

Girdling to Induce Bearing in the Fuerte Avocado

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Failure of the Fuerte avocado to bear satisfactory crops has been observed in a number of localities in the coastal belt of southern California where the trees make excellent growth and blossom regularly and heavily. In some cases, trees 12 to 15 years of age and capable of carrying 800 to 1000 fruits have never produced more than 50 to 60 normal fruits and commonly bear few or none. However, these trees usually produce fair crops of seedless fruits which, because of their small size, are hardly worth the harvesting.

In the fall of 1933 a block of 51 vigorous, well-grown trees, 12 years of age, in the Oxnard plains area was placed at our disposal for experimental use and a series of simple field trials was initiated for the purpose of elucidating the problem and indicating possible means for its solution. The general size and condition of the trees, and particularly their blossoming behavior, are shown in figure 1, the photograph for which was taken in the spring of 1934, a few months after the trials were begun.

In view of the conditions which existed, it appeared both logical and desirable to include girdling or ringing in the treatments employed. Avocado growers had previously experimented with this practice but with results which were contradictory and inconclusive.¹ The imminent removal of the trees on which the girdling was practiced has made it necessary to terminate this study, and provides the occasion for the present report.

THE FIRST EXPERIMENT

Early in November, 1933, a square of 4 trees was chosen and similar pairs of branches, with respect to size and exposure, were selected for treatment in each tree. The branches were about 4 inches in diameter and were carrying a considerable amount of bloom, the trees having come into blossom early in October. A pair of branches representing two adjacent trees was girdled on each of the following dates: November 14, 1933; December 7, 1933; January 23, 1934; March 22, 1934. A complete ring of bark about one-quarter of an inch wide was removed. The trees were still in good bloom at the last girdling and continued in that condition for approximately another month. Observations were made at irregular intervals throughout the ensuing season and limb counts were made January 25, 1935. The results are given in Table 1.

It is clear that girdling during approximately the first half of the bloom period very greatly increased the yield. In every case girdling during that period caused a single limb to bear more fruit than was produced on the 10 or more limbs comprising the rest of the

tree. In fact had all the limbs borne as well as the girdled limbs, the crop would have been light to fair for the trees in question. It seems equally clear that girdling during the latter half of the bloom period did not increase the yield.

TABLE 1
Yield of Girdled Limbs, 1933-1934 Treatments

Date of Treatment	Crop on Girdled Limb	Crop on Rest of Tree
Nov. 14, 1933	5	3
Nov. 14, 1933	13	4
Dec. 7, 1933	22	3
Dec. 7, 1933	21	4
Jan. 23, 1934	0	3
Jan. 23, 1934	0	0
Mar. 22, 1934	0	3
Mar. 22, 1934	1	0

With these preliminary results as a basis, a much more comprehensive trial of the effect of girdling was undertaken in the fall of 1935.

THE SECOND EXPERIMENT

In this experiment 17 trees were used containing 157 limbs, 96 of which were girdled and 61 left as untreated controls. These limbs varied considerably in size and exposure, but in view of the relatively large number used it is believed they provide satisfactory comparisons. During the six-month period, September 27, 1935, to March 28, 1936, twelve treatments were made, each consisting of 8 limbs, one per tree. At the time of the first girdling the trees had not yet come into bloom; terminal flower buds were barely discernible on some of the shoots. Bloom did not appear in quantity until a month to six weeks later. The trees continued in bloom, however, for nearly a month after the last girdling. Observations were made at irregular intervals during the ensuing season and the trees were harvested, limb by limb, May 28, 1937, 14 months after the last girdling. The results are summarized in Tables 2 and 3.

TABLE 2
Yield Summary, 1935-36 Experiment

Row and tree No.	No. of limbs	Girdled		Ungirdled			Total
		Yield	Average per limb	No. of limbs	Yield	Average per limb	
1-1	6	6	1.0	1	0	0.0	6
1-2	7	7	1.0	4	0	0.0	7
1-5	7	22	3.1	4	3	0.8	25
1-6	7	39	5.7	4	3	0.8	42
1-7	6	25	4.1	2	0	0.0	25
1-8	4	14	3.5	2	1	0.5	15
2-3	6	48	8.0	2	0	0.0	48
2-4	6	55	9.1	4	7	1.8	62
2-6	6	59	9.9	3	2	0.7	61
2-7	6	35	5.9	3	2	0.7	37
2-8	6	5	0.8	2	1	0.5	6
3-3	5	7	1.4	4	0	0.0	7
3-4	5	23	4.6	6	1	0.2	24
3-5	5	31	6.2	13	15	1.2	46
3-6	5	95	19.0	3	11	3.7	106
3-7	5	25	5.0	3	7*	2.3	32
3-8	4	74	18.5	1	8*	8.0	82
Average		5.93			1.00		37.1

*About half from limbs girdled in Experiment 1.

TABLE 3
Yield Summary by Periods of Grafting
Date of Girdling

Row and tree No.	9/27	10/11	10/25	11/8	12/2	12/14	12/30	1/13	1/25	2/17	3/8	3/28
1-1	4	....	0	....	2	....	0	....	0	....	....	0
1-2	0	....	0	....	0	....	0	....	2	....	....	5*
1-5	0	....	8	....	6	....	3	....	1	....	....	4*
1-6	4	....	0	....	14	....	14	....	1	....	....	6*
1-7	4	....	4	....	16	....	0	....	....	0	....	1
1-8	0	....	0	....	14	....	....	0	....	....	....	....
2-3	....	14	....	10	....	15	....	0	....	5	4	....
2-4	....	29	....	11	....	8	....	1	....	6	0	....
2-6	....	17	....	7	....	17	....	8	....	8	2	....
2-7	6	....	....	1	....	16	....	2	....	8	2	....
2-8	0	....	3	....	....	0	....	0	....	1	1	....
3-3	....	0	....	0	....	2	....	0	....	5	....	....
3-4	....	8	....	4	....	0	....	8	....	3	....	....
3-5	....	3	....	15	....	9	....	....	4	....	0	....
3-6	....	31	....	15	....	....	12	....	28	....	9	....
3-7	....	4	....	....	8	....	1	....	11	....	1	....
3-8	....	....	49	....	19	....	4	....	2	....	....	....
Total	18	106	64	63	79	67	34	19	49	36	19	16
Average	2.3	13.3	8.0	7.9	9.9	8.4	4.3	2.4	6.1	4.5	2.4	2.0

*Two limbs in the same tree.

From the data given in Table 2 it is evident that the average yield per girdled limb was approximately 6 times that of the ungirdled control limbs. The data in Table 3 seem to

indicate that ringing during the early part of the bloom period, approximately the first third, produced the maximum effect. They also suggest a second but shorter period of effectiveness later in the season, which is also less significant. And it will be observed that the greatest effectiveness is indicated for the treatment in October which was made just prior to the initiation of bloom. This is in agreement with the results summarized by Coit.²

CARRYOVER EFFECT OF GIRDLING

It seemed desirable to determine the carryover effect of girdling from one crop season to the next. Accordingly limb counts were made October 14, 1937, of the trees used in Experiment 2. The results are given in Table 4.

It will be noted that the average yield of the girdled limbs is slightly less than that of the ungirdled controls. This is certainly not a significant difference, however, for in 14 out of the 17 trees under study the difference is in favor of the girdled limbs. This corresponds also with observations made in connection with Experiment 1. It would appear therefore that the evidence suggests a slight carryover of the effect of girdling from one crop season to the next. Analysis of the data organized in the form used in Table 3 does not reveal consistent differences in the carryover effect of girdling at different times during the period of bloom though it suggests slightly greater effectiveness during the early part of the latter half of the bloom period.

TABLE 4
1936-37 Yield Summary of Experiment 2

Row and tree No.	No. of limbs	Girdled		Ungirdled			Total
		Yield	Average per limb	No. of limbs	Yield	Average per limb	
1-1	6	1	0.17	1	0	0.00	1
1-2	7	2	2.86	4	0	0.00	2
1-5	7	3	4.29	4	2	0.50	5
1-6	7	2	2.86	4	1	0.25	3
1-7	6	1	0.17	2	0	0.00	1
1-8	4	1	0.25	2	0	0.00	1
2-3	6	9	1.50	2	0	0.00	9
2-4	6	15	2.50	4	7	1.75	22
2-6	6	4	0.67	3	6	2.00	10
2-7	6	4	0.67	3	0	0.00	4
2-8	6	0	0.00	2	0	0.00	0
3-3	5	4	0.80	4	3	0.75	7
3-4	5	2	0.40	6	2	0.33	4
3-5	5	18	3.60	13	37	2.85	55
3-6	5	31	6.20	3	13	4.33	44
3-7	5	7	1.40	3	4	1.33	11
3-8	4	4	1.00	1	2	2.00	6
Average		1.13			1.26		10.9

EFFECT OF REGIRDLING

For the purpose of determining the effect of regirdling limbs previously girdled, 6 of the 8

limbs used in Experiment 1 were regirdled January 25, 1935. Yield records made a year later showed significantly higher yields from the early girdling treatments of the 1933-34 season. In fact half of the regirdled limbs of the early girdling treatments produced more fruit than was borne by the rest of the tree. The yields of the late girdled limbs showed no significant differences whether regirdled or not. While the number of limbs was small and the periods of girdling not strictly comparable, the results suggest that regirdling has a similar effect to the original girdling but definitely less marked. It should also be mentioned that the regirdling materially reduced the vigor of growth of the limbs and lessened their foliage color.

DISCUSSION

Perhaps the most striking feature of the data here presented is the very low yield of the trees under study even though girdling appears to have shown marked results. Obviously girdling has not solved the problem in this orchard of failure to bear satisfactory crops. It is our conclusion that the Fuerte variety is clearly not adapted to the climatic conditions which exist in this orchard during the period of blossom and fruit-setting. We believe that the factor chiefly responsible for failure to bear on the part of this block is unfavorable mean temperature during this period and suspect that the increased effectiveness of girdling noted for a short period later in the season was associated with a spell of warmer weather. In our opinion girdling may be decidedly more effective as a means of inducing fruitfulness under conditions of more favorable temperatures during the blossoming and fruit-setting period.

Another feature which will be noted is the wide range in yield exhibited by the trees under study. This appears to be attributable to three principal factors—size differences, windbreak competition on one end of the block, and wind protection. There is a suggestion, however, of an influence of fertilizers applied to several of the trees.

Brief reference should be made to the healing over of the girdling wounds and the effect of girdling on vigor of growth. Healing over of the girdles seemed to occur rapidly regardless of season, and connection appeared to be established within 6 weeks to 2 months. In the majority of cases the wound healed over smoothly but in some a pronounced ridge has remained which suggests imperfect or impaired connection. There can be little question, however, that the vigor of growth of trees in which many limbs were girdled has been reduced. In some instances the foliage color has paled noticeably.

SUMMARY AND CONCLUSIONS

Two girdling experiments involving 104 treated limbs and 61 ungirdled control limbs in 17 12-year old non-bearing Fuerte avocado trees in the Oxnard plains area are reported.

The following conclusions are indicated:

1. Girdling done just prior to blossoming or at any time during approximately the first third to half of the period of bloom markedly increased the set and yield of normal

fruits.

2. There appeared to be a slight carryover effect of girdling from one crop season to the next but in these experiments it was not significant.
3. These experiments suggest that regirdling has a similar effect, though much less pronounced, to the original girdling.

It is believed that the effects of girdling, and hence its usefulness, may be more pronounced in regions of more favorable temperature conditions during the period of bloom and fruit-setting.

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LITERATURE CITED

- ^{1,2}Coit, J. E. Effect of Girdling Trees on the Fruiting of Avocados. Ann. Report California Avocado Association. 1920-1921. Pp. 69-70.