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R. R. Jeffries

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MORGANTOWN, W. VA.

DEPARTMENT OF HORTICULTURE

AN ORCHARD SURVEY
OF
JEFFERSON COUNTY

BY

R. R. JEFFRIES

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An Orchard Survey of Jefferson County

By R. R. Jeffries

INTRODUCTION.

The desire for a definite knowledge of the extent of the orcharding industry in the Eastern Panhandle of the state resulted in the making of an orchard survey of Berkeley and Jefferson counties. These two counties were among the first to undertake commercial orcharding. Berkeley County is the largest apple producing county of the state. The survey of Berkeley County will be published later.

Jefferson County has many natural advantages for apple culture. The gently rolling tracts of land so common in the Shenandoah Valley, the limestone soils and ideal climatic conditions, together with splendid roads to local markets and two railroads crossing near the center of the county, make it an ideal fruit section. Although Jefferson County is not typical of West Virginia conditions, yet practically all counties in the state are admirably adapted to growing fruit of some kind.

The survey method of securing data has become very popular within the last few years. It is a quick and economical way of experimenting. Instead of carrying on experiments in one orchard for a number of years, with results which are not always conclusive because of varying conditions, a thorough

survey will often give the desired knowledge, and with few errors. It obtains figures on the farm, from the farm.

The value of an orchard survey depends upon the number of orchards considered; the completeness of the data, which is often the result of tactfully asking the questions, and upon the accuracy of the enumerator in compiling figures, and his ability to draw valuable conclusions from them. Field data is especially important because if the work is to have an experimental value it must make a correlation between income and various orchard operations in order to answer that ever-met question, "Will it pay?" Unfortunately most growers do not always keep accurate accounts so the figures given in some cases are only estimates. However, with the data at hand it is hoped to draw some conclusions which will be of value to fruit growers.

PURPOSE OF THE SURVEY.

The status of any agricultural industry cannot be better determined than by making a field survey of the subject. Such a survey is generally quite detailed and graphically shows the present condition of the industry. The purpose of the present survey is to learn the existing conditions of the apple industry in Jefferson County. By arranging the data collected, it is hoped to show:

First: The extent of the industry and the normal conditions of orchards in Jefferson County.

Second: The correlation between various orchard operations and the yield and income.

Third: Where yield and income data were not available, to show the distribution of orchards according to different factors enumerated in the survey.

Fourth: To collect and tabulate a mass of data upon practical orcharding hoping that it will clarify some moot questions and be influential in promoting better methods in orcharding.

A comparison of figures is interesting, but their value depends upon the correlation that can be made between them and the practices from which they have been obtained. It will be the aim of the author whenever possible to show rela-

tions between practices and incomes. Such relations will often show profits and losses, and perhaps explain some successes and failures in orcharding.

COLLECTION OF DATA.

During the summer of 1913 the author planned to visit every orchard of over four or five acres, announce his mission and ask questions as shown on the sample data blank printed

ORCHARD SURVEY
West Virginia Agricultural Experiment Station

Project No. Survey No.
Date 191 ..

Fruit Location of Orchard
Owner P. O.
Tenant, if any Operated by owner, tenant for years
Age Trees No. Trees Acreage
Elevation Exposure Planting plan
Soil type Drainage
Soil Management; Sod; Pasture; Cut for hay; Cut for mulch; Times cut Condition
Cultivated; When plowed Times harrowed Cultivation ceases Condition
Sod and Cultivation; Years in sod Years cultivated Condition
Cover crops, Kind Amount seed per acre
When planted Condition
Fertilizers; Kind Times applied
Amount per acre Frequency
Pruning; Heavy, Moderate, Light, Winter, Spring, Summer; Method
Frequency Character
Fungous troubles Insects
Spraying; During last 10 years
Present practice; Number applications and material, Dormant Summer
Amount of spray per application; Dormant Summer Time required; Dormant Summer
Varieties
Variety notes

	1907			1908			1909			1910			1911			1912		
	1st Bbl.	2nd Bbl.	Culls Cwt.	1st Bbl.	2nd Bbl.	Culls Cwt.	1st Bbl.	2nd Bbl.	Culls Cwt.	1st Bbl.	2nd Bbl.	Culls Cwt.	1st Bbl.	2nd Bbl.	Culls Cwt.	1st Bbl.	2nd Bbl.	Culls Cwt.
Yield																		
Price																		
No. Pickers used in 1911	Time employed			Price per day, bbl.			No. Packers											
Time employed	Price per day, bbl.			Cost of bbls., boxes			Cost hauling											
Cost storage	How sold																	
Remarks	Observer																	

on this page. These blanks were filled out as completely as possible. Through the co-operation of the growers, reports were secured from 181 orchards. Each blank is counted as a single orchard, though there may be several blanks reporting orchards owned by one person.

The less satisfactory method of obtaining data by letter was resorted to in a few instances. In many cases the collector could, by observation, get such data as referred to present condition of orchards and trees. It was thought best to limit the survey to orchards over four or five acres because of the indefinite data usually obtained from small orchards which are often merely a farm adjunct.

TABLE I. *Number of Apple Trees and Yield of Apples from Census of 1890, 1900, 1910.*

State	Census of 1890			Census of 1900			Census of 1910		
	No. Trees Bearing 1890	Bushels of Apples 1890	Rank	No. Trees Bearing 1900	Bushels of Apples 1900	Rank	No. Trees Bearing 1910	Bushels of Apples 1910	Rank
U. S.	120,152,795	143,105,689		201,794,626	175,397,626		151,322,840	147,522,318	
N. Y.	14,428,381	8,493,846	7	15,054,832	24,111,257	1	11,248,203	25,409,324	1
Penn.	8,582,386	13,154,626	2	10,927,899	8,931,569	6	7,534,343	12,332,296	2
Mich.	9,097,900	7,552,710	10	11,774,211	24,060,651	2	8,000,456	11,048,430	3
Mont.	8,150,442	8,698,170	6	8,757,238	6,496,436	9	14,359,673	9,968,977	4
Ky.	5,730,144	10,679,389	3	20,040,399	6,053,717	10	5,538,207	7,368,499	5
Iowa	3,640,588	5,040,352	12	6,869,588	5,129,682	19	5,847,034	6,746,668	6
Cal.	1,269,784	1,654,636	21	2,878,169	3,488,208	14	2,482,762	6,335,073	7
Va.	4,253,364	8,391,425	8	8,190,025	9,835,982	4	7,004,548	6,103,941	8
N. C.	4,249,468	7,591,541	9	6,438,871	4,662,751	12	4,910,171	4,775,693	9
Ohio	10,860,613	13,789,278	1	12,952,625	20,617,480	3	8,504,886	4,663,752	11
Tenn.	5,020,400	7,283,945	11	7,714,053	5,387,775	11	4,838,922	4,640,444	10
W. Va.	2,820,535	4,439,978	13	5,441,112	7,495,743	8	4,570,948	4,225,163	12

APPLE PRODUCTION AND ORCHARD AREAS.

Some idea of the extent of the apple industry of the United States and of the twelve leading apple producing states is shown in Table I.

West Virginia is primarily a fruit-growing and stock raising state. Its hills, for which it is noted, present many opportunities for an agricultural development only dreamed of now.

According to U. S. census figures for 1910, West Virginia ranks twelfth in apple production. The total area in apples is approximately 152,978 acres. The total number of apple trees in the state being 7,392,973.

EARLY HISTORY OF JEFFERSON COUNTY ORCHARDING.

Prior to 1876 no one in Jefferson County had an orchard containing more than two to four acres. The fruit was all used for eating, cider, or vinegar. In the fall of that year, Mr. D. W. Border purchased forty acres of land at Kearneysville and at once planted the entire tract to winter apples with peaches as fillers. The apple trees were set thirty-three feet apart with York Imperial, Ben Davis, Yellow Newton (Albermarle Pippin), Grimes, Rambo, Ralls, Rome, Gravenstein, Smokehouse, Pecks Pleasant, Buckingham (Winter Queen), Fallawater, Redstreak, Winesap, Winter Sweet Paradise, and Vandevere, besides several varieties of summer apples. Of the entire list only the York Imperial, Ben Davis, and Winesap lived very long and were the only paying varieties. The peaches were unsuited to the soil and became infected with yellows and borers. They soon died out.

Dr. Border says, "When my neighbors saw me planting this fruit orchard they smiled and shook their heads in amazement, saying I had made a mistake; I was visionary; that I would not be able to get rid of such a crop; it was time lost, etc. Ten years later when they saw buyers paying \$1.25 to \$2.25 per barrel for my apples they immediately began planting orchards".

The history of the early planting in Jefferson County is the same story as can be told of many counties or sections.

One man with a vision, self-confidence and industry plants a commercial orchard and when he begins reaping, others take it up and so start an orchard industry.

From forty acres of orchard land in 1876, Jefferson County has increased to 4385½ acres in 1913.

FIGURE 1—A Jefferson County orchard Showing outcrops of limestone.

AREA IN APPLES.

Jefferson County, according to figures of this survey, has 195,524 apple trees growing on approximately 4,385½ acres of land. The entire area of the county comprises 211 square miles, or 135,040 acres, 120,876 acres of which are improved farm lands. This means that 3.6 per cent. of the farm land in the county is planted to apple orchards.

TABLE II. *Number of Acres and Age of Trees Included in Survey.*

Age of trees.....	1 yr.	2 yr.	1-7 yr.	8-15 yr.	16 yrs. Plus
Number of acres....	285	1033.5	2022.5	1508.5	710
Number of trees....	13016	46140	97657	70556	27830

ORCHARD DISTRIBUTION.

Outside of a grouping of orchards about Kearneysville where the apple industry in the county started, and a group at Shenandoah Junction, the crossing of the B. & O. Railroad and N. & W. Railroad, the geographical distribution of the orchards is scattering (See map). The topography and general condition of the county being very much the same throughout, one would expect an almost equal distribution of orchards.

ASPECT OF SLOPE OF ORCHARDS.

TABLE III.
Aspect of Orchards.

Aspect	No. of Orchards	Per cent of Orchards
North	10	6.3
South	5	3.1
East	19	13.2
West	13	9.0
E. & W.	9	6.1
N. & S.	5	3.1
Rolling	20	13.9
Misc.	28	19.5
Level	34	23.7

Table III shows the distribution of orchards according to aspect. About 23.7 per cent, or nearly 1-4 of the total orchards are level. 13.9 per cent are rolling. Of all sloping orchards, by far the most slope toward the east.

The matter of aspect or slope of an orchard is often overworked, and yet in some circumstances the influence of slopes is to be considered. Light is to be considered. Light is possibly the most influential factor in determining the color of fruit and the choice of a southern slope with its consequent ripening and coloring effects is decidedly noticeable. Yet for early blooming fruits, south and southeastern slopes should be avoided. The choice of slopes is of no great import to Jefferson County orchardists.

ORCHARD MANAGEMENT.

TABLE IV.
Orchard Management.

Orchards Managed by	No. of Orch.	No. of Acres	Av. size in Acres	Per cent of Orchards
Owner	81	2643.5	32.6	74.6
Manager	12	589	48.2	11.1
Companies	8	781	97.6	7.5
Renters	5	210	42	4.7

managers, while only 4.7 per cent of the orchards are rented or leased.

Table IV. shows the method of management of orchards. 74.6 per cent of the orchards are managed by the owners themselves. 11.1 per cent are operated by managers. 7.5 per cent of the orchards are owned and operated by companies hiring

It is encouraging to see the large percentage of orchards managed by owners. In many cases, however, the owner hires a manager, and the man is usually unacquainted with good orchard practices; that kind of owner-management is not conducive to successful orcharding.

Successful orcharding might be defined as the ability to give infinite attention to orchard work. Such attention can be best given through personal supervision.

TABLE V.
*Relation of Management to
Income for 1910, 1911 and 1912*

Management	No. Acres	Total Income	Income Per acre
Company	323	\$103,366.00	255.86
Owner	1199	178,116.70	148.46
Manager	495	60,797.75	120.80

Company orchards show a larger income per acre than either orchards supervised by owner or by manager. Rented orchards could not give sufficient yield data so were not included in the table.

From Table V, company orchards show an income of \$255.86 per acre while owner managed orchards give \$158.46 per acre. That company orchards are showing higher incomes per acre is likely due to their having larger working capital, permitting better management, and the fact that large orchards can usually market their fruit more advantageously than smaller orchards.

SIZE OF ORCHARDS.

TABLE VI. *Distribution of Orchards According to Size*

Size in Acres	1-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-199	200-300
No. Orchards	17	26	16	8	11	4	7	6	1	4	3	3
Per cent of Total Orchards	16	24.5	15	7.5	10.3	3.7	6.6	5.8	.9	3.7	2.8	2.7

Table VI shows the distribution of orchards according to size. Over one-fourth of the orchards are from 10 to 19 acres. Of this class the larger number of typical sized orchards was found to be ten acres. Sixteen per cent of the orchards are from 1 to 9 acres and over one-half of the orchards are between 1 and 29 acres.

It appears from Table VII, which is the data from 82 orchards, that the large orchards are the most profitable. The

TABLE VII. *Relation of Size of Orchard to Yield and Income.*

No. Acres	No. Orchards	Yield per Acre (bbls.) 3 yr. av. 1910-11-12	Income per Acre 3 yr. av. 1910-11-12
1-5	7	28.6	\$49.75
6-10	22	35.8	71.61
11-15	12	32.4	61.54
16-20	15	38.1	80.40
21-25	7	34.4	79.66
26-50	10	49.4	94.08
51-100	9	50.9	\$110.09

highest yield and income is obtained from orchards of 51-100 acres.

That there is no inherent reason why smaller orchards should not give excellent results, is shown by the returns from a 20 acre orchard which produced on the average for three years, 93.7 barrels per acre, with an income of \$242.90.

As already suggested, we may possibly account for the higher yields of the larger orchards from the fact that most of the large orchards are company orchards usually with large working capital, which would permit of better orchard management.

It should be noted that the yields in barrels given in all the tables, mean apples actually sold. Culls were usually consumed at home.

AGE OF ORCHARDS.

TABLE VIII. *Date of Plantings*

Date of Planting	Age of Trees	No. Orchards	No. Acres	Per cent Orchards
1870-1875	38-43	2	12	1.1
1876-1881	32-37	3	26	1.6
1882-1887	26-31	1	4	.55
1888-1893	20-25	8	229	4.4
1894-1899	14-19	28	563	15.4
1900-1905	8-13	63	1466	34.8
1906-1907	6-7	14	208.5	7.7
1908-1909	4-5	9	122.5	4.9
1910-1911	2-3	43	133.4	23.7
1912-1913	1	10	285.5	5.2

The first commercial orchard was planted in 1876, but not long after the venture had proved profitable many acres were set to fruit, the greater number of plantings being from 1900-1905 when 34.8 per cent of the trees now standing were

set. There were many home orchards set before 1876, for many soldiers during the war feasted on fruit from trees still standing.

Table VIII. is interesting in showing the rise and decline

of plantings. After 1876 the plantings gradually increased until the climax of planting in 1900-1905, when almost 35 per cent of the orchards now standing were set. In 1910-11 there was another large planting of trees. In that year 43 orchards totaling 1334 acres were set out. In 1909 and also 1911 the county produced a large crop. Possibly the large crops in these years account for the numerous planting in 1910 and 1911.

TABLE IX. *Relation of Age to Yield and Income*

No. Orchards	Age Years	Yield per Acre (bbls.) 3 yr. av. 1910-11-12	Income per Acre 3 yr. av. 1910-11-12
31	7-10	15.8	\$37.60
36	11-14	25.9	55.63
18	15-18	76.1	156.36
3	19-22	83.8	207.26
5	23-26	72.6	103.90
1	27-30	16.9	22.76
0	31-34	No data	
2	35-38	39.1	118.90

The largest yield and income is obtained from trees between 19 and 22 years of age. Trees of that age yield an average of 83.8 barrels and give an income of \$207.26 per acre. Trees between 15 and 26 years of age all show incomes larger than the average income for the county. (See Table No. XXIV.)

Trees of the county bear young. Trees 7-10 years of age yield an average of 15.8 barrels and an income of \$37.60 per acre. The fact that they do bear young and reach their prime

PLANTING PLANS.

TABLE X *Planting Plans.*

Plan	Distance	No. Orch- ards	Per Cent Orch- ards	Plan	Distance	No. Orch- ards	Per Cent Orchards
Square	20x20	3	2.2	Rectangular	20x36	3	2.2
	25x25	2	1.4		20x35	2	1.4
	30x30	49	37.1		30x33	6	4.5
	30x32	7	5.3		30x35	2	1.4
	33x33	7	5.3		30x40	1	.75
	35x35	15	11.3		35x40	1	.75
	36x36	5	3.7	Hexagonal	Misc.	15	11.3
	40x40	13	9.8		34x34	1	.75
	Misc.	7	5.3		18x18	1	.75
Quin- cunx	36x36	1	.75				
	30x30	1	.75				

within twenty or twenty-five years is the excuse of some for close setting of trees.

Lack of care is often the reason for the decadence of trees over 20-25 years of age. The small number of orchards with trees of that age makes it impossible to give conclusive figures. It is a common notion, borne out by observation, that the trees seemingly reach their best development at an early age, but the fact that two orchards with trees 35 and 37 years of age give a 3 year average of 39.1 barrels and an income of \$118.90 per acre shows that old orchards can be made profitable.

About 81 per cent of the orchards are planted on the square plan, two orchards are recorded as planted hexagonally, two are of the quincunx system, and others are planted in rectangles.

The typical distance at which orchards are planted is 30x30 feet. 37.1 per cent of the orchards are planted at that distance. Table X. shows the distribution of orchards according to system and distance apart of planting.

VARIETIES.

TABLE XI.

Commercial Varieties

Varieties	Acres	Bearing Trees	Acres	Non-bearing Trees
York Imperial	536.7	22415	878.2	30232
Ben Davis	362.2	22472	143.7	8907
Grimes	309.6	9847	250.3	11090
Stayman Winesap	219.7	1885	370.7	18096
Jonathan	10.5	370	89.1	5294
Arkansas	261.5	10677	298.2	12741
Winesap	40.6	1794	83.1	4130
Delicious	2	1847	113.6	6061
Gano	42.3	1841	138.9	5645
Yellow Newton	33	1671	1	50
N. W. Greening	21	949	2	150

The commercial varieties of apples planted in the county are shown in Table XI. Besides these, Rome (Beauty), Arkansas Black, Stark and Yellow Transparent are quite popular. Some of the apples less commonly planted are the Oliver, Nero, Golden Russet, Ralls, Missouri, Yellow Bellflower, Red Astrachan, Spencer Seedless, Milan, Fall Pippin, and Early Harvest.

It is interesting to note that the Ben Davis and the York Imperial are rivals for first place. The York Imperial has a

greater acreage of both bearing and non-bearing trees than the Ben Davis. The tendency of the planting at present is also shown in the table. The better varieties—Stayman Winesap, Jonathan, Arkansas, Winesap, and Delicious show an increase of planting. The Ben Davis has fallen into ill repute of late years, and we only find 143 acres of non-bearing Ben Davis trees as compared with 362.2 acres of bearing trees of the same variety.

SOILS.

A soil survey is almost a necessary adjunct to any agricultural survey, for the soil is of primary importance in the raising of crops.

In the popular description of the soils of Jefferson County, they are classified as lime-stone, soapstone, clay, slate, etc. Out of 145 orchards 99 report limestone, 14 soapstone, 14 clay, 5 "burrstone," and others flint, shale, loam, etc. The popular description of a soil makes a very indefinite classification.

There is no government soil survey of Jefferson County, but a survey of the Leesburg area of Virginia takes in about 22330 acres of land around Harpers Ferry, Millville, and Halltown. A good description of the various soil types about Harpers Ferry district from the Government bulletin of the Bureau of Soils may help the growers to recognize their particular kinds of soil and know the agricultural value.

Hagerstown loam, shale loam, clay, and meadow land are the types of soil found in the Jefferson County area of the survey, and these types are quite general the county over.

Hagerstown Clay—Hagerstown clay consists of a heavy red or brown loam having an average depth of eight inches. The sub-soil consists of a heavy red clay. Occasional outcrops of massive blue limestone occur throughout the type, and near the outcrops the soil is much heavier, the clay often being on the surface. With the exception of the limestone outcrops which are relatively few, there are no stones on the surface. The topography of the type is that of the high rolling uplands of the Shenandoah Valley. The rolling character of the surface and a number of streams tributary to the Shenandoah extending throughout the type make it naturally well drained; however, in some places the texture of the clay sub-soil requires tile drainage to get best results.

The Hagerstown clay is the best soil in the Shenandoah Valley, being naturally very productive and especially adapted to wheat, grass, clover, and apples.

The soil is of residual origin, being derived through the removal by water of the soluble constituents which constitute a large portion of the rock, the soluble matter remaining to form the soil. Weathering has gone on to great depth, and but few outcrops of the harder, more resistant ledges still protrude from the surface. Small areas of the type near the Shenandoah River contain considerable sandstone and gravel, which have been deposited there by the river when it flowed at a higher level than at present.

Hagerstown Loam.—Hagerstown loam consists of about ten inches of a brown silt-loam, underlaid by a yellowish red clay loam, which grades into a heavy reddish clay at a depth of from 20-30 inches. The surface is free from stones although some few limestone outcrops occur and shale fragments are occasionally found in the sub-soil.

The topographical features of the type consist of broad, rolling uplands. The slopes are gentle being rarely steep enough for excessive erosion. The drainage is good throughout. The sub-soil, while not heavy for a considerable depth, is sufficiently close textured to hold enough moisture for growing vegetation, when there is anything like well distributed rainfall.

Like Hagerstown clay, the Hagerstown loam is residual in origin, being derived from the weathering of limestone. This limestone is a gray variety, not so pure as the blue, but it has weathered to a great depth, there being but few outcrops on the surface. In places the formation of the soil seems to have been slightly influenced by yellow shale.

The Hagerstown loam is much better adapted to general farming than the Hagerstown clay, having a more loamy soil covering and being much easier to cultivate.

Hagerstown Shale Loam.—Hagerstown shale loam consists of eight inches of a gray-brown loam, underlaid by a sub-soil of somewhat heavier yellow loam, which often rests upon a bed of broken shale at a depth of from 24-30 inches. On the surface and through the soil and sub-soil varying quantities of small broken shale fragments occur, sometimes form-

ing not more than 15 per cent of the solid mass. At Harpers Ferry a small area of the shale formation seems to have been partially metamorphosed and here the sub-soil consists of a reddish clay loam.

This Hagerstown shale loam is locally termed slate land and is not highly valued for agricultural purposes. The greater portion of this type occupies one long continuous belt one-third of a mile wide, extending from Harpers Ferry in a southernly direction along the west flank of the Blue Ridge. The valley phase occupies long narrow strips, extending in a north-east and south-west direction, and is surrounded on all sides by the Shenandoah limestone soils.

The topographic features consist of low foothills and rolling slopes. Where the Shenandoah and Potomac rivers cut through the areas, the banks are very steep and rise 100-200 feet above the river bed. The valley phase consists of long narrow ridges with rounded crests and steep slopes, having an altitude of 100 feet above the surrounding valley.

The surface configuration and loose texture of the soil make it not only well drained, but even leaky, and what water falls on the surface either flows rapidly away or passes quickly through the soil and sub-soil. Peaches growing on this type do well, but are short lived. Small fruits, grapes, apples, pears, and quinces thrive. The soil warms up quickly in the spring and responds to good cultivation and fertilization.

The Hagerstown shale loam is residual in origin and is formed by the weathering of a uniform argillaceous and slightly sandy shale of the Cambrian era. When fresh, this shale is of a dull bluish gray color, but on weathering the color changes to a light greenish gray. The weathering of this rock has advanced to a considerable depth, but complete decomposition is very slow, as evidenced by the numerous fragments which cover the surface of the area.

The elevation of the Shenandoah Valley is from 300-500 feet. It is a broad, gently rolling valley with occasional high rolling ridges which extend through it in a north-east and south-west direction.

The valley is composed of blue and gray limestone of the Silurian and Cambrian periods. The soils derived from these rocks are red in color and of great productiveness. The

weathering of the limestone has gone on to considerable depth, there being but few outcrops of the parent rock. This limestone contains a fairly high percentage of calcium carbonate, and is used extensively for agricultural building and manufacturing purposes, and for country roads of which there are many good ones.

The meadow land is usually a brown silty or sandy loam, with a depth of several feet. The type occurs in narrow bands along the larger streams forming a low terrace a few feet above the main water level. The nature of the soil depends greatly on the surrounding soils, as it is formed from sediment of the wash of these types and partakes of their textural characteristics to some extent. The soil is alluvial in origin, being built up by successive overflows of the streams. This type is never used for orcharding.

SOIL MANAGEMENT.

TABLE XII. *Treatment of Bearing Orchards*

Treatment	No. Orchards	No. Acres	Per cent of Orchards
Tilled since bearing, 5 yrs. or more. (Trees 15 yrs. or over)	1	7	1.5
Tilled since bearing 1-4 yrs. (Trees 1-14 yrs.).....	6	201	3.0
Tilled most of the time	7	268	10.4
Tilled half time; sod half time	11	390	16.3
Sod most of the time	7	169	10.4
Sod since bearing, 1-4 years. (Trees 10-14 yrs.).....	15	255	22.3
Sod since bearing, 5 yrs. or more. (Trees 15 yrs. or over)	20	480	29.8
Total tilled	7	208	4.5
Total Sod	35	735	52.1

The sod method may be said to be the general practice of all orchardists in the state, not from choice, but from necessity. The orchards are usually situated on slopes which can not be profitably cultivated. Jefferson County, however, is level compared to many other counties of the state, and orchard cultivation could be more generally practiced there to good advantage.

About 42 per cent of the orchards are in sod and nearly one-third of the orchards have been in sod since bearing, while only 3 per cent of the orchards have been cultivated since bearing.

It would seem from Table XIII. that about one-half of the young orchards were left in sod. This is misleading, for in

TABLE XIII. *Soil Management of Non-bearing Orchards in 1913*

Treatment 1913	No. Orchards	No. Acres	Percent of Orchards
Tilled, planted to a cultivated crop....	29	0175.5	34.1
Tilled, sowed to grain crop.....	8	289	9.4
Sod, cut for hay	12	354	14.0
Sod uncut	36	1003.5	41.1

many of the orchards reporting sod, the sod means a weed sod or growth resulting from the common practice of plowing the orchard once a year and leaving it in weeds the remainder of the time. Very few of the young orchards are in a heavy grass sod.

The cultivated crop which 34 per cent of the orchards report as growing in the young orchard, is corn. In a very few instances potatoes and truck crops were planted. As a rule the young orchards are planted to a hoed or cultivated crop in rotation with a grass or grain crop. A rotation in which a good cultivated crop is substituted for the grain crop would be good orchard management.

RELATION OF SOIL MANAGEMENT TO YIELD AND INCOME.

TABLE XIV. *Three Year Average Yields and Income Per Acre for Bearing Orchards.*

Method of Treatment	No. Orchards	No. Acres	No. Bbls.	Income Dollars
Tilled since bearing, 5 years or more				
Tilled since bearing, 1-4 years.....	6	201	28.5	66.03
Tilled most of the time.....	15	218	69.4	157.03
Tilled one-half; sod one-half.....	10	336	31.1	68.56
Sod most of the time	17	169	46.5	61.77
Sod since bearing, 1-4 years.....	14	243	24.2	47.47
Sod since bearing, 5 years or more..	14	316	60.8	112.18

Whenever possible, cultivation is recommended as the best soil management for orchards. In comparing figures from tilled and sod orchards in Table XIV., we see that orchards tilled most of the time give a higher yield and income than orchards in sod most of the time. The former giving a yield of 69.4 barrels and an income of \$157.03 per acre as compared to 46.5 barrels and an income of \$61.77 per acre from orchards which have been in sod most of the time. Also orchards that

have been tilled since bearing, 1-4 years, give a yield of 28.5 bbls. and \$66.03 per acre. While orchards that have been in sod since bearing, 1-4 years, yield 24.2 barrels and \$47.47 per acre. In both these comparisons the cultivated orchards are

FIGURE 2—A thirteen year old cultivated orchard.

paying better. Because of lack of figures from orchards cultivated since bearing, 5 years or more, no comparison can be made with an orchard in sod for the same length of time. Orchards in sod since coming into bearing 5 years or more ago, give a good average yield and income because they are older and would naturally yield better.

TABLE XV. *Treatment of Bearing Orchards in 1913*

Treatment	No. Orchards	No. Acres	Percent of Orchards
Filled with cover crop.....	6	272	8.5
Filled tree rows	5	187	7.3
Sod—pastured with hogs.....	3	106	4.4
Sod—pastured with sheep.....	10	122	14.6
Sod—pastured with hogs and sheep.....	4	122	14.6
Sod—pastured with cattle	4	35	5.8
Sod—general	8	91	11.7
Sod—grass cut and left.....	16	886	23.4
Sod—grass cut for hay.....	2	17	2.9
Sod—Not included in above.....	2	28	2.9
Total tilled ..	19	639	27.9
Total sod ..	49	1371	72.1

At the time of the survey 72.1 per cent of the orchards were in sod and about 60 per cent of the sod orchards were pastured. Of the orchards not pastured the custom was to cut the grass for a mulch, only about three per cent using it for hay. The percentage of orchards that are cultivated is very small, only about one-fifth of the orchards being so treated. The percentage of orchards that are cultivated, ordinarily no doubt, would be larger as many growers neglected the customary orchard operations in 1913 because of the freeze.

TABLE XVI.

Pasturage of Sod Orchards

Pastured with	Sod		Partly Sod		Total Sod	
	No. Orchards	Percent of Orchards	No. Orchards	Percent of Orchards	No. Orchards	P. C. of Orchards
No pasture..	8	23.5	14	73.6	22	41.5
Hogs	9	26.4	2	10.5	11	20.7
Sheep	1	2.6	1	5.3	2	3.7
Hogs & Sheep	3	8.8	0	0	3	5.6
Cattle	8	23.5	2	10.5	10	18.8
General	5	14.7	0	0	5	9.4

Since about 72 per cent of the orchards are in sod, it is well to consider how the sod orchards are managed. The sod orchards have been divided into three groups: first, orchards that have been in sod since bearing; second, orchards part time in sod and cultivated part of the time; third, orchards that have been in sod any of the time—equaling the sum of one and two.

Orchards in sod are usually pastured. About 60 per cent of the orchards pasture stock of some kind. Hogs are the chief animal pastured, cattle are pastured occasionally, and sheep in only three per cent of the orchards. Table XVI shows the treatment of sod orchards.

TABLE XVII *Relation of Pasturage to Yield and Income.*

Treatment	Yield per acre. (bbls.)						Income per acre			
	No. Orch	No. Acres.	1910	1911	1912	3 yr. av.	1910	1911	1912	3 yr. av.
Not pastured	10	205	69.3	23	24.3	38.8	120.23	65.05	46.10	77.16
Pastured with hogs..	9	92	29.1	51.1	15.1	35.3	60.15	109.06	23.54	64.25
Pastured with sheep..	2	36	10.8	55	25	30.2	20.80	125	43.55	63.11
Pastured with cattle..	4	45	13.9	12.1	12.1	15.1	23.08	21.94	43.50	26.84

FERTILIZERS.

The general practice of "not pasturing" seems to be the most profitable giving a 3 year average yield of 38.8 barrels and an income of \$77.16 per acre. Orchards pastured by hogs and sheep give about the same yield and income. Permitting hogs and sheep in an old orchard is not as bad a practice as that of pasturing horses and cattle. Usually orchards pastured by cattle are on the decline and no longer profitable.

TABLE XVIII. *General Practices in Fertilizing.*

Fertilizer	No. Orchards	No. Acres	Per Cent of Orchards
None	21	595.5	14.1
Stable manure	55	160.6	37.1
Manure and Comm'l. Fertilizers	43	1438.5	29
Comm'l. Fertilizer....	20	648.5	13.5
Cover Crops	9	377	6
Lime	14	881	8.6
Total Fertilized	127	4070	85.9
Total Not Fertilized..	21	595.5	14.1

Table XVIII. shows practices in orchard fertilization. About 86 per cent of the orchards are fertilized. Stable manure is the common form of fertilizer; 37 per cent of the orchards use it, compared to 13 per cent using commercial fertilizer. A combination

of manure and commercial fertilizer is often used. Twenty-one orchards in the county report using no fertilizer.

A complete fertilizer is the choice of a number of the orchardists. Twenty-two orchards report using complete fertilizers at the rate of 200-600 pounds per acre. About half as many orchards are using a combination of potash and phosphoric acid at the rate of 400 pounds to the acre. Only five orchards report using phosphoric acid alone. South Carolina rock and ground and steamed bone are used to a considerable extent. Basic slag and nitrate of soda are used in a few orchards. In many cases, however, much of the fertilizing was done for the benefit of the crops growing with the orchard. Young orchards are, as a rule, fertilized. About 36 per cent of them use a combination of manure and commercial fertilizer. Manure alone is used in about 30 per cent of the young orchards. About half as many of the orchards use only some form of the commercial fertilizers.

Fertilization of the bearing orchards differs from the non-bearing in that a greater number of the old orchards use more manure. It is generally applied as a mulch about the trees.

Only about 12 per cent of the orchards use commercial fertilizers alone.

TABLE XIX. *Relation of Fertilizer to Yield and Income.*

Fertilizer	Yield Per Acre (Bbls.)						Income per acre			
	No. Orch.	No. Acers.	1910	1911	1912	3 yr. Av.	1910	1911	1912	3 yr. Av.
None	8	141	4.4	20.1	12	12.1	6.20	34.42	28.42	23.01
Stable Manure	33	1170	24.9	61.3	34.1	40.1	52.42	130.30	68.01	83.38
Manure and										
Com'l. Fertilizer	16	454	38.9	57.5	30.4	43.3	85.81	140.20	69.77	98.76
Com'l. Fertilizer	9	251	10.4	34.5	20.5	21.8	24.55	71.52	38.78	44.95
Cover Crops	8	337	24.2	53.8	24.8	34.3	51.14	137.03	49.07	78.08

It pays to fertilize orchards. Those that are not fertilized --14.1 per cent are far below the general average in yield and income, producing 12.1 barrels and an income of \$23.01. Orchards that used commercial fertilizer only, also fell below the general average yield and income. From Table XIX it appears that a combination of manure and commercial fertilizer is the most profitable. Of the eight orchards using cover crops, six of them use commercial fertilizer and manure. The other two use manure alone, so no conclusion can be drawn as to the value of cover crops used alone. Cover cropping is a recommended practice and more of it should be done.

PRUNING.

TABLE XX. *Data on Pruning*

Character of Work	No. Orch.	No. Acres	Percent Orch.
Good	21	666	19.4
Fair	38	1474½	34.4
Poor	49	877	45.4
Frequency of pruning			
Every year	82	2885½	62.5
Every other year....	16	389½	12.2
Every third year....	2	67	1.5
Occasionally	20	825	15.2
Never	11	165½	8.4
Time of pruning			
Winter	29	743	24.5
Spring	89	2799½	75.5
Degree	0	0	0
Heavy	1	45	.8
Medium	22	724	18.8
Light	95	2823½	80.5
Type			
Open head	22	790½	70.9
Closed head	9	285	29.1

The character, frequency, time, degree, and type of pruning practiced may be seen from Table XX.

Pruning in Jefferson County is one of the most neglected of orchard operations. Although "good pruning" is the report from about one-fifth of the orchards, this good pruning is only a relative term. Almost half of the orchards

are poorly pruned. Thirty-five per cent are fair.

There is not enough cutting being done on the trees. See Fig. 3. This cutting should be done annually and should consist primarily of a thinning out of the close crowded branches. Systematic pruning and thinning would do much to make the trees bear more regularly. Trees are prone to produce a heavy crop after a light crop year, and vice versa. Pruning of trees and thinning of fruit will diminish this tendency. The odd numbered years are "off" or light crop years in Jefferson County.

Noting from Table XX that most of the orchards are pruned annually, it would seem that the trees should bear more regularly. Though 62.5 per cent of the orchards are

FIGURE 3—A Jefferson County apple tree showing need of pruning.

pruned every year, this pruning in a large number of cases was far from being a thorough pruning. Lack of efficient farm help to do the pruning is the reason for much of the neglect.

Spring pruning is the general practice. About three-fourths of the orchards are pruned at that time, the remainder are pruned in winter. None of the orchards are pruned in summer.

A light pruning is reported from about 80 per cent of the orchards, 18.6 per cent report a moderate pruning, while only one orchard reported a heavy pruning.

An open headed type of tree is the preference of the majority of growers. 70.9 per cent liked the open head, while about 30 per cent preferred the central leader. The central leader form of tree is advised whenever possible. It is a strong tree and at the same age bears more fruit than an open headed tree. With a good thinning out of the branches of a central leader tree, as good color can be obtained as on an open headed tree. To obtain a good color is the reason for pruning to form an open headed or vase shaped tree.

ORCHARD PESTS AND DISEASES.

That spraying is needed, is evident from the list of orchard troubles. The growers when asked what insect pests they had in the orchard would almost invariably mention scale and codling moth. Three or four years ago the scale was very bad in most of the orchards, but by more and better spraying the scale has been controlled to such an extent that serious damage is no longer done in any of the orchards. The codling moth can justly be called the pest of pests.

The green and wooly aphids were found to be the chief pests of the young trees, especially the wooly aphids upon the

FIGURE 4—Cedar trees along the fence rows are the cause of apple rust.

roots. These are causing much of the stunting and slow dying of young trees.

Of the diseases, cedar rust is the most prevalent, but by cutting down infected cedar trees within the last year or two this disease has been fairly well checked.

The bitter rot, fire blight, and collar blight are all about equally important. A few orchards report scab, apple and sooty blotch, crown gall and Jonathan spot.

The noticeable trouble in the orchards of the county is a spotting of the leaves from frog eye, black rot, scab, or cedar rust. This spotting of the leaves signifies diseased fruit, and also means that the leaves can not perform their natural function and hence the trees are stunted in their growth.

TABLE XXI. *Frequency of Spraying Orchards.*
(Bearing and Non-bearing)

How Sprayed	No. Orch.	No. Acres	Percent Orch.
Seldom or never....	12	175	9.6
Sprayed once	46	1216½	37.
Sprayed twice	29	545½	23.3
Sprayed three times	32	1108	25.8
Sprayed four times..	4	108	3.2
Sprayed five times..	1	50	.8

From the abundance of orchard trouble it is evident that a more systematic campaign of spraying must be carried out to produce healthier trees and better fruit.

In all orchards that were sprayed, the dormant spray was invariably applied. Thirty-seven per cent of the orchards report spraying once. This large a percentage is due to the fact that non-bearing orchards, over one-half of which spray but once, are included in this table. Twelve orchards, seven of which are bearing, are seldom or never sprayed.

TABLE XXII. *Frequency of Spraying*
(Bearing Orchards.)

How Sprayed	No. Orch.	No. Acres	Percent Orch.
Seldom or never....	7	77	10.4
Sprayed once	10	206	14.9
Sprayed twice	18	314	26.8
Sprayed three times	27	965	40.3
Sprayed four times..	4	108	5.2
Sprayed five times..	1	50	1.4

The bearing orchards are usually sprayed three times. Forty per cent of the orchards report spraying three times, 26.8 per cent sprayed twice, 14.9 per cent once, and about 10

per cent have seldom or never been sprayed.

According to the established order, 1913 should have been a large crop year, but two severe spring freezes permitted only about a ten per cent crop. With no fruit produced the grower did not spray as often as usual. In 1913 only 16 per cent of the orchards sprayed three times where usually forty per cent of the orchards are sprayed three times.

SPRAYING.

TABLE XXIII. *Spray Materials Used in Orchards.*

Treatment	No. Orch.	No. Acres	Percent Orch.
Lime-Sulphur solution (homemade)	22	972	11
Lime-Sulphur solution (commercial).....	91	2295½	40.5
Scalecide	10	531	5
Lime-Sulphur and Arsenate of Lead.....	62	1988	31
Arsenate of Lead	6	176	3
Bordeaux Mixture	2	73	1
Bordeaux Mixture and Arsenate of Lead.....	4	217	2
Tobacco Back Leaf "40".....	2	17	1
Kerosene Emulsion	1	10	5

Lime-Sulphur solution is the common orchard spray. It is used in about 86 per cent of the orchards. Eleven per cent of the orchards use the home-made Lime-Sulphur. Table XXIII shows what spray materials are commonly used.

YIELD, MARKET, PRICES AND INCOMES.

Marketing:—

Jefferson County in 1910, 1911, and 1912, produced 143,899 barrels of apples, realizing for the same \$322,396.70. Fully 95 per cent of this fruit was sold in barrels. In only one instance were apples reported sold in cartons and boxes. In some cases the fruit was sold in the orchard to the buyer who furnished barrels and all help to pick, pack, and market. The greater proportion of the fruit goes to commission men and jobbers in Pittsburg, Washington, and New York. Some of the fruit is sold abroad, going to England, Scotland, and South America.

The general average yield and income per acre for all orchards over 10 years of age for the three years 1910, 1911, and 1912 was 45.4 barrels and \$95.53 per acre. These figures

TABLE XXIV. *General Average Yield and Income Per Acre
For Trees 10 Years and Over For 1910-11 and 12.*

Year	No. Orch.	No. Acres	Yield Bbl.	Average Yield per acre	Income	Average Income per acre
1910	32	587	22,995	39.1	\$47899.30	81.60
1911	49	1045.5	65,508	62.6	141112.30	134.95
1912	43	1012	35,202	34.7	70882	70.04

Three year average yield per acre for 1910, 1911, 1912=45.4 bbls.

Three year average income per acre for 1910, 1911, 1912=\$95.53.

were obtained from 55 different orchards comprising 1113½ acres.

Low yields usually give a large income per barrel and vice versa, but figures from the survey show that in the large yield years, the price per barrel was greater than in the small yield years. In 1910 and 1912 the "off years" for fruit the price received per barrel was \$1.89 and \$1.88, while in 1909 and 1911, the large crop years, the price was \$2.14 and \$2.28 respectively. This can be accounted for by the fact that large crop years in Jefferson County are "off years" in fruit sections of neighboring states.

The average Jefferson County orchard over ten years of age produced 45.4 barrels of apples, giving a gross income of \$95.53. To find the net income the cost of production per barrel is necessary. It was hoped the survey would show such figures, but unfortunately few growers have kept any detailed record of expenses.

Accurate data on the cost of production of a barrel of apples is difficult to secure. More items than a yearly inventory and a balance sheet are necessary to keep orchard books. Bulletin 376 of the New York Agricultural Experiment Station gives the cost of production of a barrel of apples, including interest on investment, taxes, superintending of orchard, cost of barrels, picking, packing, hauling, cultivating, spraying, pruning, etc., as \$1.29.

The cost of production will vary under different conditions, but conditions are not so different in Jefferson County but that some fair estimate of the net income per barrel can be obtained. The price received per barrel for Jefferson County apples is lower than the New York estimate, but it is also believed the cost of production is correspondingly lower.

The four year average gross income per barrel for Jefferson County apples was \$2.04, and estimating the cost of production at \$1.29 per barrel leaves a net income per barrel for Jefferson County growers of 75 cents. The average yield per acre, 45.4 barrels, multiplied by the net income per barrel, 75 cents, gives \$34.05, which is the net income per acre received by the Jefferson County orchardist.

In all tables in the bulletin where yield and income are given, the barrels mean all barrels sold, either as firsts or seconds. Cull yields have not been included in tables because few orchards reported selling culls, the culls being used at home or fed to stock. Only \$333.00 worth of culls were reported sold for 1911, and \$178.50 for 1912. Culls brought from 50-75 cents per cwt. or 35-50 cents a bushel.

TABLE XXV. *Distribution of Orchards According to Three Year Average Yields and Incomes*

Yield per acre (bbls.)	Orchards			Income per acre (\$)	Orchards		
	No.	Per cent.	Total%		No.	Percent	Total%
0-19	8	14.2	14.2	0-39	9	16.0	16.0
20-39	7	12.5	26.7	40-79	11	19.6	35.6
40-59	9	16.0	42.7	80-119	4	7.1	42.7
60-79	8	14.2	56.9	120-159	3	5.3	48.0
80-99	2	3.5	60.4	160-199	7	12.5	60.5
100-199	9	16.0	76.9	200-239	6	10.7	71.2
120-149	3	5.3	81.7	240-279	2	3.5	74.7
150-169	2	3.5	85.2	280-319	4	7.1	81.8
170-189	3	5.3	90.5	320-359	3	5.3	87.1
190	5	8.9	99.4	360	7	12.5	99.6

Table XXV classifies orchards according to income. To state the average yield and income per acre does not tell what per cent of the orchards are getting above or below the average. The orchards are arranged in classes differing by 20 barrels to the acre in yield, and \$40.00 per acre in income. The columns headed "total per cent" are made up of the sum of the preceding percentages in columns 3 and 7. Thus 26.7 per cent equals the sum of 14.2 per cent plus 12.5 per cent and represents the per cent of orchards yielding from 0 to 39 barrels per acre. The typical yield per acre is about 50 barrels, the middle value of the class 40-59. Sixteen per cent of the orchards are in this class. The typical income per acre is

\$65.00—the middle value of the class 40-79. About 20 per cent of the orchards are in this class.

Fifty-one per cent of the orchards are producing more than 60 barrels to the acre. About 52 per cent of the orchards have an income of \$160.00 or more an acre.

FIGURE 5—The use of props is unnecessary in well pruned orchards.

SUMMARY.

Status of Fruit Growing in Jefferson County.—The county has approximately 195,524 apple trees growing on 4,385½ acres of land. 47.7 per cent of the trees are not bearing, being between one and seven years of age. In the fall of 1911, and spring of 1912, 1334 acres or 6.8 per cent of total trees in the county were set out.

Geographical Distribution.—The plantings are quite well scattered over the county. The largest groupings being about Kearneysville and Charles Town. (See map.)

Size of Orchards.—The size of orchards varies from 1 to 320 acres. The typical size of orchards is ten acres. The larger orchards as a rule show a greater yield and income per acre than the smaller orchards.

Planting Plans.—Practically all the orchards use the square system of planting. The typical distance for planting being 30 x 30 feet.

Varieties.—The York Imperial, Ben Davis, Grimes, Arkansas, Stayman Winesap, and Winesap are the chief commercial varieties planted in the county. Many of the late plantings are Jonathan, Winesap, Delicious, and Gano. The plantings of Ben Davis have decreased in the last few years.

Soils.—Limestone outcrops are met with in most of the county. "Apple Pie Ridge" soapstone is said to be the best apple soil. The Hagerstown loam is the predominant soil type. It is also good apple land.

Drainage.—Natural drainage is good throughout the county.

Soil Management.—As a rule the young orchards are planted to a hoed or cultivated crop in rotation with a grass or grain crop. About 30 per cent of the bearing orchards have been in sod five years or more. Sod culture is the general practice in bearing orchards, although cultivated orchards are more profitable. See Table XIV.

Management of Sod Orchards.—As a rule orchards are pastured. Hogs are the chief animals used. Sheep are also pastured to a considerable extent.

MAP OF JEFFERSON COUNTY

SCALE:—8950 FT.—IN.

RAILROADS ROADS

ORCHARDS

ACRES

1-5
 5-15
 15-25
 25-50
 50-100
 100-150
 150-200
 200-250
 250-300
 300-

Fertilizer.—Stable manure is the chief fertilizer. 37.1 per cent of the orchards use it alone, while 29 per cent of the orchardists use manure and commercial fertilizer. Commercial fertilizer alone is used in 13.5 and lime in 8.6 per cent of the orchards. 14.1 per cent of the orchards use no fertilizer.

Pruning.—Spring pruning is popular, 75 per cent are pruned at that time. Annual pruning is practiced in 62.5 per cent of the orchards. About half of the orchards are poorly pruned. Heavy pruning is not common. Light pruning is reported in 80 per cent of the orchards.

Orchard Pests.—The chief orchard insect pests are the codling moth and San Jose scale. The most prevalent diseases are cedar rust and bitter rot.

Spraying.—Most of the orchards are sprayed three times. 40 per cent of the orchards are thus treated. 10.4 per cent of the orchards are never sprayed. Lime-sulphur is the common spray used. Arsenate of lead is the chief arsenical poison and is usually used in combination with the lime-sulphur. Spraying orchards three times is the most profitable practice, producing an average income of \$101.13 per acre. Orchards sprayed twice yield an increase of \$69.26, sprayed once \$39.32, while orchards never sprayed have an income of \$39.38 per acre.

AN AVERAGE JEFFERSON COUNTY ORCHARD:

- Is 10 acres in area. The largest orchard has 320 acres.
- Is planted 30x30 feet apart, 48 trees to the acre.
- Is between 8 and 13 years of age.
- Is a level or slightly rolling orchard.
- Is planted with the York Imperial and Ben Davis apples.
- Is well drained.
- Is intercropped till bearing and after bearing left in sod.
- Is usually fertilized with a combination of manure and commercial fertilizer.
- Is usually pruned lightly every year.
- Is usually sprayed three times.
- Is yielding 45.4 barrels and an income of \$95.53 per acre.