

ORCHARD STUDIES: AXILLARY FRUIT BUDS
ON SOME APPLE VARIETIES IN MINNESOTA
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MAY 1953

The axillary fruit buds sometimes occur on apple varieties and species was noted long ago by Gourley (2,3) and others. Brierley (1) more recently commented on this ^{N.A.} study of the clustering habit of Haralson, Minjon and Wealthy. These buds are found commonly, also, on "Rosy-Bloom" Crabapples and contribute materially to the mass of ornamental blossoms produced. Normal fruit buds of the apple are found at the tips of short year-old spurs, or on short year-old branches of older spurs. Some varieties commonly form fruit buds also at the tips of the new terminal shoots. Axillary buds are reported as occurring on vigorous year-old shoots of trees grown under irrigation in western states. Axillary fruit buds usually develop their blossoms a little later than the typical terminal spur buds. Often, in Minnesota these buds are weak and do not set fruit, but when they do, a high percentage of the apples produced usually is of unmarketable small size, poorly colored and adds to the undesirable habit of "roping" (1).

Occurance of axillary fruit buds has a direct bearing upon the chemical thinning problem. As these buds usually bloom a little later than spur buds the blossoms are not satisfactorily thinned by blossom thinning sprays of Elgetel or Krenite. Also, because later blossoming results in somewhat shorter time for fruit development, and because there usually is a smaller number of adjacent leaves to provide foods for growth, the apples usually are small and poorly colored at harvest time. Thinning with naphthaleneacetic acid (N.A.A.) sprays seems to remove much of the axillary set and thus helps to reduce the percentage of small apples.

The occurrence of axillary fruit buds on some Minnesota apple varieties was first observed when a study of the clustering habit was carried on from 1937 to 1944 (1). No records of axillary buds were made in 1946 when frost destroyed all blossoms. In 1948 and 1950 "off-years" following years of heavy crops, no axillary buds were found. Trees in good vigor in an "off-year" tend to develop many more

axillary fruit buds than are formed in years of heavy crops. Axillary fruit buds usually are found on vigorous, more or less upright, year old shoots. These buds are larger and plumper than leaf buds. There is no spur formation until the blossoms and leaves appear. A succulent new spur growth begins with the unfolding of the bud and may grow to a length of an inch or more. This growth should not be confused with normal young spurs which grow the previous season and therefore the normal spurs are formed on two-year-old wood.

In 1947 several varieties commonly grown in Minnesota were rated according to the average number of axillary fruit buds found per shoot. No record was made of shoots not showing these buds. The variety ratings are shown in Table 1. No axillary fruit buds were found that year on Minjon. They were rare on Fireside, McIntosh and Redwell, single buds being found on only an occasional shoot. On Hibernial Patten, Oriole and Prairie Spy from three to five axillary fruit buds were found on vigorous shoots. A very heavy development of these buds was found on Erickson, Haralson, Northwestern and Wealthy. On these varieties, shoots of average vigor showed from three to five of these buds, but there were many very vigorous upright shoot on which 12 to 14 axillary fruit buds were counted.

In 1949 only the Haralson and Wealthy varieties were studied. On 12 inch long terminal shoots of Haralson from seven to nine axillary buds were commonly found in addition to the normal fruit buds at tips of the shoots. As the blossoms appeared the terminal buds produced up to seven or eight flowers and the axillary buds produced up to six or seven flowers. These terminal shoots were completely covered by the mass of blossoms. Most of the old spurs on these trees had been killed in the severe winter of 1947-48. Loss of these spurs, and the crop they might have produced, may have resulted in an extra supply of foods for the axillary and terminal buds on the shoots which grew in 1948.

On vigorous upright shoots of Wealthy three to nine axillary fruit buds were found in addition to the plump terminal buds. These fruit buds commonly produced up to seven or eight flowers making a total of 30 to 50 blossoms to a 12 inch shoot.

When seven or eight flowers developed from a single bud many flower stems were branched so that two or three flowers were supported by a single stem. This type of flower development was not found in the Haralson, but was very common in Minjon, a variety in which clusters of five to seven apples are not unusual.

There was a relatively heavy set of apples from axillary fruit buds in 1949. On both Wealthy and Haralson these buds commonly produced clusters of two to six apples which remained attached until harvest time.

In 1951 records were made on several varieties following the "off-year" of 1950. No attempt was made to determine the percentage of shoots on which axillary fruit buds were formed. But a large number of shoots was examined on each tree to detect those on which axillary buds had been formed. The range in number of axillary buds found, and the mean number per shoot were recorded as an indication of variety habit.

The figures obtained are shown in Table 2. This table shows the number of trees examined, the total number of shoots on which axillary fruit buds were found, the range in number of these buds, and the mean number of buds per shoot. No axillary fruit buds were found on McIntosh, and they were found on only a few shoots of Lakeland, Oriole and Minjon. On the other varieties shown in Table 2 axillary fruit buds were common.

The figures shown in Table 2 suggest that there is little or no relationship between the habit of developing axillary fruit buds and the habit of clustering in the set of apples per spur. In Minjon, axillary fruit buds are not commonly found, but its clustering habit is pronounced. Axillary fruit buds commonly are found on Beacon, Redwell and Northwestern, but clustering is not a problem in those varieties.

In 1952 locally grown varieties were again studied. The same procedure was followed as in 1951 and the figures obtained are shown in Table 3. Only a very few shoots of Fireside, McIntosh, Oriole and Prairie Spy showed any axillary buds, so these varieties are not included in Table 3. Axillary fruit buds were common on

Wealthy and Haralson as in previous seasons, and in 1952 they were common on Lakeland and Redwell.

It is apparent from this study that axillary buds are not rare among our locally grown apple varieties and under conditions prevailing in Minnesota. The wide variation in occurrence of these buds apparently is related to variations in tree vigor as few were found on shoots that grew in years of heavy crops. When tree vigor is built up by favorable weather in an "off-year" axillary fruit buds have been found in varying numbers on almost all of the apple varieties commonly grown in Minnesota. However, the performance of Wealthy and Haralson suggest that development of axillary fruit buds is also a variety habit. On McIntosh, Fireside, Oriole, and Minjon relatively few of these buds are formed, and their formation seems to be more casual than habitual.

Although formation of axillary fruit buds does not seem to be related to the clustering habit it is evident that formation of a relatively large number of axillary fruit buds in one season may add to the fruit thinning problem in the following season. Even if axillary fruit buds often do not set, and although they are relatively weak, a grower should be able to recognize them. If they do set and are not chemically thinned they contribute materially to "roping" and add considerably to the percentage of small, poorly colored apples at harvest time. Fortunately axillary buds are weaker than normal spur buds and well managed chemical thinning should remove most of their set.

It is obvious, also, that the occurrence of several axillary fruit buds on new shoots interferes materially with the development of normal spurs with typical terminal fruit buds when these shoots go into their second year. Normally some of the leaf buds on year-old shoots develop in the second year into typical short spurs with terminal fruit buds. Varieties that bear annual crops usually behave in that way. Blossoming or set of axillary buds prevents development of normal spurs at those nodes. Also, the spurs formed during development of axillary buds are too weak to form normal fruit buds the same season. It seems likely that this upset of

normal fruiting habit by the formation of axillary fruit buds may contribute materially to the marked biennial fruiting habit of Wealthy and Haralson.

This study suggests that a commercial grower should examine his trees carefully during the early stage of blossoming and plan for an especially thorough program of chemical thinning if he finds many axillary fruit buds in a year of heavy bloom following an "off-year". Wealthy and Haralson seem to need particular attention because of their common habit of forming axillary fruit buds.

Literature Citations

1. Brierley, W.G. "The clustering habit of Haralson, Minjon and Wealthy Apples". Proc. Am. Soc. Hort. Sci. 50:17-20. 1947.
Also Minnesota Horticulturist. Vol. 73:74-75. May 1945.
2. Gourley, J.H. "Studies in fruit bud formation" N.H. Agri. Exp. Sta. Tech. Bul. 9. 1915.
3. _____ "Fruit bud formation - a criticism" Torrey Bot. Club. 44: 455-457. 1917.

Table 1. Axillary Fruit Buds On Some
Common Apple Varieties in 1947

Rating on basis of buds found per shoot	Varieties
1. Absent	Minjon
2. Rare: 1 on an occasional shoot	Fireside, McIntosh, Redwell
3. Few: 1 to 2 per vigorous shoot	Peerless
4. Moderate: 3 to 5 per vigorous shoot	Hibernal, Oriole, Patten, Prairie Spy
5. Heavy: 5 to 7 per vigorous shoot	_____
6. Very Heavy: 8 to 10 or more per vigorous shoot.	Erickson, Haralson, North- western*, Wealthy.

1. Usually moderate, but very heavy on vigorous upright shoots.

Table 2. Axillary Fruit Buds On Some
Common Apple Varieties in 1951

Variety	Trees No.	Shoots No.	Range in number of buds per shoot	Mean No. buds per shoot
Axillary buds not common				
McIntosh	10	0	0	0
Lakeland	4	4	1 to 2	
Oriole	4	17	1 to 3	$1.71 \pm .13$
Minjon	11	21	1 to 6	$2.43 \pm .58$
Axillary buds common				
Duchess	6	31	1 to 7	$2.81 \pm .25$
Beacon	8	34	1 to 9	$3.71 \pm .68$
Fireside	8	49	1 to 11	$3.78 \pm .20$
Northwestern	5	46	1 to 8	$3.96 \pm .21$
Redwell	7	32	1 to 9	$4.03 \pm .23$
Prairie Spy	8	35	1 to 12	$4.60 \pm .33$
Wealthy	40	42	3 to 13	$6.26 \pm .02$
Haralson	32	46	2 to 14	$6.48 \pm .67$

Table 3. Axillary Fruit Buds On Some
Common Apple Varieties in 1952

Variety	Trees No.	Shoots No.	Range in number of buds per shoot	Mean No. buds per shoot
Minjon	10	39	1-5	2.05± .11
Beacon	16	44	1-6	2.75± .14
Wealthy	70	128	1-12	3.31± .15
Lakeland ¹ .	4	132	1-13	4.02± .16
Haralson	48	157	1-16	5.42± .46
Redwell ¹ .	7	103	1-14	6.18± .24

1. Lakeland and Redwell trees bore a very light crop in 1951.

Note: Axillary buds were found on only a few scattered shoots of Fireside, McIntosh, and Oriole.