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The Thinning of Orchard Fruits

Agriculture

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THE THINNING OF ORCHARD FRUITS

by

WILLIAM RICKETTS SHINN

THESIS

for the

DEGREE OF BACHELOR OF SCIENCE

in

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of the

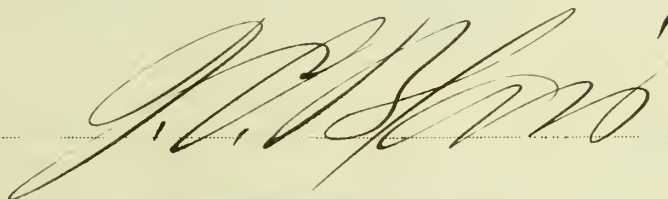## UNIVERSITY OF ILLINOIS

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

WILLIAM RICKETTS SHINN

ENTITLED The Thinning of Orchard Fruits

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

OF Bachelor of Science

HEAD OF DEPARTMENT OF Horticulture

I N D E X .

THE THINNING OF ORCHARD FRUITS.

Introducton.

In reading the Report of the Illinois State Horticul-
tural Society for 1904 the writer was much interested in the
discussion of the subject, "Thinning Apples". Having had only
a very limited experience in thinning fruit and realizing the
need of further information along this line of horticultural
work, the writer suggested to Professor J. C. Blair, Chief
in the Department of Horticulture, the possibility of doing
a thesis on the subject of "Thinning Orchard Fruits". Profes-
sor Blair being agreeable to the suggestion the work was con-
ducted jointly with the Horticultural Department.

Plan of the Work.

The work as planned was to include two distinct lines
of work: first, the performance of an experiment in thinning
apples; second, the reading and summarizing of available
literature bearing on the subject of "Thinning Orchard
Fruits" with the drawing of general conclusions upon the
practice of thinning this class of fruits.

Part I.

An Experiment in Thinning Apples.

Before plans could be made in detail it was necessary
to secure the use of some apple trees which bore sufficient
fruit to justify thinning. None of the trees on the Horti-
cultural grounds bore an ample crop so it was necessary to
look for trees in commercial orchards. At first quest was
made in the orchards of Senator Dunlap at Savoy but this

search proved futile as the late spring frost had almost destroyed the apple crop at this place. By going to Neoga, however, several trees were found in the orchards of Mr. F. D. Voris which bore sufficient fruit to apparently justify thinning. Through the courtesy of Mr. Voris the writer was allowed the use of such trees as were deemed necessary for the purposes of the experiment.

Description of the Trees Selected.

It was impossible to find trees in a solid block which were suited to the purposes of the experiment so the selection of trees was made without regard to convenience of location. Twenty four trees were finally selected after one hundred and twenty acres of orchard had been quite thoroughly examined. These twenty four trees comprised five different varieties, six trees each of the Grimes Golden, Baldwin and Ben Davis varieties, and three trees each of the Jonathan and Winesap varieties. The orchard in which these trees were located was in a high state of cultivation, having been thoroughly disked, the ground was free from weeds and grasses and the surface was broken into an excellent mulch. All trees in the orchard had been sprayed twice in the spring, once before the blossoms had opened and again after the blossoms had fallen. All the trees selected had been set in the orchard about sixteen years and were apparently thrifty and in their prime. From all appearances the

trees selected seemed to be exceptionally well adapted to the purposes of the experiment, the only objection being the fact that it was necessary, to obtain suitably filled trees, to select those which were not contiguous.

Detailed Plan of the Experiment.

Having secured the necessary trees, the next step was the working out of a plan for the conduct of the work. The following plan was the one which was adopted as it seemed to be best adapted to the purposes of the experiment.

1. To thin a portion of the fruit from some of the trees and leave the remaining trees unthinned as a check upon results.

2. To record the number and size of the windfalls and picked apples from the different trees.

3. To determine approximately the amount of injury from insects and scab.

4. To find the market grades of the picked fruit.

5. To take any other observations which might have a bearing on the thinning of apples.

The Experimental Work.

Section 1. At the beginning of the work all of the trees were numbered from one to twenty four inclusive. The trees of the different varieties were numbered as follows:

Trees numbers 1 to 6 inclusive   Baldwin.

Trees numbers   7 to 9   inclusive   Jonathan.

''   ' '   10 '' 15   ' '   Grimes Golden.

''   ' '   16 '' 21   ' '   Ben Davis.

''   ' '   22 '' 24   ' '   Winesap.

Trees Nos. 3, 5, 8, 12, 13, 17, 21 and 23 were reserv-
ed as check trees, and the remainder of the trees were thinned
as much as seemed necessary. Thinning was begun on July 8th
and completed on August 18th, a period of showery weather de-
laying the work for some time. In thinning the fruit defective
specimens injured by insects or scab were the ones removed.
The time required to do the thinning varied from one hour to
two and one half hours, but a longer time was required than
would be necessary in practical work as all fruits removed
were placed in a sack carried over the shoulder of picker
while in practical work the apples removed in the thinning pro-
cess would be dropped on the ground as picked. An ordinary
picking ladder fifteen feet in length was used in all work
while in practice a good step ladder could be used advanta-
geously while working around the lower limbs of the trees.

Table I shows the total number of apples produced by
the trees which were thinned, the number of apples remaining on
the trees at the time thinning was done, the number of apples
removed in the thinning process, the per cent of the total
removed, and the per cent removed of the number remaining on
the trees at the time of thinning. As the season progressed
more defective fruit was observed, hence those varieties

which were thinned last, Grimes Golden, Jonathan and Winesap,
were thinned more closely than the Ben Davis and Baldwin trees.

Section 2. The Number and Size of Windfalls and
Picked Fruit.

In order to form a proper estimate of the benefits
                    be
which are to_gained by thinning, the number and size of the
apples borne by each tree must be taken into consideration.   .
To count the fruits on a mature apple tree is impracticable so
the apples falling and those which were removed by picking
were counted. Table II gives the number of apples counted at
each picking of windfalls and gathered fruit, and it also gives
the total number of apples borne by each tree.

To determine what influence thinning exerts upon the
size of the fruit a record was kept of the number of apples
of different sizes produced by each tree. A board having a
number of circular holes ranging from one half inch to three
and one quarter inches in diameter, each hole being one fourth
inch larger than the preceding one, was used in determining
the **size** of the apples. Table III gives the total number of
apples of each size produced by each tree and Table IV gives
the percentages of the apples of each size.

If thinning has any value in increasing the size of **fruit**
                                                      to
it is the picked fruit which it is desired_affect, as size and
market value have a very definite relation. Hence Table V giv-
ing the percentages of the picked apples of each size, has been
prepared.

Section 3.   The Amount of injury Resulting from

Insects and Scab.

Shortly after the experiment was started one fact be-
came evident, consideration must be given to the possibility
of severe injury from insects and scab before deciding the question
of the profitableness of thinning apples. To determine more
definitely the amount of injury resulting from these enemies,
a record was kept for the greater portion of the time of the
the injury from this source. Table VI gives the result of this
work expressed in percentages of the fruits injured by insects
and scab.

Section 4.   Market Grades of Picked Fruit.

All picked fruits were carefully graded into three
grades, No. 1's, No. 2's, and culls, and the amount of the ap-
ples of each grade from each tree was recorded. Table VII
gives the results of this work.

Section 5.   Minor Observations.

Three other factors which might have an influence on
the thinning of apples are; the weather, the coloring of the
fruit, and the condition of the foliage.

The first of these factors doubtless had considerable
influence upon the development of the fruit. During a con-
siderable portion of the time the weather was extremely dry
and it is certain that the trees suffered from the drought.
Whether this unfavorable weather had any influence upon the
falling of fruit can not be definitely known but it undoubt-

edly checked the development of the apples.

One of the chief merits claimed for thinning is the higher color secured on the fruit from thinned trees. Careful observation was made at the time of final picking but no difference could be detected between the fruit from the thinned and unthinned trees in regard to color, it being uniformly high on all fruits.

To secure the highest development of the fruit the foliage must be in a thrifty, healthy condition. So far as could be detected there were no marked differences in the foliage of the different trees. All trees suffered quite uniformly from an attack of yellow leaf during the latter part of July following a protracted period of cloudy, showery weather. Brown spotting of the leaves was common on all trees, and none of the trees were attacked by tent caterpillars. Since all of the trees were affected similarly with regard to foliage injury, any differences in the fruit are not due to differences in the foliage of the trees.

Section 6. Discussion of Results.

For the purpose of comparison the trees will be grouped together by threes, the trees in each group being quite uniform in size and bearing approximately the same amount of fruit. The following table shows the trees in each group and it also gives the variety of the trees in each group.

	Nos. of Trees.	Variety.
Group I.	1, 2, and 3	Baldwin.
'' II.	4, 5, and 6	'' .
'' III.	7, 8, and 9	Jonathan.
'' IV.	10, 11, and 12	Grimes Golden.
'' V.	13, 14, and 15	'' '' .
'' VI.	16, 17, and 18	Ben Davis.
'' VII.	19, 20, and 21	'' '' .
'' VIII.	22, 23, and 24	Winesap.

For the sake of convenience the results in each group will be discussed separately as this method will give fairer comparison than by comparing all of the trees of one variety.

In Group I tree No. 1 was reserved as a check, tree No. 2 was thinned 31.0%, and tree No. 3 was thinned 34.6%. (Table I). By consulting Table II it is found that tree No. 1 produced 2099 apples, tree No. 2 produced 3327 apples, and tree No. 3 produced 2389 apples. From Tables III and IV it can be seen that the apples from tree No. 3 averaged slightly larger in size than those from the other two trees. At the final picking the apples from tree No. 1 were larger, and the apples from tree No. 2 were smaller than the apples from tree No. 3. (Table V). Evidently thinning had little influence upon the size of fruit in this group, the observed differences are probably due to other causes. By referring to Tables II and VII it is seen that tree No. 3 produced the largest num-

ber and also the largest quantity of picked fruit. As far as can be determined there was an absolute loss in this group from thinning.

In Group II tree No. 5 was used as a check, 42.6% of the fruit was removed from tree No. 4 and 32.3% from tree No. 6. (Table I). Table II shows that tree No. 4 produced 2063 apples, tree No. 5 produced 1393, and tree No. 6 produced 1599. From Tables III and IV it is seen that the fruit from tree No. 5 averaged fully as large, if not larger than the fruit from the other two trees. At the final picking the fruit from trees Nos. 4 and 6 was considerably larger than the fruit from tree No. 5. (Table V). In both cases there is a slight increase in size due to the effect of thinning. By referring to Tables II and VII it is seen that tree No. 5 produced a larger number and also a slightly greater quantity of picked fruit than either of the other trees. In this group there is a slight increase in the size of the picked fruit from the thinned trees as compared with the size of that from the check tree, but there is an absolute loss in the quantity of picked fruit from the thinned trees.

In Group No. III tree No. 8 was used as a check, 39.8% of the fruit was removed from tree No. 7 and 41.3% from tree No. 9. By referring to Table II it is found that tree No. 7 produced a total of 2593 apples, tree No. 8 produced 2010, and tree No. 9 produced 1669. Tables III and IV show comparatively slight differences in the fruit from the different trees. The

picked fruit from trees Nos. 7 and 9 was larger than the picked fruit from tree No. 8. (Table V). Tables II and VII show that tree No. 7 produced a greater number and a larger quantity of picked fruit than did tree No. 8, while the picked fruit from tree No. 9 was less in both quantity and number than the picked fruit from tree No. 8. Giving the proper consideration to the number of apples produced by each tree it appears that thinning increased the size of the picked fruit, the differences in quantity of picked fruit are probably due to the differences in the total number of apples produced by each tree.

Considering Group IV in which tree No. 12 is used as a check, 43.6% of the fruit was removed from tree No. 10, and 48.1% from tree No. 11. Tree No. 10 produced 1292 apples, tree No. 11 produced 1061, and tree No. 12 produced 1075. (Table II). From Tables III and IV it can be seen that the average size of the fruit from trees Nos. 10 and 11 is slightly larger than the fruit from tree No. 12. Table V shows that the picked fruit from tree No. 10 is larger, and that from tree No. 11 is smaller than the picked fruit from tree No. 12. Referring to Tables II and VII it is found that the number of picked fruits from tree No. 12 is greater than the number of picked fruits from either of the other trees but that the quantity of picked fruit from tree No. 12 is only equal to that from tree No. 10 and slightly greater than that of tree No. 11. The results in this group

do not seem to indicate any gain from thinning, the fruit from one tree is apparently increased in size by thinning while the fruit of the other tree is not appreciably affected. The observed differences mey be largely due to the individuality of the tree nevertheless thinning probably influenced the size of the fruit to a certain extent.

In Group V tree No. 13 is the check tree, tree No. 14 was thinned 54.2%, and tree No. 15 was thinned 44.8%. The number of apples produced by each tree as given in Table II is: tree No. 13, 1610; tree No. 14, 1887; and tree No. 15, 1669. Tables III and IV show that the fruit from the thinned trees averaged slightly larger than the fruit from tree No. 13. Comparing the size of the picked fruit,(Table V), it is found that the fruit from the thinned trees is larger than the fruit from the check tree. From Table VII it is seen that the quantity of picked fruit from tree No. 15 is larger, and that from tree No. 14 is equal to the quantity of picked fruit from tree No. 13. Table II shows that tree No. 15 produced the largest number of picked fruits and tree No. 14 produced the smallest number. The results from both of the thinned trees seem to indicate a slightly increased size due to thinning.

Tree No. 17 is the check tree in Group VI, 36.5% of the fruit was removed from tree No. 16, and 32.2% was removed from tree No. 18. Tree No. 16 produced 1978 apples, tree No. 17 produced 1695, and tree No. 18 produced 1725. (Table II). By consulting Tables III and IV it is found that the fruit of

tree No. 17 averages slightly larger than the fruit from either of the other trees. In Table V it is shown that the picked fruit of trees Nos. 17 and 18 is practically equal in size while the fruit from tree No. 16 is larger than the fruit from either. Table II shows that a larger number of apples was picked from tree No. 17 than from either of the other two trees, and Table VII shows that tree No. 17 yielded a slightly larger quantity of picked fruit than tree No. 16 or tree No. 18. This latter table also shows that the fruit from the trees which had been thinned graded somewhat better than the fruit from the check tree. In this group thinning increased the size of the picked fruit, and it also improved the grade, but there is a loss in the total yield of picked fruit.

Group VII includes tree No. 19, thinned 31.8%, tree No. 20, thinned 46.6%, and tree No. 21, check. Table II shows that tree No. 19 produced 1291 apples, tree No. 20 produced 1481, and tree No. 21 produced 1980. The average size of the picked fruit from the thinned trees is larger than the average size of the picked fruit from the check tree.(Tables III and IV). A marked difference in favor of the fruit of the thinned is found when a comparison of the sizes ~~of the sizes~~ of the picked fruit from the thinned and check trees is made.(Table V). Tables II and VII show that tree No. 21 produced a greater number and a larger quantity of picked fruit than did either of the other trees. Much of the fruit from tree No. 21 was too small to grade well hence a much larger proportion of the fruit

from this tree graded as culls. In this group thinning increased the size of the fruit and it also improved the grade but there was quite a loss in the quantity of fruit harvested.

In Group VIII tree No. 23 is the check tree, 49.9% of the fruit was removed from tree No. 22 and 56.8% was removed from tree No. 24. The total number of apples produced by each tree is: tree No. 22, 1497; tree No. 23, 1245; and tree No. 23, 1295. Tables III and IV show that the average size of the apples from the thinned trees was somewhat larger than the size of apples from the check tree. The size of the picked fruit from tree No. 22 is greatest while the size of the picked fruit from trees Nos. 23 and 24 is practically the same. The number of picked apples is greatest from tree No. 22 and is least from tree No. 24. Yields of picked fruit from these trees are so small that they are scarcely worthy of consideration. There being no harmony in the results obtained in this group it appears that the differences are not due to thinning but are the result of other causes.

Conclusions Drawn from this Experiment.

Final conclusions can not be drawn from this experiment because; (1) the trees selected did not bear a sufficiently heavy crop of fruit to justify severe thinning, (2) insect injuries and scab coupled with unfavorable weather conditions produced an extremely large proportion of windfalls. These conditions modified results tosuch an extent that they are valueless from a commercial standpoint. Instead they must be

interprepted as indicating in a general way the effect of judi-
cious thinning upon the fruit. Further investigation under
more favorable conditions and carried on for a series of years
is needed to obtain conclusive results on the thinning of ap-
ples.

One conclusion can be drawn from the experiment with-
out fear of contradiction: thinning of apples is unprofitable
when there is only a moderate setting of fruit and when there
is an unusually large amount of injury from insects and scab.
Hence it behooves the orchardist to give careful **attention** to
his trees, proper pruning, spraying,and cultivation, before
giving any attention to the secondary matter of reducing the
number of apples borne by the trees.

Results in most cases indicate an increased size and
a slightly better grade of fruit from the thinned trees. Un-
der more favorable conditions and with a discriminating mar-
ket,willing to pay higher prices for the better grade of ap-
ples, thinning might be a profitable practice.   In some ex-
ceptional cases thinning is of great value in protecting the
tree from injury from over bearing, preventing breaking of the
branches. Otherwise there does not appear to be any material
benefit from thinning apples. Further investigation may show
far greater benefits from thinning but as far as this exper-
ment goes, no thinning of apples is recommended except as
stated above for the protection of the tree.

TABLE NO.I.

Tree No.	Total No. of Apples	No.on tree at time of thinning	No.removed by thinning	Per cent of total removed	Per cent of crop then on tree removed
1	2099	1450	455	21.4	31.0
2	3327	2327	805	24.2	34.6
3	Check.				
4	2063	1505	641	31.1	42.6
5	Check.				
6	1599	1338	432	27.0	32.3
7	2593	1553	618	23.8	39.8
8	Check.				
9	1669	888	367	21.9	41.3
10	1292	972	424	32.9	43.6
11	1061	818	394	37.1	48.1
12	Check.				
13	Check.				
14	1887	1274	691	36.6	54.2
15	1669	1202	539	32.3	44.8
16	1978	1262	461	23.3	36.5
17	Check.				
18	1725	1070	345	20.0	32.2
19	1291	852	271	20.9	31.8
20	1481	1200	560	37.8	46.6
21	Check.				
22	1497	872	435	29.1	49.9
23	Check.				
24	1295	682	388	29.9	56.8

TABLE NO.I.

TABLE NO.II.

Number of Apples at each Picking.

Tree No.	Windfalls 1	2	3	4	5	6	Thinned.	Final.	Total.
1	649	177	442	213	68		455	95	2099
2	1000	278	467	422	116		805	239	3327
3	758	262	580	338	104			347	2389
4	558	142	347	227	21		141	127	2063
5	472	186	398	160	37			140	1393
6	261	127	383	232	45		432	119	1599
7	#	214	826	314			614	621	2593
8		153	656	731				470	2010
9		156	625	316			367	205	1669
10	208	112	123	235			424	190	1292
11	122	121	43	222			394	159	1061
12	102	173	262	307				231	1075
13	202	316	390	419				283	1610
14	193	420	38	287			691	258	1887
15	182	285	71	302			539	290	1669
16	716	239	220	93	44	50	461	155	1978
17	787	124	258	180	48	83		215	1695
18	655	122	229	88	42	70	345	174	1725
19	439	106	188	90	53	48	271	96	1291
20	281	82	218	138	46	59	560	97	1481
21	536	140	394	171	81	173		487	1980
22	59	106	460	178	66	101	435	92	1497
23	21	112	532	381	36	99		64	1245
24	48	139	426	146	44	62	388	42	1295

\# The fallen fruit from trees Nos.7,8, and 9 had been covered up cultivation a few days before the first picking of windfalls.

TABLE NO.III.

Size of fruit. Number of Apples of Different sizes.

Tree No.	$\frac{1}{2}$"	$\frac{3}{4}$"	1"	$1\frac{1}{4}$"	$1\frac{1}{2}$"	$1\frac{3}{4}$"	2"	$2\frac{1}{4}$"	$2\frac{1}{2}$"	$2\frac{3}{4}$"	3"	$3\frac{1}{4}$"	Total
1	22	91	393	119	140	65	127	405	171	257	215	94	2099
2	52	157	571	178	219	133	304	671	195	375	400	72	3327
3	17	103	444	145	152	65	79	275	192	357	425	135	2387
4	8	54	287	147	153	57	144	524	144	240	213	92	2063
5	6	33	257	118	116	38	46	151	135	208	184	101	1393
6	14	34	118	65	100	47	28	172	412	294	205	110	1599
7		14	51	49	206	484	486	737	306	245	13	2	2593
8		3	25	22	81	131	282	692	589	185			2010
9		5	22	38	136	274	302	439	241	205	7		1669
10	5	43	124	53	61	62	124	359	204	199	54	4	1292
11	13	29	76	32	62	70	125	314	179	128	30	3	1061
12	9	21	69	38	71	90	192	320	124	124	17		1075
13	16	42	129	55	81	118	310	480	301	74	4		1610
14	31	34	110	86	128	137	258	524	430	127	21	1	1887
15	32	68	77	58	100	159	287	376	347	131	26	8	1669
16	51	170	392	164	394	253	173	130	57	68	78	48	1978
17	48	230	391	119	95	61	111	204	183	165	75	13	1695
18	73	205	332	94	266	191	155	136	95	116	53	9	1725
19	36	118	243	82	202	153	124	66	81	81	66	29	1291
20	16	77	153	63	257	322	203	120	93	100	57	20	1481
21	52	206	247	80	293	320	378	285	77	27	13	4	1980
22	2	33	70	65	119	326	376	374	107	25			1497
23		5	45	62	103	299	386	236	76	33			1245
24		9	60	79	115	271	300	350	87	24			1295

TABLE NO.IV.

Percentages of apples of different sizes.

Tree No.	1/2"	3/4"	1"	1¼"	1½"	1¾"	2"	2¼"	2½"	2¾"	3"	3¼"
1	1.05	4.34	18.72	5.67	6.67	3.10	6.05	19.29	8.15	12.25	10.23	4.48
2	1.56	4.72	17.16	5.35	6.58	4.00	9.14	20.17	5.86	11.27	12.05	2.16
3	.71	4.31	18.59	6.07	6.36	2.72	3.31	11.51	8.04	14.94	17.79	5.65
4	.39	2.62	13.93	7.13	7.41	2.76	6.98	25.40	6.98	11.63	10.33	4.46
5	.41	2.37	18.45	8.47	8.33	2.73	3.30	10.84	9.69	14.93	13.22	7.25
6	.88	2.13	7.39	4.07	6.26	2.94	1.75	10.77	25.79	18.41	12.83	6.88
7		.54	1.97	1.89	7.94	18.51	18.74	28.42	11.80	9.45	.50	.08
8		.15	1.24	1.09	4.03	6.52	14.03	34.42	29.30	9.20		
9		.29	1.32	2.27	8.15	16.42	18.09	26.30	14.44	12.28	.42	
10	.39	3.33	9.60	4.10	4.46	4.53	9.60	27.79	15.79	15.40	4.18	.31
11	1.22	2.74	7.17	3.02	5.85	6.60	11.79	29.62	16.89	12.07	2.83	.28
12	.83	1.95	6.42	3.53	6.60	8.37	17.86	29.77	11.53	11.53	1.58	
13	.99	2.61	8.01	3.41	5.03	7.33	19.25	29.61	18.69	4.59	.25	
14	1.64	1.80	5.83	4.56	6.78	7.26	13.68	27.77	22.79	6.73	1.11	0.05
15	1.92	4.07	4.61	3.47	5.99	9.53	17.13	22.53	20.79	7.85	1.56	.48
16	2.58	8.59	19.82	8.29	19.92	12.84	8.75	6.57	2.88	3.44	3.94	2.42
17	2.83	13.57	23.07	7.02	5.60	3.60	6.55	12.03	10.79	9.73	4.42	.76
18	4.23	11.88	19.25	5.45	15.42	11.07	8.98	7.88	5.51	6.72	3.07	.50
19	2.79	9.14	18.82	6.35	15.65	12.64	9.61	5.11	6.33	6.33	5.11	2.25
20	1.08	5.20	10.33	4.25	17.30	21.74	13.71	8.10	6.28	6.75	3.85	1.35
21	2.62	10.39	12.46	4.04	14.78	16.15	19.07	14.38	3.88	1.36	.65	.20
22	.13	2.20	4.68	4.34	7.95	21.78	25.12	24.98	7.15	1.67		
23		.40	3.41	4.98	8.27	24.02	31.01	18.96	6.10	2.65		
24		.69	4.63	6.10	8.88	20.93	23.17	27.03	6.72	1.85		

TABLE NO.V.

Size of Picked Fruit.

Percentages of Apples of Different Sizes.

Tree No.	1½"	1¾"	2"	2¼"	2½"	2¾"	3"	3¼"
1			.	.	2.11	10.53	33.68	53.68
2					2.93	16.32	61.09	19.66
3					2.31	17.00	49.57	31.12
4					1.57	9.45	33.86	53.12
5					2.86	11.43	42.15	43.56
6					.84	9.24	34.46	55.46
7			.48	23.67	40.58	34.95	.32	
8			2.97	28.08	43.85	25.10		
9			.97	14.15	24.87	57.57	2.44	
10			2.10	17.89	17.37	47.37	13.69	1.58
11			5.03	35.85	20.76	30.19	7.55	.62
12		.43	7.79	29.03	18.17	38.53	6.05	
13		4.24	28.27	20.49	37.10	9.54	.36	
14		.39	1.55	12.79	62.79	18.60	3.49	.39
15		.69	4.14	12.76	56.53	19.31	4.83	1.72
16				5.81	8.39	26.45	35.48	23.87
17			4.19	14.88	18.61	34.62	22.78	5.12
18			4.60	9.19	20.31	39.65	21.26	5.17
19				2.08	11.46	28.23	39.58	18.75
20			2.06	6.19	8.25	46.39	22.68	14.43
21	.62	6.57	39.63	38.61	8.83	3.48	1.64	.62
22	4.35	20.65	22.83	31.52	16.30	4.35		
23	7.81	23.44	28.13	25.00	14.06	1.56		
24	2.38	16.67	45.24	28.57	4.76	2.38		

TABLE NO.VI.

Percentages of Fruits injured by Insects or affected by Scab.

Tree No.	Curculio.	Codling Moth.	Other Insects.	Scab.	Perfect.
1	. 76.64	55.50	18.16	89.76	.93
2	71.52	43.73	27.33	80.00	1.80
3	74.22	71.14	16.86	90.98	1.07
4	59.29	41.33	28.52	81.41	3.45
5	76.03	71.58	16.09	94.35	.34
6	38.01	55.31	20.49	84.61	4.03
7	53.46	81.10	13.97	58.82	1.20
8	57.00	78.81	17.05	76.24	.86
9	52.54	82.55	14.30	82.35	.10
10	74.97	64.04	18.06	86.50	.46
11	56.46	67.21	14.16	86.56	.90
12	63.45	72.42	18.16	93.79	.00
13	66.71	71.53	19.97	93.20	.42
14	50.60	57.75	20.70	87.82	.17
15	68.80	66.13	15.78	93.74	.46
16	81.85	36.85	16.09	91.85	.43
17	78.02	67.80	20.94	92.41	.79
18	80.46	43.39	12.64	91.52	.57
19	72.74	41.06	21.24	88.14	1.59
20	59.42	39.89	15.70	89.31	1.86
21	72.66	73.41	11.61	95.13	1.31
22	62.17	92.27	7.55	98.42	.00
23	72.13	88.50	11.21	97.64	.00
24	68.12	82.26	10.46	97.82	.00

TABLE NO.VII.

Final Picking. Market Grades of Picked Fruit.

Tree No.	Amounts of Apples of Different Grades.			Total
	No.1.	No.2.	Culls.	Yield.
1	$\frac{1}{2}$ bushel	1/16 bushel	3/16 bushels	$\frac{3}{4}$ bushel.
2	1 "	$\frac{3}{8}$ "	$1\frac{1}{4}$ "	$1\frac{5}{8}$ "
3	$1\frac{1}{4}$ "	$\frac{3}{8}$ "	$\frac{3}{8}$ "	2 "
4	$\frac{3}{4}$ "	$\frac{1}{16}$ "	$\frac{1}{4}$ "	$1\frac{1}{8}$ "
5	$\frac{3}{4}$ "	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$1\frac{1}{4}$ "
6	$\frac{5}{8}$ "	$\frac{1}{8}$ "	$\frac{1}{4}$ "	1 "
7	3/16 "	7/16 "	$1\frac{7}{8}$ "	$2\frac{1}{2}$ "
8	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$1\frac{3}{8}$ "	$1\frac{3}{4}$ "
9	1/32 "	3/32 "	$\frac{3}{4}$ "	$\frac{7}{8}$ "
10	3/16 "	3/16 "	9/16 "	1-5/16 "
11	$\frac{1}{8}$ "	3/16 "	7/16 "	$\frac{3}{4}$ "
12	$\frac{1}{8}$ "	3/16 "	$\frac{5}{8}$ "	1-5/16 "
13	$\frac{1}{4}$ "	$\frac{1}{4}$ "	$\frac{5}{8}$ "	$1\frac{1}{8}$ "
14	$\frac{3}{8}$ "	$\frac{1}{4}$ "	$\frac{1}{2}$ "	$1\frac{1}{8}$ "
15	$\frac{3}{8}$ "	$\frac{1}{4}$ "	$\frac{3}{4}$ "	$1\frac{3}{8}$ "
16	3/16 "	$\frac{3}{8}$ "	7/16 "	1 "
17	3/16 "	$\frac{1}{4}$ "	$\frac{5}{8}$ "	1-1/16 "
18	5/16 "	$\frac{1}{8}$ "	7/16 "	$\frac{7}{8}$ "
19	$\frac{1}{8}$ "	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$\frac{1}{2}$ "
20	$\frac{1}{4}$ "	1/16 "	3/16 "	$\frac{1}{2}$ "
21	$\frac{3}{4}$ "	$\frac{1}{2}$ "	$1\frac{1}{8}$ "	2 "
22			$\frac{1}{4}$ "	$\frac{1}{4}$ "
23			3/16 "	3/16 "
24			$\frac{1}{8}$ "	$\frac{1}{8}$ "

Part II.

A Summary of Available Literature on the Subject of

The Thinning of Orchard Fruits.

More or less extensive experiments in thinning orchard fruits have been coducted at several agricultural experiment stations and the results of these tests are published in the form of bulletins and in the annual reports of the stations. A review of this literature gives one a broader view of the subject in hand and ennables one to form more accurate conclusions regarding the value of thinning apples, peaches, pears, and plums.

Section 1. Literature Relating to the

Thinning of Apples.

New York Bulletin 234.

New York Bulletin 234 reports tests of thinning apples for a period of four years. Mature trees of Baldwin, Rhode Island Greening, and Hubbardston Nonesuch were used in the test. The thinning was done in June and July of each year and observations were made on the effect of thinning on the color, size, market value, and the amount and regularity of fruit production. The following is a brief summary of the results.

Color. Whenever the trees were well filled , thinning heightened the color.

Size. When the trees were full, thinning increased the size of the fruit.

Market Value. Thinning produced a superior grade of

of apples better adapted to marketing in the smaller packages.
When the fruit is marketed in barrels there is less chance for
the thinned fruit to sell at a sufficient advance to pay for
thinning.

Amount and Regularity of Fruit Production. The
practice of thinning did not appear to cause any change in the
amount or regularity of fruit production.

Time to Thin. These experiments lead to the opinion
that early thinning is best.

Cost of Thinned as Compared with Unthinned
Fruit. The cost of thinning should not exceed fifty cents per
tree. Apples from thinned trees can be handled more economi-
cally than apples from unthinned trees as there is a propor-
tionally less amount of drops, culls, and No. 2's.

Massachusetts, (Hatch), Bulletin 44.

This bulletin reports an experiment in thinning Grav-
enstein and Tetofsky apples. Much of the fruit dropped prema-
turely but the market value of the fruit from the thinned
trees was greater than the market value of the fruit from the
unthinned trees.

Table of Results.

		Firsts.	Seconds.	Windfalls.	Mkt. Val.	Gain.
Gravenstein	Thinned.	7 bus.	1 bus.	$9 \frac{1}{2}$ bus.	$4.45*	$2.33
" "	Unthinned.	$2\frac{1}{2}$ ".	$2\frac{1}{2}$".	$10\frac{1}{4}$ " .	$2.12	
Cost of thinning.						.48
Profit						$1.85
Tetofsky	Thinned.	2 " .	$\frac{1}{2}$ " .	1 " .	$1.32	$1.20
" "	Unthinned.	0 " .	$\frac{1}{2}$ " .	3 " .	$ .12	
Cost of thinning.						.35
Profit						$ .85

*
  Firsts valued at 60¢ and seconds at 25¢ per bushel.

Connecticut, (Storrs), Report 1902-3, pp28-29

Four benefits are expected to be derived from thinning
fruit. (1) Maintaining the vigor of the tree; (2) producing
fruit of maximum size, appearance and quality; (3) securing
annual crops instead of alternate; (4) preventing the spread
of parasitic diseases. An account of an experiment in thinning
apples is also given. Five Baldwin trees of medium size, in a
good state of thrift, and under the same conditions were se-
lected for the experiment. Three of the trees were thinned
July 15, 1902, and the other trees were left unthinned as a
check on the results.

Table of Results.

Tree No.	No. Thinned.	No. 1's	No. 2's	Tot. No. Apples.	Barrels No.1's	Barrels No.2's	Total Value
1	1260	2440	375	4075	4.60	.64	$6.25
2	1450	3615	1205	6270	6.84	1.64	9.80
3	----	1710	3895	5605	3.00	5.44	7.62
4	925	2825	1150	4900	5.40	1.64	8.00
5	----	2190	1970	4160	4.00	2.64	7.00

These results show that thinning increased the propor-
tion of first grade fruit and that there was a profit in thin-
ning in all but one case.

Maryland Bulletin 82.

This bulletin is for the purpose of calling the atten-
tion of fruit-growers to the benefits derived from thinning,
it also enumerates the objections to thinning. The closing
sentences of this bulletin are; " It should be distinctly un-
derstood that thinning will not pay except the other practices,
which go with proper fruit culture, have been attended to. It

will not pay to thin an orchard which has not been properly
pruned, sprayed, fertilized and cultivated ".

Section 2. Literature Relating to the Thinning of
Peaches.

American Agriculturist Vol. 69, page 700.

An account is given by Alva T. Jordan of an experiment
conducted at the New Jersey Agricultural Experiment Station in
1900. Two peach trees, one bearing 862 and the other bearing
852, were selected for the experiment.

Table of Results.

	Tree No. I.	Tree No. II.
Per cent removed by thinning.	69.5%	31.9%
Baskets of fruit picked.	2.83	3.92
Average weight per peach.	4.48 ozs.	2.81 ozs.
Price per basket offered by grocers.	$1.00	$0.45
Value per tree.	$2.83	$1.76
Gain in favor of severe thinning.		$1.07

Michigan Bulletin 87,p 67.

No tabulated results are given, but the statement is
made that the results obtained favor the thinning of peaches to
a distance of about eight inches apart.

Michigan Bulletin 205, p. 30.

In this bulletin,as in the preceding one, no table of
results is given. It was found that the thinned trees had
healthier foliage and were more thrifty than the unthinned
trees. The fruit from the thinned trees, because of its larg-

er size and better quality, was of more more value than the
fruit from the unthinned trees.   Severe thinning is recommend-
ed for peaches.

Section 3.   Literature   Relating   to the   Thinning of
Pears.

Only one reference bearing on this topic could be
found and that is in the Report of the Delaware Station for
1900.   An experiment in thinning Kieffer pears was tried in a
commercial orchard.   A severe windstorm stripped the pears from
the tops of the trees hence results are only suggestive not
positive.   Following are the results obtained.

No. I pears from the check trees ran 92 per $5/8$ bushel basket.

No. I pears from the thinned trees ran 80 per $5/8$ bushel basket.

61% of the fruit from the check trees were of No. I grade.

83% of the fruit from the thinned trees were of No. I grade.

These results while not conclusive, show a gain in
size and an improvement in quality due to the effect of thin-
ning.

Section 4.   Literature   Relating   to the   Thinning of
Plums.

Massachusetts, (Hatch), Bulletin 44.

A tree each of the Guei and Victoria plums were div-
ided into approximately equal halves and one half of each tree
was thinned.

Table   of   Results.

Variety.	Marketable Plums.	Value.	Gain.	Per cent Rot.
Guei thinned.	9 quarts.	$0.81	$.32	28%
'' check.	5.5 ' ' .	0.49		42%
Victoria thinned.	16 ' ' .	1.44	.59	20%
'' check.	9.5 ' ' .	.85		46%
	Gain.			$.91
	Cost of thinning two half trees.			.30
	Net gain.			$.61

Delaware   Report   1899.

Accounts are given in this report of two experiments
in thinning plums. In the first experiment trees of the Bur-
bank variety were used and the results were unfavorable to
thinning. The cost of thinning was ten cents per tree and
the fruit from the check trees had a greater market value
than the fruit from the thinned trees. A noticeable increase
in size was observed in the fruit of the thinned trees but
as no difference in price was obtained in favor of the plums
from the thinned trees, thinning was unprofitable.

In the second experiment trees of Poole's Pride plum
were used and the cost of thinning was fifteen cents per tree.
Practically the same quantity of fruit was produced by the
thinned and unthinned trees so there was no profit in the
thinning in this experiment. Some difference in size in fav-
or ˄the fruit from the thinned trees was noticed. The most
    of
noticeable difference in favor of thinning was seen in the

Table of Results.

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thinning in this experiment. Some difference in size in fav-
or the fruit from the thinned trees was noticed. The most
noticeable difference in favor of thinning was seen in the

condition of the trees. The unthinned trees were so badly broken that it was necessary to renew the tops while the thinned trees were in good condition to bear a good crop the succeeding year.

New Mexico Bulletin 39, pp. 123-25.

Trees of the Wild Goose, Clyman, Tragedy, and Yellow Egg varieties were thinned; check trees were also kept of each variety. In every case the percentage of first class fruit produced by the thinned trees was greater than the percentage of first class fruit produced by the unthinned trees. The percentage of salable fruit was increased in each case by thinning, hence on the whole the results are in favor of thinning.

Part III.

Final Conclusions.

1. In any kind of orchard fruit it will pay to thin the fruit if necessary for the protection of the tree.

2. Thinning of apples and pears, except in cases where a marked discrimination in favor of quality is made, has generally been unprofitable. Practically all experiments indicate that larger and better fruit is produced by thinning.

3. Thinning of peaches has generally been very profitable. Size and quality determine the market value of peaches, hence quantity can be sacrificed to secure quality with profitable results. Severe thinning of peaches is more profitable than moderate thinning.

of plums
4.   Thinning is not usually very profitable although

larger fruit is obtained by thinning. Thinning has proven to

be valuable in protecting the tree and also in the prevention

of brown rot. Experiments show that thinning the fruits so

that they do not touch prevents brown rot to a certain extent.

Size is of little importance in determining the market value of

plums hence the increased size resulting from thinning does not

enhance the value sufficiently to pay for thinning.

5.   Thinning is always unprofitable unless the other

practices of fruit culture; pruning, spraying, cultivation and

fertilization; have been given proper attention. In other words

thinning is not a problem for the careless orchardist, it is

only a problem for the skillful horticulturist. At present the

thinning of orchard fruits is usually of minor consideration,

but as progress is made in solving the other horticultural

problems, and as the demand of the market changes from quantity

to quality, thinning may, and undoubted will, become of great-

er importance in the management of orchards.

6.   A final word should be added as to the cost of

thinning. The experiment conducted cost $52.35 but only a

small portion of this total cost should be credited to thin-

ning. The time required to thin a medium sized apple tree

bearing a full crop should not be greater than two or two and

one half hours, valuing labor at 15¢ per hour the cost would be

30 to $37^1/2$ ¢ per tree .