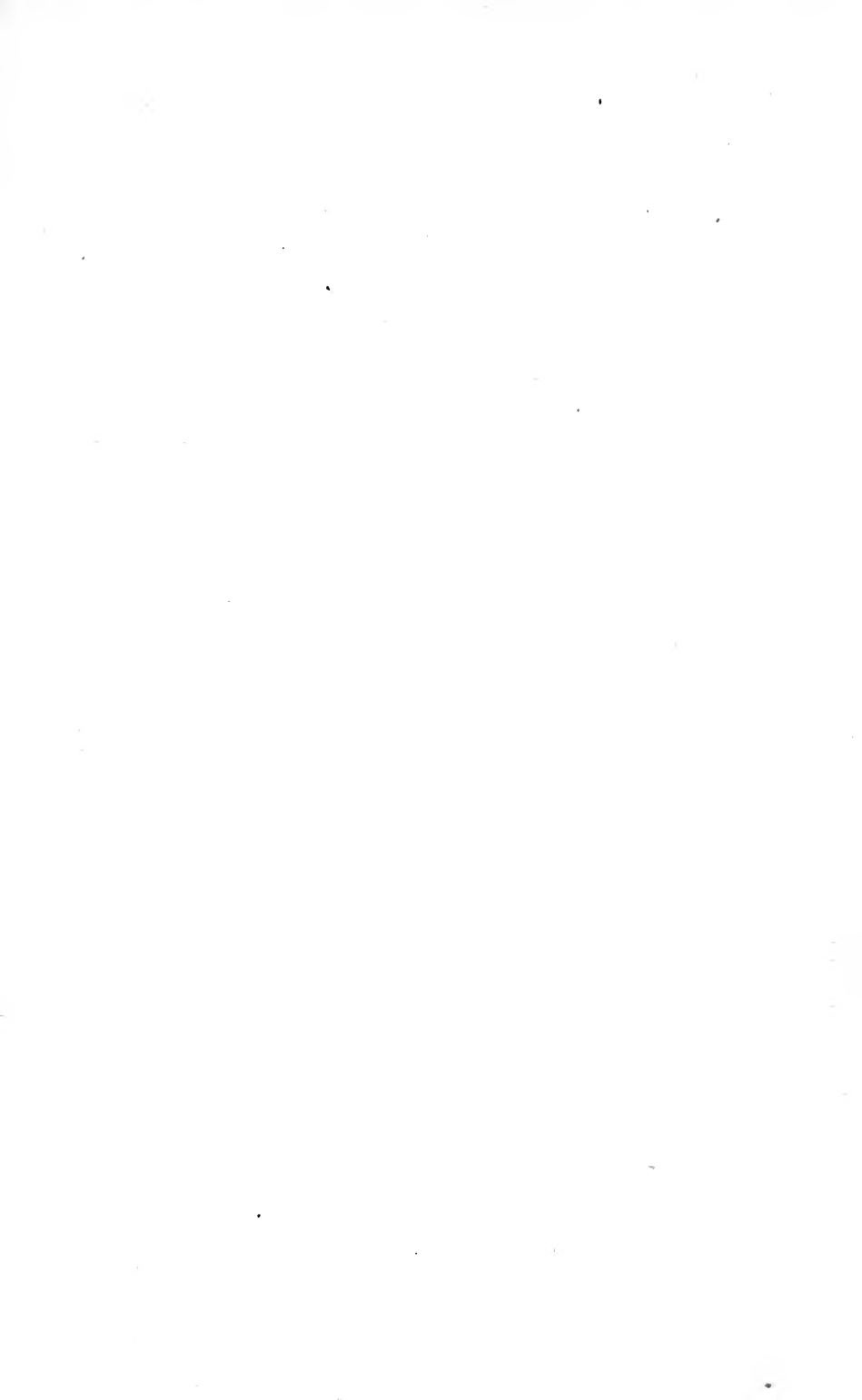
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Figures 44, 48, 75, 78, 79, 82, 92 and the figures in Part II were furnished by the Department of Horticulture. Figure 85 was furnished by Professor Slingerland.



PART I.

THE APPLE INDUSTRY OF WAYNE COUNTY,
NEW YORK.

G. F. WARREN.



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INTRODUCTION.

GENERAL METHOD OF WORK.

The field work.—The field work was done between June 10 and September 12, 1903. Nearly all of this time was spent in the apple orchards.

In Walworth township, which is in the center of the west part of the county, every orchard as large as one acre was examined. In nearly every case the owner was interviewed for statistics on variety, age, fertilization, tillage, spraying, past troubles, yields, market, price, etc. The orchard was examined in order to determine the site, aspect, area, distance between trees, present treatment, present condition of health

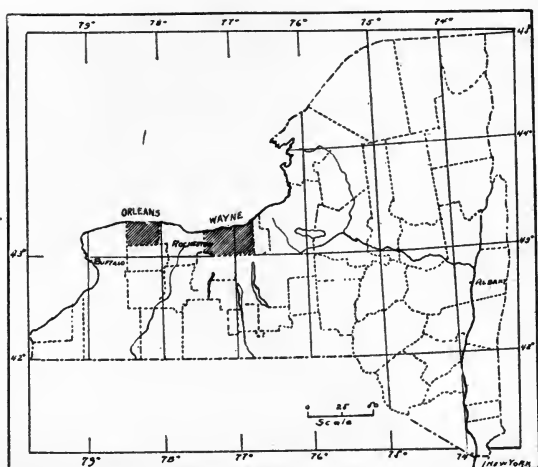


FIG. 37.—Map showing the location of Wayne and Orleans counties, New York.

and crop, pruning, diseases, insects, etc. A three-foot soil auger was a part of the outfit, and frequent borings were made to determine the physical condition of the soil, texture, structure and the drainage conditions. Samples for laboratory analyses were taken of the different soil types. In short, an effort was made to study whatever factors enter into the successful production of apples. All the information obtained was entered in the blank report provided for that purpose (see Fig. 38). These reports are preserved in the Department of Horticulture for reference for the future worker and are, of course, not open to the public. The position and approximate size of each orchard with its number is shown on the map prepared by the United States Geological

APPLES.

ORCHARD SURVEY.
CORNELL EXPERIMENT STATION.

No. *Omitted.*
Soil *S-T* 1903.

Proprietor *Omitted.* (Owner 10 yrs.) P. O. *Omitted.* Wayne County.
Location *Omitted.* When planted 1866. How laid out *40 feet in row, Rows 20 ft. apart.*
Site *Elevated.* Aspect *Slight E.*
Drainage *No drains. Eleven acres fair, natural. One acre trees drowned out.*
Varieties *One-half Baldwin; one-fourth Greening; one-fourth Roxbury Russet.*
How cared for *Entirely neglected and cattle pasture till 10 years ago. Tilled 9 years.*
Pruning *Formerly neglected and 6-inch stubs left. Now well pruned every other year.*
Fertilizer used *About 100 loads barnyard manure 9 years ago. Buckwheat plowed under nearly every year.*
Present Treatment: *Tilled. A cover crop of buckwheat to be plowed under.* Sprayed *Ordinarily, but not this year.*
Troubles: Past *Trees were badly infested with canker.*

Present condition: Crop	Health		Thrill		12 Acres
	1900	1901	1902	1903	
Yield, bushels	3,000	200	2,050	3,050	
Market and price	<i>Sold to dry, 14 cents.</i>	<i>Sold in bulk, 50 cents.</i>	<i>Sold to dry, 25 cents.</i>	<i>Sold to dry, 20 cents.</i>	
	\$ 35.00	\$ 8.35	\$ 42.70	\$ 50.85	

Has orchard been profitable? *Yes. Has paid nearly every year for 8 years.*

General observations: *This orchard was considered worthless 10 years ago, the neglect and canker having nearly ruined the trees. The canker is now nearly subdued and the trees are in fair shape, but are much too close together. The owner thinks of removing half of them. He is trying to keep up the orchard with cover crops and no fertilizer. Some manure or fertilizer would pay as the trees need a little more vigor. When the present owner [over.]*

* Refers to a description of this type. This number refers to the Miami story loan. Observer G. F. Warren

Survey. These maps show the 20-foot contour lines on a scale of one inch to a mile (see Fig. 39). This method of locating the orchard makes it possible to look it up at any time in the future. Very many other items were determined, some of which were entered under "general

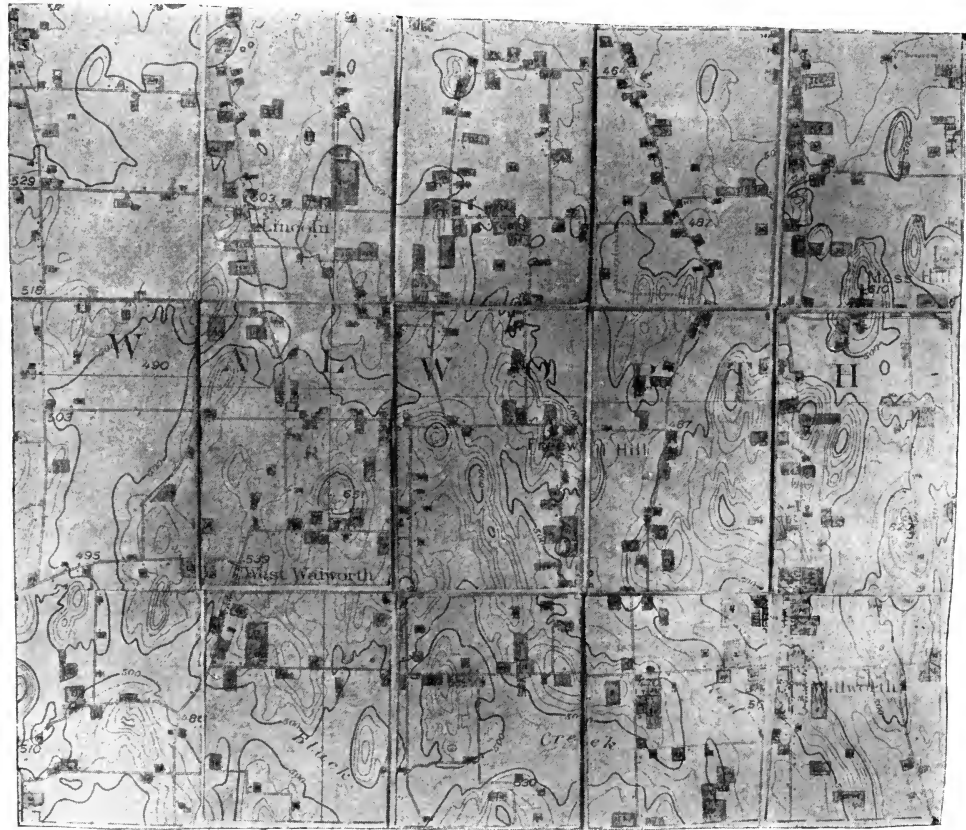


FIG. 39.—A reduced photograph of the field map of Walworth township, showing the position and number of the orchards. This map was on a scale of four inches to the mile.

observations," and some of which were recorded in a note-book kept for that purpose.

In Ontario township, which lies between the lake and Walworth, every orchard as large as ten acres and a number of smaller ones were likewise examined. Nearly all the other orchards were seen, and a comparison made with those that were carefully recorded.

In Macedon township, which extends from Walworth to the southern boundary of the county, every orchard as large as ten acres and nearly all of those as large as five acres were examined. Practically all the other orchards of this town were examined sufficiently to be able to make comparisons with those recorded.

These three townships gave a representative north and south section of the county. The differences in going north and south are very much greater than those from east to west.

The degree of accuracy of the reports.—The results are based on all the orchards of Walworth as large as one acre, or 443 orchards containing 1,773½ acres; and on 131 orchards of the remainder of the county containing 1,987½ acres. This is between one-fifth and one-sixth of the orchards of the county. Probably at least one-third of the orchards were examined more or less carefully. The careful records were made of the above number.

The location, site, aspect, area, distance between trees, present treatment, pruning, present condition, present troubles, soil and soil conditions were determined by the observer, aided by any suggestions that the owner might give.

The ages are a question of memory and sometimes of hearsay. The appearance of the trees would usually enable the inspector to avoid any large error. The past troubles except canker-worm, tent caterpillar and scab or "fungus" are not often given, as they are not recognized by many growers. This does not by any means indicate that no other important enemies have been present. Some have left their effects so apparent that the observer could, without difficulty, fill in the past troubles. The varieties, methods of former treatment, spraying, fertilization, etc., are fairly accurate, except that the amount of fertilization is not often known. The market and price per bushel are quite accurate. The farmers are practically all glad to be able to help in the work of the Experiment Station. They understand that the reports are confidential, and therefore have no incentive to give too high yields. The only limit to the accuracy is the memory of the grower. The apple crop is, however, the chief crop and is therefore well remembered. The yields are usually the result of measurement, as the people remember the number of bushels, or the number of pounds, or remember the income and price, from which the yield can be computed.

The yields for 1903 were secured by letters to the growers. They doubtless average too high, for those who had a very small crop sometimes considered it too small to be worth reporting.

The records of the 1902 yields are the most complete and the most accurate of all.

Method of making the computations.—Since every orchard in Walworth was examined, all computations have been made for this town by itself, and separate ones made for the south and for the north parts of the county. In some cases Ontario and Macedon townships were each considered separately. Nearly all these computations when yields are concerned are made for the crops of 1900, 1901, 1902, 1903. The conclusions have almost invariably been the same for each year and for each part of the county. In this bulletin they have, in most cases, been summarized under two heads, Walworth and the remainder of the county.

In computing yields under various methods of treatment, the yields of the orchards set before 1880 are ordinarily used. Trees set since that date have mostly not arrived at maturity.

In computing any one item the others have generally been ignored. The justification for this lies in the fact that so many orchards have been examined that other items will balance. For example, in determining the average yields for orchards having trees set at different distances apart, no attention has been given to the care of the orchard. There are orchards set at all distances that have been well cared for and others that are neglected. The large number examined makes an average of conditions. The danger of this method of making calculations lies in possible coordinate factors. The man who tills his orchard may be the man who sprays. Some points of this kind are discussed under the different chapters. To test the method, some computations have been made on the basis of sub-groups of orchards otherwise similarly treated. The results have sometimes been changed in absolute amounts, but have been unchanged in their relation to each other, or have been so slightly changed as not to alter the conclusions to which they point.

The independent calculations for Walworth township and for the north and the south parts of the county, furnish additional checks. There are usually twelve independent calculations—one for each of these divisions for each of the four years. When these results all

point to the same conclusion, they would seem to establish it beyond any reasonable doubt. In this report the results are frequently summarized in order to save space. There might seem to be some danger of a large orchard controlling the average, but in no case of any importance has such an orchard changed the relative order of the results.

In making most of the computations, there were orchards for which the information or yields were not secured. These were, of course, omitted, just as an orchard that was not seen. The computations always include every orchard for which the particular data were secured.

Work in Orleans county.—During the summer of 1904, orchards to the number of 564, including 4,881 acres, were similarly examined in Orleans county. In this county the writer was assisted by Mr. C. Bues. Some of the pictures in this report were obtained in that county. Many references are also made to it, but all the tabulations are from Wayne county. The tables for the Orleans county work will be published later.

General observations on the work.—The method of doing the work and the kind of information sought were much changed during the progress of the investigation. In the beginning the type of soil was thought to be of much more importance than it really is. The most important points were not considered in the first few reports. The relative importance of the different problems was better seen as the work progressed. The report blank (Fig. 38) is very different from the first one used. Many improvements were made when similar work was started in Orleans county, but there are others that will be made if another county is studied.

The succeeding pages may be said to be results of experiments of the past seventy-five years in apple-growing in Wayne county. "Every farm is an experiment station and every farmer the director thereof." But when these experiments are viewed singly, there are so many factors that the success or failure is as likely to be assigned to a wrong cause as to the right one. As a result we have the great diversity of opinion that exists among apple-growers. It is by studying and tabulating results from large numbers of orchards that important and unimportant factors can be properly correlated.

The standards in this bulletin are not ideals, but are in all cases based on what successful men are doing. No one man is following all of them, but each one has been tried. It is impossible to give credit to each

farmer who has aided in the work, for that would mean to enumerate six hundred in Wayne county and an equal number in Orleans county, but I can not refrain from mentioning the willingness with which nearly every one gave the information about his orchard and about his successes and failures. It would be very hard to find a region where the farmers are more willing to cooperate with every enterprise of the experiment stations. In writing this bulletin, I have tried to keep in mind the many questions asked by the farmers, as well as to present the tables of the results of various methods of treatment.



Making apple barrels.



Hawling the barrels to the orchard.

CHAPTER I.

THE MAGNITUDE OF THE APPLE INDUSTRY.

Fruit production per capita.—The commercial demand in the United States for fresh fruit has been created during the past fifty years. The small quantity of fruit that was produced half a century ago was largely used for wine and cider manufacture, but fresh fruit and canned fruit are now among the staple articles of diet for the laborer as well as for the wealthy. Table I shows that the value of the orchard products on the farm has increased from 33 cents per capita in 1850, to \$1.11 per capita in 1900. If all fruits are included the value would be about fifty per cent greater, the amount for 1900 being \$1.74 per capita (see Table 2). Much more than these amounts must be spent

TABLE I.

Relative increase of population and of value of orchard products from the census reports.

	Population.	Per cent of gain in 10 years.	Value of Orchard Products.	Per cent of gain in 10 years.
1850 ¹	23, 191, 876	.....	\$7, 723, 186	.....
1860	31, 443, 321	35.6	19, 991, 885	159.0
1870	38, 558, 371	21.3	38, 000, 000 ³	90.0
1880	50, 155, 783	32.4	50, 876, 154	33.9
1890 ² .....	.....	Gain in 20 yrs.	.....	Gain in 20 yrs.
1900	75, 568, 686	52.1	83, 751, 840	64.6

¹ Values of orchard products are for the year preceding the census.

² The value of orchard products was not given for 1890.

³ "In 1870 the value of orchard products returned was \$47,335,189. The reduction of this amount by the then existing premium on gold (25.3 per cent on the average for the twelve months of the census year, May 31, 1869, to June 1, 1870) would yield about \$38,000,000." Tenth Census, Statistics of Agriculture, page xxii.

by the consumer for the transportation, commissions and profits increase the cost several times. A larger proportion of the crop may now be exported, but the great change has been in the creation of a home demand for fresh fruit, such as does not exist in any other country. The great fruit market of the world is the American workman, and his staple fruit is the apple.

The magnitude of the apple crop.—Of the total number of orchard trees reported in 1900, 55 per cent were apple, and these produced 83 per

TABLE 2.

Relative rank in fruit production of the ten leading fruit-producing states, from the census of 1900.

	ORCHARD PRODUCTS.			ALL FRUITS.		
	Total value.	Per cent.	Rank.	Total value.	Per cent.	Rank.
United States.....	\$83,751,840	100.0	.....	\$131,423,517	100.0	.....
California.....	14,526,786	17.3	1	28,280,104	21.5	1
New York.....	10,542,272	12.6	2	15,844,346	12.1	2
Pennsylvania.....	7,976,464	9.5	3	9,884,809	7.5	3
Ohio.....	6,141,118	7.3	4	8,901,220	6.8	4
Illinois.....	3,778,811	4.5	5	5,455,213	4.1	6
Michigan.....	3,675,845	4.4	6	5,859,362	4.5	5
Indiana.....	3,166,338	3.8	7	4,630,169	3.5	7
Missouri.....	2,944,175	3.5	8	4,309,813	3.3	8
Virginia.....	2,662,483	3.2	9	3,515,475	2.7	10
New Jersey.....	2,594,981	3.1	10	4,082,788	3.1	9

Leading fruit counties in New York.

	ORCHARD PRODUCTS.			ALL FRUITS.		
	Total value.	Per cent of the N. Y. crop.	Rank.	Total value.	Per cent of the N. Y. crop.	Rank.
Niagara.....	\$1,078,042	10.2	1	\$1,184,482	7.5	2
Orleans.....	839,732	8.0	2	875,270	5.5	6
Monroe.....	768,927	7.3	3	928,673	5.9	4
Wayne.....	584,254	5.5	4	903,875	5.7	5
Ontario.....	497,354	4.7	5	730,222	4.6	7
Dutchess.....	377,427	3.6	6	429,679	2.7	10
Ulster.....	354,262	3.4	7	989,024	6.2	3
Westchester.....	306,010	2.9	8	329,419	2.1	15
Columbia.....	300,645	2.9	9	434,660	2.7	9
Chautauqua.....	296,679	2.8	10	1,620,923	10.2	1

cent of the total number of bushels of fruit reported. The average production of apples is about two to three bushels per capita.

Of the crop of 175,000,000 bushels in 1899, the States of New York, Pennsylvania and Ohio produced nearly 69,000,000 bushels, or over 39 per cent of the total crop in the United States (see Table 3). New York justly claims first place in the quantity and quality of her apple crop. Apples are grown in nearly all parts of the State, but it is in the lake counties, Niagara, Orleans, Monroe and Wayne that the industry has been most extensively developed. In 1900, fifteen states outside of New York had a greater number of apple-trees than the combined number in these four counties, but only nine of these states gave a larger crop in 1899. No other county in the United States produced as many apples as any one of these. Only four counties; one in Illinois, one in Missouri and two in Arkansas had as many trees as any one of these.

The production of evaporated apples.—Wayne county has come to market the great bulk of its apple crop as evaporated apples. The other counties sell nearly all their crop in barrels. According to the last census (see Table 4), Wayne county produces over two-thirds of the evaporated fruit in New York, and produces an amount exceeded by only three states. Two of these, Oregon and North Carolina, only slightly exceed Wayne county. This report includes all kinds of evaporated fruit. Of evaporated apples, Wayne county doubtless produces more than any State in the Union, except, of course, New York (see Table 4I).

TABLE 3.

Number of apple-trees and yield of apples, from the census of 1890 and of 1900.

	CENSUS OF 1890.			CENSUS OF 1900.		
	No. bearing trees 1890.	Bushels of apples for the year 1889.	Rank.	No. trees of bearing age 1900.	Bushels of apples for year 1899.	Rank.
United States	120, 152, 795	143, 105, 689	. . . .	201, 794, 764	175, 397, 626	. . . .
New York	14, 428, 381	8, 493, 846	7	15, 054, 832	24, 111, 257	1
Pennsylvania	9, 097, 700	7, 552, 710	10	11, 774, 211	24, 060, 651	2
Ohio	10, 860, 613	13, 789, 278	1	12, 952, 625	20, 617, 480	3
Virginia	4, 253, 364	8, 391, 425	8	8, 190, 025	9, 835, 982	4
Illinois	6, 949, 336	9, 600, 785	4	13, 430, 006	9, 178, 150	5
Michigan	8, 582, 386	13, 154, 626	2	10, 927, 899	8, 931, 569	6
Indiana	6, 089, 106	8, 784, 038	5	8, 624, 593	8, 620, 278	7
West Virginia	2, 870, 535	4, 439, 978	13	5, 441, 112	7, 495, 743	8
Missouri	8, 150, 442	8, 608, 170	6	20, 040, 399	6, 496, 436	9
Kentucky	5, 730, 144	10, 679, 389	3	8, 757, 238	6, 053, 717	10

TABLE 3—*Concluded.*
Leading Counties in New York.

	CENSUS OF 1890.			CENSUS OF 1900.		
	No. bearing trees 1890.	Bushels of apples for the year 1889.	Rank.	No. trees of bearing age 1900.	Bushels of apples for year 1899.	Rank.
Monroe	758,729	439,682	5	789,409	1,436,391	1
Niagara.....	1,033,454	623,204	2	924,086	1,421,796	2
Wayne	659,890	1,030,381	1	796,610	1,393,585	3
Orleans.....	591,767	321,726	7	629,401	1,391,630	4
Dutchess.....	288,762	194,916	13	400,811	990,244	5
Westchester.....	364,333	578,679	4	336,135	979,411	6
Ontario.....	425,236	591,073	3	419,483	933,764	7
Ulster.....	251,329	190,038	14	347,497	901,162	8
Chautauqua.....	460,111	175,704	15	449,317	825,633	9
Cattaraugus.....	366,536	32,999	43	434,319	718,201	10
Erie.....	730,458	65,212	37	631,283	476,091	15

TABLE 4.

Pounds of dried and evaporated fruit produced in 1899, from the census of 1900.

	Pounds of dried fruit.	Per cent.	Rank.
United States	144,804,638	100.0	.....
California.....	117,935,727	81.4	1
New York.....	3,658,610	2.5	2
Oregon.....	2,818,200	1.9	3
North Carolina.....	2,744,450	1.9	4
Tennessee.....	2,533,810	1.8	5

Counties in New York.

	Pounds of dried fruit.	Per cent of the N. Y. product.	Rank.
Wayne.....	2,698,350	73.8	1
Ontario.....	508,300	13.9	2
Yates.....	105,820	2.9	3
Monroe.....	87,160	2.4	4
Orleans.....	9,500	0.3	10

TABLE 5.
Value of orchard products, 1850 to 1900, from the census reports.

	1850.		1860.		1870.		1880.*		1900.	
	Value.	Rank.	Value.	Rank.	Value.	Rank.	Value.	Rank.	Value.	Rank.
United States.....	\$7,723,186	.....	\$19,991,885	.....	\$47,335,189	.....	\$50,876,154	.....	\$83,751,840	.....
Alabama.....	15,408	23	223,312	21	37,590	36	362,203	30	476,574	28
Alaska.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Arizona.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Arkansas.....	40,141	22	56,025	30	157,219	27	5,530	42	96,764	44
California.....	17,700	27	754,230	10	1,384,480	8	867,426	20	1,252,203	19
Colorado.....	.....	.....	.....	.....	.....	.....	2,017,314	7	14,526,786	1
Connecticut.....	175,118	13	508,848	14	9	43	3,246	44	378,119	31
Delaware.....	46,574	21	114,225	27	535,594	22	456,246	28	1,011,359	21
District of Columbia.....	14,843	28	9,980	35	1,226,893	12	846,092	22	263,127	35
Florida.....	1,280	33	21,259	32	6,781	40	12,074	41	773	51
Georgia.....	92,776	17	176,048	24	53,639	32	758,295	24	192,893	40
Hawaii.....	.....	.....	.....	.....	352,926	24	782,972	23	497,847	27
Idaho.....	.....	.....	.....	.....	.....	.....	.....	.....	879	50
Illinois.....	446,049	7	1,126,323	5	725	42	23,147	40	365,224	32
Indiana.....	324,940	9	1,258,942	4	2,858,086	6	3,502,583	4	3,778,810	5
Indian Territory.....	.....	.....	.....	.....	.....	.....	2,757,359	6	3,166,338	7
Iowa.....	8,434	30	118,377	25	1,075,169	13	1,494,395	11	136,598	42
Kansas.....	.....	.....	656	37	158,046	26	358,860	31	1,849,767	13
Kentucky.....	106,230	16	604,849	12	1,231,385	11	1,377,670	12	1,728,659	14
Louisiana.....	22,359	26	114,339	26	142,129	28	188,604	32	1,943,645	12
Maine.....	342,865	8	501,767	15	874,569	16	1,112,026	13	225,476	38
Maryland.....	164,051	14	252,196	20	1,319,495	9	1,563,188	10	833,634	24
Massachusetts.....	463,995	6	925,519	7	939,854	14	1,005,303	14	1,266,047	18
Michigan.....	132,650	15	1,122,074	15	3,447,085	5	2,760,677	5	1,170,868	20
Minnesota.....	.....	.....	649	38	15,818	37	121,648	35	3,075,845	6
.....	.....	.....	.....	.....	.....	.....	.....	.....	109,050	43

*Values are for the crop preceding the census year. The value of orchard products is not given in the census report for 1890.

TABLE 5—Continued.

	1850.		1860.		1870.		1880.*		1900.	
	Value.	Rank	Value.	Rank.	Value.	Rank.	Value.	Rank.	Value.	Rank.
Mississippi	\$50,405	20	\$254,718	19	\$71,018	30	\$378,145	20	\$440,118	30
Missouri	514,711	5	810,975	8	2,617,462	7	1,812,873	8	2,944,175	8
Montana							1,530	45	59,414	45
Nebraska			125	39	9,932	39	72,244	37	684,751	26
Nevada					900	41	3,619	43	10,433	47
New Hampshire	248,563	11	557,934	13	743,552	19	972,291	15	707,739	25
New Jersey	607,268	4	429,402	17	1,295,282	10	860,090	21	2,594,981	10
New Mexico	8,231	31	19,651	34	13,606	38	26,706	39	197,331	39
New York	1,761,950	1	3,726,386	1	8,347,417	1	8,409,794	1	10,542,272	2
North Carolina	34,348	25	643,688	11	394,749	23	903,513	18	1,269,614	17
North Dakota									1,061	49
Ohio	695,921	3	1,929,399	2	5,843,679	2	3,576,242	3	6,141,118	4
Oklahoma									245,990	37
Oregon	1,271	34	478,479	16	310,041	25	583,663	27	906,015	23
Pennsylvania	723,389	2	1,479,937	3	4,208,094	3	4,862,826	2	7,976,464	3
Rhode Island	63,994	18	83,691	28	43,036	35	58,751	38	155,571	41
South Carolina	35,108	24	213,989	22	47,096	33	78,934	36	272,794	33
South Dakota									29,508	15
Tennessee	52,894	19	395,003	18	571,520	21	919,844	17	1,479,915	40
Texas	12,505	29	48,047	31	69,172	31	876,844	19	1,345,423	16
Utah			9,281	36	43,938	34	148,493	33	263,098	36
Vermont	315,255	10	211,693	23	682,241	20	640,942	25	450,429	29
Virginia	177,137	12	800,650	9	891,231	15	1,609,663	9	2,662,483	9
Washington			20,619	33	71,863	29	127,668	34	999,487	22
West Virginia					848,773	17	934,400	16	2,155,599	11
Wisconsin	4,823	32	78,690	29	819,268	18	639,435	26	267,391	34
Wyoming									1,420	48

*Values are for the crop preceding the census year. The value of orchard products is not given in the census report for 1890.

TABLE 6.
*Exports of Apples.**

	FRESH.			DRIED.		
	Barrels.	Value.	Ave'ge price.	Pounds.	Value.	Average price.
1851	28,842	\$71,367	\$2.47	.....	.....	.....
1852	18,411	43,635	2.37	.....	.....	.....
1853	45,075	107,283	2.38	.....	.....	.....
1854	15,326	51,766	3.38	.....	.....	.....
1855	33,959	107,643	3.17	.....	.....	.....
1856	74,287	143,884	1.94	.....	.....	.....
1857	33,201	135,280	4.07	.....	.....	.....
1858	27,711	74,363	2.68	.....	.....	.....
1859	32,979	99,803	3.03	.....	.....	.....
1860	78,809	206,055	2.61	.....	.....	.....
Annual average.	38,860	\$104,108	\$2.68	.....	.....	.....
1861	112,523	\$269,363	\$2.39	.....	.....	.....
1862	66,767	238,923	3.58	.....	.....	.....
1863	174,502	364,628	2.09	.....	.....	.....
1864	183,969	487,140	2.65	2,841,532	\$246,051	\$0.087
1865	120,317	481,334	4.00	892,075	105,548	.118
1866	51,612	246,118	4.77	551,350	55,265	.100
1867	29,577	142,023	4.80	510,750	79,922	.156
1868	19,874	94,748	4.77	775,700	121,910	.157
1869	†	†	†	†	†	†
1870	38,157	250,013	6.03	836,110	79,387	.095
Annual average.	88,589	\$283,810	\$3.20	1,067,920	\$114,681	\$0.107
1871	49,088	\$136,693	\$2.78	1,150,122	\$79,026	\$0.069
1872	36,508	198,948	5.45	2,644,592	190,560	.072
1873	241,663	819,664	3.39	4,483,186	272,028	.061
1874	44,928	204,312	4.55	4,234,736	294,893	.070
1875	276,209	722,247	2.61	4,053,696	326,193	.080
1876	64,472	221,764	3.44	713,840	67,915	.095
1877	417,065	986,112	2.36	14,318,052	920,292	.064
1878	101,617	386,261	3.80	4,188,173	260,085	.062
1879	505,018	980,455	1.94	7,379,836	296,794	.040
1880	407,911	1,190,560	2.92	3,158,367	192,069	.061
Annual average.	214,448	\$584,702	\$2.73	4,632,460	\$289,986	\$0.063
1881	1,117,065	\$2,301,334	\$2.06	22,623,652	\$1,247,891	\$0.055
1882	176,704	539,543	3.05	2,893,270	228,945	.079
1883	313,921	1,085,230	3.46	10,187,957	786,800	.077
1884	105,400	422,447	4.01	5,558,746	394,350	.071
1885	668,867	1,572,126	2.35	18,416,573	1,062,859	.058
1886	744,539	1,810,606	2.43	10,473,183	548,434	.052
1887	591,868	1,382,872	2.34	8,130,396	413,363	.051
1888	489,570	1,378,801	2.82	11,803,161	812,682	.069

*Bulletin 64, and circular 16, Division of Foreign Markets. U. S. Department of Agriculture.

† Record not kept.

TABLE 6—Concluded.

	FRESH.			DRIED.		
	Barrels.	Value.	Ave'ge price.	Pounds.	Value.	Average price.
1889	942,406	\$2,249,375	\$2.39	22,102,579	\$1,201,070	\$0.054
1890	453,506	1,231,436	2.72	20,861,462	1,038,682	.050
Annual average.	560,385	\$1,397,377	\$2.49	13,305,098	\$773,508	\$0.058
1891	135,207	\$476,897	\$3.53	6,973,168	\$409,605	\$0.059
1892	938,743	2,407,956	2.57	26,042,063	1,288,102	.049
1893	408,014	1,097,967	2.69	7,966,819	482,085	.061
1894	78,580	242,617	3.09	2,846,645	168,054	.059
1895	818,711	1,954,318	2.39	7,085,946	461,214	.065
1896	360,002	930,289	2.58	26,691,963	1,340,507	.050
1897	1,503,981	2,371,143	1.58	30,775,401	1,340,159	.044
1898	605,390	1,684,717	2.78	31,031,254	1,897,725	.061
1899	380,222	1,210,459	3.18	19,305,739	1,245,733	.065
1900	526,636	1,444,655	2.74	34,964,010	2,247,851	.064
Annual average.	575,549	\$1,382,102	\$2.40	19,368,301	\$1,088,104	\$0.056
1901	883,673	\$2,058,964	\$2.33	28,309,023	\$1,510,581	\$0.053
1902	459,719	1,628,886	3.54	15,664,468	1,190,593	.076
1903	1,656,129	4,381,801	2.65	39,646,297	2,378,635	.060
1904	2,018,262	5,446,473	2.70	48,301,665	2,791,421	.058

Areas.—There are in Walworth township 1,773¼ acres of orchard made up of areas as large or larger than one acre. This township contains about 34½ square miles. There are, therefore, 51 acres of apples per square mile; or a little over 8 per cent of the land is devoted to orchards. In Ontario township there are about 40 acres per square mile, in Macedon about 19 acres. With the exception of Walworth and probably Marion townships, it may be said that the area devoted to orchards increases as we approach the lake.

The total area devoted to apples in the county is about 21,000 acres. The area of the county is 621 square miles. This gives 33.8 acres of apples per square mile, or 5.3 per cent. The census shows that there are 305,299 acres of improved land in farms. The apple orchards equal 6.9 per cent of this area.

According to the census report for 1899, there were 796,610 "trees of bearing age" in the county. This survey shows the average number per acre to be 41.8. This number of trees would therefore represent an area of about 19,000 acres. Probably 2,000 acres were not of bearing age, or have been set since 1899. This would seem to support

the above estimate, or perhaps the estimate substantiates the census returns, for this work should be much more accurate than the census.

The average area for each proprietor in Walworth is 5.4 acres. This includes all orchards as large as one acre. In the remainder of the county such small orchards were not recorded, so that the average does not give an accurate idea of the average size. The average of those examined was 17.2 acres.

The development of the commercial orchard.—Half a century ago the agriculture of Western New York was grain raising and general farm-



FIG. 40.—Many of the public roads are lined with apple-trees.

ing. The orchards were “kitchen orchards.” They were planted around the house or in some corner that could not be used for the regular crops. The busy farmer paid little attention to the trees. He merely gathered the apples, and gave about the same attention to the orchard that the boys gave to the chestnut tree. The apples were a clean gift. If there were enough for the kitchen and the cider barrel the farmer was satisfied. He had no quarrel with the worms or the scab fungus. The more worms the more cider apples, and since the farmer sometimes appreciated the cider barrel fully as much as he did the apple barrel, he was willing to share the crop with the insects.

About 1860 men began to plant real commercial orchards. For the first time in the history of the new world, large commercial apple orchards were planted with a view to selling the fruit. It is no wonder that some mistakes were made. The old ideas gained from the kitchen orchard and cider manufacture were naturally carried over into the new industry. Little was really known about the apple-tree. No one knew much about insects and fungi, or how to treat them. Nor did they know how to market fruit. Transportation and markets had to be developed. The poor fruit and low prices discouraged many men. A few even cut down their orchards.

But these years accomplished much. The cheap apples educated the taste of the public and created a demand for more apples. Together, the farmer and Experiment Station man have worked out methods of culture, and have learned how to control the enemies of the apple.

But it takes time for new ideas to become established. The farmer is conservative. It is well that he is so. Because he moves slowly, he moves surely. He never needs to retrace his steps. We cannot expect every one to accept all the new ideas in orchard treatment as soon as they are advanced. It has always required a generation of men to establish any new agricultural system. Changes must largely come through the new generation. Some mature men can readily adapt themselves to new conditions, but it is usually the young man, born under these conditions, who really accepts them.

The many neglected orchards are records of the agriculture of the past, the growing number that are well cared for are the forerunners of the new. In the next fifty years the lake counties of western New York seem destined to become one continuous fruit farm of apples, pears, peaches, cherries, plums and small fruits.

The change from general farming to fruit farming has been very gradual. The decrease in the fertility of the soil and western competition have forced men who were trained in grain farming and who preferred that work to become fruit growers. The grain crops have generally ceased to be profitable when grown for market. This has directed attention to the small apple orchard which has so frequently supported a family when the remainder of the farm gave no profit, or an actual loss. There are many men who still neglect the orchard to care for the field crops when there is not time to take good care of both, but others take the businesslike view and tend to the most profitable crop first.

All through this report the fewer orchards, poorer care, and less yields in the south part of the county are apparent. This difference may be due partly to the more favorable climate near the lake, but this factor is a minor one. The south part of the county has, in general, soils that retain their fertility longer than those in the north part. The grain crops consequently continued profitable for a longer time. The orchards are less profitable because less care is given to them. When equally well cared for they have given as good crops as have those in the north part of the county.

The last few years have seen a rapid improvement in orchard management. Ten years ago there were few cultivated orchards except those in which crops were grown. Orchards were quite commonly considered to be an unprofitable investment. How could they be profitable when not tilled, pruned, fertilized or sprayed? But a gradual improvement has been taking place and has been reflected in the increased profits, until apples are now looked upon as the money-producing crop of the county. Nearly all orchards have received improved care in some respect. It may have been nothing more than a spraying or pruning, or an application of manure when all of these were needed, but the trees have almost invariably responded to any kind of improved care. Fourteen per cent have been distinctly renovated during the past ten years. These have been fairly well cared for in every way.

The canker worm formerly devastated large numbers of orchards year after year. Spraying came into popularity in combating this pest. The canker worm is now almost exterminated, but the many other good effects of spraying have firmly established this practice. Even those orchards which are not sprayed must be greatly benefited, because the men who do spray help to keep the insect enemies of the entire neighborhood in check.

But what has been done in the past ten years in renovating orchards is small in comparison with what remains to be done. The apple-consuming public is constantly demanding a better product. This means that the fruit-grower who can not or will not produce good apples must fall out of the race. Each year a large number of such men is giving place to energetic men who are not satisfied to grow anything but the best. It is these good fruit-growers that will insure the continued supremacy of New York apples.



Picking the crop. The customary method.

CHAPTER II.

TILLAGE.

Acreege of tilled and untilled orchards.—About 30 per cent of the orchards that were set before 1880 were tilled in 1903. This percentage is slightly below what it would have been in a favorable season. The very dry weather in the early spring prevented many from plowing.

About half of the orchards of the county have been in sod five to ten years or more. The other half are tilled more or less. In the south part very few old orchards are tilled,—only 12 per cent in 1903. In the north part tillage is much more common. It is practiced more in Walworth township than in any other part of the county. Here less than one-third of the orchards are in sod permanently (see Table 7 and 8).

TABLE 7.
Treatment prior to 1903. Trees set before 1880.

TREATMENT.	WALWORTH.			REMAINDER OF THE COUNTY.			ENTIRE COUNTY.		
	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.
Tilled 5 years or more..	44	307¾	25	12	219½	15	56	527¼	20
Tilled most years.....	64	242	20	8	208	14	72	450	17
Sod most years, tilled occasionally.....	73	323	27	18	195½	13	91	518½	19
Sod 5 years, or more...	87	335	28	58	852½	58	145	1187½	44

TABLE 8.
Treatment in 1903 of orchards set before 1880.

TREATMENT.	WALWORTH.			SOUTH PART COUNTY.			NOR'H PART COUNTY.			ENTIRE COUNTY.		
	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.
Sod (not pastured)	132	460	30	9	95	23	17	218½	19	158	773½	25
Sod (cattle pas- ture).....	71	342	22	18	173½	43	14	333	29	103	848½	27
Sod (sheep pas- ture).....	8	47	3	5	44	11	11	239	21	24	330	11
Sod (hog pasture)	44	151	10	6	46	11	3	27	2	53	224	7
Total sod.....	255	1000	65	38	358½	88	45	817½	71	338	2176	70
Tilled.....	124	538½	35	6	49	12	17	343	30	147	930½	30

Crops were grown in 1903 in about one-third of the tilled orchards. About 8 per cent of the entire area, or 27 per cent of the tilled area, was sown to cover-crops, to be plowed under. The remainder were tilled without any crop, but a cover-crop of weeds was quite common.

Three-fourths of the orchards set since 1879 were tilled in 1903. Crops were grown in all but 7 per cent of those that were tilled. The young orchard generally takes its place as one field in the crop rotation. This keeps it in sod about one-fourth of the time, in small grain one-fourth of the time, and in tilled crops half the years (Table 9).

TABLE 9.
Treatment in 1903 of orchards set since 1879.

TREATMENT.	WALWORTH.			REMAINDER OF THE COUNTY.			ENTIRE COUNTY.		
	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.
Sod (not pastured).....	13	41	19	4	16½	4	17	57½	9
Sod (pastured).....	3	11½	5	4	82	20	7	93½	15
Total sod.:.....	16	52½	24	8	98½	24	24	151	24
Tilled.....	48	163½	76	16	312	76	64	475½	76

Yields of tilled and untilled orchards.—Table 10 gives the yields for four years of orchards that have been tilled every year for at least five years previous to the crop reported, those that were tilled over half the years, those that were tilled occasionally but not half the time, and for those that have been in sod every year for at least five years.

It will be seen that the tilled orchards have given a uniformly large yield than those in sod, the four-year average of the tilled ones being 80 per cent above that of the untilled. Perhaps the most striking point in the tables is the uniform agreement of the averages for each of the three parts of the county and for each of the four years. It should be remembered that these tables include every orchard set before 1880, for which reports of yields could be obtained, and that every orchard in Walworth was examined. There can be no further question as to whether the average sod or the average tilled orchard in Wayne county gives the larger yield.

TABLE IO.
Yields in bushels of tilled and untilled orchards. Trees planted before 1880.

	WALWORTH.			SOUTH PART OF COUNTY.			NORTH PART OF COUNTY.			ENTIRE COUNTY.		
	No. orchards	Acres.	Average yield.	No. orchards	Acres.	Average yield.	No. orchards	Acres.	Average yield.	No. orchards	Acres.	Average yield.
1900.												
Tilled 5 years or more.....	29	145 1/4	347	.....	.....	.....	6	77 1/2	328	35	222 3/4	341
Tilled most years.....	29	94 1/2	388	.....	.....	.....	7	204	273	36	208 1/2	309
Sod most years, tilled occasionally....	33	145 1/2	294	6	40	332	4	55 1/2	297	43	241	301
Sod 5 years or more.....	26	100	264	8	81 1/2	110	17	439	139	51	620 1/2	156
1901.												
Tilled 5 years or more.....	26	155 1/4	59	.....	.....	.....	6	77 1/2	126	32	232 3/4	82
Tilled most years.....	32	123	79	.....	.....	.....	6	196	69	38	319	73
Sod most years, tilled occasionally....	43	190	15	7	47	61	4	55 1/2	55	54	202 1/2	56
Sod 5 years or more.....	40	181 1/2	45	13	133 1/2	31	16	294	23	69	609	31
1902.												
Tilled 5 years or more.....	42	303 3/4	301	.....	.....	.....	11	179 1/2	344	53	483 1/4	317
Tilled most years.....	59	220 1/2	265	.....	.....	.....	8	208	295	67	428 1/2	279
Sod most years, tilled occasionally....	69	306	227	10	99	211	6	86 1/2	173	85	491 1/2	214
Sod many years.....	70	295	202	25	221 1/2	181	27	584	160	122	1100 1/2	176
1903.												
Tilled 5 years or more.....	27	293	335	.....	.....	.....	4	86	291	31	379	325
Tilled most years.....	20	79 1/2	274	.....	.....	.....	4	45 1/2	222	24	125	255
Sod most years, tilled occasionally....	22	118 3/4	261	4	33 1/2	242	5	73 1/2	199	31	225 3/4	238
Sod 5 years or more.....	24	123 1/2	268	11	74	196	8	171	218	43	368 1/2	230

Four-year averages per acre:
 Tilled 5 years or more..... 266 bushels
 Tilled most years..... 229
 Sod most years, tilled occasionally..... 202
 Sod 5 years or more..... 148

A part of this very great difference is doubtless due to other factors. The man who regularly tills his orchard is more likely to fertilize, prune and spray well. To see how much of this difference is due to tillage and how much is due to other factors another classification was made.

Table II shows the average yields of those orchards that have been fairly well cared for. They differ only in the factor of tillage. All have received some fertilization, have been fairly well pruned, are not diseased or in bad condition from any cause. Of these well cared for orchards the tilled ones gave an average of 35 per cent above the untilled. This tabulation doubtless gives too high a yield for the

TABLE II.

Yield in bushels of tilled and sod orchards. Average for the entire county of trees set before 1880. Orchards all well cared for.

TREATMENT.	1900.			1901.		
	No.	Acres.	Average yield.	No.	Acres.	Average yield.
Tilled 5 years or more.....	25	175¾	348	22	177¼	99
Tilled most years.....	22	181	353	21	188	38
Sod most years.....	24	209	260	25	244½	72
Sod 5 years or more.....	25	206	224	31	249	45

TABLE II—Concluded.

TREATMENT.	1902.			1903.			Four-year average.
	No.	Acres.	Average yield.	No.	Acres.	Average yield.	
Tilled 5 years or more....	38	401¾	311	23	345	326	271
Tilled most years.....	38	261½	339	16	99½	249	245
Sod most years.....	46	365½	235	15	122	257	206
Sod 5 years or more.....	47	356½	269	22	157¾	263	200

orchards in sod, for in making it all diseased ones were thrown out. In many cases these should have been included, for the disease frequently gets a foothold because the sod has lowered the vitality of the trees. The real difference due to sod will therefore lie between the 80 per cent shown by Table 10 and the 35 per cent shown by Table II.

Does tillage pay?—These tables do not show that every sod orchard should be tilled, but they do show that it would pay to till the average

one. If a sod orchard is giving good yields, and if the trees are making sufficient growth to keep up their vitality, it may be desirable to keep it in sod. By the liberal use of barnyard manure or straw mulch, an orchard may be kept in good condition without tillage. The trouble is that so many do not receive enough of either. The same results may be accomplished with much less manure if the orchard is tilled. If the orchard is in sod and is not yielding well, or if the trees are losing their vitality, even if the yield is still good, it will probably pay to till.



FIG. 41.—*One year's growth in a cornfield. A five-acre orchard planted by Jay E. Allis. Compare with Fig. 42.*

Whatever the best treatment of a thrifty orchard may be, there is no question about the advisability of tilling one that needs renovating or of tilling young trees (see page 309, and Figs. 41, 42, 43).

There are some marked advantages of sod. It requires less work to leave the trees in sod. If the land is very stony, the tillage brings the stones to the surface and makes a bad place for the apples to fall. Sod is also better to haul spray rigs over. Perhaps the greatest advantage is in having a sod for the apples to fall on. This is particularly desirable when the entire crop is to be shaken off for evapo-

rating. Cover-crops will, to some extent, take the place of sod, but it is difficult to get a good cover-crop under large trees. Apples usually color better on sod and are said to keep better, but are not so large. Some experiments are now being conducted on these points.



FIG. 42.—*One year's growth when set in timothy sod. A 13-acre orchard in Orleans county. (Compare with Fig. 41.) Here the trees are of secondary importance.*

Tillage, fertilization, pruning and spraying are the chief factors that enter into good care of an orchard. One or more of these may sometimes be omitted without seriously affecting the trees. Tillage may



FIG. 43.—*A few furrows plowed along each tree row lessen the evil effects of sod. Would it not pay better to raise only tilled crops?*

lessen the need for fertilization. Fertilization may help to make up for lack of tillage. Some years few insects or fungi attack the trees, so that spraying is not much needed. Very frequently a grower becomes impressed with the importance of one of these factors and makes a hobby of it to the exclusion of all the others;

but the most successful man is the one who keeps a proper balance between all four, and who does not expect spraying to replace manure, tillage or pruning, or vice versa.

Where does your orchard come, in the table on page 350? Is it where you want it to be? If so, continue your present methods; if not, then try to find out where the trouble is.

The results of good and bad treatment are not always apparent the first year.—The great difficulty in determining what kind of treatment pays best in any particular orchard is the fact that it may be several years before the results are apparent in the difference in crops. If this fact were kept in mind by the orchardists, a very large part of the differ-



FIG. 44.—*Tillage v. neglect.* The rows on the right were left in sod, those on the left were tilled. The trees were otherwise similarly treated, and are of the same age.

ence of opinion as to the best method of caring for an orchard would disappear. Very frequently a grower has followed a few years of good care by a period of neglect and has received an increased yield as a result. The trees may be making almost no new wood, and may be so lowered in vitality as to be easy victims of canker and other diseases. Yet the increased crop may have persuaded the grower that this is the ideal treatment. *No care can be good if it does not look out for the future of the orchard.* Many orchards need treatment that will actually decrease the yield for several years, while care that will

greatly increase the yield may be destroying the trees or shortening their period of life. *The most profitable crop that could be grown in many orchards is new wood, and consequent new vigor in the trees.* The returns may be more apparent in five or ten years than in the first year or two. Occasionally there is an orchard that is growing too



FIG. 45.—One kind of "culture." This twelve-acre orchard could be renovated and made a good orchard.

fast and that would be benefited by sod, but they are not common. A much larger number are dying back faster than new wood is being formed.

In Fig. 44 is shown an experiment in orchard management that was carried on by T. G. Yeomans & Sons for many years. The trees on the left were tilled and fertilized. Those on the right were fertilized the same

but were left in timothy sod. The trees in sod are so badly weakened that the land has been plowed and a start made toward renovating them.

Methods of tillage.—Orchards are commonly plowed in the fall. This is frequently done so as to have less spring work. Early spring plowing would seem to be much more desirable for an orchard. The grass or weeds will hold the snow and leaves.

In a few orchards the roots are so near the surface as to prevent plowing. Such an orchard may be tilled with a spading harrow, disk or, on sandy soils, with a spring-tooth harrow.

The ideal system of tillage for most orchards is early plowing or disking, followed by clean tillage until about July 1st. Some kind of a cover-crop is then sown. This cover-crop will produce humus to be plowed under; it furnishes a partial substitute for sod for the apples to fall on; it will help to remove surplus water during the latter part of the season and thus cause the fruit to color better. Fig. 61 and the frontispiece show orchards that are receiving this kind of treatment.

Methods of sod treatment.—Many of the orchards that are in sod are pastured by cattle, hogs, sheep and horses. From some hay is cut; from others the grass is not removed,—usually because there is not enough to pay for cutting. A very few farmers are trying the so-called mulch method of cutting the grass that grows in the orchard and leaving it where it falls or throwing it under the trees. There were not enough of them, nor had the work been continued long enough so that a statistical report could be made.

Table 12 shows the yields for 1902, with the different methods of sod treatment. The number of orchards is not sufficient to give conclusive results. It would appear that pasturing with cattle is the worst possible treatment for an orchard, a conclusion that is in

TABLE 12.

Yields in bushels for 1902, with various methods of sod treatment. Trees set before 1880.

TREATMENT.	No. orchards.	Acres.	Average yield.
Pastured with hogs	22	105½	271
Pastured with sheep	15	232	216
Pastured with cattle	54	392	159
Sod, not pastured ..	47	256½	185

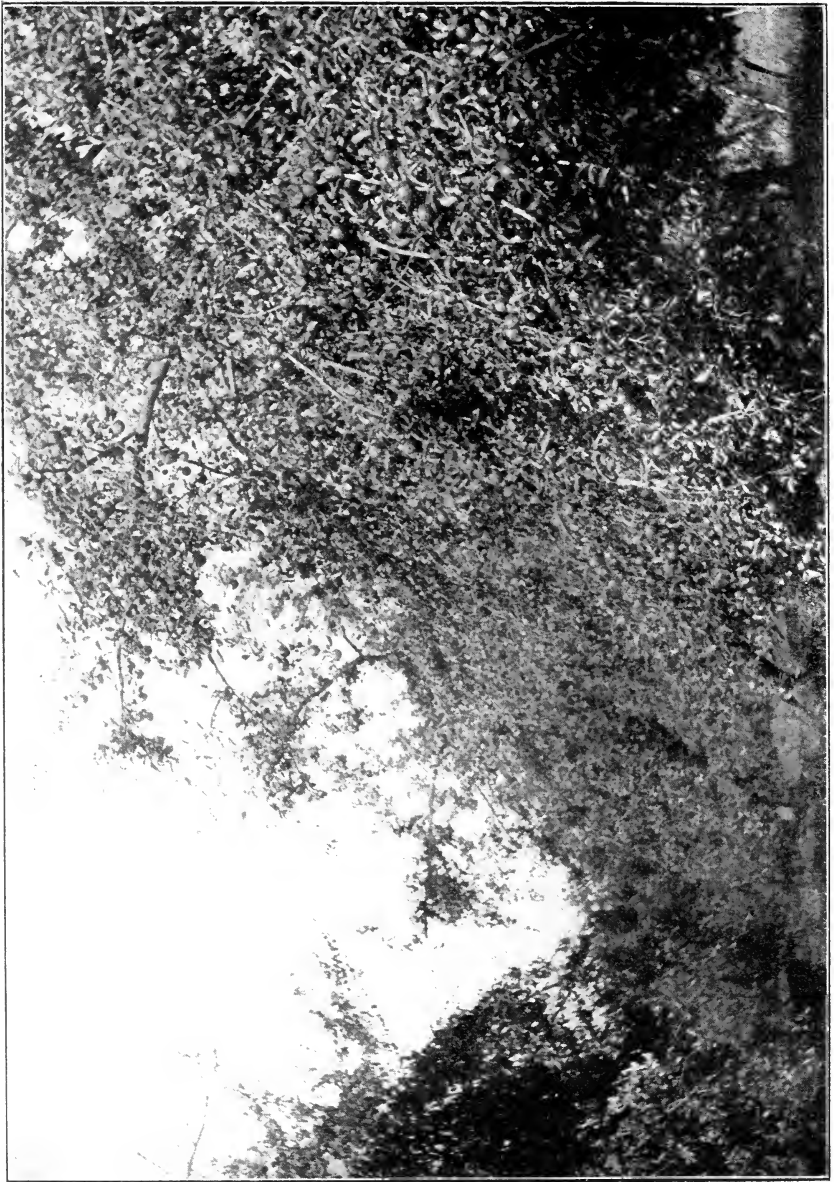


FIG. 46.—A noted sod orchard. This has been in sod fourteen years and has always been an excellent producer.

accord with the appearance of the orchards thus pastured. Cattle rub on the trees, break the branches and browse the limbs as high as they can reach. The few dollars that it would cost to procure a regular pasture for them is lost many times over by the damage to the trees. Horses are not so frequently pastured in the orchards, but are equally injurious. In one case a good young orchard had nearly every tree stripped of its bark by a span of horses. The orchard was worth about five times as much as the horses.

Next in the scale of injuriousness to pasturing cattle in an orchard is the raising of hay in it. The hay crop grows in the spring at the time when the apple-trees make their growth. It therefore uses the plant-food and water at the time when the trees need it most. If the grass is left on the ground the mulch helps to preserve the moisture, and leaves the plant-food so that the damage is not so great.

Sheep crop the grass close to the ground, and so to some extent prevent the large evaporation that occurs in a hay field. The manure dropped by them is also of considerable value. Fig. 46 shows an

orchard that is pastured by sheep early in the season. This is one of the best sod orchards. Large applications of barnyard manure are used. Several of the limbs that show a lack of foliage are infected by canker. If sheep are allowed to run in the orchard during the latter part of the season, they frequently pick many apples. If prices are good, the apples eaten may be of more value than the sheep (see Fig. 47).

Pasturing with hogs seems to give better yields than any other method of sod treatment. The hogs usually do considerable rooting, and so prevent the formation of a tough sod. In some cases the orchard that has hogs in it might almost be classed as a tilled orchard. The difference is also largely due to the manure. The hogs receive most of their food from outside the orchard, so that there is a constant addition to the plant-food in the soil. Cattle and sheep are usually fed much less.



FIG. 47.—*Sheep have removed about a barrel of apples from each tree in this orchard.*

Hogs frequently do considerable damage to the trees, particularly if the feed-yard is in the orchard. Around the place where they are fed they rub the trunks and roots, pack the soil so as to make it impervious to air, and sometimes bark the trees. It is well to remember that one good apple-tree is worth more than a hog, and that a small strip of bark removed will usually result in a decayed tree. There should always be a feed-yard outside the orchard.

Hogs or sheep do considerable good by eating the apples that fall early, and so disposing of many worms.

None of the methods of sod treatment equal tillage in average yields. A comparison of Table 12 with Table 10 shows the force of this statement.

CHAPTER III.

FERTILIZATION.

Fertilizers used.—The majority of orchards receive no commercial fertilizer or green manure, but are given a limited amount of barnyard manure—usually much too limited. One-third receive no fertilizing of any kind. Sixty per cent receive barnyard manure, either alone or in combination with commercial fertilizer, green manure, etc.; green manure is used alone or in combination in 12 per cent; commercial fertilizer is used alone or with other manures in 13 per cent (see Table 13).

These figures show too high a percentage receiving some kind of fertilizer. In many cases only a little manure was applied, but the orchard was included with those receiving manures. In others the fertilization was given so long ago as to be of no consequence at present. Probably less than half the orchards receive enough to entitle them to be properly included with those receiving fertilization.

TABLE 13.

Summary of fertilizers used. All ages of orchards included.

FERTILIZER.	USED ALONE.			USED WITH OTHER FERTILIZERS.			TOTAL.		
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.
None.....							154	1101½	33.5
Barnyard manure	214	1453¾	44.3	58	509	15.5	272	1962¾	59.7
Commercial fertilizer.....	10	103	3.1	40	313	9.5	50	416	12.6
Green manure...	14	117½	3.5	17	291½	8.8	31	409	12.3

Orchards receiving no fertilization of any kind.

	No. orchards.	No. acres.	Per cent.
Walworth.....	117	453	31.4
South part of county.....	21	241	62.2
North part of county.....	16	407½	28.1

In many of the fertilized orchards the manure was used with a view to helping some crop planted in the orchard. Of course if it is applied, the apple-trees will make use of a part of it.

Fertilization and yield.—The records of the use of barnyard manure and fertilizers do not cover a long enough period to be used in comparing crops before 1902. The average yields of fertilized orchards for the years 1902 and 1903 were 55 bushels above that of those that were unfertilized (see Table 14).

TABLE 14.

Yield in bushels for 1902 and 1903 for fertilized and unfertilized orchards. Trees set before 1880.

	1902.			1903.			Two-year average.
	No. orchards.	Acres.	Average yield.	No. orchards.	Acres.	Average yield.	
Fertilized	292	2, 116¼	233	147	1, 210½	281	257
Unfertilized	111	692	173	44	343½	231	202

Necessity for fertilization.—The cultivated orchards demand much less fertilization than the untilled ones, for the tillage makes food that is in the soil available. There are, however, very few soils that do not need some material added at least in the form of green manure.

Many of the less progressive growers fail to recognize the orchard as a crop that requires food as do other crops. A common reply to the question of the kind of manure used was, "We don't raise anything in the orchard so we do not use any manure or fertilizer," the growth of wood, leaves, and apples not being recognized as a drain on the plant-food in the soil. But the number of those who recognize the orchard as a crop requiring food and care is rapidly increasing. The small, light-colored leaves, the very little growth, the small apples, are requests for food. The owner should answer the demand with manure or tillage, usually with both.

The amount of plant-food removed by the apple crop compared with that removed by the wheat crop.—The following tables, based on Bulletin No. 103 of this Station, show something of the demands made by the apple orchard. All the leaves were gathered from a medium-sized, mature apple-tree and were analyzed. The trunk, branches and the roots were also analyzed.*

*Cornell Bulletin 103. October, 1895. This bulletin is now out of print.

TABLE 15.

Plant-food in apple leaves.

	Leaves of one tree analyzed.	Estimated for one acre of 35 trees.
Total weight.....	232.02 lbs.	.....
Total weight water.....	139.51 "	.....
Total weight dry matter.....	92.51 "	.....
Total weight nitrogen.....	.96 "	33.6 lbs.
Total weight phosphoric acid.....	.37 "	12.95 "
Total weight potash.....	1.32 "	46.2 "

TABLE 16.

Plant-food in wood and roots.

	Wood and roots of one tree analyzed.	Estimated for one acre of 35 trees.	Estimated amount removed per year.*
Total weight.....	5,251.4 lbs.	.....	.....
Total weight water.....	2,300.18 "	.....	.....
Total weight dry matter.....	2,951.22 "	.....	.....
Total weight nitrogen.....	8.09 "	283.15 lbs.	6.29 lbs.
Total weight phosphoric acid....	3.07 "	107.45 "	2.39 "
Total weight potash.....	7.55 "	264.25 "	5.87 "

*To get the estimate of the amount required for wood and roots each year, it was assumed that $\frac{1}{3}$ of the mature tree was grown each year. Trees 45 years old are usually larger than the tree analyzed.

TABLE 17.

Composition of wheat.

	Water.	Nitrogen.	Phosphoric acid.	Potash.
Grain	14.75%	2.36%	0.89%	0.61%
Straw	12.56	.56	.12	.51

Composition of apples.

Water.	Nitrogen.	Phosphoric acid.	Potash.
85.3%	0.13%	0.01%	0.19%

TABLE 18.

Total plant-food removed in one year by wheat and by apples.

	Nitrogen.	Phosphoric acid.	Potash.
300 bushels of apples.....	19.50 lbs.	1.50 lbs.	28.50
Leaves.....	33.60 "	12.95 "	46.20
Wood.....	6.29 "	2.39 "	5.87
Total	59.39 lbs.	16.84 lbs.	80.57
20 bushels of wheat.....	28.32 lbs.	10.68 lbs.	7.32
2,500 pounds wheat straw.....	14.00 "	3.00 "	12.75
Total	42.32 lbs.	13.68 lbs.	20.07

According to these estimates it requires, for crops of the size indicated, about four times as much potash, and more nitrogen and phosphoric acid, to grow the apples than is required to grow the wheat. In considering these tables there are several points to keep in mind. The apple roots go deeper into the ground and so have more soil from which to draw their food supply. If the ground has some kind of a crop growing on it, the leaves may be largely retained in the orchard. The amount of plant-food used by the wood is not very well known, as it is difficult to determine what an average growth is. But even the 300 bushels of apples, without any leaves or wood growth, require more potash and nearly half as much nitrogen as is required to produce the wheat and straw.

Manure may be shipped in from the cities.—A few of the more progressive growers have shipped in manure from Buffalo. This costs about \$28 per car, but if applied when needed it gives a very large return. Some have feared to use it on account of the danger of getting weed seed. There seems to be no trouble in subduing any weeds that come with it when it is applied to the orchard. There may be some danger of animal diseases being carried in the manure. A much larger total of manure is secured from the many smaller cities and towns, but this is usually not obtainable in very large quantities.

Manure may be profitably secured by the feeding of cattle.—A few growers have fed cattle during the winter in order to secure manure. This enables them to buy their fertilizer in the form of feed. The cattle usually give a fair profit. The manure obtained, added to this, makes

the practice quite profitable. It seems probable that more of this winter feeding will be done in the future. The expense of caring for stock in the winter is not very great. The fertilizing value of the feed is frequently over half of its cost.*

Method of applying manure.—Manure is almost always applied in a small circle around the base of the tree. This is a serious mistake. The roots of a bearing orchard occupy all the ground. Those from one row may extend beyond the next row. The small feeding roots are naturally most numerous at some distance from the tree, much as the active twigs are found at the ends of the large branches. The manure should therefore be applied to the entire ground. If any place is not covered, let it be that near the trunk. Professor Roberts has aptly likened the application around the trunk to putting the hay under the horse's feet.

Cover-crops.—More orchards are in need of humus than are in need of the direct application of plant-food. For this reason the application of barnyard manure generally gives much better results than the use of fertilizers. This is particularly true of sod orchards. Tilled orchards usually do as well when green manure with potash and phosphoric acid are used. On some of the stronger soils no fertilization of any kind may be needed for many years, if plenty of green manure is plowed under.

Eight per cent of the mature orchards of the county were sown to cover-crops in 1902. Buckwheat was the most common, followed by crimson clover and common red clover. Rye, large clover, cow-peas, alfalfa, peas and oats, and vetch were also grown. Buckwheat furnishes a large amount of humus and leaves the soil in a friable condition. It is not a legume, and so can not use nitrogen from the air. Crimson clover has generally done well, but some growers have had difficulty in getting a stand. One man has grown it every other year for fourteen years. Common red clover has been most satisfactory when a year of tillage has been followed by a year in which the clover is cut and left on the land to be plowed under the second year. Peas and oats have given good results in most cases.†

*For tables of the value of the fertilizing elements in various feeds, see Cornell Bulletin 154.

†For a more extended discussion of orchard cover-crops, see Cornell Bulletin 198.

CHAPTER IV.

PRUNING.

The former methods of pruning.—Pruning was at first greatly neglected. Just as the majority of orchards were formerly left to fight their way in competition with other plants, so the limbs in each tree were allowed to fight with each other. Only a few orchards have been well pruned from the time of planting. In some pruning was almost entirely neglected for years; in others it was done and is still



FIG. 48.—Years of neglect followed by too severe pruning.

done in such a manner as to do more harm than good. There is a tendency among careless farmers to let the trees go for several years and then give them a “thorough trimming” (see Fig. 48), rather than prune some every year, as the careful grower does. Perhaps one-fifth of the orchards are now well pruned, and this number is being added to each year, as the number of real fruit-growers increases. The problem of pruning among the bearing trees of Wayne county is, therefore, not that of training an ideal tree from the time it is planted; but the far more difficult problem of correcting the effects of former neglect.

How wounds heal.—Intelligent pruning is based on a knowledge of the causes of decay, and of the way in which wounds heal.

The living and growing part of a tree is the cambium layer. This is a tissue lying upon the outside of the wood and beneath the bark. From its outside it produces bark, and from its inside it produces wood. It is this layer of young, tender cells that makes the bark "slip" so readily in early summer. The inner part of the tree is not active; its value to the tree is in supporting the living part. If this center part decays, the tree usually continues to grow till it breaks down (see Fig. 52).

This dead inner wood is protected by the bark and living portion so that fungi and bacteria cannot reach it. When a large limb is removed the seal is broken and the dead wood is exposed. Having no life, it cannot resist infection by germs any more than a dead log can do so. The safety of the tree depends on having the wound healed over before it becomes infected. The wound heals by the growth of the cambium layer. If the wound is small it will usually be sealed up before the fungi get established; but if the dead stub is exposed for a long time the wood-rot fungi are almost certain to attack it and cause the trunk to decay. If the wound does then heal over, the mycelium of the fungi is established and may continue to grow within the tree.* The decay may reach into the living tissue, but its most serious effects are in so weakening the trunk as to cause it to break down. In order to avoid the rotten trunks that are so common in the majority of the orchards, three things should be observed:

1. Large limbs should not be removed unless it is absolutely necessary.
2. When such limbs must be removed, the pruning should be so done as to favor rapid healing of the wounds.
3. Large wounds should be protected by paint till the tree can seal them.

The removal of large limbs.—The ideal way would be to have the tree so pruned from the time it is planted that there would never be occasion for the removal of large limbs. But very many orchards were neglected so long that it may be necessary to cut out such limbs. Eighteen per cent of the orchards are still practically unpruned. In a neglected orchard some limbs may be damaged by neglect or lack of food. Others die as a result of the shade caused by dense tops, or the trees being too close together. Even in a well cared for orchard an occasional limb will be broken by the wind, or by too heavy a load of fruit, or will die from other causes. But much of the removal of

*Cornell Bulletin 193, Shade Trees and Timber-Destroying Fungi.

large limbs is done without cause. In the orchard shown in Fig. 48, the trees had too many of these as a result of neglect, but it would have been better to have thinned the tops by the removal of small branches than by cutting out the scaffold limbs. It takes more time to prune by the former method, but the time is well spent. The ultimate death of most trees can be traced to the careless removal of large limbs. The wound is too large to heal, or the cut is made in such a way that it can not heal. Wood-rot fungi get a foothold and soon the tree has a hollow trunk. The wind then breaks off the branches one by one till the tree is gone (see Figs. 52 and 54).

Stub pruning.—Much can be done to prevent the fungi and bacteria from getting a foothold. If the limb is cut close to the body of the tree, and parallel with it, the tree will be able to heal wounds of considerable size before decay sets in. The pruning should be done in such a manner that no portion of the amputated branch is left. If a limb is cut an inch from the body the wound requires much longer to heal than it would if no stub were left. A stub several inches long seldom heals over. It has no life of its own, and so must depend on material that comes from other branches to heal it; but a projecting stub is out of the line of movement of the sap—it is sidetracked. Instead of healing over the end of the stub, a roll of new growth is thrown up around its base where the cut should have been made.

In a little over sixteen per cent of the orchards examined bad stubs were left, varying in length from one or two inches to one foot.

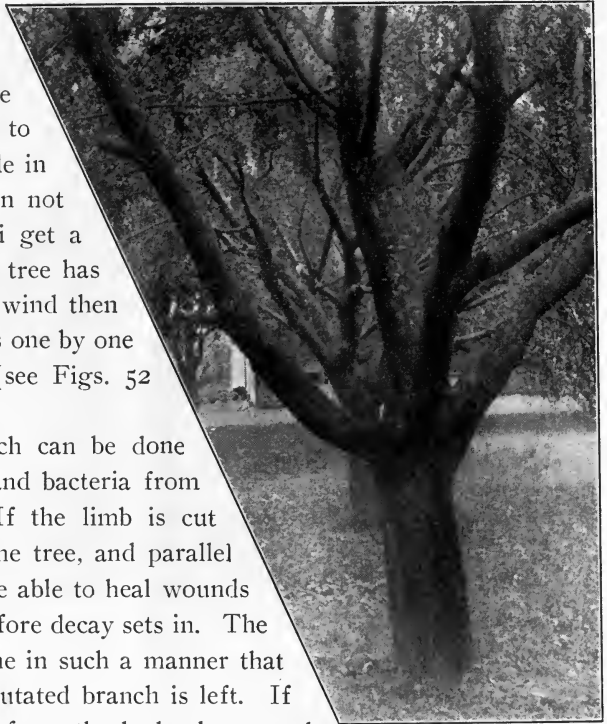


FIG. 49.—Long stubs left when pruning. These cause the trunks to decay and finally result in broken trees.

There are two reasons for leaving these long stubs. One, I fear the more common one, is because it is easier to do so. But many farmers leave a long stub when a large limb must be removed because they think that the wound will be too large to heal, and by leaving the long stub they hope to keep the rot away from the tree. The rapidity with which fungi penetrate the wood after they get started refutes this practice. Success must come from preventing the start of decay, not from giving it a long distance to travel before it gets into the trunk. In one forty-acre orchard the owner left stubs about a foot long to serve as ladders! His successor has gone through the orchard and cut these off and has done what was possible to prevent further decay.

In Fig. 49 is shown a tree with long stubs that will result in its death. Fig. 54 gives what will be the next step. The outside of this



FIG. 50.—The decayed hole caused by wood-destroying fungi. (See Figs. 51 and 52.)

stub shows the seed-forming bodies (spore fruits) of the fungi; but it does not look very bad, while the inside is so decayed that it only needed a good load of fruit to break the tree. Fig. 53 is another stub that will ultimately cause the death of the tree. The tape-measure shows how far the stick extends into the decayed hole. The decay, of course, goes much farther. Fig. 50 shows a decayed hole that was caused by leaving a large wound



FIG. 51.—The same tree as Fig. 50, showing the extent of the decay. The tree was about 16 inches in diameter and had only about two inches of sound wood on the outside, a mere shell. The white mould is the mycelium of fungi.

unpainted. The hole is now nearly closed, but it is too late, as will be seen by Fig. 51, which shows the inside of the same tree. There is only a few inches of undecayed wood on the outside of the trunk. The white mould (mycelium) all through the trunk shows how badly decayed the tree is. The tree was a very thrifty one, and was apparently unaffected, but the rotted trunk was no longer strong enough to support it (Fig. 52).

Paint should be used on the larger wounds.—Only a very few orchards were seen where paint was used. Painting the wounds should become

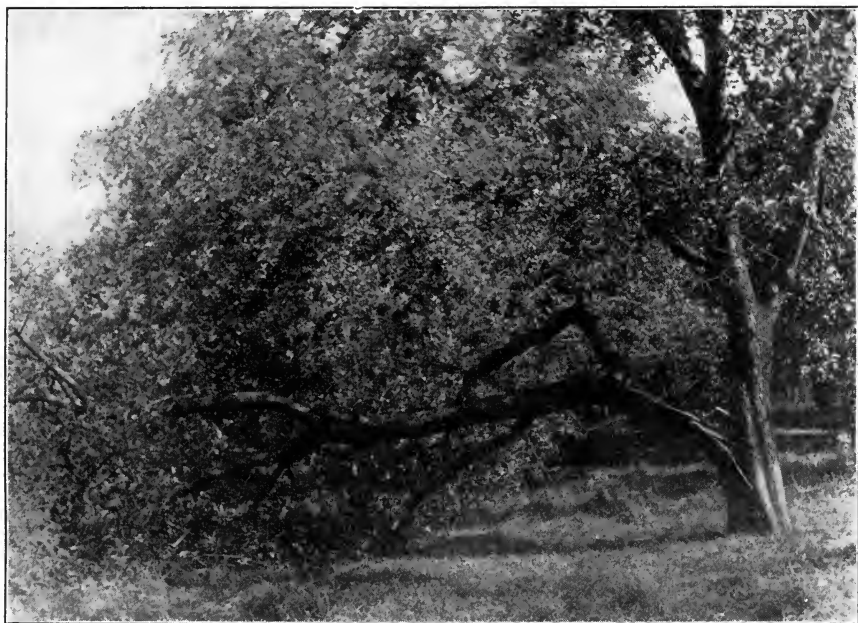


FIG. 52.—The rotten trunk resulted in the breaking of the tree. (See Figs. 50-51.)

an accepted practice. The paint does not help to heal the wounds, nor does it hinder healing, as some have supposed. It is to prevent the wood-rot fungi from getting a foothold. It acts as a partial seal till the tree can protect the wound in its own way—by healing over the place. It has a similar effect as it has on farm machinery. It protects from weather and prevents fungi and bacteria from causing decay. The cost of painting all the wounds above two inches in diameter is not great. If this is done, and if the larger ones are repainted every year, the increased longevity of the tree will amply repay the cost. One good apple-tree will pay for

painting many wounds. Lead paint is the most satisfactory for this purpose, but any durable paint is probably good.

Thinning the tops.—If the tops are so dense that air can not circulate through them it is almost impossible to spray well. The moisture remains long after every rain or dew, and so favors all kinds of fungous growths. The fruit will be of poor quality and poorly colored. Dense tops favor the development of insects and diseases, but not of apples.



FIG. 53.—*The long stub continued. The tape shows how far the stick extends into the rotten trunk.*

The frontispiece shows a well-pruned tree. Notice that the light shines through the top in spite of the fact that there is a large crop of fruit and excellent foliage. Contrast this with Fig. 59. But even this latter orchard is better pruned than the average.

Pruning should vary with the thrift of the trees.—If an orchard is so treated that the leaves are small and the growth very little, many more limbs should be left than in a thrifty orchard. Poor color of the fruit in tilled orchards could be improved to some extent if these trees were pruned more openly. The tree in the frontispiece shows ideal conditions. The air and light can filter through the top and reach every leaf and every apple. If this tree were not tilled or fertilized it could have about double the number of limbs without making the tops any denser. A neglected tree would be a mere skeleton if pruned as this thrifty tree is pruned.

When is the best time to prune?—As a result of a series of experiments in pruning at various times in the year Professor Bailey concludes as

follows: "The conclusion,—and my general opinion,—in respect to the season of pruning, so far as the healing of wounds is concerned, is this: The ideal time is in spring, before growth begins (late February, March and early April in New York;) but more depends on the position of the wound in the tree and



FIG. 55.—*The crotch which will probably cause the tree to split. One of the leaders should be removed.*



FIG. 54.—*The long stub resulted in the broken tree.*

the length of the stub than on the time of year."* The best time to prune will generally be the time when labor is least expensive.

How to treat crotches.—The best way to treat a crotch is never to allow one to form; but when one secures an orchard in which they are already formed he must do what is possible to correct the weakness.

In Fig. 55 is shown a young tree with a bad crotch that will be quite certain to ruin it. One of the forks should be cut off. Fig. 56 shows the trunk of an old tree similarly pruned. Fig. 57, from the same orchard as

*The Pruning-Book, fourth edition, 1902.

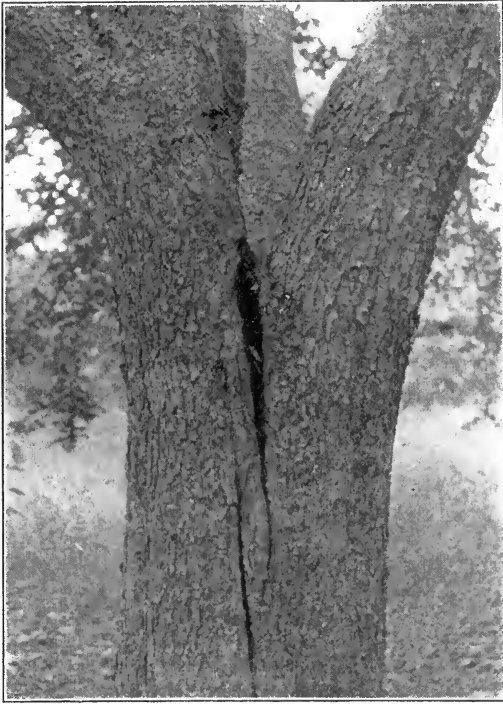


FIG. 56.—*The result of bad crotches. The tree can be saved for further usefulness by bolting the two halves together.*

Fig. 56, shows two of the split trees and several vacant spaces where broken trees have been removed. Nearly one-fourth of the trees in this seven-acre orchard are already broken down, and as many more are split. There are only a few orchards in the hundreds examined in which the trees were thus systematically pruned to form crotches, but in a large number of orchards a few trees have them.

The split trees and those that are in danger of splitting can yet be saved by the use of bolts. A band put around a tree will girdle it, but a bolt put through it does no appre-



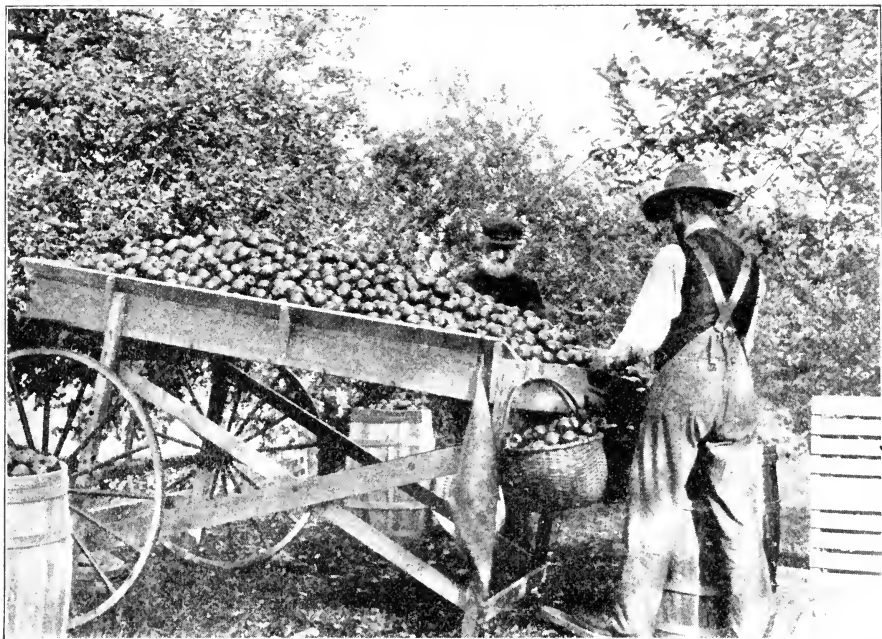
FIG. 57.—*The final result of bad crotches.*

ciable damage. If two bolts that hook into a connecting chain of suitable length are used, the work can be much more easily done. The two holes are then not necessarily in the same line. The chain also allows for variation in length. One bolt is put through one branch, the other is put nearly through the other branch, and the chain is hooked on at the proper length. The bolts are then drawn up. Or bolts with hooks or rings on one end may be used and strong wire used to fasten them together.

Number of scaffold limbs.—In Fig. 58 is shown a tree with too many scaffold, or frame work, limbs. The time to avoid this is when the tree is young. Some of the smaller limbs might still be removed with safety if the wounds are kept well painted.



FIG. 58.—*Too many scaffold limbs. Half of these should have been pruned out when the tree was young.*



The usual method of sorting in Orleans county—directly from the table.



Picking from the table—a slower but more careful method of sorting.

CHAPTER V.

SPRAYING.

The extent of the practice.—The fact that so many growers evaporate their entire crop gives rise to a general laxity in spraying. A little over 41 per cent of the trees set before 1880 were sprayed in 1903. One-third are seldom or never sprayed.

In 1902 most buyers of apples for evaporating paid the same price regardless of the scab fungus. This fungus does not seriously damage apples for evaporating unless it is so bad that it stunts or distorts the apple or makes it crack. (See Fig. 81.) In 1902 it was very bad in many orchards. The clean apples were generally considered to be worth more, but were bought at the same price, as one man said, "in order to keep peace in the neighborhood." This puts a premium on neglect and probably accounts for the large number who do not believe in spraying and for the considerable number of those who do spray but do not use the Bordeaux mixture.

Effects of spraying on the yield and price.—The damage from insects and the apple-scab in 1903 was much less than usual. But even in this year of few insects and little fungus, when most people "saw nothing to spray for," spraying paid. The average yield of the sprayed orchards was 27 bushels more than that of the unsprayed. (See table 19). This was probably due chiefly to the prevention of the large loss caused by the bud-moth and to the loss from the codlin-moth. The bud-moth did considerable damage in many orchards, but its work was not commonly seen, or if seen, was attributed to a bad wind that made many leaves turn brown at about the time when the bud-moth caused the young shoots to die. The codlin-moth causes many apples to fall early in the season. A part of the difference may be due to other factors as the sprayed orchards averaged a little better in other treatment.

TABLE 19.

Yield in bushels in 1903 of sprayed and unsprayed orchards. Trees set before 1880.

	No. of orchards.	No. of acres.	Average yield per acre.
Sprayed	66	626¼	280
Unsprayed	107	673	253

TABLE 20.

Price per barrel of sprayed and unsprayed apples in 1903.

	No. of barrels.	Average price per barrel.
Sprayed	8,430	\$2 02
Unsprayed	6,365	1 80

TABLE 21.

Average price per bushel of sprayed and unsprayed apples in 1903.

	No. of bushels.	Average price per bushel.
Sprayed	110,445	\$0 31.8
Sprayed, dried by grower	63,145	.....
Unsprayed	96,345	27.7
Unsprayed, dried by grower	64,305	.....

The average price per barrel of the sprayed apples was \$2.02; of the unsprayed, \$1.80. From the sprayed orchards 15 per cent of the crop was barreled; from the unsprayed, 12 per cent. Without considering the apples that were evaporated by the grower, the average price of sprayed apples was 31.8 cents per bushel; of unsprayed, 27.7 cents.

If we count the apples that were evaporated by the growers as worth 20.7 cents, the average price paid for apples by the evaporators, then the income per acre from sprayed orchards averaged \$77.84; from the unsprayed, \$63. (See tables 20 and 21.)

Most of the sprayed orchards were sprayed but once. Apples from many of these brought no higher prices than unsprayed ones, but some of those that were well sprayed gave so much better yields and secured so much higher prices that they were able to raise the average as shown above.

The kinds of sprays used.—Nearly one-fifth of the trees that were sprayed received applications of arsenical poison sprays only. The smaller orchards were quite commonly so treated. This one-fifth of the area included one-third of the number of sprayed orchards. In 21 orchards Paris green and water were used without any other materials. (See table 22.) In view of this and of the exceptionally favorable year the showing made by such spraying as was done is satisfactory.

Arsenic is coming to be quite commonly used instead of Paris green, particularly in the larger orchards. It stays in suspension better than Paris green and is somewhat cheaper. Arsenic was used in 58 per cent of the area and in 36 per cent of the number of sprayed orchards.

TABLE 22.
Spraying in 1903. Trees set before 1880.

	WALWORTH.			REMAINDER OF COUNTY.			ENTIRE COUNTY.		
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.
Sprayed.....	144	741	50	37	698½	35	181	1439½	41
Sometimes sprayed — not in 1903.....	126	487¼	33	35	406½	20	161	893¾	26
Seldom or never spray'd	64	257½	18	55	882½	45	119	1140	33
<i>Trees set since 1879.</i>									
Sprayed.....	18	83	42	3	80	19	21	163	26
Unsprayed.....	40	112½	58	19	343	81	59	455½	74
<i>Poison used.</i>									
Arsenic.....	25	170	41	19	458½	69	44	629½	58
Paris green.....	58	241	59	19	209½	31	77	450½	42
<i>Bordeaux mixture used.</i>									
Poison only.....	33	122	30	8	74	11	41	196	18
Poison and Bordeaux..	50	289	70	30	622	89	80	911	82

Six orchards were sprayed with lime, salt and sulfur for the San José scale. One of these did not have any of the scale within about ten miles, but the owner was afraid it might come. A few young orchards were sprayed with kerosene emulsion for aphids.

Many of the owners of these small orchards have used Bordeaux mixture at some time or other, and because one careless application did not keep the apples entirely free from fungus have concluded that the copper sulfate was of no value. Some even cite the effects of spraying with Paris green and lime as evidence that spraying does not affect the fungus. The failure of Paris green to kill the aphids, which were quite bad in 1903, is also cited to show the futility of spraying. Of course those who conduct apple-growing on a good business basis are not among these.*

*There are three general classes of sprays: 1. Poisons. 2. Sprays that kill insects by contact. 3. Fungicides.

The insects that chew are the only orchard enemies that we can expect to kill with Paris green, arsenic or other poisons of this nature. The lice, San José scale

When is the best time to spray?—The number of sprayings and the time to give them must be determined by the season and the objects for which a man is spraying. But many of the enemies, like the apple-scab, must be treated before they appear. The time of attack by this fungus varies to some extent in different years. (See page 335 for a discussion of the fungus.) In the 564 orchards examined in Orleans county in 1904 it was found that those apples that were not sprayed *immediately* after blossoming were invariably scabby, regardless of the earlier and later sprayings. To keep the fruit in the best condition more sprayings were needed, but this was by far the most important application. If there is much rain during the blossoming period and for two to three weeks following more sprayings will, of course, be necessary than in a dry season. No hard and fast rules can be given, but unless some special enemy threatens the crop the best times will be about as follows:

If three sprayings are given, one just before blossoming, one *immediately* after blossoming, and one from ten to fourteen days later, will generally give the best results. If two are given, omit the first or third. The second and third are the important ones for the codlin-moth. If only one spraying is given it will usually do the most good if applied *immediately* after blossoming. For the bud-moth and case-bearer a spraying is needed just as the leaf buds begin to open.

Do not expect too much from one spraying. If you give three thorough applications you will, under ordinary conditions, have a right to expect clean fruit.

Some years, as in 1903, good fruit is grown without spraying; but these years can not be foretold. If we wait till the fungus shows, it is too late to spray. The most successful men spray every year. They consider spraying as insurance. They spray even if there is no crop, for they

and other insects that suck their food, are not hurt by poisons for the very simple reason that they can not eat poison. We would not expect to kill a mosquito by putting poison on the hand and letting him suck the blood from under it—his food, the blood, is not poisoned. These insects feed in a similar manner. They suck the juices from the plant and do not take any material from the surface. They must be killed by kerosene; whale oil soap; lime, salt and sulfur, or by some other spray that kills by contact. Only those which are hit by the spray are killed.

The various fungi are plants. We might call them weeds that have chosen to grow on the apple rather than on the ground. They can not eat Paris green nor are they killed by kerosene and such sprays. For them some fungicide, as Bordeaux mixture, must be used.

consider that good, clean foliage is necessary in order to form the next year's fruit-buds and in order to store up food for the next year's crop.

Winter treatment for apple-scab.—Quite a number of farmers are considering the advisability of spraying for the scab before the buds open. This treatment will not take the place of later applications. If one gives it he should do so with the understanding that it is in addition to the later sprayings, and not a substitute for them.

“When these are made the winter treatment does not bring sufficient additional benefit to justify the additional expense of making it against the scab alone, but it may pay when directed also against the canker disease and combined with some application which must be made against insects such as case-bearers or bud-moth.

“It is known that the scab lives during the winter on the fallen leaves and in the spring produces spores by means of which it spreads to the new foliage. Probably it may exist during winter to some extent on the bark of young twigs also. Granting that this is the case and that a large part of the fungus on the tree is killed by winter treatment, which is improbable, it is evident that when the new foliage appears it must be covered with some fungicide to protect it from the spores produced on the fallen leaves. * * *”

Method of applying the spray.—In order to do effective spraying there must be plenty of power back of the pump. Good work is sometimes done with hand pumps; but the tops of large trees are not often well sprayed, nor is the work usually as well done with these machines as when power sprayers are used. The power sprayer is rapidly displacing the hand pump.

Many orchardists go through the orchard twice for each spraying—always spraying with the wind. The first time through may be done at the most convenient opportunity. For the second wait till the wind has reversed. Three sprayings therefore require six trips through the orchard. This method secures thorough spraying for each side of the tree.

Russeting of the fruit.—A sound and perfect fruit sometimes shows areas where the skin is reddish brown and rough. This is commonly attributed to too strong a spray. It is frequently caused in that way, but in 1903 and 1904 apples in many unsprayed orchards were russeted. It is caused by any irritation of the skin of the fruit. This is caused by too strong a spray, by late frosts that hurt the skin of the young apple,

*Bulletin 170, New York Agricultural Experiment Station, Geneva, N. Y.

or by anything else that irritates the skin. To prevent injury from the Bordeaux mixture plenty of lime must be used. Four pounds of blue vitriol to fifty gallons of water is sufficient for the later sprayings. This lessens the danger of russetting and seems to be effective in preventing the scab fungus. Six pounds to fifty gallons of water are ordinarily used for the first spraying.

Damage to foliage from spraying.—The foliage is sometimes burnt by too strong a spray. This is particularly likely to occur in rainy weather. However, most of the spots on the leaves that are attributed to the spray are not due to the spray, but to fungi. (See page 340.)

Professor G. W. Cavanaugh gives the following suggestions about spraying in rainy weather:

“In the preparation of Bordeaux mixture, which is made from a solution of blue vitriol and lime, there is a definite chemical union brought about between the copper of the vitriol and the lime. In order that this union may occur, the lime must be in a water-slaked condition, chemically known as calcium hydroxide. Should the lime be air-slaked, i. e. in the form of carbonate of lime, this chemical union with the copper does not take place. The action of the carbonic acid of the air on water-slaked lime is to change the lime to the air-slaked form.

“The chemical union between the lime and the copper in the Bordeaux mixture is not a very stable one. In fact, it is so weak that the carbonic acid of the air can, under certain conditions, break up the union and change even that lime which was combined with the copper into air-slaked lime. This, of necessity, frees the copper and puts it in a condition similar to that where an insufficient amount of lime is used in the original mixture. This action of the carbonic acid of the air is facilitated if the mixture remains moist for a considerable time on the foliage. The result of this is a burning of the leaves by the free copper sulfate. When the mixture dries on the trees this action of the gas is so much retarded that no injurious results have ever been noticed. It therefore seems a wise precaution, during a wet season at least, to use more lime than the formula ordinarily calls for.”

CHAPTER VI.

RENOVATING AN APPLE ORCHARD IN WESTERN NEW YORK.

BY CHRISTIAN BUES.

With the increase of our knowledge of the "how" of apple-production comes naturally a greater interest in the apple business. Out of a few apple-trees around the house has grown the commercial orchard. The manager of a large orchard enters the open market. He learns the value of business methods. He looks for opportunities in the business of apple-production. To plant young trees and nurse them into bearing age is a long-term investment. It should be profitable ultimately. But how shall he find an outlet for his energies while his trees are growing; how shall he improve his trade; in short, where is the immediate opportunity for business?

There are thousands of acres of apple orchards of bearing age in Western New York which are not giving the revenue that they ought to give. Many of these can be bought at a reasonable price. If the trees are in a fairly good state of health the renovation of such orchards may be profitable. We have heard a great deal during the last few years about this feature of fruit-raising. What are the actual facts? A concrete example will illustrate better than any amount of theory.

In 1896 Mr. George Pettit bought a "run down" farm at Kenyonville, Orleans county, N. Y. The farm was neglected. Therefore the price paid was not high. Fifty-four acres were bought for \$2,200. On the farm was an apple orchard of eleven acres, two acres of which had been drowned out, literally killed by standing water, when an outlet could be found not more than fifty yards away into the steep gorge of Oak Orchard creek. This left nine acres of orchard with which to work. The trees had been planted in the spring of 1864, i. e. they were thirty-two years old and should have been just entering into their prime of production.

The soil on which this orchard stands is Miami silt loam. (See page 317.) On the remaining nine acres the drainage was not perfect. Because of lack of care the trees were older than their actual age would indicate. Pruning and feeding had been sadly neglected, and canker was rapidly unfitting many limbs for the bearing of a crop. Mr. Pettit tells me that it was in about as bad a state as regards care as it could possibly be.

The problem of renovation was undertaken with vigor. The water was drained off, the land was plowed, and thus the soil brought into such a condition that the plant-food would be available. The trees were freed of dead wood, the worst canker-diseased limbs removed, and the whole was disinfected by the liberal use of Bordeaux mixture and arsenic. Plant-food was supplied to produce the most essential crop—new wood. The following tabulates the cultural method:

1896. Orchard was in sod; the grass was mowed.

1897. Orchard was plowed and beans were grown.

1898. Orchard was manured and beans grown again, followed by crimson clover.

1899. Orchard was manured and crimson clover plowed under.

1900-1904. Orchard has been manured every year and buckwheat is grown, to be rolled down toward ripening time of the fruit.

During the last three years every tree in the orchard received each year one-quarter of a load of manure, to which was added in 1904 for each tree 12 pounds of a good commercial fertilizer containing 8 per cent potash and 10 per cent phosphoric acid.

Spraying has always been faithfully done, crop or no crop; for Mr. Pettit knows that he must have a healthy vigorous tree before he can obtain a profitable crop. Here is the spraying program of the season of 1904:

First spray: When blossom buds began to swell.

Second spray: As soon as the blossoms dropped.

Third spray: About two weeks after second spray.

Fourth spray: A partial spray July 25. This had no apparent effect.

The spray used was Bordeaux mixture and Paris green, slightly decreasing the amount of blue vitriol with each successive spraying.

This orchard may well be called a "rejuvenated" orchard, for hardly any of the old tree-tops exist now. The Kings, Greenings and Russets have grown entirely new tops in the course of the eight years during which Mr. Pettit has handled the trees, and the Baldwins are doing so, although at a slower rate. I remember one particular Spitzenburg tree which tells the story of many hardships. By continued spraying and generous feeding the many old cankers are nearly overgrown by new wood, and a new top has been produced which looks vigorous and healthy and ready to do business for many years to come.

Now if we want to renovate orchards, for business, how does the account of this orchard balance? Is it worth while to borrow money in order to invest it in orchard renovation? Mr. Pettit kindly placed at my

disposal an itemized account for the season of 1904. The price charged for team and machinery is large enough to allow for "wear and tear." To the debit should be added interest on capital invested. Every hour of work done in the orchard by the proprietor or by his men has been charged to it.

<i>Apple orchard.</i>		Debit.	<i>Apple orchard.</i>		Credit.
1904. June	To 8 days' hauling and spreading manure, at \$1.50	\$12 00-	1904. By 1,765 barrels of apples, No. 1, at \$1.50		\$2,647 50
	To 3 days' teams for hauling, at \$2.....	6 00	By 75 barrels of apples, No. 2, at \$1		75 00
	To 80 loads of manure, at \$1.50	120 00			
	To 1½ tons commercial fertilizer, at \$20.....	30 00			
	To 2 days' pruning, at \$2.	4 00			
	To 3 days' hauling brush.	5 00			
	To 6 days' work, spraying, 3 men and team, at \$7.	42 00			
	To 1 day dragging with 3 horses	4 00			
	To 1 day dragging with 2 horses	3 00			
	To 2 days' spreading fertilizers	4 00			
	To 1 day dragging with 3 horses	4 00			
	To 1 day hoeing around trees	1 50			
	To 1 day with team.....	3 00			
	To 1 day cleaning out ditches	1 50			
	To 1½ days' cultivating, at \$4.....	6 00			
June 20.	To 3½ days' spraying, at \$7	24 50			
	To 1 day getting material.	3 00			
	To 30 lbs. Paris green, at 18c	5 40			
	To 400 lbs. blue vitriol, at 5¼c	23 00			
	To 4 barrels of lime, at \$1.25	5 00			
	To 1 pair of pruning shears	2 00			
July 6.	To 1 day of dragging....	3 00			
	To ½ day sowing buckwheat	1 00			
25.	To spraying 3 hours, at 70c	2 10			
	To spraying mixture....	70			
	To 7 bushels buckwheat seed, at 75c.....	5 25			
Aug. 13.	To 4 hours' breaking buckwheat	1 60			
16.	To dragging down buckwheat, 1 horse.....	2 00			
17.	To dragging down buckwheat, 1 horse.....	2 00			
18.	To propping trees, 2 men and team	3 00			
27.	To propping trees, 2 men 2½ days	10 00			
	To 1,840 empty barrels, at 36c	662 40			
	To harvesting 1,840 barrels of fruit and hauling to the railroad, at 25c...	460 00			
	Balance	1,260 55			
		\$2,722 50			\$2,722 50

Thus our account for this year gives a net profit above expenses of \$1,260.55. To do justice to the orchard it is fair to state that at the date

when the figures were received there remained about 1,300 bushels of apples in the orchard which might have been sold as evaporating stock had not the evaporators been filled to their utmost capacity.

How do the crops taken from the orchard compare with the original investment? It is not possible to give these figures net, as an itemized expense account is not available. The gross returns from the orchard are:

1896.....	\$250 00
1897.....	12 00
1898.....	800 00
1899.....	200 00
1900.....	1,200 00
1901.....	300 00
1902.....	2,000 00
1903.....	1,400 00
1904.....	2,722 50

It will be seen that there is a gradual general increase in the amount of the crop. Naturally there exists a corresponding increase in the cost of production and marketing.

In a considerable percentage of New York orchards the renovating process has begun. It can not be done according to a fixed schedule. Conditions in one orchard are not often the same as in another. However, the experiences of other men and close observation will soon lead one in the right direction. Two things are most needed. The first is the consideration of the orchard as a business proposition, with which we enter into an account and from which we want to exact a fair profit. We may have to wait a few years for the returns, but we must look for ultimate profits. The usual experience is that vigorously renovated orchards begin to give fair returns in about three years, but this depends on the condition of the trees and the manner of treatment. The second important factor is: the man who takes charge of the orchard should know and love an apple-tree. He should be able to put himself into its position and to realize the various influences which this or that line of treatment would have upon a living organism. Only then can he understand such things as why a soil needs draining and why parasites should be kept off. It is not so much any particular kind of soil that produces the apple, or any special brand of fertilizer, or any individual spraying mixture. The essential thing is the crop of thought raised in the well-cultivated mind of a nature-loving man.

CHAPTER VII.

NUMBER OF TREES PER ACRE AND DISTANCE BETWEEN TREES.

The trees are planted too close together.—One of the greatest enemies of the apple orchard in Wayne county, as in most other apple-growing regions, is the apple-tree. When the greater part of the orchards were planted, about forty years ago, there was a universal tendency to plant too closely. On 43 per cent of the area planted before 1880 the trees are 30 x 30 feet or less; 82 per cent are 35 x 35 feet or less. Only 18 per cent are over 35 x 35 feet; and a part of these were planted more closely but have been thinned. (See table 23.)

TABLE 23.
Distance between trees.

DISTANCE APART.	PLANTED BEFORE 1880.				PLANTED SINCE 1879.			
	Average no. trees per acre.	No. orchards.	No. acres.	Per cent.	Average no. trees per acre.	No. orchards.	No. acres.	Per cent.
Not over 25x25 ft.	82	55	151½	5	70	3	4	1
26x26 to 30x30	52	198	1165¾	38	51	27	118½	18
31x31 to 35x35	38	143	1195	39	37	24	148½	22
36x36 to 40x40	27	73	534½	18	27	31	328	50
41x41 to 50x50					19	6	61	9
					Planted before 1880.	Planted since 1879.	All ages.	
Average number of trees per acre.					43.6	33.2	41.8	
Average distance apart.					31.6	36.2	32.3	

A comparison with the recent plantings shows that many growers have learned not to plant so closely. Nearly two-thirds of the area set since 1879 has the trees 35 x 35 feet or over, the average distance being 36.2 feet or 33.2 trees per acre, as compared with a distance of 31.6 feet and 43.6 trees for the older orchards. Some growers have not yet learned the lesson, and need to have their attention called to it. Forty by forty feet is close enough for nearly all varieties. The Duchess, Wealthy and a few other varieties might perhaps be planted a little closer. Mature Baldwin and Greening trees should be at least 40 x 40 feet apart.

About one-fourth of the orchards in Walworth township were planted on the quincunx system with the rows 20 feet apart and the trees 40 feet apart in the row. This makes the trees in squares 28.4 x 28.4 feet, cornerwise of the field. Some nurserymen recommended this system with the idea of removing every other row, so as to leave the trees 40 x 40 feet. A few growers did this before much damage had been done by crowding, and may have secured enough fruit from the extra trees to pay for the increased labor which these trees necessitated.

Outside of Walworth this system was much less used, but the trees averaged almost the same distance apart. Rather than blame the nurserymen who recommended the thinning system, as some have done, we should give them credit for being better informed than most persons of that time, for they recognized that mature trees would need to be 40 x 40 feet. Other persons planted equally close without having any idea that a part would need to be cut out.

This system may be all right if carried out, but it is certainly not to be recommended to the general public. Few people have the courage to cut down good, thrifty trees. If they do thin them it is usually not done until the trees have been greatly damaged—all the lower limbs killed. It will be better for most persons to leave out half the trees and raise crops in the orchard for a few more years, or plant some short-lived fruit like peach-trees, that will die before the apple-trees need the room.

Effect of close planting on yield and health.—The more trees per acre the less the yield. The average yield for four years of orchards where the trees are not over 30 x 30 feet apart is 186 bushels; for those over 30 x 30 feet but not over 35 x 35 feet, 222 bushels; for those over 35 x 35 feet, 229 bushels. (See table 24.)

The question is still more important than these figures indicate. In many orchards the trees are being ruined because they are so close together. In Orleans county more growers have removed half the trees, but few in Wayne county have yet done so, and more attention needs to be given to the question. Farmers usually fail to notice what is happening until the trees have been greatly damaged. The decrease in yield does not call attention to the trouble till it is too late. When the tops begin to meet so as to shut out the light from the lower limbs it is time to cut out half the trees. (See Fig. 59.) If this is not done the lower limbs first bear inferior fruit, then no fruit, and finally die. The changes take place so gradually that the owner usually fails to realize what is

TABLE 24.

Distance apart and yield in bushels. Trees set before 1880.

DISTANCE APART.	WALWORTH.			REMAINDER OF COUNTY.			ENTIRE COUNTY.		
	No. orchards.	Acres.	Average yield.	No. orchards.	Acres.	Average yield.	No. orchards.	Acres.	Average yield.
1900.									
Not over 30x30 feet ...	78	285¼	282	22	305½	231	100	590¾	256
31x31 to 35x35 feet....	32	140½	389	18	217½	264	50	358	314
36x36 to 40x40 feet....	18	93	332	6	80½	224	24	173½	282
1901.									
Not over 30x30 feet....	83	310¼	38	23	334½	30	106	644¾	34
31x31 to 35x35 feet....	41	206	60	21	255½	83	62	461	75
36x36 to 40x40 feet....	33	192	92	8	100½	81	41	292½	88
1902.									
Not over 30x30 feet....	154	556¼	229	44	604½	212	198	1160¾	220
31x31 to 35x35 feet....	77	380½	249	34	682½	212	111	1063	226
36x36 to 40x40 feet....	50	338½	256	11	115½	220	61	454	249
1903.									
Not over 30x30 feet....	65	274¼	252	23	342½	215	88	616¾	232
31x31 to 35x35 feet....	29	137	309	12	112½	224	51	249½	271
36x36 to 40x40 feet....	27	254½	302	5	74½	281	32	329	296

Four-year average:

Not over 30 × 30 feet.....	186 bushels
31 × 31 to 35 × 35 feet.....	222 "
36 × 36 to 40 × 40 feet.....	229 "

It might seem that the closer plantings would include many old trees, but the change in the distance apart has been made largely since 1880.

happening till some year he finds that instead of an orchard of well-rounded apple-trees he has a lot of forest trees with a bouquet of leaves at the top.

In the end the bearing surface becomes the nearly level surface on the tops of the trees. This is a very small surface when compared with a succession of well-rounded tops. (See frontispiece.) If trees are 30 x 30 feet and are left till they interfere so as to kill the lower limbs, the bearing surface approaches the level surface on the top of the trees. Each tree approaches 900 square feet of exposure to sunlight, or bearing surface; or two trees approach 1,800 square feet. This is what was done in the orchard shown in Fig. 60. The owner of this orchard started to cut out half the trees about ten years ago. He cut down one tree, but it seemed to make such a big hole that he decided to prune them instead. The

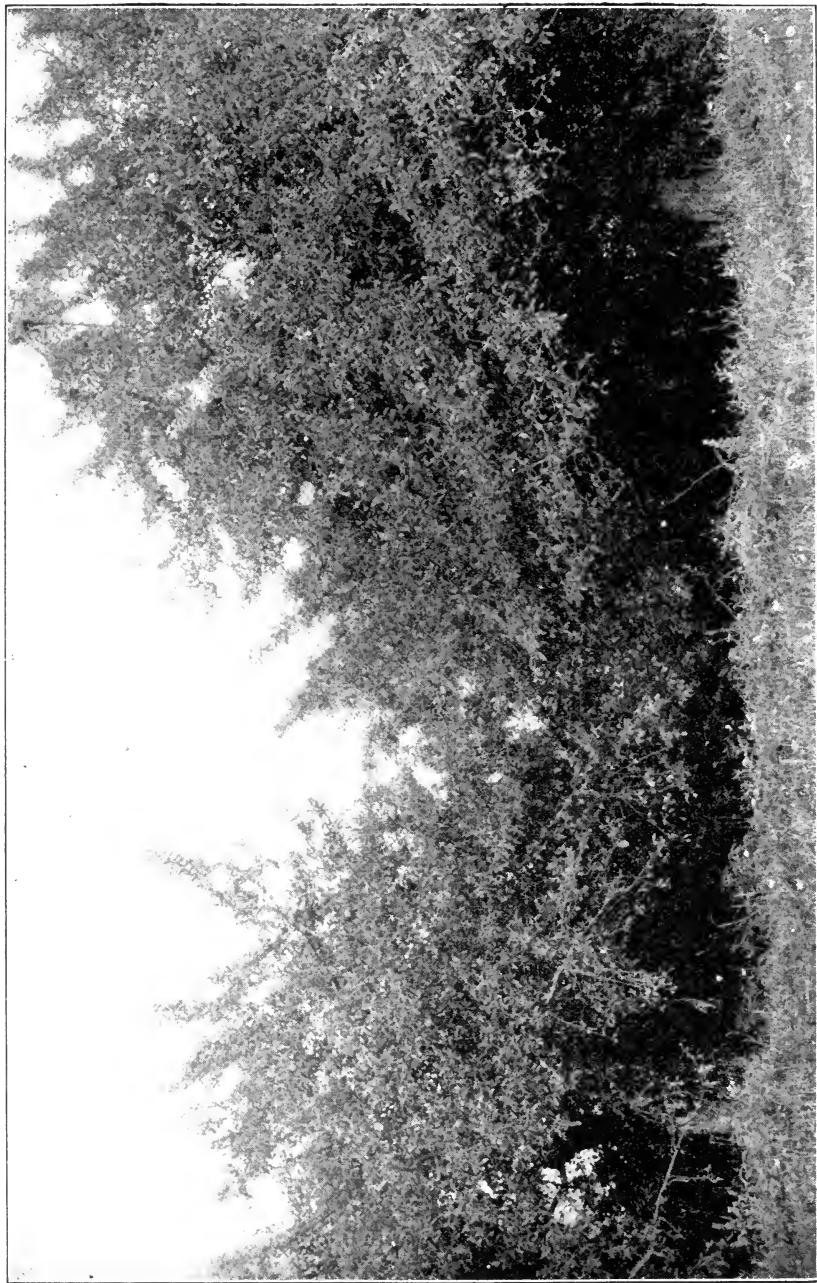


FIG. 59.—Beginning to crowd. When the tops begin to meet so as to shut off the sunlight from the lower branches it is time to cut out some of the trees.

figure shows the result. Suppose half of the trees had been cut out at the proper time, they would then be 42.4 x 42.4 feet. This was done by Mr. Albert Woods in the orchard shown in Fig. 61. These trees average about 32 feet high and have a spread of about 40 feet. The area of the surface of a well-rounded tree 32 feet high and having a spread of 40 feet is about 4,000 square feet. Trees of this size still lack 2.4 feet

of meeting, and 30 per cent of the surface of the ground is exposed to light—none too much. In other words they are a reasonable distance apart, but the one tree has at least twice as much bearing surface as the two trees in the former orchard. This calculation assumes the tree to have a regular form and is, of course, hypothetical, but it clearly indicates that there are two reasons why trees that are planted too closely do not bear as much as do those that have more room: (1) They are not as healthy.

(2) They do not have as much bearing surface.

Trees that are too close together furnish favorable conditions for fungi and insects; they are hard to spray; the apples are more difficult to pick and are of poorer color and quality. Probably the most serious result is an indirect effect of the death of the lower limbs. Trees are left until the large lower limbs die for want of light. These are then removed and the wounds are too large to heal. In time they cause the trunk to decay. (See Fig. 62.)

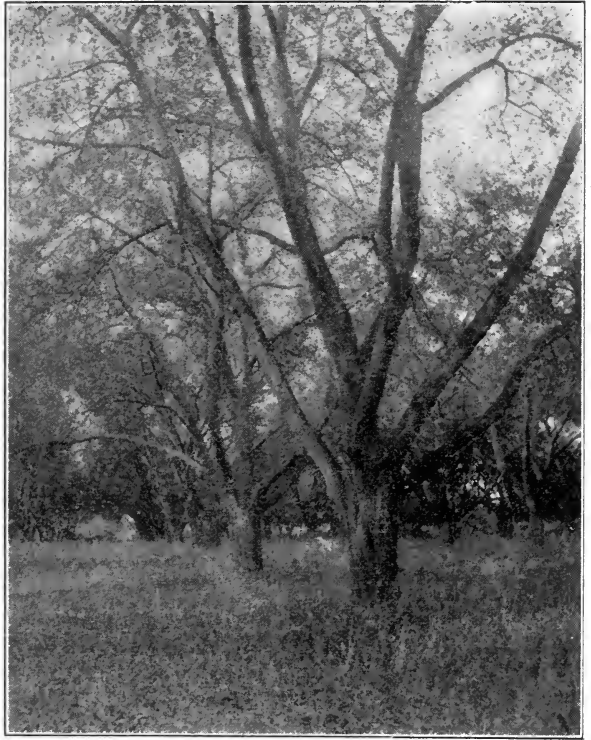


FIG. 60.—A poor system of pruning. The best bearing wood removed and the trees almost ruined rather than cut out half of them. (Compare with Fig. 61.)

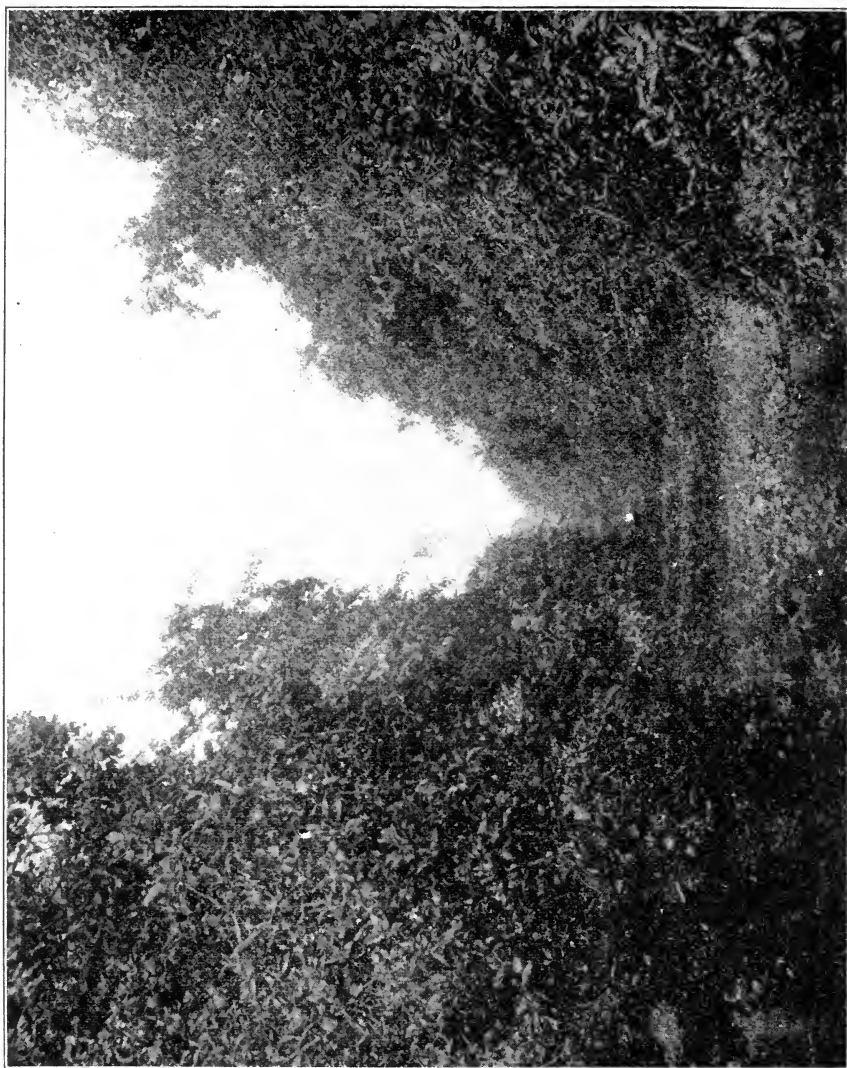


FIG. 61.—Half of the trees were removed fourteen years ago. They are a convenient distance for working between and give an opportunity for sunshine to reach part of the ground. (Compare with Fig. 60.)

Top-grafting or pruning every other row.—Some men have top-grafted half of the trees a few years before cutting them out. Most of those who have tried this would not do so again. It is some expense to do the grafting, and by the time the grafts are ready to bear well it is about time to cut the trees down. Some have cut back the tops of the trees to be removed, leaving the center part to bear a few years before removing the tree. This seems to have paid in some cases, but has not always been satisfactory. Too much must not be expected of any such devices, for they do not relieve the condition under ground. The roots interfere before the tops do. When the tops begin to interfere it is high time to remove half the trees.

How to thin.—If the trees are planted in squares the best way to thin is to cut out every other tree in each row. This is done by cutting out every other row diagonally. It leaves the trees in squares cornerwise of the field. (See Fig. 63.)

It is interesting to note what removing half the trees would mean. Persons sometimes think that doing so in an orchard that is 25 x 25 feet would leave the remainder 50 x 50 feet. As a matter of fact they would be in squares

of 35.3 x 35.3 feet, when viewed from the corners of the field; if 30 x 30 feet, and half removed, the remainder would stand 42.4 x 42.4 feet; if 33 x 33 feet, and half removed, they would be 46.7 x 46.7 feet. None of these distances is too great for large, mature trees. If 35 x 35 feet, and half removed, they would be 49.5 x 49.5 feet. Large Baldwin trees can make good use of this much room.

One of the problems to be met in thinning is that, if every other tree is removed regularly, there will be some places where the tree to be cut out

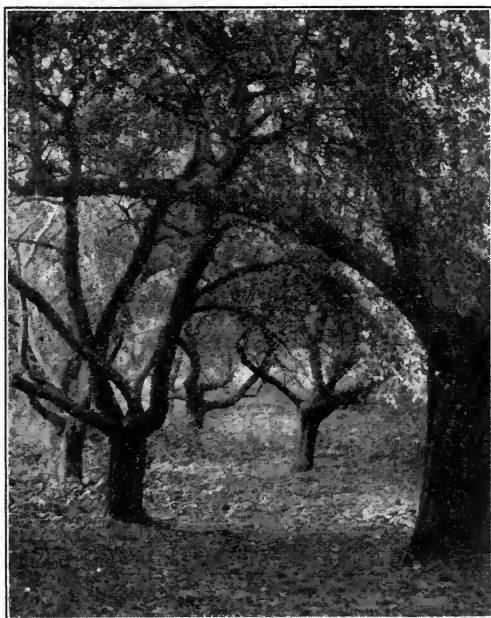


FIG. 62.—*The large lower branches die because the trees are too close. The limbs are then removed, and the next stage is a decayed trunk. Notice the holes in the second tree on the left.*

is better than the one to be left; or it may occur that the one which should be left is missing. Will it pay to leave a tree that would otherwise be removed if it comes next to a vacant place? This question must be

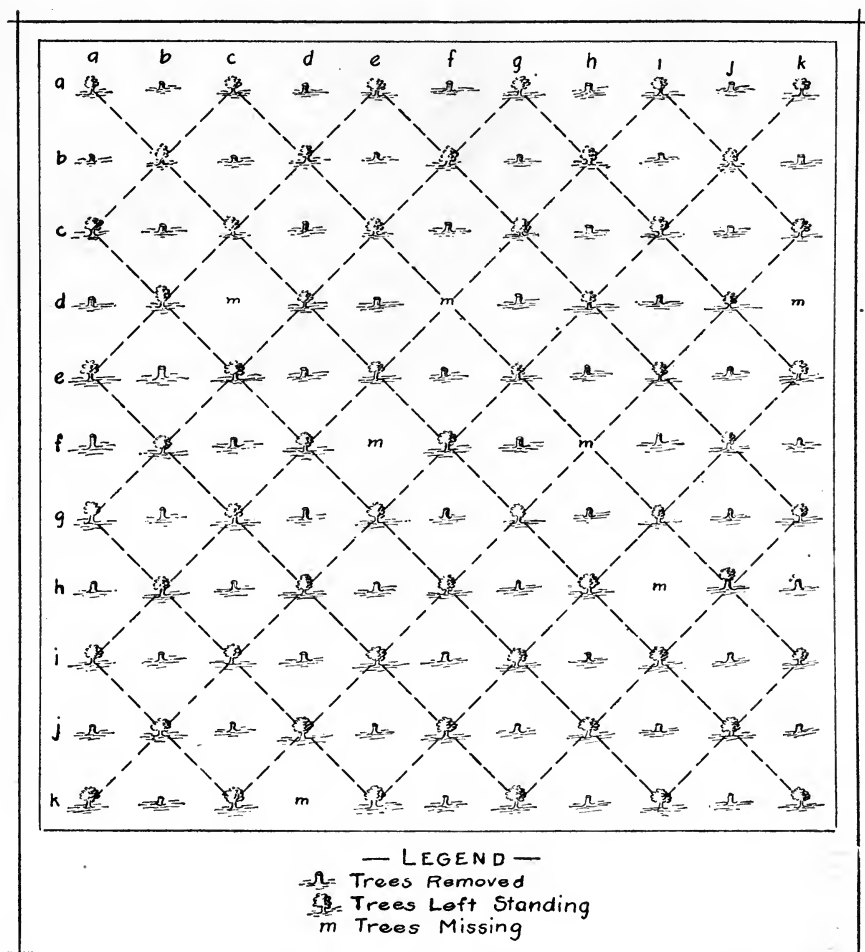


FIG. 63.—Diagram showing half the trees removed. The dotted lines show that the trees remaining are in squares cornerwise of the field.

answered as each case arises, but it is well to remember that if the tree is left it will damage one side of three other trees.

Before cutting out the trees it will pay to make a map of the orchard and locate the vacant spaces and poor trees, and so determine which way of cutting will include the greatest number of these. In Fig. 63 the rows

bb, dd, ff, etc., or the rows *cc, ee, gg, etc.*, may be removed. Sometimes it will make a difference of several trees which is done. Suppose that the trees marked *m* are poor trees or missing; then by removing rows *bb, dd, etc.*, five of these will be included. If the other set of rows are removed only two will be included, a gain of three trees by the former method—enough to much more than pay for the trouble of making the map.

It requires courage to go into a fine apple orchard, one that has been watched over for years, and cut out good, healthy trees. But in many orchards the time has come when a choice must be made between two poor trees or one good one. If one has definitely made up his mind that his trees are crowding, perhaps the best way to thin them is to do as the owner of a fine Baldwin orchard of twenty acres did. He decided which rows should be removed. Then, to be sure that he would not repent and have some of the trees left, he went away on a two weeks' visit while the boys did the work.

CHAPTER VIII.

AGE OF THE ORCHARDS.

Date of planting.—Few of the old orchards are now owned by the men who set them, or even by the descendants of these men. It is, therefore, difficult to get the exact age in all cases, but the reports are probably accurate enough to give reliable conclusions.

Most of the trees set before 1850 were for the purpose of supplying the family wants. About this time growers began to set commercial orchards. The majority were set between 1860 and 1875. The number planted decreased till 1895. Since then there has been a gradual increase. (See table 25.)

The young orchards are nearly all in the north part of the county. Very few trees have been set in the south part during the last twenty-five years. (Some discussion of the reason for this will be found on page 259.)

TABLE 25.

Number of acres planted during each five-year period. The table includes only those orchards that are still living. Some of the earlier plantings have disappeared.

DATE OF PLANTING.	No. of orchards.	No. of acres.	Per cent.
Before 1840.....	18	73	2
1840-49 (10 years).....	33	167½	4½
1850-54.....	42	167	4½
1855-59.....	45	298½	8
1860-64.....	153	810¼	22
1865-69.....	91	717	19
1870-74.....	67	450	12
1875-79.....	43	380½	10
1880-84.....	22	194	5
1885-89.....	12	71½	2
1890-94.....	19	54	1½
1895-1903 (8 years).....	47	377	10

Yield at different ages.—The fact that apples are the chief source of income for so many farmers, and that practically every one considers them to be a paying crop, would seem to raise the question of why more orchards are not planted. The great deterrent to such planting is the long time that one must wait for returns. With the usual treatment of

Baldwin and Greening trees they do not begin to be profitable for nearly twenty years. A much less profitable crop that gives returns the first year can therefore compete with apples.

If well cared for, the trees will usually pay sooner. But the very fact that it is so long before a revenue is secured causes the owner to neglect the trees, so that the normal period is increased. The young orchard usually takes its place as a field in the crop rotation, and is therefore in sod or small grain half the time. One frequently sees young orchards in wheat-fields or hay-fields. "The short growth, knotty bodies and yellow leaves tell the story of shallow roots, dry soil, borers, and all the ills which every farmer who follows such methods deserves to have

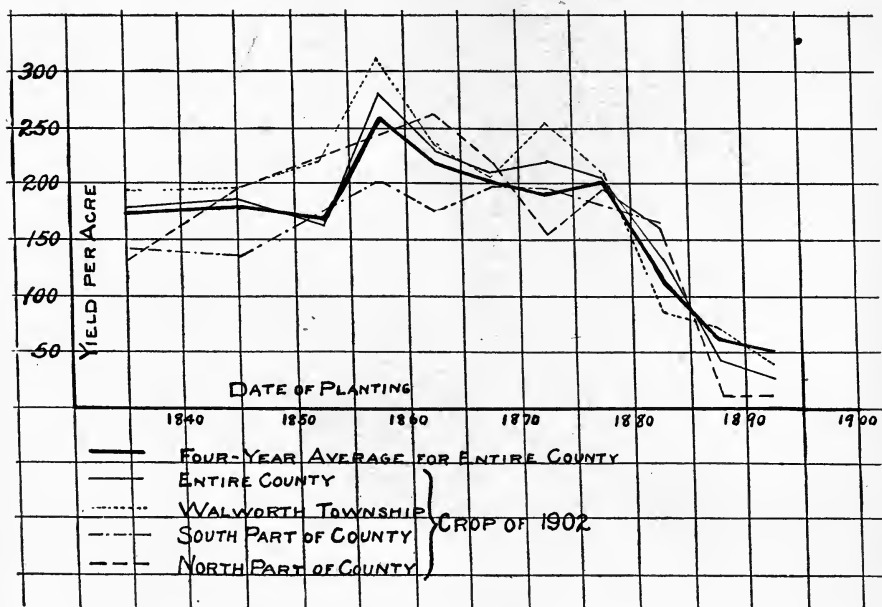


FIG. 64.—Diagram showing the yield in bushels at different ages.

fastened to his trees."* Grain and hay should never be grown in a young orchard. The first thing to grow is an apple-tree. Tilled crops are the only ones that can be grown without damaging the trees and lengthening the period before they are ready to bear. (See Figs. 41, 42 and 43.)

Many of the orchards now being set are composed of Ben Davis, Hubbardston, Duchess and other early-bearing varieties, but Baldwin and Greening still hold a place.

*Cornell Bulletin 72.

It is a long time to wait for Baldwins and Greenings to begin to bear, but they make up for this delay by continuing to be profitable for many years. The life of an apple-tree has commonly been spoken of as about forty to fifty years, but the maximum yield in Wayne county is not reached till forty-four years from the time of planting. (See table 26 and Fig. 64.) After this there is a gradual decrease. Several orchards



FIG. 65.—Ninety-six years old and still young. This orchard contains about 145 of the original 270 trees set 96 years ago. Orchard of J. A. Kuck, Kuckville, Orleans county.

set before 1820 are still profitable. With the better care that trees are now receiving, their age of maximum yield will doubtless be increased. It is probable that the returns for good treatment will be even more marked in prolonging the life of the orchard than in increasing the annual yield. (See Fig. 65.) There are very few 45-year-old trees that have not seen some very rough treatment. They have gone a number of years without any fertilization or tillage. The canker-worm has feasted on them; cattle have damaged them. They have gone years without pruning, or, worse, have had large limbs cut off in such a way that the wounds can not heal. Some orchards of this age are composed of sound, thrifty trees that give promise of an increased yield for some years to come.

Will it pay to plant young orchards?—From the ages at which the yields begin to decrease it would seem that in about twenty years a large

part of the present orchards would cease to be profitable. It must be remembered that table 26 includes only those orchards that have survived. Many orchards set sixty-five years ago have entirely disappeared.

TABLE 26.

Age and yield per acre in bushels.

DATE OF PLANTING.	1900.			1901.		
	No. orchards.	No. acres.	Yield.	No. orchards.	No. acres.	Yield.
Before 1840.....	4	10	215	7	24½	83
1840-49.....	1	10	200	6	37	38
1850-54.....	12	43	245	13	47	34
1855-59.....	9	33	368	17	84¾	67
1860-64.....	54	278¾	347	63	360½	57
1865-69.....	41	366	293	44	465	55
1870-74.....	26	238	219	34	278½	61
1875-79.....	12	81½	255	15	101	64
1880-84.....	9	67	164	9	69	6
1885-89.....	1	5	80	1	5	0
1890-95.....	4	18	50	4	14	36

 TABLE 26—*Concluded.*

DATE OF PLANTING.	1902.			1903.			FOUR-YEAR AVERAGE.	
	No. orchards.	No. acres.	Yield.	No. orchards.	No. acres.	Yield.	Average age.	Yield.
Before 1840.....	14	60	175	1	1½	210	64	171
1840-49.....	17	93½	186	3	18	267	59	173
1850-54.....	38	154	220	13	48¾	224	49	181
1855-59.....	34	255½	281	12	161½	312	44	257
1860-64.....	115	612¾	232	54	284½	236	39	218
1865-69.....	74	652	212	25	274¾	238	34	200
1870-74.....	51	380½	222	23	211½	261	29	191
1875-79.....	25	138½	204	11	45¾	286	24	202
1880-84.....	9	120	133	7	47½	155	19	115
1885-89.....	6	26	42	1	10	140	14	66
1890-95.....	10	21½	29	1	10	100	9	54

The tabulation for each division of the county gives the maximum yield at this same age—44 years.

It is difficult to tell just how much effect the better care will have in prolonging the life of the trees, but it is quite certain that the well-cared-for orchards will continue to pay much longer than the average. But over half the orchards are not well cared for, and it is perfectly reasonable to suppose that many of these neglected ones will be gone in twenty years. The advisability of planting more orchards to take the place of these old ones is therefore worth considering. More immediate profit would come from the rejuvenation of the old orchard.

CHAPTER IX.

SOILS AND SOIL PROBLEMS.

Topography.

Topographical regions.—Wayne county is divided into two distinct topographical regions: a very hilly or drumlin region, and a region of gently rolling land; but each of these regions has a subdivision, so that we have four divisions (see Fig. 66):

- (1) A drumlin area.
- (2) A region where the drumlins were once wholly or partially submerged.
- (3) A gently rolling glaciated area.
- (4) An area of rolling land that was formerly the old lake bed.

The elevations above sea level vary from 246 feet, the level of the lake, to 670 feet, the top of the highest hill.

During the glacial period the lake level was about 440 feet above sea level, or about the height of the "ridge". This ridge was a sand-bar or lake shore line. The present sand-bar running across Sodus Bay probably appears somewhat as the ridge appeared during this period. (See Fig. 141.) This ridge is more or less continuous from Sodus Bay to Buffalo. It is a gravel formation ten to thirty feet high and about four rods wide on top. It makes a natural roadway and has always been used for that purpose. The Rochester and Sodus Bay trolley line, built on this nature-graded roadbed, has furnished a very important supplement to the railroads in marketing the fruit of the northern part of the county.

During the glacial period the entire county was covered with a thick mass of ice. This ice was gradually moved southward, and carried with it

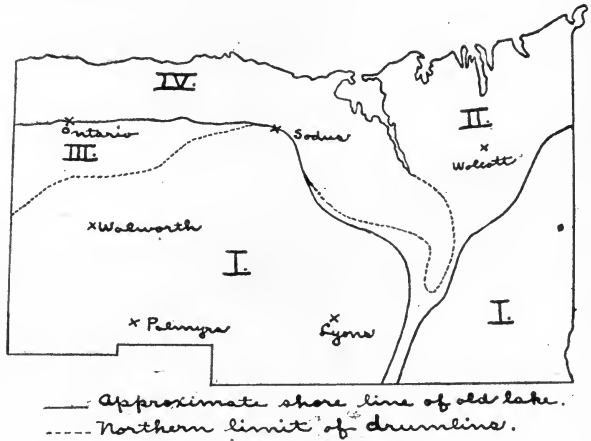


FIG. 66.—*Topographical regions.* I. Drumlin area. II. Region where the drumlins were once wholly or partially covered by the lake. III. Gently rolling glaciated area. IV. Old lake bed.

the stony material that now makes up the soil of the south part of the county. This material was deposited in the long hills, or drumlins, and in the sheet of stony material that occurs between them. The depth of this covering of glacial drift varies from a few feet to about one hundred and seventy-five feet. In many places between the hills the bed-rock is very close to the surface, what soil there is having been largely brought from the hills by the rains. In some places the bed-rock is still uncovered. Many of the small streams that drain the area run on this rock. In order to drain some of the lower land, the rock must be blasted out in order to deepen the streams.

The drumlin area.—About two-thirds of the county is covered with a succession of the long north and south hills or drumlins. (See page 364.)



FIG. 67.—Near Sodus Bay. A sandy soil. This was formerly the old lake bed. The hills in the foreground have been caused by subsequent erosion.

These hills have a slightly northwest and southeast direction. They are from one-fourth of a mile to three miles long—usually a little over a mile—and are about one-fourth as wide as long. Their tops are from 450 to 670 feet above sea level, and rise from 75 to 175 feet above the valleys. These heights for such narrow hills give very steep east and west slopes. The north and south slopes occupy comparatively little of the area. The former are abrupt, the latter more gentle. The greater part of the elevated land, therefore, consists of very steep east and west slopes. The orchards are situated on these slopes and on some of the rolling land of lower levels. The soil type of the hills and the higher part of the lower land is the Miami stony loam. (See page 316.)

The drumlin area that was once partly submerged.—In the northeast part of the county, east of Sodus Bay, there is a considerable area where

the drumlins were once islands or were covered by the lake at the same time when the ridge was formed. (See Fig. 67.) The sediment deposited in the quiet water that filled these lower places formed the Miami silt loam (see page 317), which has proved to be an excellent apple soil. The higher-lying land is mostly the Miami stony loam and Alton stony loam. Areas of Miami fine sand also occur.

The gently rolling, glaciated area.—Between the ridge and the drumlins of Marion and Walworth townships the soil was mostly removed by the glaciers. In many places the rock is so near the surface as to interfere with the growth of apples. The soil is a good apple soil where deep enough and where there is an outlet for the water.

Area of rolling land that was once the lake bed.—North of the ridge the land was once the old lake bed. The soil is formed from sedimentary deposits in the old lake and to some extent from deposits by the glaciers. It is now a gently rolling plain with a quite variable soil. (See Fig. 144.) In many places the drainage is poor, but there are many desirable sites for orchards. The soil types used for apples are the Alton stony loam, Miami silt loam and Miami fine sand.*

Soils.

The soil types.—The chief apple soils of the county are the Miami stony loam, the Miami silt loam and the Alton stony loam. Apples are also grown on the Miami fine sand, the Ontario gravelly loam and on a phase of the Alton stony loam that has the bed-rock too near the surface.†

*For a further discussion of the topography, geology and origin of soils, see Part II of this report.

†For a more extended discussion of soils, see the report of "A Soil Survey of the Lyons Area," a reprint from the "Field Operations of the Bureau of Soils, 1902." This gives a discussion of the soils and a soil map of all the county except the west tier of townships. It is sent free to all who apply to the Secretary of Agriculture, Washington, D. C.

This report was not published at the time the orchard survey was made, so that the soil classification was independent of the Bureau of Soils, though following the same methods. More subdivisions were made in the orchard work, with the idea of combining, if the differences were found to be insufficient to warrant the separation. The Miami stony loam, Alton stony loam and Miami fine sand were each divided into two subtypes. These divisions seem to be entirely unnecessary. One subdivision of the Alton stony loam, in which the bed-rock is so near the surface as materially to affect the production of apples, is retained as a distinct type. The Ontario gravelly loam was mapped by the Bureau of Soils with the Miami stony loam and Alton stony loam. This is kept as a distinct type. The smallness of the

The Miami stony loam is the stony soil that covers the drumlins and most of the rolling land between these hills. It is a light brown loam, eight to ten inches deep, containing five to forty per cent of stone and gravel. The stones are usually small and well rounded. The subsoil is a brownish-yellow, stony loam. The proportion of stone and gravel usually increases at greater depths, but the reverse is sometimes true. The gravel is sometimes cemented together so as to form a gravel hardpan. This occasionally occurs near enough to the surface to interfere with the growth of apple-trees. Table 27 gives a summary of the average mechanical analyses of four samples of this soil.

TABLE 27.

Mechanical analyses of the fine earth of Miami stony loam. Average of four samples, three of which were taken from the report of the Bureau of Soils.

	Soil. Per cent.	Subsoil. Per cent.
Organic matter	1.96	1.13
Fine gravel and coarse sand (2—0.5 mm).....	6.	7.
Medium, fine and very fine sand (0.5—0.05 mm).....	44.	46.
Silt (0.05—0.005 mm).....	39.	34.
Clay (0.005—0.0001 mm).....	11.	13.

The Alton stony loam.—This type of soil occurs north of the drumlin area. The surface soil, to a depth of seven to ten inches, consists of brown sandy or silty loam. The subsoil is a yellowish-brown sandy or silty loam. The type contains ten to fifty per cent of stone, which generally consists of more angular fragments than those in the Miami stony loam. It also contains more fine sand or silt than that type. South of the ridge there are considerable areas of it that contain limestone fragments. Table 28 gives the averages of three analyses of this type.

TABLE 28.

Mechanical analyses of the fine earth of the Alton stony loam. Average of three analyses made by the Bureau of Soils.

	Soil. Per cent.	Subsoil. Per cent.
Organic matter	3.89	.61
Fine gravel and coarse sand (2—0.5 mm).....	5.	4.
Medium, fine and very fine sand (0.5—0.05 mm).....	52.	46.
Silt (0.05—0.005 mm).....	30.	31.
Clay (0.005—0.0001 mm).....	13.	19.

individual areas would make it difficult, if not impossible, to map it separately by the Bureau of Soils method. The Miami silt loam (called the Elmira silt loam in the Bureau of Soils report, but since changed to Miami silt loam) corresponds exactly with one of the classifications made by the writer. In general the soil types and the mechanical analyses agree remarkably well for results secured from independent work.

South of the ridge, in the west part of the county, there are considerable areas of the Alton stony loam, where the soil rests on limestone rock that is so near the surface as to interfere with the growth of apples. The soil is too shallow to admit of good root-growth or to allow good drainage.

The Miami silt loam.—This is a brown or yellowish-brown silt loam, eight or ten inches deep, underlaid by brownish-yellow or yellow silty loam. This type occurs on the rolling land near the lake and around Sodus Bay. (See table 29.)

TABLE 29.

Mechanical analyses of Miami silt loam. Average of four samples, three of which were analyzed by the Bureau of Soils.

	Soil. Per cent.	Subsoil. Per cent.
Organic matter	1.44	.32
Fine gravel and coarse sand (2—0.5 mm).....	1.	1.
Medium, fine and very fine sand (0.5—0.05 mm).....	22.	18.
Silt (0.05—0.005 mm)	64.	66.
Clay (0.005—0.0001 mm).....	13.	14.

Miami fine sand.—This type is a light brown sandy loam, eight or ten inches deep, underlain by light yellow sand, usually free from stones. Its chief occurrence is north of the ridge. (See table 30.)

TABLE 30.

Mechanical analyses of the Miami fine sand. Average of three analyses made by the Bureau of Soils.

	Soil. Per cent.	Subsoil. Per cent.
Organic matter	2.15	0.38
Fine gravel and coarse sand (2—0.5 mm).....	4.	3.
Medium, fine and very fine sand (0.5—0.05 mm).....	78.	85.
Silt (0.05—0.005 mm).....	14.	9.
Clay (0.005—0.0001 mm).....	3.	2.

Ontario gravelly loam.—This is a brown gravel underlain by a light brown gravel or gravelly loam. The predominating characteristic is the gravel. Most of the gravel is less than one inch in diameter. It occurs in small deposits in the Miami stony loam and is the common type along the ridge. It is a very open soil—too well drained. Along the ridge it is nearly all planted to apples. The deposits of gravel that occur in the drumlins are frequently used on the public roads. (See Fig. 69.)

Average yield on the different soil types.—Table 31 shows the average yields on the six different types of soil. The number of orchards on the last three types is not large enough to give positive results. The table

shows definitely that the Miami stony loam averages better than the Alton stony loam and that the soil with the bed-rock near the surface is by far the poorest of all. I believe that the four-year average shows the relative merits of the soils quite accurately, except that the average for the Ontario gravelly loam seems to be a little too high. It is certain, however, that this type usually gives a good yield. All previous discussions of apple soils, so far as I have been able to determine, would consider this a very poor apple soil.

TABLE 31.

Average yield in bushels on different soil types. Trees set before 1880.

SOIL TYPE.	1900.			1901.		
	No. orchards.	Acres.	Average yield.	No. orchards.	Acres.	Average yield.
Miami stony loam	116	542½	287	159	834¼	57
Alton stony loam.....	24	182	255	20	144½	33
Alton stony loam (bed rock near surface)	8	35	218	5	26	7
Miami silt loam	7	125	379	6	115	99
Ontario gravelly loam	2	17	474	7	35½	73
Miami fine sandy loam.....	5	41	100	6	51	93

TABLE 31—Concluded.

SOIL TYPE.	1902.			1903.			Four-year average.
	No. orchards	Acres.	Average yield.	No. orchards	Acres.	Average yield.	
Miami stony loam.....	272	1419¾	234	132	788¾	283	215
Alton stony loam.....	43	358	215	19	185	229	183
Alton stony loam (bed rock near surface)	12	66	151	5	29½	237	153
Miami silt loam.....	8	129	260	3	44	214	238
Ontario gravelly loam...	12	63½	295	2	9	278	280
Miami fine sandy loam ..	8	63	353	7	172	220	192

Summary of the soil factor in apple-production.—While the kind of soil is important, in this locality, it is evidently not the most important factor in apple-production and is not as important as the kind of treatment that the soil receives. The kind of care required varies with the soil. The Miami silt loam will doubtless produce a good crop with less manure

than is required on any of the other types. The Miami stony loam is next strongest. The other types require larger applications of manure, but give good results when so treated. These latter are more open and are more in need of humus. The soil with the bed-rock near the surface is entirely unsuited to apples. For the best production of apples, there should be at least six feet of well-drained soil in every part of the orchard.

Drainage.

The condition of the natural drainage.—In selecting a soil for an orchard, more important than chemical or physical composition is the



FIG. 68.—In the center of a 35-acre orchard that is on a hill. Several acres have been gradually killed and many more damaged by ground water. This land has grown up to weeds and gives no income. It could easily be drained.

question of drainage. No well-drained soils were found in the county that were not producing good crops of apples when properly cared for.

The majority of the orchards are on fairly well drained land. A large number would be benefited by underdrainage, but in some cases the benefit would not be great enough to pay. Some orchards have been set on such wet land that they have entirely failed; others have one corner extending down into a low place where drainage is needed; others are divided by small "draws" that need underdrains. Where the orchards are on steep hillsides it might seem as if underdrainage would be unnecessary, but there are many places where the seepage water calls for drains. In other places the long slopes accumulate such a large volume

of surface water that drains are needed. Fig. 68 shows a 35-acre orchard, in the center of which are several acres that have been drowned out. This orchard is on a high hill and has a fair slope, but it needs drainage. There is usually a strip of poorly drained land on each side of the "ridge". Kettle-holes occur occasionally in the north part of the county. In a few orchards near the lake shore there are successions of parallel waves of land, making a few rods of good soil followed by some that needs drainage.



FIG. 69.—An excavation showing stratified Ontario gravelly loam. Too well drained!

In the northeast part of the county several orchards were examined the foliage of which was of a reddish hue when viewed from a distance. Some of the leaves were quite red in the latter part of August. This seemed to be due to the lack of drainage. It was characteristic of foliage in undrained places. Several farmers attributed this to a "new insect" that had "stung the leaves".

The Ontario gravelly loam and the Miami fine sand drain too easily—that is, they do not retain enough water. On such soils tillage is particularly profitable. A cover-crop or barnyard manure is a necessity. They add humus and increase the water-holding capacity of the soil. Tillage and humus will make any of these soils good for apples. (See Fig. 69.)

Losses caused by lack of drainage.—Of the 1,773½ acres of orchard land in Walworth, only 182 acres have any kind of underdrainage. Most of these have only a stone drain or two in a particularly wet place. A

few have tile drains. Fifty-four orchards, aggregating 232 acres, are reported as in need of drainage. This means that, in the opinion of the inspector, some tile drainage would pay. The average yield of these 54



FIG. 70.—A twelve-acre orchard, two acres of which are dead, and two acres damaged by lack of drainage.



FIG. 71.—The trees are all damaged by insufficient drainage. The grower continues to plant young trees and these are continually drowned out. It would pay better to "plant" tile drains.

orchards in 1902 was 203 bushels, 42 bushels below the average of the other orchards in this town. Of the 1,987½ acres inspected in the remainder of the county, 317 acres have some underdrains, but 831 acres need drainage in whole or in part.

Perhaps five to eight per cent of the orchards of the county need under-drainage throughout. About thirty per cent need drainage in part. The great loss through neglect of drainage is not in the destruction or damage



FIG. 72.—A "draw" in a 140-acre orchard where the trees are being gradually drowned out. The tree in the foreground is dying but is bearing a large crop of little apples and few leaves. The owner considers it a phenomenal tree, but it will probably not bear many more crops.

of the few entire orchards, but in the loss from the few small wet places in hundreds of orchards; for there are hundreds of orchards that have from one to fifteen per cent of the trees drowned out or badly damaged. There is a low place, a "draw" (see Fig. 72), or a kettle-hole, or a place where the water seeps out, and a few trees are killed or damaged. These vacant places are in most cases waste land. If they were occupied by trees it would not add materially to the expense of caring for the orchard,

but would add very substantially to the income. Figs. 68, 70 and 71 show such areas of waste land, due to lack of drainage. Many of the trees that are not killed are badly damaged. In such places a few tile or a good stone drain would pay many times over. A manufacturer would not long allow any such loss. Why should a farmer give less attention to losses in his business?

Lack of drainage may not be apparent while the trees are young. It is a growing evil, for as the trees get larger and the roots extend deeper, they get into poorly drained and poorly aerated soil.



FIG. 73.—In the same orchard as Fig. 68, showing the border line between the dead and dying trees. The trees are 45 years old. Their size can be seen by comparing with the small boy. The gnarly horizontal spread of the limbs is characteristic of trees that are in the most poorly drained places.



FIG. 74.—This orchard is ordinarily fairly well drained but in the wet seasons it suffers. The picture was taken Oct. 10, 1904. At this date the leaves had all fallen, because of the wet soil. The leaves had been falling badly for two months.

The trees may do very well till they are about old enough to bear, then some wet season they will be damaged or even killed.

Those who propose to set new orchards should consider the question well before starting such an expensive and long-continued enterprise on soil that is not well drained naturally or artificially. It is not enough that the soil will raise an ordinary farm crop. The roots of such a crop do not go as deep as do apple-roots. Furthermore, if a corn crop is lost or damaged by water, it does not prevent raising a good crop next year. When an apple orchard is damaged one can not start over the next spring as if nothing had happened. The corn is an annual, a one-year investment; the apple, a perennial, a long-time investment.

CHAPTER X.

ELEVATIONS AND EXPOSURES.

Sites.—The sites are classified as elevated, or well up on the hills; moderately elevated; slightly elevated, and low. Table 32 shows the areas of each division.

TABLE 32.

Sites of orchards. Table includes all ages of trees.

	WALWORTH.		REMAINDER OF CO.		ENTIRE COUNTY.	
	No. orchards.	Acres.	No. orchards.	Acres.	No. orchards.	Acres.
Elevated	158	790½	34	359	192	1149½
Moderately and slightly elevated.	133	495½	91	1488	224	1983½
Low	147	487¼	10	140½	157	627¾

Relation of the sites to yields.—The yields do not indicate any particular advantage for any of the divisions. The four-year average in Walworth on elevated sites was 227 bushels; moderately and slightly elevated, 224 bushels; low, 213 bushels. For the remainder of the county



FIG. 75.—An orchard on the east side of a drumlin.

the differences are about the same but are in the reverse order. Evidently the site is not a very important factor. The best site is doubtless one that is sufficiently elevated to give good opportunity for air and water-drainage, but not so high as to be sharply exposed to wind.

The aspects or exposure.—The majority of the orchards in the drumlin area are on east or west slopes occupying the sides of the drumlins (see Fig. 75 and page 364). There are, however, many orchards on the rolling land of lower levels, and in the north part of the county, where there are

no drumlins, the land is rolling. Table 33 shows the predominance of east and west slopes in Walworth.

TABLE 33.

Aspect.

Exposure.	WALWORTH.	
	No. orchards.	Acres.
N	25	80
N. E.	27	88
E	84	313½
S. E.	19	74½
S	26	91½
S. W.	20	74
W	71	268
N. W.	15	61
Level	45	129¼
Rolling*	106	593

*Most of those classed as rolling are a combination of east and west slopes. The south part of the county has equally marked east and west slopes. The north part is rolling.

The effect of aspect on yields.—The easterly slopes in Walworth gave a larger yield each of the past four years than have the westerly slopes. The difference in 1902 was 23 bushels per acre in favor of the easterly slopes. In each of the other years the difference was greater. The north part of the county does not show this marked uniform difference. The differences are greater than one would expect. In each of the four years the northeast slopes have exceeded the northwest, the east have exceeded the west; the only exceptions are that in two cases the southeast have failed to exceed the southwest. The four-year average in Walworth was 43 bushels in favor of easterly slopes.

It seems safe to conclude that the easterly slopes have marked advantages over the westerly. This is due to the protection from the strong west winds which do considerable damage at times. In the first part of June, 1903, the leaves of the west rows in many orchards were badly injured by winds. In many cases the foliage looked brown from the distance. The outer part of most leaves was damaged and many entire leaves were killed. The effects were still apparent in July. These strong west winds also cause more loss from windfalls on the west sides of the hills. The orchards on the level exposures give the least yields of all, a difference that is probably due to poorer drainage.

CHAPTER XI.

A COMPARISON OF RENTED ORCHARDS WITH THOSE MANAGED BY THE OWNER.

Census of rented orchards.—Between twenty and twenty-five per cent of the area devoted to apples is rented. (See table 34.) The usual method of renting an orchard is the share system. The renter takes entire charge of the orchard and delivers a certain share of the crop—usually half—to the owner. A cash rental is not uncommon, but is given in a much smaller number of cases. Many of the renters do not remain on one farm longer than one or two years.

TABLE 34.

Area of rented orchards and of those not rented. Trees set before 1880.

PROPRIETOR.	WALWORTH.			REMAINDER OF COUNTY.			ENTIRE COUNTY.		
	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.	No. or- chards.	Acres.	Per cent.
Owner	243	1,080 $\frac{3}{4}$	81	85	1,451	75	328	2,531 $\frac{3}{4}$	77
Renter	64	259 $\frac{1}{2}$	19	37	487 $\frac{1}{2}$	25	101	747	23

Effects of the rental system on the health of the orchard.—The large number of rented orchards gives rise to a serious problem in orchard management. When a man rents land for the growth of field crops, there is not only a definite basis for the rent but there is also an unwritten law that has established quite definitely how he should raise these crops. There are no such definite customs that determine the care which a rented apple orchard should receive.

The greatest obstacle in the way of good care is the fact that the returns for good treatment do not come immediately. Good care of field-crops gives an immediate effect; good care of an apple orchard may give less returns the first year than it gives several years later. A renter does not like to plow up a pasture that is of immediate value for the benefit of a future apple-crop. If he mows the grass, he is not likely to leave it for a mulch, unless it is not good for hay. The farm manure will bring him quicker returns if used on the field-crops. The greatest return which

he gets from pruning may be in the fire-wood procured, and some of the pruning is therefore done so as to get the most wood with the least work. If he has no crop, he does not see the profit in spraying for the benefit of a future crop that he may not reap.

All these points are emphasized when the renter is certain that he will not stay another year. Their effect on the tree is partially indicated by the average yields. This average for the past four years has been 174 bushels for the rented orchards and 210 bushels for those not rented. (See table 35.)

TABLE 35.

Yields of rented orchards compared with those not rented. Trees set before 1880.

PROPRIETOR.	WALWORTH.			REMAINDER OF COUNTY.			ENTIRE COUNTY.		
	No. or- chards.	Acres.	Aver- age yield.	No. or- chards.	Acres.	Aver- age yield.	No. or- chards.	Acres.	Aver- age yield.
1900.									
Owner	94	387 $\frac{1}{4}$	332	31	542	247	125	929 $\frac{1}{4}$	283
Renter	13	75 $\frac{1}{2}$	305	15	242 $\frac{1}{2}$	232	28	318	249
1901.									
Owner	118	607 $\frac{3}{4}$	64	32	567	49	150	1174 $\frac{3}{4}$	57
Renter	20	113	36	23	367 $\frac{1}{2}$	47	43	480 $\frac{1}{2}$	45
1902.									
Owner	196	935 $\frac{3}{4}$	262	61	1004 $\frac{1}{2}$	217	257	1940 $\frac{1}{4}$	239
Renter	45	208 $\frac{1}{2}$	196	28	395 $\frac{1}{2}$	183	73	604	187
1903.									
Owner	99	580 $\frac{3}{4}$	280	33	575 $\frac{1}{2}$	239	132	1156 $\frac{1}{4}$	260
Renter	12	70	222	9	178 $\frac{1}{2}$	215	21	248 $\frac{1}{2}$	216

Four-year average:

Managed by owner	210 bushels
Managed by renters	174 "

The attitude of the renter is, on the whole, about as good as that of the owner of a rented farm. Owners are usually very slow to spend money on improvements, or in keeping up a place. Both men often squeeze the farm for the last penny and let the future look out for itself.

In a very few cases the difficulty has been overcome by a contract with the renter, that he is to give the orchard certain definite care. One such contract calls for at least two sprayings and two cultivations.

Suggestions and reflections on the rented farm.—Many renters would be glad to improve the orchard, but the pruning and renovation of a neglected orchard is an expensive undertaking. One cannot afford to do this unless he has a lease for several years, or unless the owner helps to pay the cost. The owner does not like to spend money for such work, for he feels that he will likely have a poor tenant about the time that the orchard gets in good shape. Some have taken the broader view and have spent money in the renovation of the orchard. These have almost invariably been well repaid by the increased income. An owner who takes a pride in keeping up his place and who is willing to spend money, if necessary, in improving it, stimulates the renter by his own interest. Such a man also attracts the better class of renters. He may occasionally have a very poor one, but the average is certainly much above that found on the farm where the owner begrudges new shingles on the barn. The renter sometimes takes so much pride in his work that he will take good care of an orchard even if he does not expect an immediate return. This is also a good investment for such a man becomes known and can therefore secure a farm more readily and sometimes on better terms.

Unquestionably the most effective way to bring the rented orchards up to the average is to give leases for a longer time. The commonest reason for not doing this is the fear that a shiftless tenant will secure the place and retain it. There is abundant reason for this fear, but if the renter changes every year or two, the chances of a bad one at some time are multiplied. Such a man may do more damage in one year than can be overcome in many years. A fairly good man, or even one that is below the average, if kept from year to year will give better results than a rapid succession of good and bad tenants.

As one travels through orchard after orchard, he becomes more and more impressed with the desirability of maintaining the American ideal of every farm owned by the man who works it. But if the owner secures the best renter possible, gives him a lease of several years, requires good care of the orchard, and then is willing to bear part of the expense of renovating the orchard where this is necessary, the renter ceases to be a menace to the apple industry.

CHAPTER XII.

VARIETIES.

The varieties grown.—Nearly all the bearing orchards are made up of a mixture of Baldwin and Rhode Island Greening, with a few trees of other kinds. There are more Baldwins than of all other varieties combined. Probably eighty to ninety per cent of all the trees are either Baldwin or Greening. The larger part of the balance are Tompkins King, Northern Spy, Twenty Ounce and Roxbury Russet. There are some trees of many other varieties but the numbers are so small as to be unimportant in comparison with the above kinds. Some of these less important varieties are: Hubbardston, Ben Davis, Esopus Spitzenburg, Wagener, Duchess of Oldenburg, Red Astrachan.

The young orchards also differ much in varieties, but the larger part are planted to Baldwin, Ben Davis, Greening, Hubbardston. Other varieties that are being planted to a very limited extent are: Duchess of Oldenburg, Wealthy, Wolf River, Mann, Grimes Golden, Rome Beauty, Maiden Blush, Red Astrachan, Northern Spy, Russets, Snow, Yellow Bellflower, Boiken, McIntosh Red, Gravenstein, Sutton Beauty, Bismark, etc.

Variations within the variety.—"We know that no two trees in any orchard are alike, either in the amount of fruit which they bear or in their vigor and habit of growth. Some are uniformly productive and some are uniformly unproductive. We know, too, that scions or buds tend to reproduce the characters of the tree from which they are taken. A gardener would never think of taking cuttings from a rose-bush, or chrysanthemum, or a carnation which does not bear flowers. Why should a fruit-grower take scions from a tree which he knows to be unprofitable?"

"The indiscriminate cutting of scions is too clumsy and inexact a practice for these days, when we are trying to introduce scientific methods into our farming."*

Long ago men learned that two cows were not necessarily alike because they were both Jerseys. The man who would raise cattle from any individual merely because it belonged to the desired breed would be ridiculed. But there are as great differences between Baldwin apple-trees as there are between Jersey cows.

*L. H. Bailey, Cornell Bulletin 102, Oct., 1895.



FIG. 76.—The old "mother tree" from which all of Mr. Smith's trees were grafted. It bears excellent apples and good crops of them. About 500 trees have been grafted from this tree.



FIG. 77.—Trees in Mr. Smith's young orchard. Top-worked with scions from the "mother tree."

When the farmer has top-grafted his trees, as is sometimes done for other reasons, there has probably been more or less unconscious selection from good trees. Few nurserymen have yet paid any attention to the matter, nor are they likely to do so till fruit-growers are willing to pay for the increased work.*

One good example of care in the selection of scions was seen in Orleans county. Fifty-three years ago Mr. Russell Smith of Albion grafted one tree to Baldwin. This proved to be so exceptionally productive that he grafted some of the other trees in the same orchard with scions from it. A few years later another orchard of three acres was planted. A large part of these trees were top-worked to Baldwin with scions from the original tree. In 1868 his sons, S. W. and William Smith, decided to plant ten acres more. They bought good Northern Spy trees for stocks and top-worked them to Baldwin. Most farmers would have taken the scions from the young orchard because longer and better-looking shoots could have been obtained, but they were not satisfied to do this. They went to the original "mother tree" for all the scions. This mother tree is still living and producing apples. "It is literally bearing itself to death." (See Fig. 76.) The orchards grafted from it are all producing large crops. (See Fig. 77.) Of course there are plenty of good trees in New York that were budded or grafted with scions taken from young trees or that were taken indiscriminately from old trees, just as there are good cattle that were produced without any care in breeding. Some good ones will certainly be secured by accident, but the scientific fruit-grower eliminates all accidents so far as possible. He increases his chances for success when he secures good nursery-grown stock and top-works it from trees of bearing age—trees of known productiveness, vigor and quality.

*J. H. Teats & Sons, of Williamson, are growing "pedigreed" peach trees. They have several good orchards, but have only a few trees that they consider good enough to bud from. Such a tree must be hardy, it must bear the best peaches and plenty of them. They find that the public is willing to pay more for these trees than for trees where no selection has been practiced.

CHAPTER XIII.

ENEMIES OF THE APPLE.

The more serious enemies.—The codlin-moth and the scab fungus are the most serious enemies of the apple in Western New York. The scab is not so injurious if the apples are to be evaporated, but it probably causes more loss than any other enemy when apples are to be barreled. It was very destructive in 1902, was of small importance in 1903, and was very prevalent in 1904.

Of the insects that attack the tree, the canker-worm (commonly called "army worm") has done the most damage, but it is now practically subdued. Probably the wood-rot fungi have done more to shorten the lives of the trees than any other enemy. These gain entrance through wounds and rot out the trunk so that the trees eventually break down. (See pruning, Chap. IV.) Canker of the limbs has done much damage and has killed a number of entire orchards. (See page 341.) The collar rot, "King disease," or "winter injury," as it is variously designated, is the worst enemy of King and Spitzenburg varieties. It is not so serious with other varieties. (See page 345.)

In addition to these there are many kinds of insects and diseases that do a small amount of damage every year. In their ups-and-downs sometimes one and sometimes another becomes serious. The bud-moth probably did as much damage as any other insect in 1903. Aphids were the worst enemy of young trees and caused considerable damage in old orchards. They were worse on thrifty trees than on slow-growing ones. The best orchardists therefore suffered the most loss from them. The apple bucculatrix, or ribbed cocoon-maker of the apple, the apple weevil and the mites each did considerable damage in a few orchards. Table 36 indicates something of the relative importance of the various enemies in 1903.

TABLE 36.

Insect and fungus enemies of the apple in 1903.

	Injury.	No. orchards.	No. acres.
Canker (<i>Sphaeropsis malorum</i>).....	serious	87	526½
	considerable	83	729½
Bud-moth (<i>Tmetocera ocellana</i>).....	serious	45	590¾
	considerable	37	221
	slight	148	614¼
Codlin-moth (<i>Carpocapsa pomonella</i>).....	serious	61	333½
	considerable	45	631
	slight	all bearing orchards	

TABLE 36—*Concluded.*

	Injury.	No. orchards.	No. acres.
Collar rot	considerable	31	212
	slight	nearly all old orchards	
Aphis (<i>Aphis pomi</i>)	serious	55	458
	considerable	44	324½
	slight	all orchards	
Scab (<i>Venturia inaequalis</i>)	serious	66	424½
	considerable	68	440
	slight	all bearing orchards	
Apple-weevil (<i>Anthonomus quadrigibbus</i>)	serious	13	87½
	considerable	13	79½
	slight	28	182
Apple bucculatrix (<i>Bucculatrix pomifoliella</i>)	serious	7	73
	considerable	9	156½
	slight	all old orchards	
Canker on leaves (<i>Sphaeropsis malorum</i>)	serious	4	94
	considerable	3	67
	slight	1	4
Leaf-blister mites	serious	4	25½
	considerable	6	34
	slight	56	372¼
Leaf spot (<i>Phyllosticta sp.</i>)	serious	5	44
	considerable	9	383½
	slight	nearly all orchards	
Leaf sewer (<i>Phoxopteris nebeculana</i>)	serious	4	43
	considerable	7	104
	slight	33	719
Canker-worm (<i>Paleacrita vernata</i>)	serious	3	21
	considerable	3	12½
	slight	3	27½
Tent caterpillar (<i>Clisiocampa americana</i>)	serious	1	10
	considerable	2	6½
	slight	36	146½
Woolly aphis (<i>Schizoneura lanigera</i>)	serious	2	6
	considerable	4	22
	slight	nearly all orchards	
Fall web worm (<i>Hyphantria cunea</i>)	serious	0	0
	considerable	2	3½
	slight	27	479½
San José scale (<i>Aspidiotus perniciosus</i>)	serious	0	0
	considerable	1	4
	slight	1	2

This table includes all the enemies that were found to be serious in any orchard, except borers and the wood-rot fungi. Many other insects and fungi were seen but were not doing any considerable harm.

Common notions regarding orchard enemies.—It is interesting to note the enemies that have impressed themselves on the minds of the orchardists. In answer to the question as to what insects or diseases had damaged the orchard in the past, the canker-worm was mentioned for 173 orchards, scab for 120, tent-caterpillars for 112; codlin-moth came fourth. No other enemy was mentioned more than five times. Among those mentioned were canker, borers, San José scale, pink rot, case-bearers, collar rot, leaf-roller, oyster-shell bark louse, aphids, handmaid moth, curculio, palmer-worm. Losses due to mice, sun scald and russetting of the fruit were also mentioned.

THE APPLE-SCAB FUNGUS (*Venturia inaequalis*).

Importance of this disease.—The worst disease with which the apple-grower has to contend is the apple-scab, commonly called “the fungus.” More questions are asked about it than about any other enemy of the apple, and there is great difference of opinion among farmers as to what it is and what to do about it. True, spraying has become an accepted practice and the best fruit-growers practically eliminate the scab, but the majority of farmers do not do so. The varying opinions are due to the fact that the fungus is invisible or inconspicuous until it “goes to seed.” A knowledge of its life history is essential to any intelligent treatment of it. It has been frequently described, but the information is not yet sufficiently disseminated. I shall, therefore, attempt to answer some of the common questions that are asked about it. A few questions are asked over and over again. “What is the fungus?” “What causes it?” “Why is it worse in wet seasons?” “Why are some varieties more affected than others?”

What is the scab fungus?—“This apple-scab is no new pest. It has no doubt been seriously present ever since apples were grown in the country, causing many failures of crops which were laid to the weather or the moon.”*

This fungus is a very small plant that grows as a parasite on the leaves and on the apple,—the apple is its soil. We might say that it is a weed that grows on the apple and allied fruits rather than on the ground. It lives over winter on the fallen leaves and perhaps to a very limited extent on the branches. “Scab makes its first appearance early in the spring, usually soon after the leaves begin to unfold, and it is while these and the fruit are in a young condition that the fungus can best infect them.”† (See Fig. 78.) The seed (spore) falls on the

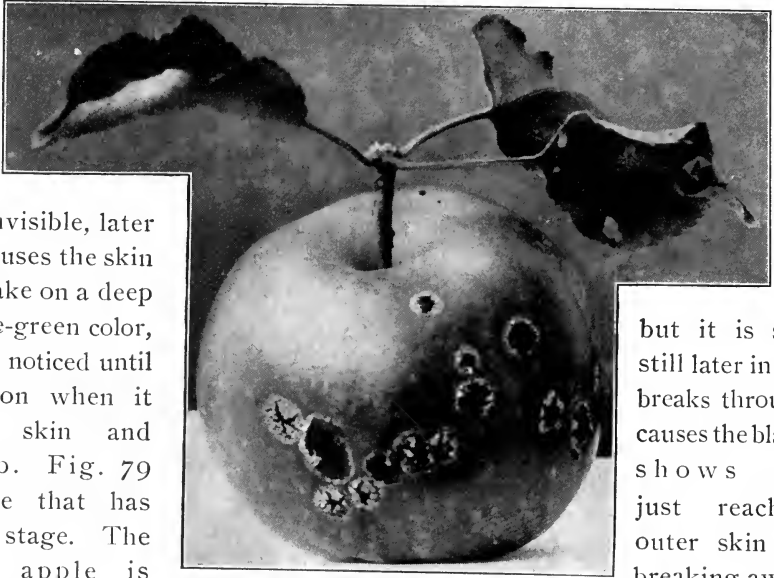


FIG. 78.—Young apples severely attacked by the scab fungus.

*L. H. Bailey in Cornell Bulletin 84, Jan., 1895.

†George P. Clinton, Bul. 67, Univ. of Ill. Agr. Exp. Sta. Dec., 1901.

young apple or on the leaf and there grows, sending its roots (mycelium) into the tissues of the apple. At first the infected spot



is invisible, later it causes the skin to take on a deep olive-green color, dom noticed until season when it the skin and scab. Fig. 79 apple that has this stage. The the apple is exposing the which has now

FIG. 79.—The outer skin (cuticle) ruptured, exposing the fungus.

but it is sel- still later in the breaks through causes the black shows a just reached outer skin of breaking away black fungus, "gone to

seed." In time the spores are blown and washed away and some of the fungus cells and dead tissue are more or less worn away so that the color

may become a reddish-brown, due to the exposed dead corky tissue. The scab spots on the left in Fig. 80 show the spores and fungus cells beginning to leave from the center of the spot. The large scab on the right shows the rusty scar that is left after the disease tissue has scaled off. Farmers describe this change by saying that "the fungus leaves the apple," or "the fungus changes to rust."

If this takes place before the apple is picked, the appearance



FIG. 80.—The diseased tissue scaling off from the apple.

and keeping quality are not so seriously affected as when picked in the stage shown in Fig. 79, but the fungus may make some further growth around the edge of the scar if put in warm storage.

Fig. 81 shows a Baldwin apple so badly attacked that it has become distorted and cracked. Most cases of cracking of the apple are due to this fungus.

Fig. 82 shows three sections of apple-leaves. "In Fig. 1 the leaf is healthy. Observe the regularity of the three upper layers of cells. In Fig. 2, the brown fungus may be seen growing on the upper surface, and at this stage it has

destroyed the upper or epidermal cells, although it is probable that the mycelium of the fungus first spreads just under the cuticle, on top of the layer of epidermal cells. Fig. 3 shows the fungus when it is better established, and it will be seen that all the cells of the leaf are disarranged, the chlorophyll or green grains being few in number, and the leaf has increased in thickness.

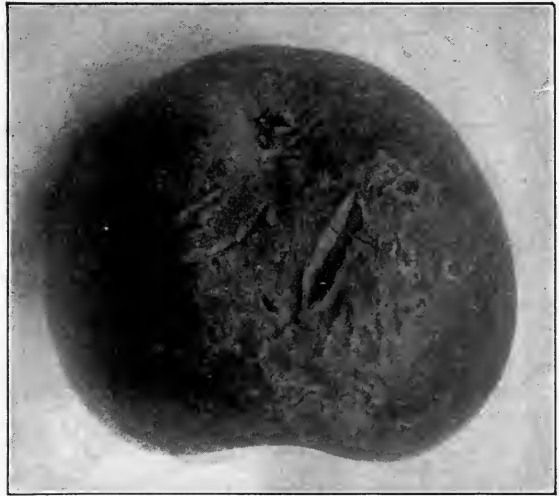


FIG. 81.—Baldwin apple showing cracking due to the fungus.

This, Fig. 3, is a cross-section through one of the blister-like elevations which are shown on the leaf in Fig. 83. It will be seen that the fungus does not enter the deeper tissues of the leaf, although it disorganizes them by its parasitic effects. In Fig. 3, a spore can be seen at A, and two are shown broken off their stem or hyphae at B. In Fig. 2 the spores can be seen in process of formation at the ends of the threads, and at C one of the threads is cut off."*

Relation of the weather to the scab fungus.—Nearly all fungi are favored by wet weather; wheat rust, bean rust, potato blight, etc., are all worse in wet seasons. The wet weather does not create any fungus

*L. H. Bailey in Cornell Bulletin 84, Jan., 1895.

any more than favorable weather creates a corn crop. A fungus cannot develop unless the spores get on the host plant any more than a corn crop can be grown without planting the seed. But there are usually plenty of spores on hand so that all they need is weather favorable to their growth. Unusually wet weather during the blossoming period favors the growth of the scab fungus. For the same reason it does more damage in shady, unpruned and undrained orchards. Dense tops prevent the evaporation of the moisture. Open tops allow the air to circulate freely, and they therefore quickly dry out after a rain or dew.

Some varieties are more affected than others.—The Snow, Spitzenburg

and Maiden Blush are particularly subject to scab. The Greening and Twenty Ounce are more affected than the Baldwin. Golden Russet and Hubbardston are among the more resistant varieties. The difference is probably due to the more tender outer skins of some varieties. The fungus must penetrate the

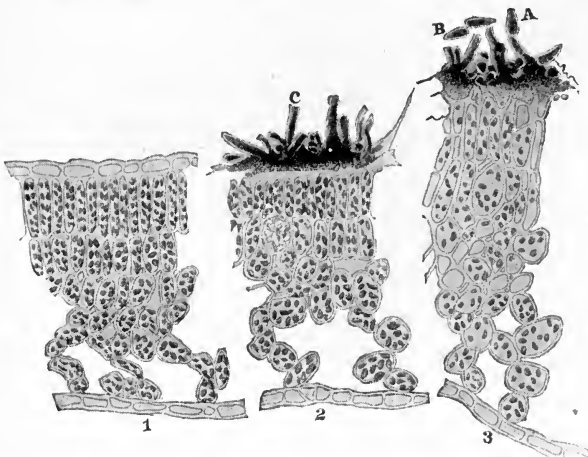


FIG. 82.—Cross-sections of apple leaves. 1. Healthy leaf. 2. The upper surface attacked by the scab fungus. 3. A later stage in the growth of the fungus.

outer skin before it can do any damage. It is interesting to note that while the Greening apples are much more affected than the Baldwin, yet the Baldwin foliage is very much more affected than that of the Greening.

Relation to other fungi.—The scab fungus is often confused with other fungi that secure a foothold in the wounds caused by the scab. Part of this confusion is doubtless due to the fact that the scab is almost always called “the fungus.” It would be well if farmers would call it the apple-scab, in order to distinguish it from the hundreds of other fungi. The scab fungus causes the dark spots on the apple that may later change to rusty spots. It is never white. The white moulds that sometimes grow on these same spots are other fungi that could not have

hurt the apple had the skin not been broken by the scab or by some injury. One of these, the pink rot, caused much damage in 1902.*

Treatment.—A sufficient number of thorough sprayings with the Bordeaux mixture will keep the apples practically free from scab. The essential points are thoroughness and promptness. Spraying after the scab becomes established does little or no good. Some men have been surprised to see the scab develop under spots where the spray was still visible. This simply means that the spraying was too late—the fungus was already in the apple.

Since the spores do not all germinate at once, we should not expect one appli-



FIG. 84.—Leaf spots probably caused by *Phyllosticta* sp.



FIG. 83.—The scab fungus on the leaf.

cation of Bordeaux to keep off all the scab any more than we would expect one cultivation of a corn crop to kill all the pigweeds. One application if made at the right time will, however, frequently make a great difference. Three sprayings at the right times will nearly always keep the apples free from scab. Two will sometimes do so. A further discussion of the method of summer treatment and of winter treatment will be found under spraying. (Pages 392 to 394.)

Leaf spots caused by the scab fungus.—Fig. 83 shows the large blister-like elevations caused by the scab. These spots usually occur on the upper surface, but are not confined to that surface. Late in the season they are nearly black, the color

*Cornell Bulletin 207.

of the scab on the apple. Scab did considerable damage to the foliage in unsprayed orchards in 1904.

Leaf spots caused by other diseases.—Fig. 84 shows the spots caused by a different fungus, probably *Phyllosticta*. These spots are of a reddish-brown color. They do not blister the leaf. This fungus did little damage in 1903, but in the wet season of 1904 it caused much damage to the leaves. Spraying seems to have had little or no effect in checking this disease.

The so-called "yellow leaf" that caused the leaves to fall during July and August was partly due to this trouble and partly due to wet soil. Many orchards that are ordinarily well drained were wet this year. (See Fig. 74.) Those that are ordinarily too wet were very bad in 1904. The leaf spot was generally much worse in the poorly drained orchards. In some orchards the scab on the leaf and the mites also caused leaves to fall.



FIG. 85.—Under side of leaf, showing leaf blisters caused by mites.

Leaf-blister mite.—Fig. 85 shows the under side of a leaf infested with the blister mite. This had not been reported as occurring on the apple until it was found during the orchard survey in Wayne county. Specimens were sent to Professor Slingerland, who wrote as follows concerning them: "The pear-leaf-blister mite is now a well-known

pest in many sections of the country, but never before until last summer had we seen or heard of a similar pest in apple-leaves. Scattered through central New York there were many apple-trees with many of their leaves showing the corky blisters characteristic of these mites. We have not yet made a careful study of the mites to determine if they are the same as the pear species. The blisters in the apple-leaves differ slightly from those in pear, but this may be due to the different food-plants."* These mites were found in 53 orchards in 1903 and were found in many orchards

*Bulletin 46. Division of Entomology, U. S. Department of Agriculture.

in Orleans county in 1904. They were not very bad in more than a half dozen orchards in each county, but in a few orchards some trees had practically every leaf affected. Their local distribution even in the severe cases seems to indicate that they do not spread rapidly. The ordinary spraying has no effect on them, because they live within the leaf where poison can not reach them. It is probable that kerosene emulsion applied before the buds open would kill them.

Injuries due to these three causes and to many other enemies that attack the leaves are quite commonly confused with each other and with spots that are sometimes caused by spraying.

THE APPLE-TREE CANKER (*Sphaeropsis malorum* Pk.).

Description.—The black, rough bark and partially girdled limbs are so characteristic of this disease that it is easily recognized. (See Fig. 86.) The diseased part may extend for several feet along the branch, or may be only a small spot. Usually it is five to ten inches long. The bark may be merely roughened and black (as in *B*, Fig. 86) or the limb may be partially girdled (as in *A*, Fig. 86). In the worst cases the dead limbs stick out all over the tree-top. (See Fig. 87.)

Extent of the injury.—The canker causes more loss than any other disease except the scab fungus and, possibly, the fungi that cause the trunks to decay when improperly pruned. It was found to be very serious in 14 per cent of the orchards and was doing considerable damage in 19 per cent. Injuries of this character are less conspicuous but are much more serious than those that affect the leaves—canker attacks the tree directly. It does not often do much damage on young trees. It usually occurs on limbs two to three inches in diameter, but sometimes attacks the twigs or larger limbs. It very rarely occurs on the trunks, except on the Twenty Ounce. This variety is particularly subject to the disease. I have seen very few mature Twenty Ounce trees that were not badly infected. It is also serious on the Spitzenburg. The Baldwin is more affected than the Greening, Russet, King or Northern Spy.

The same fungus occurs on the leaves, but does not seem to be serious. In Wayne county in 1903 it was found on the leaves in eight orchards and was doing considerable damage in seven of them. It was not found on the foliage of any orchard examined in 1904. On the leaf it shows a distinct series of concentric circles. One infected point may develop

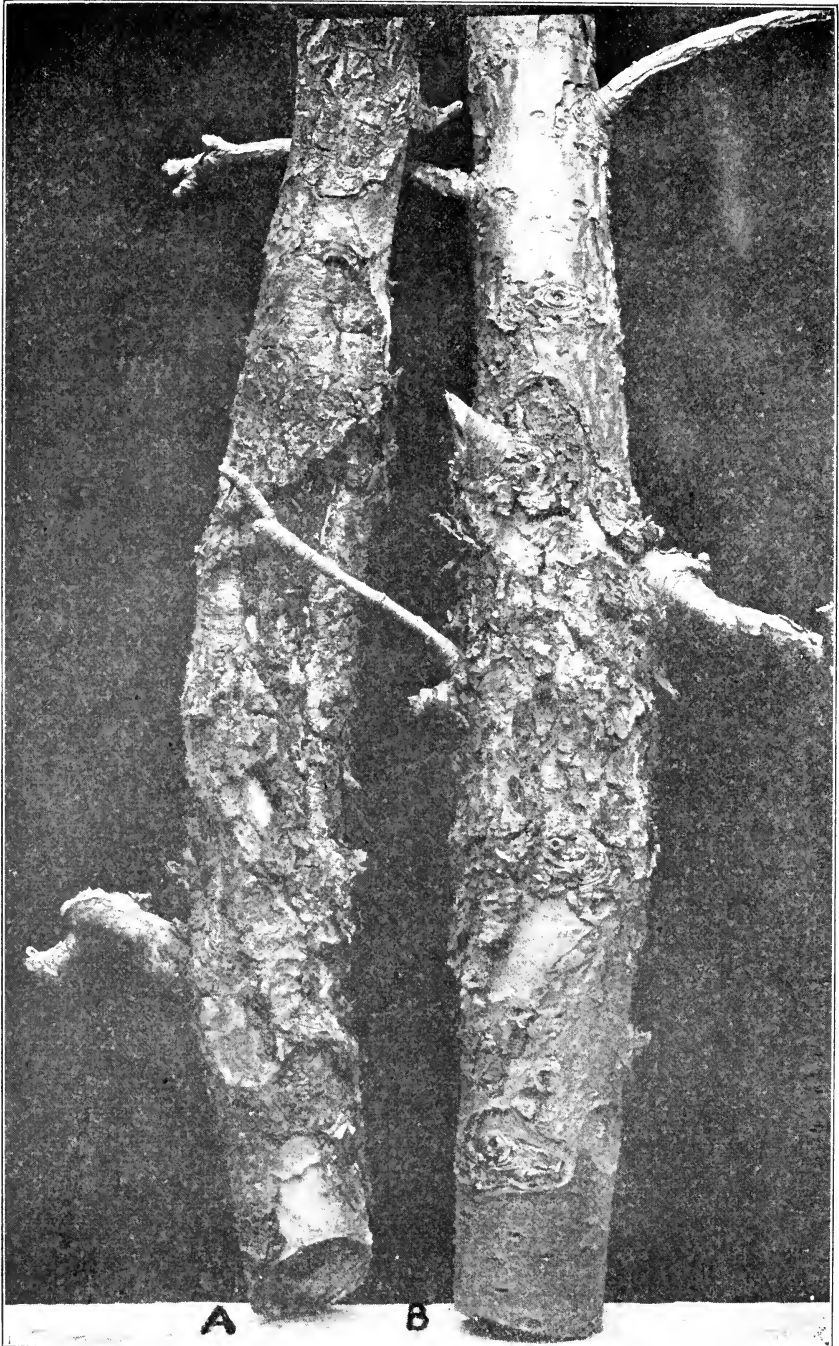


FIG. 86.—Canker of the apple-tree. In B only the outer bark is affected. A shows the branch half girdled.

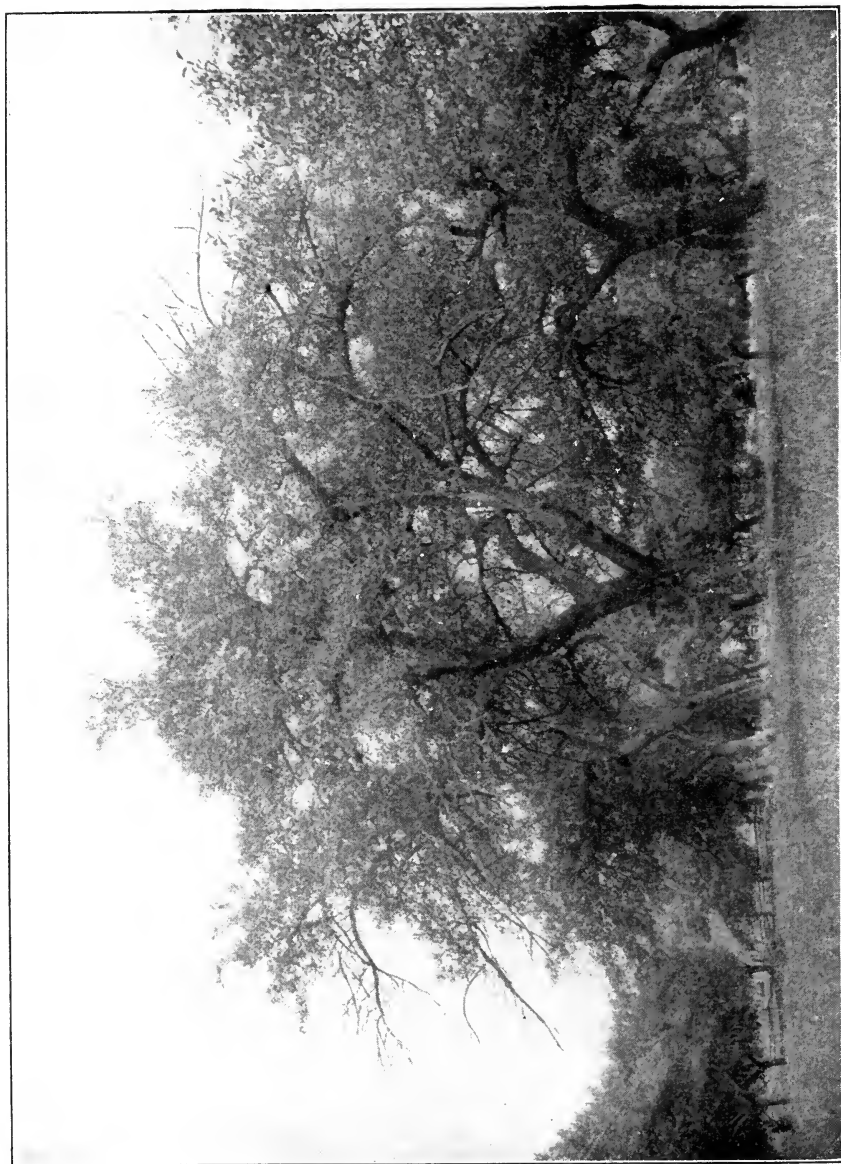


FIG. 87.—An orchard badly infested with canker. The dead limbs have all been killed by it.

to nearly half an inch in diameter. The brown rot of stored apples is also due to the same fungus.

Cause.—The cause was not known until about six years ago, when it was worked out by Wendell Paddock of the Geneva station.* Until that time it was commonly attributed to sun-scald. Comparatively few fruit-growers are yet informed of the real cause. It is still attributed to sun-scald or lightning, or passes as “dead limbs” without any cause. Practically no sun-scald has been seen in either of the counties studied.

Mr. Paddock found that the canker is caused by a fungus that grows on the bark and cambium† layer of the tree. The black color of the canker is partly due to the spore-fruits of the fungus. Many of the spores (seeds) remain on the branches till spring or longer, when they are given off and disseminated. The fungus seems to be unable to penetrate to the cambium layer through living bark. The cankers are thought to be formed by those spores that chance to fall in some slight wound and there germinate and produce more cankers. Sometimes the fungus grows for some distance on the outer bark without penetrating to the cambium. (See *B*, Fig. 86.) In such cases no direct injury is done to the tree, but spores are produced and disseminated so that a constant source of infection is maintained.

Treatment.—With the exception of the Twenty Ounce, no orchard in which the trees have always been kept in a good growing condition has been found to be seriously affected. Something more than thrifty growth seems to be necessary in order to prevent the destruction of the Twenty Ounce.

A few farmers in Wayne county and more in Orleans county have been treating the disease during the past few years and have had excellent results. The essential points of the treatment are:

- (1) Prune out the limbs that are badly diseased.
- (2) Spray the limbs with Bordeaux mixture.
- (3) Most important of all, get the trees to growing.

Mr. G. D. Simpson of Carlton has carried the treatment a step farther. When pruning he scraped off the rough, diseased bark around each canker and gave a generous application of strong blue vitriol. This was undoubtedly a good thing, but the treatment given above seems to be invariably successful.

*New York Agricultural Experiment Station, Bulletin 163, Dec., 1899.

†The cambium layer is a tissue that lies between the wood and the bark. It is the tissue that produces the new wood and inner bark.

Mr. Albert Wood of Carlton Station has even grown new tops on his Twenty Ounce trees and has kept the new growth from becoming diseased by spraying the limbs and by keeping the trees growing. This variety is so subject to canker that it can not be kept healthy without constant vigilance.

COLLAR ROT.

Occurrence and description.—In nearly every mature orchard one comes across some trees on which the bark around the base is dead and loose, or has fallen away. The injury usually extends only 6 to 18 inches above the ground, but sometimes it extends 3 to 4 feet up the trunk. As the area of dead bark increases, the tree may be entirely girdled. (See Fig. 88.) It is quite commonly attributed to the hired man having hit the tree with the machinery when working in the orchard, and the injury does resemble a wound made by hitting the trunk at the surface of the ground. But before the blame can be fixed on the hired man we must explain how he happened to hit all the King and Spitzenburg trees and missed most of the Baldwins and Greenings, also why the disease is as bad or worse in those orchards that have not been tilled.



FIG. 88.—A Baldwin tree killed by collar rot. Note the spot at base of tree. In this twenty-acre orchard about one-third of the trees are dead and one-third more are badly affected. In this case the very poor drainage has been largely responsible.

This disease is the worst enemy of the King apple. It has sometimes been called the "King disease."* Probably the majority of all the trees

*Bulletin 191. N. Y. Agr. Exp. Sta.



FIG. 89.—Collar rot of the King, showing diseased and cracked condition of bark.

decay and frequently girdle the tree.

Treatment.—Little can be done except to treat the wound as any other wound should be treated. If the dead bark is cleaned away and paint applied, it will delay the decay of the wood. In some cases this has preserved the wood and the wound has healed over.

The effective treatment must be prevention. If hardy stocks are planted and top-worked to King or Esopus Spitzenburg, the trouble is avoided. (See Fig. 92.) The losses of Baldwin from this disease are not very great, but are enough so that it might pay to top-work them

of this variety that are thirty years old are affected. It is nearly as serious on the Spitzenburg. The Baldwin is more affected than the Spy, Greening or Russets, but none of these are as badly affected as are the King and Spitzenburg. It seems to be worse on poorly drained land than on good soil.

Cause.—The cause is not definitely known. It is probably sometimes due to winter injury, but this does not seem to account for it in all cases. Whatever the original cause, the wound once made becomes infected by the wood-rot fungi, which cause the trunk to

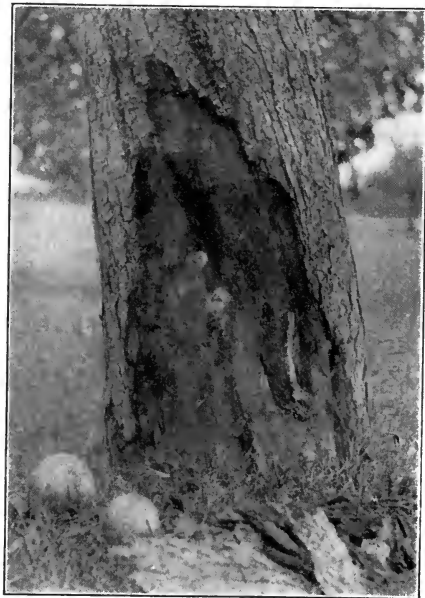


FIG. 90.—Collar rot of the King. The same tree as in Fig. 89 with the dead bark removed.

also on some hardier stock, as the Spy. When we add to this the desirability of each grower selecting his own scions from productive trees, it will probably be well worth while to top-bud or graft.

The planting of the King has almost ceased on account of prevalence of this disease. But it furnishes no reason whatever for abandoning this excellent apple. In the many cases where the Kings were top-

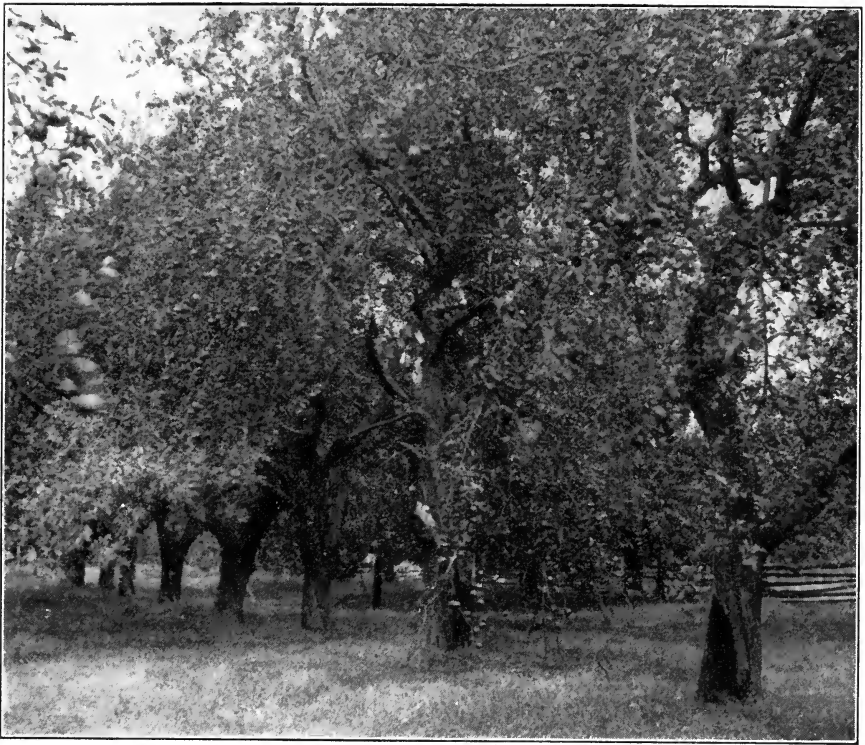


FIG. 91.—A row of Kings, all affected with collar rot. Dying gradually but surely.

grafted, as suggested above, there has been no appearance of the trouble, or no more trouble than was usual for the variety of stock on which it was grafted. *In view of these facts, it seems fair to say that no King or Esopus Spitzenburg tree propagated in the ordinary way should be set in Western New York. If these varieties are desired, secure them by top-grafting on some hardy stock.*



FIG. 92.—Collar rot avoided by top-working on *Spy* stock.

CHAPTER XIV.

YIELDS, MARKETS AND PRICES.

Average yields.—The following tables give some of the chief points in the average yields:

TABLE 37.

Approximate total yield for entire county.

	Bushels.
1899 (U. S. Census report).....	1,394,000
1900	4,872,000
1901	672,000
1902	4,053,000

TABLE 38.

Average yield per acre.

	TREES SET BEFORE 1880.			TREES SET SINCE 1879.			AVERAGE.		
	No. orchards.	Acres.	Average yield.	No. orchards.	Acres.	Average yield.	No. orchards.	Acres.	Average yield.
1899*								19,000	73
1900	171	1,496¾	252	18	190	46	189	1,686¾	229
1901	293	2,041¾	34	25	240	22	318	2,281¾	32
1902	385	2,734¾	222	31	333	74	416	3,067¾	206
1903†							200	1,621¼	265

*The yield for 1899 is for "trees of bearing age" and is taken from the census report.

†The average yield for 1903 is too large for it does not include young trees nor does it include orchards that gave no yield.

TABLE 39.

Average yield per tree.

Trees set before 1880.	Bushels.
1899 (trees of bearing age).....	1.75
1900	5.78
1901 .....	.78
1902	5.01
Average	3.33

This calculation is for the number of trees that the orchards would contain if there were no trees missing.

TABLE 40.

Average number of bushels raised by each grower in Walworth.

	Bushels.
1900	1,700
1901	210
1902	1,200

The three-year-average yield in Walworth township is about thirty-four bushels above that of the entire county. This difference is due to the poorer care given in the remainder of the county, particularly in the southern part.

TABLE 41.

Variations in yields of orchards.

The following table will give some idea of the distribution of yields that produced the averages in 1902, trees set before 1880.

YIELD.	WALWORTH.		REMAINDER OF COUNTY.		ENTIRE COUNTY.	
	No. orchards.	No. acres.	No. orchards.	No. acres.	No. orchards.	No. acres.
0-100 bushels.....	36	191½	17	386½	53	578
101-200 bushels.....	75	361½	27	417½	102	779
201-300 bushels.....	75	312¾	28	344½	103	657¼
301-400 bushels.....	46	301	11	194	57	495
401-500 bushels.....	26	67½	5	55	31	122½
Over 500 bushels.....	31	85	5	53	36	138

The largest yield reported for the year 1902 was 1,000 bushels per acre from a four-acre orchard.

Markets—the evaporating industry.—The orchard industry of this county cannot be understood without a knowledge of the evaporating industry. How predominant this industry is can be seen by referring to table 42. The proportion of apples evaporated varies from year to year, being influenced by the quality of the fruit and the relative prices of green and dried apples. Probably seventy-five per cent of all the apples raised in this county during the past four years has been evaporated. A little less than half the evaporated fruit was evaporated by the man who grew it. That which is sold usually goes to some farmer's evaporator. The evaporators are almost as characteristic of the farmyards as are the barns. They also occur in all of the villages, but the largest part of the evaporating is done on the farms. The industry is a rural one and seems likely to remain such for some years.

TABLE 42.

What becomes of the apple crop.

HOW DISPOSED OF.	1900.		1901.		1902.		1903.	
	Bushels.	Per cent.	Bushels.	Per cent.	Bushels.	Per cent.	Bushels.	Per cent.
Evaporated by the grower.....	90,650	33	12,175	22	191,480	32	160,840	37
Sold to be evaporated.....	92,641	33	14,094	26	213,643	36	134,319	31
Picked and sold in barrels or in bulk.....			9,933	18	73,000	12	139,085	32
Part evaporated or sold to evaporate and part barreled, the proportion not given.....	88,178	32	18,600	34	107,830	18	.....	.....
Otherwise disposed of.....	6,000	2	.....	.....	7,950	2	5,392	1

If we apportion the yield that was partly barreled and partly evaporated then the percentage of the crop evaporated would be about as follows: 1900, 85 per cent; 1901, 60 per cent; 1902, 75 per cent; 1903, 68 per cent.

TABLE 43.

Orchards from which the entire crop was evaporated or sold to evaporate—none were hand-picked.

YEAR.	No. orchards.	No. acres.	No. bushels.	Per cent of the total yield.
1900.....	104	526½	151,700	57
1901.....	41	329½	17,060	31
1902.....	288	1657½	316,980	45
1903.....	113	583	147,830	34

In many cases the fact that the women and children of the household can help in the work, so reduces the expense that the small evaporator can successfully compete with the larger ones.

The evaporating industry furnishes a good outlet for fruit that is not good enough to barrel. It should be encouraged by every possible means. The ease of preserving and the small space into which a bushel of apples can be condensed make this a very desirable way of reaching the cheaper trade in Europe and Asia as well as in our own cities.



A good harvest. Barreled and ready for storing.



Hauling to the depot.

The dried apples occupy only about one-seventh of the space occupied by the green apples from which they came. This makes a great saving in the cost of transportation. The Government can be of great assistance in helping to develop these markets. There should be a good future for the evaporating industry.

But in order to secure and retain this trade the evaporator men must furnish a product that will keep. One of the reasons for the present low price is undoubtedly the result of marketing what has been aptly termed "apple sauce." The stock is not dried sufficiently to keep well. One reliable firm evaporated 52,000 bushels in 1903, which averaged 6.29 lbs. of dried stock per bushel. Their average in 1902 was 6.85 lbs. The average of a number of small evaporators in 1903 was 7.45 lbs.

The number of pounds dried stock that a bushel will give varies greatly with the variety of the apple. Winter varieties average from one-fifth to one-seventh above the fall varieties. Russets give a larger product than Greening or Baldwin. Ben Davis and Twenty Ounce give less than these. The amount is said to vary in different years. But none of these factors account for the difference between 6.29 and 7.45 pounds. If the stock that was dried till a bushel gave only 6.29 pounds was properly dried, what can we say of that which contained 1.16 pounds more water, or what of that where nearly 9 pounds of dried stock were secured from a bushel? The whole subject of evaporating and marketing deserves a careful study.

It would pay to raise better fruit and barrel more of it.—Desirable as the evaporating industry is in disposing of poor fruit, there is little question that it would pay the growers to raise better apples and pick the best for barreling. From a third to a half of the crop, depending on the year, is sold to evaporate without thus selecting the best to barrel, that is, the entire crop is shaken from the trees for evaporating. (See table 43.) This includes a still larger proportion of the number of orchards, in some years as many as three-fourths, for it is more practiced in the small orchards than in the larger ones.

A few growers, particularly in the western part of the county, sell a part of their crop in Rochester to retail dealers or sell it on the streets. This is particularly profitable with apples of extra good quality.

There are a number of secondary markets. One man used 50,000 bushels in 1902 for the manufacture of brandy. The vinegar works

of the American Fruit Product Company at Newark make about half a million gallons of cider and vinegar per year. Many others make smaller quantities of cider and vinegar.

Prices.—Apples for evaporating are sold by the 100 pounds. The average prices and the prices of barreled apples are given in table 44.

TABLE 44.

Average price paid for apples to evaporate per 100 lbs. (2 bushels).

Year.	Price.
1900	\$0 30
1901	64
1902	44
1903	41.3

Average price per barrel.

1902	1 75
1903	1 85
Average price per bushel picked apples sold in bulk, 1903..	44.2
Average price per pound for dried stock, 1903.....	.0504

Apples sold on the streets and to grocerymen in Rochester are quite variable in price, but usually bring two to three times as much as when sold to dry.

The vinegar factories pay the lowest price of any market. The 1902 prices ranged from 12 to 20 cents per hundred.

Income per acre.—The average gross income per acre for the entire county from orchards set before 1880 has been as follows: 1900, \$37.80; 1901, \$14.28; 1902, \$48.18. The averages in Walworth township have been considerably better than the average for the county. If these incomes seem rather small, it must be remembered that averages include orchards that have received no care of any kind as well as those that have received the best possible treatment. Unfortunately the average expense can not be obtained, for very few men keep an account of the expense of caring for the orchard. In a very large number of orchards—the ones that lower the average yield and income—there is practically no expense except the use of the land and the expense of hauling the apples to the evaporator. Table 45 will give a better idea of the average income, as it gives the number of orchards for each difference of \$10 in income.

TABLE 45.

Average income per acre from orchards set before 1880, entire county.

INCOME PER ACRE.	1900.			1901.			1902.		
	No. or- chards.	No. acres.	Per cent.	No. or- chards.	No. acres.	Per cent.	No. or- chards.	No. acres.	Per cent.
Less than \$10....	14	121 ½	10.0	118	670 ½	44.5	16	105 ½	4.4
\$10 to \$19.....	14	161	13.3	25	276	18.4	33	252 ½	10.6
20 to 29.....	16	164 ½	13.5	29	201	13.4	34	213 ½	9.0
30 to 39.....	30	186 ½	15.4	8	55 ½	3.7	52	356 ½	15.0
40 to 49.....	21	103 ½	8.5	9	52	3.5	40	277	11.2
50 to 59.....	23	88	7.3	16	147	9.8	43	230 ½	9.7
60 to 69.....	25	134 ½	11.1	1	8	0.5	22	98	4.1
70 to 79.....	11	74 ½	6.2	1	4	0.3	34	175 ¾	7.4
80 to 89.....	5	13	1.1	2	22 ½	1.5	18	138 ½	5.8
90 to 99.....	2	6	0.5	.....	.....	.....	16	85 ½	3.6
100 to 124.....	9	144	11.1	5	23 ½	1.6	30	135 ½	5.8
125 to 149.....	2	8	0.7	4	33	2.2	18	140 ½	5.9
150 or more....	5	14	1.2	3	12 ½	0.8	10	169	7.0

	1900.	1901.	1902.
Average income per acre—entire county— trees of all ages.....	\$34 35	\$13 44	\$44 70
Average income per acre—entire county— trees set before 1880.....	37 80	14 28	48 18
Average income per acre in Walworth—trees set before 1880.....	49 50	17 22	52 58
Average total income per grower in Walworth	255 00	88 20	264 00

SUMMARY.

Extent of the Survey.—During the summer of 1903, 574 orchards, containing 3,761 acres, were examined in Wayne county. In 1904, 564 orchards, of 4,881 acres, were examined in Orleans county. The statistics in this report are based on Wayne county. The results from Orleans county we hope to publish later.

Area planted to apples.—There are in Wayne county about 21,000 acres of apple orchards. The total area of improved land in farms is 305,299* acres; or, 6.9 per cent of the improved farm land is planted to apples.

Varieties.—Baldwin and Greening are the leading varieties. Roxbury Russet, King, Northern Spy and Twenty Ounce are also rather extensively grown. The recent plantings have some of these same varieties, but there is a tendency to plant the earlier-bearing kinds.

Rented orchards.—Between twenty and twenty-five per cent of the orchards are rented. The four-year average yield of those managed by the owner has been 210 bushels; of those managed by renters, 174 bushels.

Orchard renovation.—Nearly all of the orchards have been badly neglected, but during the past few years a large part of them have received more attention. Fourteen per cent have been distinctly renovated during the past ten years.

Tillage and yields.—Twenty per cent have been tilled five years or more; 44 per cent have been in sod at least five years; the others have been tilled part of the time. Thirty per cent were tilled in 1903.

The four-year-average yields have been: Tilled every year for at least five years, 266 bushels; tilled most years, 229 bushels; sod most years, 202 bushels; sod at least five years, 148 bushels. Or the average yield of those that are regularly tilled is 80 per cent above that of those regularly in sod. A part of this difference is due to tillage and a part is due to the fact that the man who tills his orchard is likely to give it improved care in other respects. Taking only those orchards that are otherwise well cared for, the difference is reduced to 35 per cent in favor of tillage, the four-year-average yields being: Tilled every year, 271 bushels; tilled most years, 245; sod most years, 206; sod every year, 200.

Of the various methods of sod treatment, pasturing with hogs or sheep

*Twelfth Census Report.

gave better yields than not pasturing or pasturing with cattle or horses; but none of the methods of sod treatment equalled tillage in average yields. A few sod orchards are among the best producers, but the average is much below that of the tilled ones. Liberal applications of barnyard manure reduce the need of tillage.

Very many orchards are in need of more growth in order to place the trees in a vigorous condition. Tillage is usually the cheapest and most effective way of producing this. Barnyard manure may also be needed.

Fertilization and yields.—One-third of the orchards received no fertilization of any kind. The other two-thirds received more or less manure. Probably less than half received enough of anything so as to be classed as fertilized. Commercial fertilizers have been used in about twelve per cent and green manure (cover-crops) in about the same area.

The average yield for 1902 and 1903 of fertilized orchards was 257 bushels; for unfertilized it was 202 bushels.

A few men have shipped in manure from Buffalo. Some have found that they can profitably buy cattle for winter-feeding, and thus secure manure.

Cover-crops.—On most of the soils, humus is needed more than mere plant-food. Barnyard manure or cover-crops usually give better results than commercial fertilizers.

Cover-crops were grown in eight per cent of the orchards in 1903. Buckwheat is the most commonly used. Crimson clover, red clover, rye, large clover, alfalfa, peas and oats, and vetch are also grown.

Pruning.—The ultimate death of most trees is due to neglect of pruning coupled with a type of pruning that is worse than neglect. In sixteen per cent of the orchards, stubs from two to twelve inches long were left. Paint is rarely used on wounds. This treatment causes the trunks to decay and results in a broken tree.

The important points in pruning are: (1) The limbs should be cut close to the trunk. (2) Large limbs should not be removed without cause. (3) Paint should be used on large wounds. (4) Pruning should be done every year rather than give the occasional "thorough trimming."

Spraying.—Thirty-three per cent of the orchards are seldom or never sprayed; 41 per cent were sprayed in 1903.

Spraying gives less profit when fruit is grown for evaporating than when grown to barrel. In 1903 the damages from insects and fungi were small, but in this year the sprayed orchards averaged 27 bushels per acre

above the unsprayed and averaged better in price. The average income per acre from sprayed orchards was \$77.84; from unsprayed, \$63. In many cases only one spraying was given.

Distance between trees.—A great loss is caused by the trees being too close together. When trees are too close, the lower limbs die and cause a loss not only in the crop, but the dead limbs lead to decayed trunks. In 43 per cent of the mature orchards the trees are 30 x 30 feet or less, the average distance being 31.6 feet. The four-year-average yields have been: Trees not over 30 x 30 feet, 186 bushels; 31 x 31 to 35 x 35 feet, 222 bushels; 36 x 36 to 40 x 40 feet, 229 bushels.

If trees are too close: (1) They are not so healthy. (2) The fruit does not color well. (3) The trees have less bearing surface. (4) Insects and fungi do more damage. (5) The cost of labor is greater.

Orchards should be thinned as soon as the trees begin to interfere, before the lower limbs have been killed. Thinning should ordinarily be accomplished by removing every other row diagonally, first having determined which way will leave the largest number of sound trees.

Age and yield.—The maximum yield in Wayne county seems to come at 44 years after planting. This age will doubtless be greater in the future, for good care seems to give a greater gain in the longevity of the trees than in the yearly yield.

Some orchards planted nearly a century ago are still profitable, but a large number of the neglected orchards that were planted about forty years ago will be of little value in twenty years. In the north part of the county, some young orchards are being planted to meet this contingency.

Drainage problems.—About eight per cent of the orchards need drainage throughout. Thirty per cent need drainage in part of their area. The greatest loss from poor drainage is not in the damage to entire orchards, but in the small undrained places that occur in many orchards.

Fifty-four orchards in Walworth township were reported as needing drainage. These gave 42 bushels less yield per acre than the average of the township.

Poor drainage not only affects the vigor of the tree directly, but it encourages canker, collar rot, etc. Land that is well drained for grain crops may not be well drained for apples.

Soils.—The loamy soils are the best for apple production, but good apple crops are grown on quite diversified soils. The treatment that the

orchard receives is far more important than the kind of soil. This treatment must vary to some extent with the type of soil. A good apple soil in Wayne county may be said to be one that is well drained and deep.

Site and aspect.—The elevation above the surrounding country does not have a marked effect on the yield.

The easterly slopes give considerably better yields than the westerly, probably owing to the strong west winds.

Enemies.—The most serious enemies of the apple are the scab fungus and the codlin-moth. Both of these can be controlled by spraying.

The collar rot or King disease is a rot that kills the bark at the surface of the ground. It is worst on Kings, attacking nearly all the mature trees. It is also bad on the Spitzenburg and occurs to some extent on all varieties. It is usually worst on poorly drained soil. Little can be done except to treat the wounds as any wound should be treated. But the trouble can be avoided by planting hardy stocks, as the Spy, and top-working to King. If this is done, the trouble furnishes no reason whatever for abandoning the King apple.

Canker is a disease attacking the limbs. It is doing considerable damage in one-fifth of the orchards of the county. If the trees had been well cared for, it would seldom have secured a foothold, except in the Twenty Ounce. It can be overcome, except in extreme cases, by pruning out the diseased limbs, spraying the limbs with Bordeaux mixture, and, most important of all, putting the trees in a healthy growing condition.

Evaporating apples.—Wayne county is the home of the apple-evaporating industry. The proportion of the crop that is evaporated varies from year to year, but averages about seventy-five per cent. Some growers pick the best apples to barrel, others shake off the entire crop for evaporating. In 1902 the entire crop was thus shaken from the trees in 45 per cent of the orchard area. A much greater profit would usually be made if the orchard were so managed as to produce a really No. 1 apple, and if more of these were then sold in barrels.

Yields.—The average yields per acre for mature orchards have been: 1900, 252 bushels; 1901, 34 bushels; 1902, 222 bushels.

Income per acre.—The gross average incomes per acre from mature trees have been: 1900, \$37.80; 1901, \$14.28; 1902, \$48.18.

CONDENSED CONCLUSION.

Tillage, fertilization, pruning and spraying are the chief factors that enter into good care of an orchard. One or more of these may sometimes be omitted or poorly done without any serious results. To some extent tillage may replace fertilizers, or vice versa. A thrifty orchard may resist the attacks of disease. Some years there are few insects or fungi, so that spraying is not so much needed. A farmer frequently gets good results from some one of these factors and becomes so impressed with its importance that he makes a hobby of it, to the exclusion of all the others. But the most successful apple-grower is the man who keeps a proper balance between all four agencies and does not expect good care in one respect to make up for neglect in other ways. There is not a recommendation in this report that has not been successfully carried out by some growers; but few men have given attention to all the questions, though some of the most successful have come very near to doing so.

But these factors are not all. The successful man must study; he must learn something of the life processes of the apple-tree; he must know the most serious insect and fungous diseases, and why certain treatment is effective in combating them; he must know something of the drainage, humus and other soil problems.

No set of rules can cover all these points. The apple-grower must go into the orchard and get acquainted with his trees. As one farmer expressed it, he must go into the orchard occasionally and say to his trees, "Good morning! Is there anything that you would like to-day?" There are many more or less successful farmers who never really see the apple-tree—they see only the crop. Any treatment that will temporarily increase the crop seems to them to be good, but this very treatment may be destroying the prospects for future crops.

Nor is success in orcharding wholly dependent on a large crop. There is a business side to the question. Does it pay to grow cheap apples to be evaporated or to be sold at the lowest market price, or would it pay better to grow a first-class article that costs more and then commands the highest price? A few men in each county are known as growers of good apples. Some other men grow just as good apples and yet have no reputation. Sometimes it is because

their "firsts" and "seconds" all get into one barrel, sometimes it is because the growers are not known. The grower of good apples should establish a business reputation that will bring buyers to him and make a competition for his product.

Last of all, let me urge the advisability of keeping an account with the orchard and with the other important crops (as shown on page 297). See which crops really pay. If the apple orchard proves to be the most profitable crop, then give it first attention.

BULLETINS FOR APPLE-GROWERS.

The most progressive fruit-grower studies his business not only in his own orchard but in every way possible. To keep abreast of the progress made in orchard management he must know what other orchardists are doing and must be familiar with the results of experiment station work. The following are a few of the many free bulletins that are available to New York farmers, so long as the issues remain in print.

The following bulletins are sent free to residents of New York on application to the Cornell University Agricultural Experiment Station, Ithaca, N. Y.:

- Bulletin 73. The Cultivation of Orchards.
- 93. The Cigar Case-Bearer.
- 142. The Codling-Moth.
- 153. Impressions of Fruit-Growing Industries.
- 155. The San José Scale.
- 170. Tent Caterpillars.
- 198. Orchard Cover-Crops.
- 207. Pink Rot, an Attendant of Apple-Scab.
- 214. The Ribbed Cocoon-Maker of the Apple.
- 216. Spraying for Wild Mustard and the Dust Spray.
- 217. Spray Calendar.

Bulletins in the following list are sent free to residents of New York on application to the New York Agricultural Experiment Station, Geneva, N. Y.:

- Bulletin 122. The Pistol Case-Bearer.
- 163, 185. The New York Apple-Tree Canker.
- 167. A Fruit Disease Survey of the Hudson Valley in 1899.
- 170. Diseases Injurious to Fruits.

- Bulletin 191. A Fruit Disease Survey of Western New York in 1900.
 196. Spraying in Bloom.
 220. Two Unusual Troubles of Apple Foliage: Frost Blisters;
 and Spotting and Dropping of Leaves Caused by
 Spraying.
 235. Two Decays of Stored Apples.
 239. Thinning Apples.
 248. New York Apples in Storage.
 258. A Study of the Chemistry of Home-Made Cider Vinegar.
 193, 194, 202, 209, 213, 228. San José Scale.

Publications sent free on application to the Secretary of Agriculture,
 Washington, D. C.:

Soil Survey of the Lyons Area, New York.

Extract from the Yearbook for 1901.

230. Commercial Apple Orchardling.

Extract from the Yearbook for 1902.

266. Top-Working Orchard Trees.

Extract from the Yearbook for 1903.

317. Relation of Cold Storage to Commercial Apple Orchardling.

Farmers' Bulletins.

Bulletin 113. The Apple, and How to Grow It.

127. Important Insecticides: Directions for their Preparation
 and Use.

146. Insecticides and Fungicides: Chemical Composition and
 Effectiveness of Certain Preparations.

161. Practical Suggestions for Fruit Growers.

181. Pruning.

187. Drainage of Farm Lands.

208. Varieties of Fruit Recommended for Planting.

PART II

THE APPLE INDUSTRY OF ORLEANS COUNTY
NEW YORK

AN APPLE ORCHARD SURVEY OF ORLEANS COUNTY, NEW YORK.

BY G. F. WARREN.

General statement and acknowledgments.—This Bulletin is a supplement to Bulletin 226, "The Apple Orchard Survey of Wayne County," which discussed apple-growing in both counties, the conclusions in it being based on observations made in both counties and on the statistics gathered from Wayne county. In this Bulletin the tables from Orleans county are presented, but the discussions are not repeated except when new or contradictory conclusions are shown. It is therefore expected that the reader of this Bulletin will have at hand Bulletin 226.

Nearly half of the field work was done by Mr. Christian Bües, who not only assisted in the investigation but gave many valuable suggestions on the methods of work.

I wish to thank the five hundred or more farmers who so willingly placed at our disposal the statistics about their orchards and told us of their successes and failures. I might mention in particular the help given

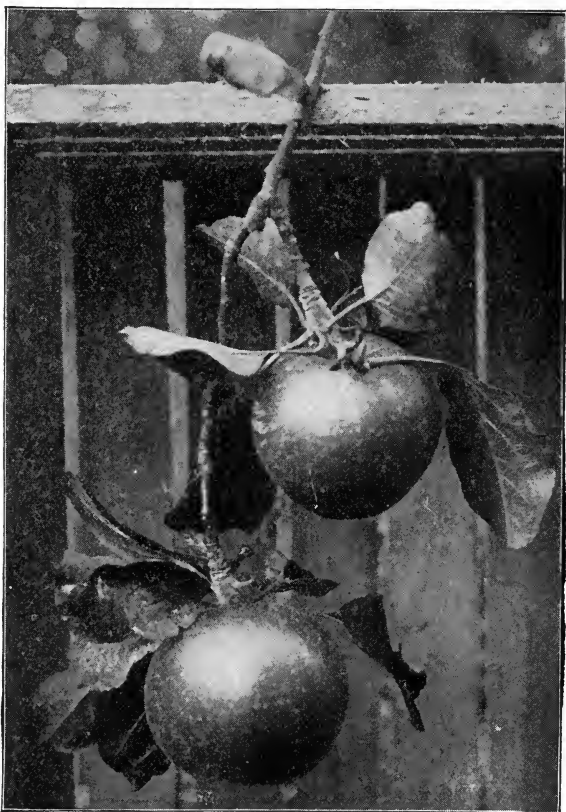


FIG. 158.—*Twenty-ounce.* A profitable apple where the tree is well cared for.

by S. W. Smith, William A. Laffler, J. N. Stebbins, Albert Wood and many others, but no such list can be properly given without including four or five hundred names. The acknowledgments must therefore be to the apple-growers of Orleans county.

The field work.—The work of gathering the statistics was done between August 24 and October 22, 1904. This later period than was spent in Wayne county allowed a more careful study of the condition of the fruit at the time of picking and the relation of the quality to prices. The yields

for 1904 were secured by letter. A total of 564 orchards, containing 4,881 acres, were examined.

Methods of work.—The field equipment, as in Wayne county, consisted of a soil auger, camera, notebook, blanks for reports, bicycle, etc. Mr. Bües and myself were together each evening and worked together in the field frequently, so that the work was kept on a uniform basis.

The methods of making computations were



FIG. 159.—*Baldwin: The leading commercial apple of Western New York.*

carried out as formerly described, except that in computing average yields all bearing orchards were included. But there was an average of only eight orchards set since 1879 whose yields were secured, and these yields were not low (table 17). The average yields are therefore comparable with those in Wayne county for orchards set before 1880. In all computations, a barrel is taken as three bushels. This is a little high, but is necessary as it is the measure generally used by farmers.

In Carlton township, which is the middle one of the three townships bordering on Lake Ontario, every orchard as large as five acres, and most of those above four acres, were examined. In the remainder of the county most of the orchards above eight or ten acres and many smaller ones were examined, the average size being nine acres. The investigation covered the entire county.

Area planted to apples.—The census of 1900 shows that there were at that time 629,401 apple-trees of bearing age in Orleans county. Since the average number of trees per acre is 41.5 (table 15), the total area of trees of bearing age must have been about 15,200 acres. Adding to this the 1,300 acres of young trees (8 per cent of the total area, see table 16), gives a total of 16,500 acres of apples in the county.

The entire area of the county is 399 square miles, so that there is an average of 41 acres of apples per square mile. The area of improved land in farms is 205,279 acres.* Of this area, 6.9 per cent is planted to apples. Nearly all of the orchards are in the north two-thirds of the county. A total of 1,530 acres were examined in Carlton township, which has an area of about forty-six square miles. The area of apples in this township is probably nearly 2,000 acres, as only orchards as large as four or five acres were examined.

TILLAGE.

Acreage of tilled and untilled orchards.—About eleven per cent of the mature orchards have been tilled every year for at least five years; 33 per cent have been in sod for at least the same period; the others have been tilled more or less (table 1).

TABLE I.
Treatment prior to 1904. Mature orchards.

TREATMENT.	No. orchards.	No. acres.	Per cent.
Tilled 10 years or more.....	29	232	5
Tilled 5 years or more.....	34	260½	6
Tilled over half of preceding 5 years.....	97	857½	20
Sod over half of preceding 5 years.....	186	1,617	37
Sod 5 years or more.....	65	635	15—
Sod 10 years or more.....	92	770½	18

Twenty per cent were tilled in 1904. About half of the remainder were pastured and half not pastured. A marked contrast with Wayne county is shown in the very large area pastured by sheep. The area given as pastured by cattle is doubtless too small, as some orchards that had been used as a cattle pasture early in the season were not so used at the time of the survey, and were not reported as having been so used (table 2).

Thirty-six per cent of the young orchards were in sod in 1904, and 9 per cent were sown to grain crops. The remaining 55 per cent were

* Twelfth Census, 1900.

tilled, usually planted to beans or potatoes (table 3). This shows that many farmers are coming to realize that the young orchard should not be considered as one field in the crop rotation, and that tilled crops are

TABLE 2.
Treatment in 1904 of mature orchards.

TREATMENT.	No. orchards.	No. acres.	Per cent.
Tilled with cover-crop	13	127½	3
Tilled without cover-crop	89	745½	17
Sod, sheep pasture.....	102	981	22
Sod, sheep and hog pasture	30	249	5
Sod, hog pasture	62	432½	10
Sod, cattle pasture.....	20	192½	4
Sod, grass cut and left.....	56	627½	14
Sod, not included in above	141	1,132	25
Total tilled.....	102	873	20
Total sod	411	3,614½	80

the only ones that should be grown in it. Needless to say, the young trees that are in sod are usually making a very poor growth as compared with that of those that are tilled. Probably more damage is done to young trees by sod than by all other causes. Some of those that are in

TABLE 3.
Treatment in 1904 of young trees—set since 1895.

TREATMENT.	No. orchards.	No. acres.	Per cent.
Tilled, planted to a cultivated crop.....	31	216½	55
Tilled, sowed to grain crop	5	33½	9
Sod, hay cut.....	9	107	27
Sod, grass and weeds not cut.....	4	33½	9

sod are plowed along the rows or are mulched around the trees so that the damage is lessened.

Yields of tilled and sod orchards.—As shown by table 4, the five-year average yield of orchards that have been tilled ten years is 86 per cent larger than that of those that have been in sod ten or more years, and those tilled five years gave 34 per cent larger yield than those in sod five years. This computation, like all others, was made for Carlton and for the remainder of the county separately. But the conclusions shown were the same in each case, therefore the totals only are given.

Undoubtedly the tilled orchards have fared better in general care. Neglected orchards are likely to be in sod. This table therefore shows too great a difference in favor of tillage. To eliminate other factors, another computation has been made in which all neglected orchards were thrown out. This excluded about half of the orchards that are regularly in sod and excluded some from all classes.



FIG. 160.—*York Imperial*. Prized in Pennsylvania as a winter apple.
Of questionable value in Orleans county.

Table 5 includes only those orchards that are fairly well cared for. All have received some fertilizer and some spraying. None are badly damaged by lack of fertilization, spraying, or drainage, or badly damaged by disease or other causes. Of these fairly well cared for orchards, those that have been tilled ten or more years gave 45 per cent larger yield than those in sod ten or more years, and those tilled five or more years gave 15 per cent larger yield than those in sod the same period. This tabulation doubtless gives too favorable a showing for the sod orchards, for some of the diseased ones thrown out were diseased because of the sod treatment. The real difference due to tillage is probably between the differences shown by tables 4 and 5.

TABLE 4.
Average yield in bushels and income per acre of tilled and sod orchards.

METHOD OF TREATMENT	1900.				1901.				1902.			
	No. orchards	No. acres.	Average yield.	Average income.	No. orchards	No. acres.	Average yield.	Average income.	No. orchards	No. acres.	Average yield.	Average income.
	Tilled 10 years or more	14	113	457	\$209	14	130½	68	\$76	23	182½	361	$203
Tilled 5 years or more	6	64½	294	113	7	71½	71	80	16	136½	331	209
Tilled over half of preceding 5 years.	31	250	269	116	45	349½	61	67	80	664	246	132
Sod over half of preceding 5 years.	64	507½	277	126	70	630	48	54	132	1174	260	130
Sod 5 years or more	18	155½	233	107	25	209	59	04	45	433	219	123
Sod 10 years or more	36	270	200	94	41	337½	46	41	51	442½	204	108

TABLE 4—Continued.

METHOD OF TREATMENT.	1903.				1904.			
	No. orchards.	No. acres.	Average yield.	Average income.	No. orchards.	No. acres.	Average yield.	Average income.
	Tilled 10 years or more.	26	215½	265	\$157	12	111½	487	$266
Tilled 5 years or more.	30	231	277	146	25	208½	399	142
Tilled over half of preceding 5 years.	91	788½	250	137	49	475	207	112
Sod over half of preceding 5 years.	167	1455½	224	119	107	1003	299	106
Sod 5 years or more.	57	502½	239	127	31	284	272	118
Sod 10 years or more.	73	606½	195	112	39	358½	233	81

Five-year average per acre:

	Bushels.	Income.
Tilled 10 years or more	327	\$182
Tilled 5 years or more	274	138
Tilled over half of preceding 5 years.	225	113
Sod over half of preceding 5 years.	222	107
Sod 5 years or more.	204	108
Sod 10 years or more.	176	87

In computing this table, the number of years given is the number preceding the crop reported. Tilled 10 years or more means that those orchards included in the report for 1900 were tilled 10 years preceding the 1900 crop, and the same for other years.

TABLE 5. *Average yield in bushels and income per acre of tilled and sod orchards. Orchards all well cared for.*

METHOD OF TREATMENT.	1900.				1901.				1902.			
	No. orchards	No. acres.	Average yield.	Average income.	No. orchards	No. acres.	Average yield.	Average income.	No. orchards	No. acres.	Average yield.	Average income.
	Tilled 10 years or more	13	106	459	\$216	12	114½	74	\$75	21	166½	374	$207
Tilled 5 years or more	4	47	263	106	6	62	75	83	11	102	329	211
Tilled over half of preceding 5 years.	24	171	279	134	31	239	76	84	52	414½	244	134
Sod over half of preceding 5 years...	49	384½	202	133	50	429	52	65	91	778	296	149
Sod 5 years or more	12	103	286	131	18	154½	69	75	28	234½	279	154
Sod 10 years or more	22	195	228	105	22	196	46	44	27	213½	248	138

TABLE 5—Continued.

METHOD OF TREATMENT.	1903.				1904.			
	No. orchards.	No. acres.	Average yield.	Average income.	No. orchards.	No. acres.	Average yield.	Average income.
	Tilled 10 years or more.....	25	206	267	\$159	11	102½	513	$286
Tilled 5 years or more.....	14	97½	329	178	8	84½	482	159
Tilled over half of preceding 5 years	65	533	253	133	37	345	319	121
Sod over half of preceding 5 years ..	109	925	239	126	78	715½	329	118
Sod 5 years or more	36	310½	314	161	20	182½	343	150
Sod 10 years or more	35	271	264	153	17	146½	374	143

Five-year average per acre:	Bushels.	Income.
Tilled 10 years or more.....	337	\$189
Tilled 5 years or more	296	148
Tilled over half of preceding 5 years.....	234	121
Sod over half of preceding 5 years.....	242	118
Sod 5 years or more.....	258	134
Sod 10 years or more.....	232	117

Effect of tillage on the quality of the fruit.—Apples from sod orchards are frequently more highly colored than are those from tilled orchards, but are not necessarily so. Tillage may make it a little more difficult to secure good color, but there are many tilled orchards that give highly colored fruit. Drainage and feeding are important factors.

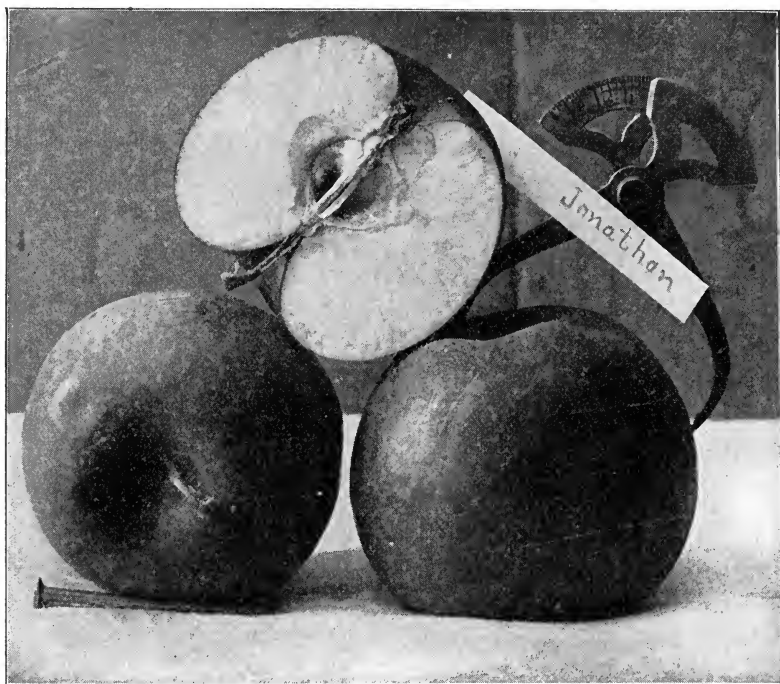


FIG. 161.—Jonathan. *Combines high quality and handsome appearance.*

Many farmers think that apples from the sod orchards have a better flavor and keep better. If these views are correct, the differences are certainly not very great. The increased size of apples from tilled orchards usually more than makes up for any such differences. Apple-buyers frequently discuss this question, sometimes favoring one kind of treatment and sometimes the other. But more conclusive than their discussions or than farmers' opinions are the actual prices paid. It will be seen by tables 4 and 5 that, if there is any difference, the tilled orchards exceed the untilled by a slightly larger per cent in average income than in average yield. That is, the ruling prices per bushel have been a little higher from tilled orchards than from those in sod.

Methods of sod treatment.—Sod orchards pastured with sheep and hogs have given a much better average yield than those not pastured, or than those pastured by cattle (table 6). Probably one reason for the extremely low average for those pastured by cattle is that in Orleans county, cattle are not commonly allowed in any but neglected orchards. Table 6 includes orchards that have been in sod most of the time as well as those regularly in sod. By comparing with the corresponding years in table 4, it will be seen that none of the methods of sod treatment equals tillage in average yields. The corresponding yield for tilled orchards,

TABLE 6
Yield in bushels with various methods of sod treatment.

METHOD OF TREATMENT.	1902.			1903.			1904.		
	No. orchards.	No. acres.	Av'ge yield.	No. orchards.	No. acres.	Av'ge yield.	No. orchards.	No. acres.	Av'ge yield.
Pastured with hogs....	34	236	280	34	233	264	21	131	393
Pastured with sheep...	44	447½	288	85	854½	228	37	343	309
Pastured with cattle...	9	92	99	10	102½	168	7	69	192
Not pastured.....	70	670½	209	98	887	208	60	567	235

Three-year average per acre:

Pastured with hogs.....	312 bushels
Pastured with sheep.....	308 "
Pastured with cattle.....	153 "
Not pastured	217 "

that is the three-year average for orchards that have been tilled five to ten years and more, is 350 bushels.

A few growers are trying the so-called mulch method of cutting the grass and throwing it around the trees. Theoretically this would seem to be undesirable since the great demands for water and plant-food that are made by growing the hay come at the time when the apple-trees need the moisture and food for their own growth. But practically there is a much more serious difficulty. There are comparatively few orchards in which anything like enough hay can be grown to furnish an efficient mulch. For most orchards, additional straw and hay must be obtained from outside the orchard.

Does tillage pay?—After examining tables 4 and 5, and the corresponding tables from Wayne county, one is forced to the conclusion that if there is a method of sod treatment that is as good as tillage, the average farmer has certainly not yet found it. Both counties show that the best

sod treatment thus far generally tested is to pasture with sheep or hogs and give liberal applications of barnyard manure.

There are many sod orchards that are giving good yields. Some of these are producing well, but are having their period of productiveness shortened by sod; some are yielding well and are thrifty. Of the seventy orchards that have been in sod five to ten years or more and that reported



FIG. 162.—*Fall Pippin. One of the old household favorites.*

the yields for 1904, only 14 gave yields equal to the average of the tilled ones. The average proportion for the five years has been the same. That is, one in five of the sod orchards give as good yields as the average tilled ones. Not nearly this number could be said to be very successful. To be called successful the orchard should certainly be in the better half of the tilled ones—not merely equal to the average, which has been lowered by the neglected orchards. Allowing for the trouble and cost of plowing, the loss of pasture, etc., it would still seem that about four-fifths of the sod orchards would pay better if tilled.

Many who have tried tillage have made the mistake of tilling too late in the season. Much of the objection to the practice would not exist were it not for this mistake. If a cover-crop is sown early in July, the trees

may be somewhat checked in growth so that the fruit will color better, and a good floor can usually be secured by picking time. If buckwheat is sown, it should be harrowed down before picking time. If clover is sown, it may need to be mowed. Some very successful orchards are tilled until early in July, then seeded to clover. The next year this clover is mowed, and left as a mulch to be plowed under the following spring. This gives an alternation of tillage and light clover sod.

From the results obtained in the few orchards where it has been systematically tried, it seems safe to strongly recommend to those who wish to continue sod treatment that they go through the orchard once each way with a disc or cutaway harrow early in every spring. This

does much to prevent the formation of a compact soil and a tough sod. It may be advisable to sow a little clover at the time of discing.



FIG. 163.—*Bellflower.* An old-time favorite of good quality.

FERTILIZATION.

Fertilizers used.—Formerly large numbers of orchards were neglected, and received little fertilization of any kind, but now 93 per cent are reported as receiving some kind of fertilization. Not all of these receive adequate applications, for this area includes all that are reported as having received any, regardless of the amount and frequency. The most striking feature is the liberal use of barnyard manure by the majority of the growers. It is used by 91 per cent. A very large number report that all the manure produced on the farm is used in the orchard.

Commercial fertilizers, including wood ashes, have been used in 24 per cent of the area. These are usually applied in combination with manure. Fertilizers without nitrogen or low in nitrogen are usually used. Sometimes the phosphorus is also omitted.

Cover-crops.—Cover-crops were reported as having been used in 3 per cent of the area examined. They have probably been used more than this indicates. Many kinds have been tried, but the majority of the men who use cover-crops favor common red clover or buckwheat. Crimson clover, rye, vetch, rape, alfalfa and others have been used to some extent.

TABLE 7.
Summary of fertilizers used on mature orchards.

FERTILIZER.	USED ALONE.			USED WITH OTHER FERTILIZERS.			TOTAL.		
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.
None.....							43	304½	7
Barnyard manure.....	350	2,738	66	107	1,017	25	457	3,755	91
Commercial fertilizers.	11	83½	2	97	915½	22	108	999	24
Green manure—cover-crops.....				15	133½	3	15	133½	3

Kinds of commercial fertilizers.

FERTILIZER.	No. orchards.	No. acres.
Potash or ashes.....	46	414
Phosphorus with potash or ashes.....	19	158
Complete fertilizer.....	40	404

As already suggested under tillage, it would seem to be desirable to replace some of the manure by tillage and cover-crops. In estimating the profitableness of various methods, farmers usually underestimate the cost and value of manure. But unless tillage and cover-crops are used, the danger is that too little rather than too much manure will be applied. A very few orchards have possibly received a little too much.

PRUNING.

In about half of the orchards the pruning is good or fair. In 11 per cent it is entirely neglected. Very long stubs were left in 17 per cent, and rather bad stubs in 7 per cent more. In 7 per cent the large lower

limbs have been cut off because the trees were too close together. Paint has been used on the wounds in 16 orchards.

The points that need to be considered are the same as those in Wayne county, and are discussed in Bulletin 226. They are:

1. The branches should be cut close to the limb.
2. Large limbs should not be removed unless it is necessary. If the trees are too close together, half of them should be removed rather than spoil the entire orchard by cutting off the large lower limbs.
3. Paint should be used on all large wounds, and renewed yearly until the wounds are healed over.
4. Pruning should be done every year rather than give the occasional "thorough trimming."

TABLE 8.
Pruning.

QUALITY OF WORK: OTHER FEATURES.	No. orchards.	No. acres.	Per cent.
Good	121	931½	21
Fair	175	1,424	32
Poor or neglected.....	161	1,562	35
None.....	57	503	11
Tops too dense.....	65	520	12
Long stubs left.....	104	746½	17
Few stubs left.....	40	406	9
Large limbs removed because trees too close together.....	41	307½	7
Paint used on wounds	16	98	2.

SPRAYING.

Methods of spraying.—Nearly all the orchards are sprayed occasionally. Sixty-one per cent were sprayed in 1904. Only two of the orchards set since 1895 were sprayed in 1904. One-fifth of the area was sprayed with arsenic and Bordeaux mixture. Nearly all the remainder was sprayed with Paris green and Bordeaux. A few growers used prepared mixtures, but none were seen who found these satisfactory (tables 9 and 10).

Effects of spraying on yields and prices.—Spraying has practically eliminated the canker-worm from the county. At present the codling-moth and the apple-scab (commonly called "the fungus") are the most serious enemies. In 1904 fungous troubles were worse than usual, though not as serious as in some years.

In order to get an accurate estimate of the damage done by the scab, the percentage of the apples thus affected was determined for each orchard. This was done by counting and examining apples in each. Every apple that had any scab spots was counted as scabby. Those orchards given in table 11 as having 0-5 per cent scab gave practically perfect fruit—the real No. 1 apples. Those reported as having 6-25 per cent scab gave

TABLE 9.
Spraying, 1904.

HOW SPRAYED.	No. orchards.	No. acres.	Per cent.
Seldom or never sprayed.....	64	565	12
Usually sprayed, but not sprayed in 1904....	143	1, 226	27
Sprayed once.....	98	944½	21
Sprayed twice.....	126	1, 249½	28
Sprayed three times.....	53	521	11
Sprayed four times.....	7	58	1
Total unsprayed.....	207	1, 791	39
Total sprayed.....	284	2, 773	61

TABLE 10.
Kinds of sprays used in 1904.

TREATMENT.	No. orchards.	No. acres.	Per cent.
Paris green and Bordeaux mixture.....	219	1, 883	79
Arsenic and Bordeaux mixture.....	46	424*	18
Prepared mixtures.....	6	41	2
Bordeaux mixture only.....	3	32	1
Paris green only.....	1	7	.....

very good fruit. From those having over 50 per cent scab, it was practically impossible to put up real No. 1 apples.

In practically no unsprayed orchards were over half of the apples free from scab. In nearly all such orchards about ninety per cent were scabby. In 56 per cent of the orchards sprayed once, the apples were not over half scabby. The percentage decreased with the number of sprayings. Over half of those orchards that were sprayed three times were practically free from scab.

These facts will not agree with the opinions of some of the owners of unsprayed or poorly sprayed orchards. Many such men do not recognize the scab; or if they do, they think that when the diseased tissue peels

off, leaving the rusty-colored spot, the scab has left the apple (Bulletin 226, page 337). A still larger number see the scab but underestimate its importance, thinking that the scabby apples keep as well as others and are therefore as good. Such apples do not often keep as well as others, but the serious error in this reasoning is that it leaves out of account the value of beauty in selling fruit. Even if the scabby apple should

TABLE II.

Relation of spraying to the apple-scab fungus in 1904.

METHOD OF SPRAYING.	0-5% SCAB.			6-25% SCAB.			26-50% SCAB.		
	No. orchards.	No. acres.	Per ct. of the area.	No. orchards.	No. acres.	Per ct. of the area.	No. orchards.	No. acres.	Per ct. of the area.
Unsprayed.....	....	.....	...	...	.....	...	5	55	3
Sprayed once.....	2	11	1	21	228	25	26	272½	30
Sprayed twice.....	35	340	27	44	430	35	26	245½	20
Sprayed three times...	31	295½	57	13	169	32	7	42½	8
Sprayed four times....	5	33	57	1	15	26	1	10	17
Total.....	73	679½	...	79	842	...	65	625½	....

TABLE II—(Concluded).

METHOD OF SPRAYING.	51-75% SCAB.			76-100% SCAB.		
	No. orchards.	No. acres.	Per ct. of the area.	No. orchards.	No. acres.	Per ct. of the area.
Unsprayed.....	16	170	10	169	1551	87
Sprayed once.....	12	117	13	34	292	32
Sprayed twice.....	12	123½	10	9	103½	8
Sprayed three times.....	1	4	1	1	10	2
Sprayed four times.....	...	.....	...	...	.....	...
Total.....	41	414½	...	213	1956½	...

happen to keep as well and should taste as well, it would still be a cheap-selling product. To be No. 1, apples must be attractive to the eye. Many growers have honestly considered that their fruit was practically free from scab, when not more than five or ten apples in a hundred were free from it. In order that the question of opinion might not enter into the work, the percentage of scab was determined by counting. Table II shows the results.

Relation of spraying to yields and prices.—Table 12 shows that the sprayed orchards give a much higher yield and income per acre than the unsprayed. The difference in income is due to the larger yield, larger percentage of the crop barreled and higher price per barrel. It will be seen that those sprayed three times gave 31 per cent larger yield and 51 per cent larger income than those not sprayed.

TABLE 12.
Spraying and yield and income per acre, 1904.

HOW SPRAYED.	YIELDS.			Per cent. of crop barreled.	INCOMES.		
	No. orchards.	No. acres.	Av'ge yield.		No. orchards.	No. acres.	Av'ge income.
Unsprayed.....	100	917½	245	71	94	861½	\$92
Sprayed once.....	49	504	307	71	46	468	116
Sprayed twice.....	90	921½	343	75	84	864½	127
Sprayed three times.....	40	426	322	83	37	406	139
Sprayed four times.....	6	43	569	77	6	43	211

TABLE 13.
Spraying and yield and income per acre, 1904. Orchards all well cared for.

HOW SPRAYED.	YIELDS.			Per cent of crop barreled.	INCOMES.		
	No. orchards.	No. acres.	Av'ge yield.		No. orchards.	No. acres.	Av'ge income.
Unsprayed.....	43	381	328	66	54	449½	\$103
Sprayed once.....	33	352	346	74	30	316	139
Sprayed twice.....	70	701	374	78	64	644	143
Sprayed three times.....	27	247½	414	87	25	236½	184
Sprayed four times.....	6	43	569	77	6	43	211

A part of the difference in yield and income is due to other factors. The unsprayed orchards are likely to be somewhat neglected in other respects. To eliminate this factor, another classification was made after all neglected orchards were thrown out.

Table 13 includes only those orchards that are fairly well cared for. They are not badly diseased or damaged from any cause. This shows a marked difference in the percentage of the crop barreled and in average yield and income; the average income per acre being: unsprayed, \$103; sprayed once, \$139; sprayed twice, \$143; sprayed three times, \$184. Allowing for the cost of the extra barrels required, for the cost of spray-

ing and for a possible difference due to other causes than spraying, there is certainly enough difference left to give a large profit from the practice.

The relation of the scab, to the average yield and price.—It will be seen from table 11 that some of the orchards that were sprayed twice or three times had as much scab as some that were sprayed only once. Another classification was made on the basis of results obtained, rather than on the number of sprayings. Table 14 is a summary of these results, when the orchards were grouped according to the freedom from scab, regardless of how that freedom was secured. As would be expected, this



FIG. 164.—Ben Davis. The commercial standard of the Middle West.

shows a greater difference than is shown by table 12. Those orchards that were practically free from scab gave 54 per cent larger yield and 61 per cent larger income than those with over three-fourths of the apples scabby. A large part of the difference in income is due to the fact that from the

TABLE 14.
Relation of scab to income and yields, 1904.

PER CENT OF SCAB.	Average yield per acre—bushels.	Average income per acre.	Per cent of the crop barreled.
0- 5	382	\$143	81
6- 25	319	102	75
26- 50	325	105	72
51- 75	284	87	68
76-100	248	88	70

former, 81 per cent of the crop was barreled, while from the latter, only 70 per cent was thus sold. The difference in yield is partly due to the poorer care given to unsprayed orchards, and is partly due to direct loss caused by worms and scab. The scab probably caused many apples to fall early in the season. Throughout the season it caused some apples to crack and drop.

The time to spray.—As will be seen from table 11, nearly half of those farmers who sprayed only once accomplished little in preventing scab. One-sixth of those who sprayed twice accomplished little, still having over fifty per cent scab. Of the 95 orchards sprayed once, only two were practically free from scab; while of the 126 sprayed twice, 35 were practically free from scab. None of the unsprayed orchards had less than 25 per cent scab, but nine-tenths of those sprayed three times had less than this amount.

The table seems to show that:

1. All unsprayed orchards were badly infected with scab in 1904.
2. Marked results were accomplished by one spraying in half the cases.
3. While two sprayings were sufficient in 27 per cent of the orchards, three was the only safe number.
4. Much of the spraying is done at such a time or in such a manner that it is of little value.

Perhaps the most striking point in this table is the difference in results from the same number of sprayings. Some of the difference is probably due to the weather conditions following the application, but most of it is due to thorough spraying at the right time as contrasted with careless work, or work done at the wrong time.

In 1904 that fruit that was not sprayed IMMEDIATELY after blossoming was invariably scabby. This one spraying was not enough, but it was the most essential one. Farmers frequently put off spraying a few days because they are too busy. This, of all farm operations, must be done at the right time. The seeds (spores) of the scab grow when conditions are favorable. They do not wait for the farmer. Unlike weeds, they are not readily killed when once established. After the mycelium of the scab is within the apple it is safe from the influence of sprays. Since it must be killed by contact, it is evident that every apple must be sprayed on all sides. The results from spraying would be still more striking if only those orchards that were thoroughly sprayed at the right times were included.

Three sprayings are usually sufficient for the codlin-moth and scab in Western New York. The applications should be made:

1. Just before the blossoms open.
2. Immediately after the blossoms fall.
3. Ten to 14 days after the second.

Bulletin 226 gives a fuller discussion of scab and its treatment.



FIG. 165.—*Rome Beauty*. Needs thinning and good care to give size and color.

NUMBER OF TREES PER ACRE.

As in Wayne county, the trees in the old orchards were planted too close together. The favorite distance was 33 x 33 feet. Half of all the orchards were planted at this distance. The average distance was 32.4 x 32.4 feet. Only 5 per cent were over 35 x 35 feet. (In some orchards half of the trees have been cut out so that table 15 shows 13 per cent over 35 x 35 feet.)

In the young orchards, 40 x 40 feet is the commonest distance—57 per cent are set in this way. The average distance is 36.6 x 36.6 feet, but this includes some that have been set more closely with the idea of removing half.

Much damage has resulted in the old orchards from this close planting. In 347 acres, 8 per cent of the total area, half of the trees have been removed, but there is 15 per cent more in which half of the trees should be removed. That is, in one orchard in seven, half of the trees ought to be cut out. In some this should have been done 10 years ago. Some

TABLE 15.
Distance between trees.

DISTANCE APART.	TREES SET BEFORE 1890.			TREES SET SINCE 1895.		
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.
Not over 25 x 25 feet	22	143	3	1	5	1
26 x 26 to 30 x 30	124	1,021½	23	2	35	9
31 x 31 to 35 x 35	308	2,667	60	8	61½	16
36 x 36 to 40 x 40	37	414½	9	34	261½	67
41 x 41 to 50 x 50	4	177	4	3	25	6

	Trees set before 1890.	Trees set since 1895.
Average number of trees per acre.....	41.5	32.5
Average distance apart.....	32.4	36.6

have been almost ruined by the death of the lower limbs or by cutting these limbs off. But in nearly all of this 15 per cent it would still pay to cut out half of the trees. In those orchards where damage has not yet been done, the trees should be removed as soon as they begin to interfere, before they have been damaged. For a further discussion of thinning, see Bulletin 226.

AGE OF THE ORCHARDS.

Date of planting.—Comparatively few orchards were set before 1860, and these orchards were usually small ones, set more for the purpose of supplying the family than for raising fruit to sell. Over eighty-one per cent of the orchards were planted between 1860 and 1879. Planting then

practically ceased till 1899. It then began again, and has constantly increased (table 16). The young orchards are largely in the north part

TABLE 16.

Number of orchards planted during each five-year period. The table includes only those orchards that are still living. Some of the earlier plantings have disappeared.

DATE OF PLANTING.	No. of orchards	No. of acres.	Per cent.
1805-19 (15 years).....	5	22½	0.5
1820-29 (10 years).....	10	51½	1.1
1830-39 (10 years).....	7	28½	0.6
1840-49 (10 years).....	8	32	0.7
1850-54 (5 years).....	30	147½	3.1
1855-59	19	109	2.3
1860-64	105	937	19.5
1865-69	129	1,301	27.0
1870-74	113	939½	19.5
1875-79	69	732½	15.2
1880-84	15	97½	2.0
1885-89	5	22	0.5
1890-94	0	0	0.0
1895-99	6	34½	0.7
1900-04	43	356	7.4

of the county. Fifteen per cent of the total orchard area of Carlton township has been set since 1895.

Age and yield.—The maximum yield seems to come at about 45 to 50 years from the date of planting (table 17). The tabulations for Carlton

TABLE 17.

Age and yield per acre in bushels, entire county.

DATE OF PLANTING.	1900.			1901.			1902.		
	No. orchards	No. acres.	Av'ge yield.	No. orchards.	No. acres.	Av'ge yield.	No. orchards.	No. acres.	Av'ge yield.
1805-29	4	20½	140	4	20½	40	7	36½	189
1830-39	1	2½	180	.....	.....	.....	3	18½	86
1840-49	1	2	255	1	2	50	4	16	229
1850-54	8	45½	415	11	63	73	18	98	351
1855-59	9	51	241	12	67	84	17	101	310
1860-64	41	397	241	42	434	53	72	709½	271
1865-69	37	383	260	48	505½	55	87	874½	270
1870-74	41	352½	210	43	389	69	68	583½	248
1875-79	22	208½	225	28	249½	80	47	504½	174
1880-84	2	23	130	3	32	94	9	53½	165
1885-89	1	3	0	3	11	68	3	11	300

TABLE 17—*Concluded.*

DATE OF PLANTING.	1903.			1904.			FIVE-YEAR AVERAGE.	
	No. orchards.	No. acres.	Av'ge yield.	No. orchards.	No. acres.	Av'ge yield.	Av'ge age.	Av'ge yield.
1805-29.....	9	48½	184	5	25½	226	81	156
1830-39.....	2	12½	102	.....	.....	.....	67	.....
1840-49.....	6	25	252	1	4	88	57	175
1850-54.....	19	104	246	7	42	332	50	283
1855-59.....	19	109	339	14	90	355	45	266
1860-64.....	91	860	245	51	515	336	40	229
1865-69.....	111	1,046½	255	65	688½	283	35	225
1870-74.....	97	831	234	57	579½	291	30	210
1875-79.....	55	605	207	28	305½	210	25	179
1880-84.....	12	80½	170	5	25½	204	20	153
1885-89.....	4	18	216	1	4	125	15	162

No orchards set between 1890 and 1894 were seen. Those set since 1894 have given no yields worth considering. In no year has the average reached one-fourth of a bushel per acre.

and for the remainder of the county, when made separately, show the maximum yields to come at this same age.

There are several orchards from 75 to 100 years old that are still profitable. There are other old trees, but few entire orchards. Most of the orchards have had trees set in at later dates, so that the orchards could not be used in this tabulation of yields. It must, of course, be remembered that most orchards set in the early part of the century have disappeared.

TOPOGRAPHY.

Orleans county is divided into two rather distinct topographical regions: the old lake bed and a glaciated region. Over one-third of the county lies north of the ridge and was formerly the old lake bed. The ridge was a sand bar or the old lake shore line. This is the same ridge that crosses Wayne county and extends from Sodus Bay to Lewiston.

The entire county is gently rolling. There are comparatively few hills, and these are not very high. The general slope is to the north, the rise being from 246 feet, the level of the lake, to about 650 feet, the general level in the south part of the county. The highest elevation in the county is 737 feet.

In many parts of the county there is not enough slope to give good natural drainage. A strip north of the ridge about two miles wide is particularly level. In the south and southeast parts of the county there

are considerable areas of swamp land. The south one-third has few orchards, largely because of the poor drainage. In all parts of the county drainage is the great soil problem. My impression is that one-third of the land should be underdrained.

There are no such marked elevations or steep slopes as in Wayne county; consequently, the question of the direction of the slope is of less importance. The most essential factor is good drainage.



FIG. 166.—*Sutton Beauty*. Resembles highly colored *Baldwin*. A fairly early and regular bearer.

SOILS.

The soil types.—There are four types of soil on which apples are commonly grown: the Miami fine sand, Dunkirk clay, Miami stony loam, and Miami fine sandy loam.* Small areas of several other types of soil are devoted to apples. In general, the soils are quite free from stones; but there are areas both north and south of the ridge that are quite stony.

Miami fine sand.—This is a light brown or brownish-yellow fine sandy loam, underlain by a light yellow fine sand. It is generally free from stones, has a good natural drainage and is easily tilled. It occurs in all parts of the county, but is commonest south of the ridge and about half way between the ridge and the lake.

* For soil analyses and further description of these types, see Bulletin 226.

Miami fine sandy loam.—This is a variation of the fine sand that contains enough fine particles to give it a slightly loamy character.

Dunkirk clay.—This type is light brown, yellowish-brown, or sometimes a reddish-brown clay loam, 8 to 10 inches deep, underlain by chocolate-colored, yellowish-brown, or reddish-brown clay. The subsoil is

TABLE 18.
Relation of yields to soil types.

	1900.			1901.			1902.		
	No. orchards.	No. acres	Average yield.	No. orchards.	No. acres.	Average yield.	No. orchards.	No. acres.	Average yield.
Miami fine sand.....	52	476½	235	67	638½	92	106	955	253
Miami fine sandy loam	21	152	314	28	194	89	47	379½	261
Dunkirk clay.....	63	510	277	80	738½	87	132	1197	256
Miami stony loam.....	41	431	215	37	405½	67	72	757½	206

TABLE 18—*Concluded.*

	1903.			1904.			Five-year average yield.
	No. orchards.	No. acres.	Average yield.	No. orchards.	No. acres.	Average yield.	
Miami fine sand.....	146	1240	242	80	755½	344	233
Miami fine sandy loam	61	500½	239	31	278½	331	247
Dunkirk clay.....	165	1514	221	112	1028½	270	222
Miami stony loam.....	87	912½	240	56	623½	315	209

frequently mottled. This type is most common near the lake, but occurs in all parts of the county. It is a heavy soil and very frequently needs drainage.

Miami stony loam.—This soil is a brown stony loam containing from 10 to 40 per cent of stone, and contains considerable sand. The subsoil is of a yellowish-brown color and contains less stone and sand.

Yields on the different soil types.—Table 18 shows the average yields on the different soil types for the past five years. The sandy loam gave the largest five-year average, followed by the fine sand, then by the clay. But the differences are not great enough nor are they uniform enough in the different years to indicate any particular advantage for any type.

The trees on the sandy soils have a tendency to grow faster, and the fruit seems to grow a little larger. Orchards on the sandy soils are likely to be older before they begin to bear. A suggestion of this is given in the practice of girdling the trees. Some years ago large numbers of trees in orchards on the sandy soils were girdled by running a saw around the trunk. Few on the Dunkirk clay were so treated.

The sandy soils are easier to work and are better drained than the heavier soils, but they require more manure.

As a result of the work in both Orleans and Wayne county, it seems that while a light loam is doubtless best, any well-drained soil in these counties will raise good apples. The sandy soils are certainly better than most of the publications on apple-growing would lead one to believe.

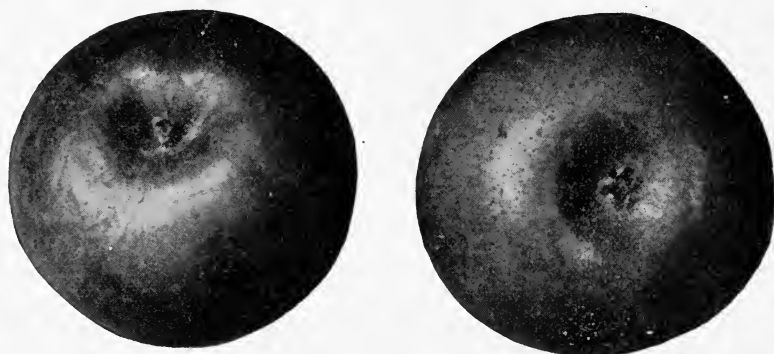


FIG. 167.—Mann. *Greening* type, keeps well, bears irregularly.

Drainage.—A careful study was made of the effect of poor drainage on the orchards. The number of missing trees that had been killed by water was usually counted and a careful estimate was made of those that were badly damaged, and of those that, while not so seriously injured, would still probably pay for tile drainage. A loss of about 8 to 10 per cent can be traced to this cause; 2.3 per cent of the trees have been killed and 9.4 per cent more have been so badly damaged that they are of very little value. According to the opinion of the inspectors, about 20 per cent would pay for underdrainage—all those marked poor, damaged or dead in table 19. This does not mean one orchard in five, but one-fifth of the area. Sometimes a whole orchard is damaged, but usually only a part of the orchard needs drainage.

The subject of tile drainage is one that is worthy of careful thought on the part of Orleans county farmers, not only for orchards but for farm crops.

RENTED ORCHARDS.

More than one-fourth of the orchards are rented, and in about half of these rented orchards the tenant changes every year (table 20). The rented orchards average much below those worked by the owners. Where

TABLE 19.
Drainage.

CHARACTER OF DRAINAGE AND EFFECT ON TREES.	No. acres.	Per cent.
Good.....	2031 $\frac{1}{4}$	47.2
Fair.....	1240	28.8
Poor.....	525 $\frac{3}{4}$	12.2
Trees badly damaged.....	403 $\frac{1}{4}$	9.4
Trees killed.....	100 $\frac{3}{4}$	2.3

the leases have been given for a longer period, the differences are not so great. Even if each tenant were a good orchardist, the rapid changes would soon spoil an orchard, for each man comes with different ideas of pruning and orchard management.

TABLE 20.
Orchards rented and orchards worked by owner.

	No. orchards.	No. acres.	Per cent.
Rented.....	143	1, 273	27
Worked by the owner.....	368	3, 122 $\frac{1}{2}$	73

Years of tenure.

	No. orchards.	Per cent.
First year.....	35	49
Second year.....	19	26
Third and fourth years.....	7	10
Five or more years.....	11	15

Average tenure, 3.3 years.

ENEMIES OF THE APPLE.

The scab probably caused more loss than all other enemies of the apple in 1904. It is discussed under SPRAYING. A leaf-spot, probably *Phyllosticta*, did much damage in many orchards, particularly where the drainage

was poor. Much of the falling of the leaves, called the "yellow leaf," was due to this cause. The damage was not quite as serious as table 21 might indicate. The diseases that attack the tree directly, as the canker



FIG. 168.—*Roxbury Russet*. One of Mr. Albert Wood's "money-makers."

and collar rot, are the worst enemies of the tree itself in orchards where these diseases occur. These and a few other diseases are fully discussed in Bulletin 226.

TABLE 21.

Principal enemies of the apple in 1904.

Apple-scab (*Venturia inaequalis*) see table under SPRAYING.

		No. orchards.	No. acres.
Apple-scab on the leaves.....	<i>slight</i>	53	440
	<i>considerable</i>	55	442
	<i>serious</i>	34	294½
Canker (<i>Sphaeropsis malorum</i>).....	<i>slight</i>	92	809
	<i>considerable</i>	74	613½
	<i>serious</i>	49	450½
Collar rot	<i>slight</i>	56	462
	<i>considerable</i>	22	204½
	<i>serious</i>	16	159
Leaf-spot (probably <i>Phyllosticta</i> sp.).....	<i>slight</i>	100	785½
	<i>considerable</i>	127	1057½
	<i>considerable to serious</i>	151	1429½
Codlin-moth (<i>Carpocapsa pomonella</i>).....	<i>slight</i>	all orchards	
	<i>considerable</i>	47	433½
	<i>serious</i>	55	443½
Leaf-blister mites	<i>slight</i>	11	115
	<i>considerable</i>	4	50½
	<i>serious</i>	4	31½

Injuries usually slight, due to the following, were also recorded: Leaf-hopper, borer, leaf-miner, leaf-sewer, bud-moth, aphid, tent caterpillar, tussock-moth, tortricid, cuculio, *Aspidiotus forbesi*, rose bug, fall web-worm, oyster shell bark-lice, woolly aphis, pink rot, San José scale, etc., etc.

YIELDS, MARKETS, PRICES AND INCOMES.

Yields.—The following tables will give some of the chief points. In computing yields one barrel is taken as three bushels. This is a little too high an estimate, but this basis had to be used as it is the one used by farmers and on which many of the yields were reported by them.

TABLE 22.

Approximate total yield for the entire county.

	Bushels.
1889 (U. S. Census report).....	321,726
1899 (U. S. Census report).....	1,391,630
1900	3,663,000
1901	958,000
1902	3,770,000
1903	3,405,000
1904	4,317,000

The estimates for the last five years were obtained by multiplying the approximate area of 15,200 acres (page 465) by the average yields (table 23). To determine the number of barrels, compare these yields with the per cent barreled (table 26). The yield for 1904 may be too high as there may have been a tendency for those who had a small crop not to reply to the letter requesting that year's yield.

TABLE 23.

Average yield per acre in bushels.

YEAR.	No. orchards.	No. acres.	Average yield.
1899 (U. S. Census report).....	.....	.....	92
1900	176	1,581 ½	241
1901	212	1,972	63
1902	356	3,194 ½	248
1903	485	4,344 ½	224
1904	283	2,869 ½	284

TABLE 24.

Average yield per tree.

	Bushels.
1899	2.2
1900	5.8
1901	1.5
1902	6.0
1903	5.4
1904	6.8
Average	4.6

These results were obtained by dividing the average yields per acre (table 23) by the average number of trees per acre (table 15).

TABLE 25.
Classification of yields.

YIELD PER ACRE IN BUSHELS.	1900.			1901.			1902.		
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.
0 to 100....	36	391	24.8	118	1213	76.4	56	612	18.8
101 to 200....	26	252	16.0	30	264	16.6	93	875	26.9
201 to 300....	53	416½	26.4	8	65½	4.1	89	805½	24.7
301 to 400....	26	192½	12.2	3	18	1.1	53	455	14.0
401 to 500....	23	165½	10.5	3	27	1.7	28	240½	7.4
501 to 600....	10	88	5.6	.....	.....	.....	22	153	4.7
601 to 700....	1	45	2.8	.....	.....	.....	9	63½	2.0
701 to 800....	3	21½	1.4	.....	.....	.....	4	17½	0.5
801 to 900....	.....	.....	.....	.....	.....	.....	.....	.....	.....
901 to 1000....	.....	.....	.....	.....	.....	.....	3	25	0.8
Over 1000....	1	6	0.4	.....	.....	.....	.....	.....	.....

TABLE 25—Concluded.

YIELD PER ACRE IN BUSHELS.	1903.			1904.			Five-year average per cent.
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.	
0 to 100.....	71	674	16.4	29	298½	10.8	29.4
101 to 200.....	124	1169	28.4	49	538½	19.5	21.5
201 to 300.....	137	1248½	30.3	55	631½	22.8	21.7
301 to 400.....	62	497½	12.1	52	508½	18.4	11.6
401 to 500.....	38	292	7.1	49	399½	14.4	8.2
501 to 600.....	13	107½	2.6	22	239½	8.7	4.3
601 to 700.....	6	37	0.9	12	77½	2.8	1.7
701 to 800.....	1	65	1.6	5	29½	1.1	0.9
801 to 900.....	5	28½	0.7	5	25½	0.9	0.3
901 to 1000....	.....	.....	.....	2	8½	0.3	0.2
Over 1000....	.....	.....	.....	1	8	0.3	0.1

Markets.—The characteristic feature of the apple industry in Wayne county is the evaporator; in Orleans county it is the sorting-table. In Wayne county a large part of the crop goes to the evaporator without sorting out the best apples; in Orleans county too much of it is barreled. Few, if any, farmers in Orleans county run their own evaporators. This may partly explain the low price paid for apples to be evaporated (compare table 27 with table 44 in Bulletin 226), but the difference is largely due to the fact that in Orleans county only the culls and drops are usually dried. It seems that each county might learn much from the other. Wayne county should spray better and then sell more of the crop in barrels. Orleans county should sort much more closely and then keep

TABLE 26—*Concluded.*

HOW MARKETED.	1903.		1904.	
	Bushels.	Per cent.	Bushels.	Per cent.
Sold in barrels.....	819,204	82.7	627,231	72.1
Sold in bulk.....	32,104	3.2	17,909	2.1
Sold to evaporate.....	128,096	12.9	153,109	17.6
Sold to vinegar factory.....	4,450	0.5	53,626	6.2
Otherwise disposed of.....	7,200	0.7	17,720	2.0

To get the number of barrels, divide the number of bushels by 3.

Those sold in bulk were nearly all sold to be barreled.

The table indicates too small a proportion sold to dry or for vinegar as the farmers pay little attention to these. This is particularly true for crops before 1903. The 1904 report is probably correct in this respect.

Of the 72.1 per cent barreled in 1904, 64.3 per cent were "firsts" and 7.8 per cent were "seconds" or "drops."

is exceedingly difficult to pay \$2 per barrel to one man and then buy of his neighbor at \$1.50. When a buyer offers these prices he is met by the unanswerable argument that, "My apples are as good as my neighbor's," and he is quite likely to offer \$1.75 to both men. Every effort should be made to persuade the man who raises poor fruit, to improve his product not only for his own good but for the good of the whole county. The County Fruit Growers' Association is doing good work along this line.

Prices.—Table 27 gives the average prices for the past five years. The price per barrel in 1904 is too low, for it includes only those that were sold when the reports were received, about January 25th. At this time 18 per cent of those that were barreled were still held by the farmers. These were worth more than the average price.

TABLE 27.
Average price paid to the grower.

	1900.	1901.	1902.	1903.	1904.
Price per barrel.....	\$1.41	\$3.15	\$1.79	\$1.85	\$1.46
Price per bushel sold in bulk.....	.224	.382	.273	.302	.260
Price per 100 pounds (2 bushels) sold to dry.....	.178	.298	.218	.268	.194
Price per 100 pounds (2 bushels) sold for vinegar.....	.....	.....	.....	.154	.148

In 1904 the average price of firsts was \$1.49 per barrel; of seconds and drops, \$1.15.

Expenses and income per acre.—Table 28 gives the average gross income per acre for the past five years, and table 29 shows how these incomes were distributed.



FIG. 170.—One of the original Hubbardstons of Western N. Y. in the orchard of Mr. T. B. Wilson, Hall's Corners, Ontario county, N. Y.

Unfortunately, the average expense per acre can not be secured, as few farmers keep any record of expenses. The largest expense is for barrels, picking, packing and marketing the fruit. One orchard of 9 acres, for which an itemized account was kept in 1904, gave a total expense of \$339.55 for tillage, pruning, fertilization, spraying, labor, etc. The cost of barrels, picking, etc., was \$1,122.40 (Bulletin 226, page 297). This made an expense of \$37.73 per acre for raising the crop up to the time of picking, not including interest on the land. Probably not over five to

ten per cent of the orchards cost this much, but it would pay to spend this amount in nearly all orchards. The average grower probably spends from one-fourth to one-half this amount. There are many neglected orchards in which there is practically no expense up to the time of picking.

Table 30 gives an approximate estimate of the cost of barrels, picking, packing and marketing. It includes only that part of the crop that was sold in barrels. Barrels cost 34 to 38 cents in 1904, cost as much or more in 1903, and cost less formerly. It costs about 25 cents per barrel for all labor connected with marketing, 10 to 12 cents of which is paid for picking. This gives a total cost of about 60 cents per barrel, which, of course, varies from year to year with the cost of labor and of barrels. It is probably a little low for 1903 and 1904.

TABLE 28.
Average gross income per acre.

1900	\$122 00
1901	58 00
1902	134 00
1903	126 00
1904	116 00

TABLE 29.
Classification of incomes.

INCOME PER ACRE.	1900.			1901.			1902.		
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.
\$ 0 to \$ 25..	17	169	10.4	94	877½	44.2	29	287½	8.5
26 to 50..	24	308½	19.1	32	293½	14.8	30	341½	10.1
51 to 75..	15	109	6.8	21	203	10.3	41	371½	11.0
76 to 100..	27	221½	13.7	18	213½	10.8	38	304	9.0
101 to 125..	28	239	14.8	15	113½	5.7	60	558	16.5
126 to 150..	15	130½	8.1	11	104	5.3	34	297	8.8
151 to 175..	13	90	5.6	5	46½	2.3	31	307	9.1
176 to 200..	18	122½	7.7	5	38	1.9	25	184	5.4
201 to 225..	7	87½	5.4	2	7½	0.4	17	139½	4.1
226 to 250..	4	25	1.5	1	18	0.9	12	85	2.5
251 to 275..	4	43	2.7	3	32	1.6	10	97	2.9
276 to 300..	4	24½	1.5	.....	.....	.....	11	84	2.5
301 to 325..	1	6	0.4	1	8	0.4	6	61	1.8
326 to 350..	2	7½	0.5	.....	.....	.....	5	35	1.0
351 to 375..	1	9	0.6	.....	.....	.....	7	69½	2.1
376 to 400..	.....	.....	.....	.....	.....	.....	1	6	0.2
401 to 425..	.....	.....	.....	.....	.....	.....	2	79	2.3
426 to 450..	1	23	1.4	.....	.....	.....	2	17	0.5
451 to 475..	.....	.....	.....	.....	.....	.....	1	13	0.4
476 to 500..	.....	.....	.....	3	21	1.1	1	7	0.2
Over \$500..	.....	.....	.....	1	6	0.3	2	23	0.7

TABLE 29—*Concluded.*

INCOME PER ACRE.	1903.			1904.			Five-year average per cent.
	No. orchards.	No. acres.	Per cent.	No. orchards.	No. acres.	Per cent.	
\$ 0 to \$ 25...	28	206	4.9	17	192	6.5	14.9
26 to 50...	44	504	12.0	37	415	14.1	14.0
51 to 75...	50	439½	10.4	36	344½	11.7	10.0
76 to 100...	63	680½	16.2	31	419½	14.3	12.8
101 to 125...	62	574½	13.6	44	434	14.8	13.1
126 to 150...	54	515	12.2	26	275½	9.4	8.8
151 to 175...	47	371	8.8	30	248	8.4	6.8
176 to 200...	34	268½	6.4	18	283	9.6	6.2
201 to 225...	29	253½	6.0	14	116½	4.0	4.0
226 to 250...	18	140½	3.3	15	110½	3.8	2.4
251 to 275...	12	78	1.9	4	16½	0.6	1.9
276 to 300...	8	67½	1.6	3	13½	0.5	1.2
301 to 325...	3	22½	0.5	4	41	1.4	0.9
326 to 350...	5	29	0.7	2	15	0.5	0.5
351 to 375...	3	16	0.4	1	5	0.2	0.7
376 to 400...	1	6	0.1	.....	.....	.....	0.1
401 to 425...	2	9	0.2	2	11	0.4	0.6
426 to 450...	2	11	0.3	.....	.....	.....	0.2
451 to 475...	1	5	0.1	.....	.....	.....	0.1
476 to 500...	2	14½	0.3	.....	.....	.....	0.3
Over \$500.....	.....	.....	.....	.....	.....	.....	0.2

TABLE 30.

Approximate cost per acre of barrels, picking, packing and marketing that part of the crop that was sold in barrels.

	No. barrels required.	Approximate cost.
1900.....	74	\$44
1901.....	19	11
1902.....	69	41
1903.....	62	37
1904.....	68	41



FIG. 171.—Baldwin. The standard apple of Western New York.

SUMMARY.

Extent of the survey.—Altogether, 564 orchards, containing 4,881 acres, were examined in Orleans county in the summer and fall of 1904. There are approximately 16,500 acres of apples in the county.

Varieties.—Baldwin and Rhode Island Greening are the leading varieties. Roxbury Russet, Tompkins King, Twenty-Ounce, Hubbardston, Northern Spy, Duchess of Oldenburg and a few other varieties, are also commonly grown but are all secondary in extent to the Baldwin and Greening.

Tillage.—Eleven per cent of the orchards have been tilled five or more years; 33 per cent have been in sod five or more years; the others have been tilled part of the time.

The five-year average yield of orchards that have been tilled ten years is 86 per cent larger than that of those which have been in sod ten or more years, and those tilled five years gave 34 per cent larger yield than those in sod five years. A part of this difference is due to tillage and a part is due to the fact that the man who tills his orchard is likely to give it improved care in other respects. Of the orchards that were well cared for in other respects, the ones that have been tilled ten or more years gave 45 per cent larger yield than those that were in sod ten or more years, and those tilled five or more years gave 15 per cent larger yield than those in sod the same period. The average prices per bushel have been a little larger from tilled than from sod orchards, so that there is a slightly greater difference in income per acre than in yields.

Of the various methods of sod treatment thus far tried, pasturing with hogs or sheep gave the largest average yields.

One-fifth of the sod orchards are as good as the average tilled ones, but no method of sod treatment equals tillage in average yield or income.

Fertilization.—Many farmers apply all or nearly all the manure from the farm in the orchard. Ninety-one per cent of the area is given some manure. Commercial fertilizers or wood ashes have been used in 24 per cent. The fertilizers used usually contain no nitrogen or are low in nitrogen.

Cover-crops.—Cover-crops have been used in three per cent of the area. Common red clover and buckwheat are the most commonly used. Crimson clover, rye, vetch, rape and alfalfa are grown by some.

Pruning.—Poor pruning, resulting in rotten trunks, is the cause of the premature death of many trees. The important points in pruning are: (1) The limbs should be cut close to the trunk. (2) Large limbs should not be removed without cause. (3) Paint should be used on large wounds. (4) Pruning should be done every year, rather than give the occasional "thorough trimming."

Spraying.—Sixty-one per cent of the orchards were sprayed in 1904. One-fifth of this area was sprayed with arsenic and Bordeaux mixture. Nearly all of the remainder were sprayed with Paris green and Bordeaux mixture.

In practically none of the unsprayed orchards were over half of the apples free from scab. In 56 per cent of those sprayed once, 82 per cent of those sprayed twice, and 97 per cent of those sprayed three times not over half the apples were scabby. None of the unsprayed orchards had less than 25 per cent of scab, but one-fourth of those sprayed once, two-thirds of those sprayed twice, and nine-tenths of those sprayed three times had less than this amount.

The yields, per cent of the crop barreled and the income per acre are all much larger from sprayed than from unsprayed orchards. Those sprayed three times gave 31 per cent larger yield per acre and 51 per cent larger income than those not sprayed. A part of the difference is doubtless due to other factors, for the unsprayed orchards are likely to be neglected in other ways. Taking only those orchards that have been well cared for, the average income per acre is: unsprayed \$103; sprayed once, \$139; sprayed twice, \$143; sprayed three times, \$184.

Distance between trees.—The average distance between trees in the bearing orchards is 32.4×32.4 feet. Only five per cent were planted over 35×35 feet. In nearly three-fifths of the young orchards the trees are 40×40 feet. In fifteen per cent of the bearing orchards half of the trees should be removed.

Age of the trees.—Eighty-one per cent of the orchards were planted between 1860 and 1879. Planting then practically ceased till 1899, since when it has been constantly increasing. The young orchards are largely in the north part of the county. They now amount to about eight per cent of the total apple orchard area.

The maximum yield seems to come at 45 to 50 years from the date of planting.

Soils.—The loamy soils seem to be best for apple production, but good apples are grown on quite sandy soils. The clay soils are likely to need drainage in order to fit them for apple-growing. A loss of about 8 to 10 per cent of the apple-trees is due to poor drainage.

Yields.—The average yields per acre have been: 1900, 241 bushels; 1901, 63 bushels; 1902, 248 bushels; 1903, 224 bushels; 1904, 284 bushels. The five-year average yield has been over 200 bushels in half the orchards.

Markets.—Seventy to 90 per cent of the crop is sold in barrels. Most of the remainder is sold to be dried or is sold to vinegar factories.

Prices.—The average prices per barrel have been: 1900, \$1.41; 1901, \$3.15; 1902, \$1.79; 1903, \$1.85; 1904, \$1.46. The price per bushel for those sold to dry has averaged about 11½ cents during the past five years. Those sold to the vinegar factories average about 7½ cents per bushel.

Income per acre.—The average gross incomes per acre have been: 1900, \$122; 1901, \$58; 1902, \$134; 1903, \$126; 1904, \$116. In half of the orchards the income has averaged over \$100 per acre for the past five years.









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