

7. LOCALIZATION OF FRUIT ON THE TREE, BRANCH GIRDLING AND FRUIT THINNING

E. Lahav

a. Localization of Fruit on the Tree

A survey was carried out to obtain a clearer picture of the localization of fruit on avocado trees.

Fifty branches on eight trees of the Ettinger variety were marked in one orchard and 100 branches on 16 trees in another orchard. Branches were noted as young or mature; horizontal, vertical or bending; and, in addition, exposure to wind direction and illumination. For three years, details of flowering and fruiting were recorded.

There was no clear-cut difference in flowering between young and mature branches, but mature branches produced more cukes. On vertical branches flowering was earlier and fruiting percentage was higher than on either horizontal or bending branches. Better illumination produced earlier flowering. Shaded branches usually produced small fruits (Table B. 7.1).

Flowering on the top of the tree was earlier than on its lower branches and on the northern side. The western side of the tree was generally the least productive. In most cases, the fruit was concentrated in the upper half of the tree. The fact that vertical branches are not less fruitful than horizontal or bent ones makes it rather doubtful if branch bending can contribute to greater productivity of the trees.

TABLE B. 7.1
ESTIMATION OF MEAN FRUITING ON BRANCHES OF ETTINGER
(0 = none, to 5 = very high)

Year	Orchard A			Orchard B		
	Shade	Partial shade	Light	Shade	Partial shade	Light
1965	0.7	1.3	3.2	1.1	1.7	2.1
1966	1.4	4.7	4.2	2.3	2.9	3.5
1967	0.4	0.7	1.1	0.6	0.9	1.0
Mean	0.8	2.2	2.8	1.3	1.8	2.2

In both Ettinger and Fuerte, illumination seems to be of prime importance in fruit production.

For the Fuerte variety survey, seven trees in each of three orchards were used. Tree volume was divided into 27 blocks of approximately 15 m³ each. In each block fruits were counted and their number per cubic meter was calculated. Table B. 7.2 shows the distribution according to three height levels on the trees. The figures do not show the

actual, physiological distribution of the fruit, but merely the topographical. This is due to the fact that branches from the top of the tree, heavy with fruit, tend to bend down and may, at least in part, be included in the intermediate level. In many cases, the lower part of the tree gives little fruit because of lack of illumination, and the same is true of the interior part of the tree.

TABLE B. 7.2
DISTRIBUTION OF FUERTE FRUITS ACCORDING TO
HEIGHT OF BRANCH ON TREE

Height above ground (m)	Distribution (%)				Number of fruits per m ³			
	Orchard				Orchard			
	A	B	C	Mean	A	B	C	Mean
0-2	20.2	19.0	50.4	29.9	0.55	0.62	2.70	1.29
2-4	47.0	63.0	34.0	48.0	1.47	2.11	2.40	1.99
4-6	32.8	18.0	15.6	22.1	1.35	0.88	1.70	1.31

Distribution of fruit according to wind direction was not found to be uniform. In two orchards more fruit was found on the eastern side and in the third orchard on the western side. Such differences are sometimes due to alternate bearing of different parts of the tree.

b. Girdling (In cooperation with B. Gefen and D. Zamet)

Girdling is a common practice with many fruit trees. It serves to raise the concentration of nutrients and growth substances in the girdled branch and thus creates favorable conditions for fruit set and development. After some preliminary observations and trials on avocado trees, work was started to find out whether, and by how much, fruitfulness can be improved by girdling. An additional aim in certain varieties was to obtain smaller fruits, more suitable for export.



Plate B.7.1. Effect of girdling in the Nabal variety: early and total leaf drop.

weight). In the packing house fruits from girdled branches and trees were compared to those from controls as to size and percentage of export quality.

Results: In all varieties girdling weakened the strength of vegetative growth and brought about earlier leafing. In many cases, and especially on trees of the Nabal variety (Plate B.

Methods: The work was started in 1965 and continued until 1969 in many orchards, mostly in the Western Galilee. Thousands of branches on trees of Ettinger, Fuerte, Scotland, Nabal, Benik and Hass were included. Different methods and times were compared. The influence of the girdling was measured on strength of growth of the branch, leaf color, time of leaf drop, time of flowering, and yield (estimated number or total

7.1), early and sometimes total leaf fall was recorded. Girdling in the autumn brought about earlier flowering, especially in Fuerte. Fruitfulness was very much improved in most cases (Table B. 7.3). In the second and third years after girdling, fruitfulness of the girdled branches declined in most varieties, but not in Benik. This decline could be prevented by repeated girdling. In the alternating varieties Nabal and Benik, girdling sometimes resulted in a second on-year. Girdling seems to be especially suitable for raising productivity of the shy-bearing Benik variety. However, girdling cannot bring about a total change in the inherent nature of the tree. Thus, sterile Fuerte trees have not been brought into production by girdling, neither here nor in other countries.

TABLE B. 7.3
MEAN PERCENTAGE OF ADDITIONAL YIELD OF GIRDLED BRANCH
OVER CONTROL

Variety	Year of harvest	Year of girdling						
		1965	1966	1967	1965/66	1965/67 (repeated girdling)	1966/67	1965/66/67 (repeated girdling)
Ettinger	1966/67	99						
	1967/68	-27	77		58			
	1968/69	-9	76	56	10	52	42	74
Fuerte	1966/67	34						
	1967/68	58	91					
	1968/69	238	-8	211			296	
Scotland	1966/67	0						
	1967/68	-14	940					
	1968/69	525	191	261		744	158	
Nabal	1966/67	202						
	1967/68	173	18		7			
	1968/69	-30	13	16	128		293	
Benik	1966/67	292						
	1967/68	179	116		65			
	1968/69	68	9	36	19	92	324	
Hass	1967/68		44					
	1968/69		24	89			190	

In many cases, girdling resulted in the production of smaller fruits and higher export percentage. Results with Ettinger are shown in Table B. 7.4.

Girdling resulted in many cases in a very unwelcome high production of cukes (Plate B. 7.2). This, too, diminished during the years after girdling.

TABLE B. 7.4
GRADING ETTINGER FRUIT (1966/67)

Grade	Orchard A				Orchard B			
	Girdled		Control		Girdled		Control	
	kg	%	kg	%	kg	%	kg	%
Export	559	72.4	176	48.8	1560	49.9	554	26.7
Local	158	20.5	145	40.2	1311	42.0	1288	61.7
Culls	55	7.1	40	11.0	252	8.1	243	11.6
Total	772	100	361	100	3123	100	2085	100
Mean fruit weight (g)	265		326		298		336	



Plate B.7.2. Effect of girdling in the Ettinger variety: increase in number of small seedless fruits.

Effectual girdling was carried out between September and May, but in some cases girdling in late winter or early spring was less effective. Most trials and most positive results were in the period October-December. Girdling with a saw gave results as good as with a special tool, and better and quicker healing due to the much thinner cut.

Girdled branches of all varieties had paler leaves in the first summer after girdling. During the second and third years, leaf color gradually returned to normal. Chlorosis was found to influence leaf composition. Girdled branches showed less nitrogen, calcium, magnesium, manganese and total ash in the leaves, and less calcium, potassium, magnesium, manganese and ash in the bark (Table B. 7.5).

TABLE B. 7.5
COMPOSITION OF LEAVES AND BARK OF GIRDLED AND CONTROL BRANCHES
IN TWO ORCHARDS

<i>Sampling year</i>	<i>Tissue</i>	<i>Treatment</i>	Ash (%)	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	Mn (ppm)
1966	Leaves	1965 girdling	7.45	1.75	0.106	0.66	1.79	0.65	125
		control	8.60	1.98	0.109	0.63	2.16	0.72	180
1967	Leaves	1966 girdling	4.85	1.69	0.110	0.83	0.91	0.40	76
		control	5.76	1.79	0.110	0.79	1.27	0.48	81
1968	Bark	1967 girdling	4.39	0.69	0.070	0.84	0.96	0.130	42
		control	6.65	0.65	0.070	0.99	1.66	0.155	54

Girdling trials which were carried out in other districts (Upper Galilee, Central District and Bet Dagan) generally gave similar results.

Not all the after-effects of girdling are clear, and it is not yet known how often the same tree or branch may be girdled without damage. It is therefore recommended to proceed with care and to girdle only strong healthy trees with insufficient productivity.

c. Fruit Thinning and Other Practices to Improve Fruit Size in the Hass Variety (In cooperation with B. Gefen and D. Zamet)

In contrast to some other avocado varieties, the Hass variety shows a tendency to over-production and consequently production of too small fruits (under 170 g), which are not suitable for export. Work has been started to control over-bearing and to bring about production of bigger fruits.

Methods

Hand thinning

Spray thinning with growth substances (see section B. 6)

Girdling (see also section B. 7.b)

Pruning: Three levels of pruning have been compared: light — about one quarter of the length of the branch; medium — one third to half the length of the branch; and strong — cutting of primary branches to 1-2 m from the point of branching. Pruning was done after harvest and after the yield was recorded. In all three treatments, trees were compared before the off-year. Trees before the on-year received only light to medium pruning.

Fertilizer treatment: 70 kg N fertilizer per dunam (in two portions) was compared with 100 kg N fertilizer per dunam (in four portions). In the orchard where this trial was carried out, girdling trials were also made and thus fruit was picked for both differentials, counted, weighed and graded.

Results

Hand thinning: The fewer fruits were left on the tree, the higher was the mean weight (Table B. 7.6). In earlier trials in the Central District, similar results were obtained.

TABLE B. 7.6
INFLUENCE OF HAND-THINNING ON FRUIT SIZE

Number of fruits		Thinning (%)	Mean fruit weight (g)
Picked	Removed		
663	0	0	158.5
506	176	25.8	179.4
352	302	46.2	185.5
181	275	60.6	229.1

No conclusive results were obtained with *sprays* of growth substances.

Girdling: Table B. 7.7 shows the influence of girdling on fruit weight.

TABLE B. 7.7
INFLUENCE OF GIRDLING ON FRUIT SIZE AND GRADING

Orchard	Year	Treat-ment	% fruit in sizes*				Export (%)	Smalls (%)	Number of fruits per branch
			15 (283g)	18 (236g)	21 (202g)	24 (177g)			
A	1968/69	girdled	0.3	10.1	19.1	30.6	51.4	39.9	340
		control	1.9	10.5	16.8	29.3	44.5	41.5	473
B	1967/68	girdled	0.2	4.6	52.9	15.3	71.0	27.0	224
		control	0.5	6.2	55.3	21.4	81.4	16.6	229

* Fruits per package.

Pruning: Pruning was found to be beneficial (Fig. B. 7.1). From pruning in the spring of 1967, fruit was obtained in 1967/68 only from trees in the on-year. The year after, yield was recorded from trees which had been off-year trees the year before (Table B.7.8). The heavier the pruning, the fewer and heavier were the fruits produced.

Fertilizer treatment: Table B. 7.9 shows that the addition of N may serve as an additional way to obtain bigger fruits. Non-girdled branches and non-girdled trees had bigger fruits and showed the influence of added nitrogen, in spite of heavy yield. The reason for the lack of response to N in the girdled branches is not clear.

Work on improving Hass fruit size is being done also by A. Ben-Ya'acov in the Central District. In addition to thinning and pruning, he is investigating the influence of differences in illumination produced by differential pruning of neighboring trees and tree removal.

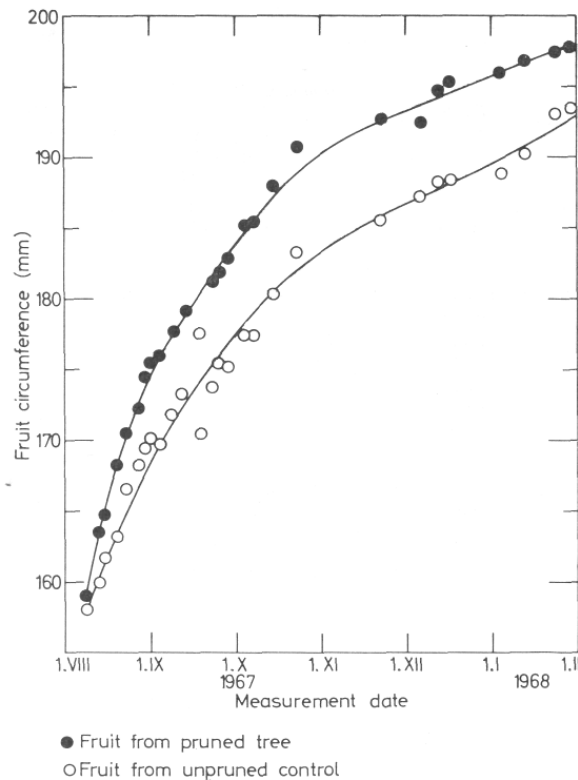


Fig. B.7.1. Increase in circumference of Hass fruits from pruned as compared to unpruned control trees.

TABLE B. 7.8
INFLUENCE OF PRUNING ON FRUIT SIZE AND GRADING

Orchard	Year	Treatment	% fruit in sizes*				Export (%)	Smalls (%)	Number of fruits per tree
			15 (283g)	18 (236g)	21 (202g)	24 (177g)			
A	1967/68	pruned control	0.4	6.7	59.9	17.4	82.4	15.6	433
			0.3	3.4	45.5	19.7	66.9	31.1	439
	1968/69	pruned, heavy	—	13.6	48.4	21.5	81.2	16.5	435
		pruned, medium	—	12.5	52.4	22.7	85.7	12.4	420
B	1967/68	pruned control	3.8	26.5	34.5	22.1	85.1	13.1	519
			—	10.6	18.6	33.1	60.3	37.7	429
1968/69	pruned, medium	7.5	46.4	23.8	15.5	76.9	6.8	608	
		pruned, light	5.1	20.1	31.3	19.8	65.3	23.7	1094
		control	1.0	17.1	29.5	24.8	64.3	27.6	1145

* Fruits per package.

TABLE B. 7.9
INFLUENCE OF NITROGEN FERTILIZER ON HASS FRUIT NUMBER AND WEIGHT, 1968/69
(figures are means of all fruit per branch or per tree)

Treatment	70 kg/du		100 kg/du	
	Number	Weight (g)	Number	Weight (g)
Girdled branches	300	216.2	251	205.1
Control branches	217	206.0	285	216.4
Total, girdled trees	517	211.9	536	211.1
Control trees	386	204.0	423	218.1