

## EFFECT OF VARIOUS DEGREES OF HEADING BACK ON SUBSEQUENT GROWTH OF AVOCADO TREES

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In the development of the avocado industry in Florida attention has been necessarily directed so acutely to the proper choice of varieties and suitable soils that pruning practices have received scant attention. Avocado pruning has in recent years been recognized as important in make practices recommended for the Southwest California (1, 2, 3, 4) but the varieties grown, as well as climatic and soil conditions and methods of culture, make practices recommended for the Southwest not strictly applicable in the humid Southeast. It is desirable, therefore, to carry on avocado pruning experiments under Southeastern conditions.

In approaching the subject of avocado pruning the grower wants to know (a) at what season of the year to carry out this operation; (b) how severely to prune—for he realizes in general that the degree of pruning will depend somewhat on the age of the tree, since young non-bearing and young bearing trees will require different treatment than old bearing trees, especially aged trees which require rejuvenating; and (c) how the practice should be varied due to varietal differences since a tree of spreading habit such as the Fuerte so generally grown in California would need pruning treatment different from such upright growing varieties as Lula and Taylor, for instance. (6, 7)

The answers to such questions can be arrived at only after carefully planned experiments have been carried on. The present preliminary progress report is concerned only with the type of pruning practice commonly referred to as "heading back," which is a necessary sanitary measure after hurricane damage and is also applicable in rejuvenating aged trees. The main purpose was to secure accurate measurements of avocado tree growth following such severe pruning. Such information is of value in planning further experiments with the object of maintaining the avocado tree in a commercially profitable bearing condition over an indefinite period.

The experiments were the outgrowth of preliminary trials with only a few trees begun in 1932 when a 14-year-old Winslowson avocado tree at the United States Department of Agriculture laboratory at Orlando was cut back to three feet in November. This tree was 20 feet high, with little foliage and not in a vigorous condition due to neglect, and the fruit as a rule was undersized and badly sunburned. The tree which was cut back to three feet grew to a height of 15 feet during the following season, 1932-'33, and during the next season, 1933-'34, it bloomed profusely in February and set a heavy crop of fruit which was protected from sunburn by ample foliage. The success in this case led to further trials in succeeding years, with similar results.

## PLAN OF EXPERIMENT

Following the damage to avocado trees in the summer and fall hurricanes in 1935 in South Florida it became necessary or advisable to cut back injured avocado trees severely in a number of places, affording a chance to note the response of different varieties to different degrees of cutting back. In some instances the cutting back was in fact so severe that it should be considered as "tree renewal" since only a few feet of the original trunk were left. A grove of this character was selected in Dade County, the experimental trees being 18 years of age. Another grove was selected in Highlands County where the grower had adopted the rejuvenation pruning method as a result of the preliminary experiments briefly referred to above. These trees, 15 years of age, were in a devitalized condition due to lack of care for several years previous to cutting back, but received regular fertilizer applications thereafter.

The trees were classified as to degree of cutting back in to very heavy (A), heavy (B), intermediate (C), and light (D), the actual average degree of cutting back depending somewhat on the variety and the apparent vigor of the individual tree. A spreading variety like Linda was cut to approximately 3½ feet for the heavy treatment (class B), and more upright varieties as Winslowson, Waldin, Collinson and Wagner, were cut back to approximately 5½ feet for the same class.

The complete information for the trees (classes B, C, and D) at the Dade County location is given in TABLE 1, and similar data for the trees (classes A, B, C, and D) for the Highlands County grove are shown by the summarized measurements in TABLE 2.

At the beginning of the experiment, season 1935-'36, the degree of cutting back, as well as the trunk diameters, was determined. In the following seasons, 1936-'37 and 1937-'38, the trunk diameters were taken again and also the tree height. The length of new growth was then determined by difference. The complete data are indicated in TABLES 1 and 2. A photographic record was made each season of typical trees and fruiting wood. The views for one variety, Lula, at the end of the experiment are shown in FIGS. 1, 2, 3 and 4, PLATE 1.

## RESULTS

The results in terms of growth responses to different degrees of pruning are shown in TABLES 1 and 2. With trees in normal condition as in the Dade County grove (TABLE 1) some differences are to be noted for different varieties in their responses to different degrees or severities of pruning. During the first year, except for Waldin variety, the new growth extension was most rapid for trees more severely cut back (classes B and C), as contrasted with those least severely pruned (class D). At the end of the next growing season, the trees in the intermediate group (class C), except for Wagner variety, made the greatest growth. In all classes, however, the total height reached in the period covered, as shown in TABLE 1, was slightly in favor of the moderately pruned trees (class C). Schrader and Auchter (5) have reported similar results with the peach. The relatively slow growth extension of the controls, in no case greater than 1.6 feet, is indicated by the fact that in some cases the pruned-back trees have in a short period reached a height equal to or in excess of the controls.

In the case of subnormal trees (TABLE 2), during the first season, represented by the Highlands County grove, the most severe cutting back (A group, 0.5 to 3.4 feet) resulted in somewhat less growth extension as compared with those less severely pruned (B, C, and D groups). This is most marked in the Lula variety (av. S.S ft. for the A group as compared with 7, 8.5, and 9.5ft. for B, C, and D groups, respectively) for the first year, 1936-'37. In the following year, however (1937-'38), the A group of trees made nearly as much, and for Winslowson variety, greater growth extension than those less severely cut back (av. 3 ft. as compared with 3.8, 4.4 and 3 ft. for the B, C, and D groups). In some of the controls (Lula and Winslowson) there has been actual loss in height due to dying back of upper branches. In each case, moreover, the total height reached during the period covered was least for the trees severely cut back, as in the normal grove trees. Judged by total heights recorded, these trees did not recover as rapidly as the severely cut back normal trees in the Dade County grove. This is reflected also in the fact that the controls, where available (Lula and Winslowson), maintained a considerable height advantage over the cut-back trees, 3.6 ft., despite the fact that the new growth on the controls was very scanty (.8 ft.). This may be explained by the fact that when pruning was done, the trees in Class A, most severely cut back, were less vigorous than those in the Classes B and C, moderately pruned.

TABLE 1  
Growth responses of 18-year-old avocado trees following cutting back, 1936-1938  
Dade County Florida

Variety	Classification of trees cut back 1935-36			Tree						Length of new growth since cutting back av. ft. (by difference)		
	Class	No. of trees in each class	Class range Height, ft. (after cutting back)	Trunk diameter <sup>1</sup> in.		Total height ft.			1936-37	1937-38	Total <sup>2</sup>	
				1935-36	1936-37	1935-36	1936-37	1937-38				
Winslowson .....	B	19	3.5 - 6.4	9.2	10.0	5.5	16.8	17.7	11.3	0.9	12.2	
	C	13	6.5 - 9.4	9.9	10.2	7.7	20.0	21.5	12.3	1.5	13.8	
	D	2	9.5 - 16.5	10.7	11.1	13.5	21.3	21.5	7.8	0.2	8.0	
	Control	9	-	8.8	9.4	18.5	19.9	21.5	1.4	1.6	3.0	
Waldin .....	B	20	3.5 - 6.4	8.9	10.2	5.2	17.0	18.5	11.8	1.5	13.3	
	C	16	6.5 - 9.4	9.1	9.8	7.1	18.9	21.4	11.8	2.5	14.3	
	D	5	9.5 - 16.5	10.2	10.2	10.2	23.9	24.1	13.7	0.2	13.9	
	Control	13	-	8.9	10.8	19.5	20.9	20.7	1.4	-0.2	1.2	
Wagner .....	B	11	3.5 - 6.4	8.8	8.8	5.2	14.7	16.1	9.5	1.4	10.9	
	C	13	6.5 - 9.4	8.6	9.4	7.5	16.5	17.6	9.0	1.1	10.1	
	D	10	9.5 - 16.5	9.1	9.1	10.9	17.6	18.7	6.7	1.1	7.8	
	Control	6	-	9.1	10.3	17.7	18.7	19.4	1.0	0.7	1.7	
Linda <sup>3</sup> .....	B	7	3.1 - 4.5	8.1	10.0	3.7	14.1	14.7	10.4	0.6	11.0	
	C	19	4.6 - 6.2	8.3	9.4	5.2	15.2	17.1	10.0	1.9	11.9	
	D	6	6.7 - 9.0	8.2	10.4	8.0	17.3	18.7	9.3	1.4	10.7	
	Control	6	-	8.5	9.9	16.2	17.8	17.7	1.6	-0.1	1.5	

<sup>1</sup> Trees in most cases were branched so close to the ground that consistent measurements of base diameters were not found feasible; hence these measurement were discarded after 1937.

<sup>2</sup> Total for the two years

<sup>3</sup> Variety spreading in growth; trees cut back proportionately

TABLE 2  
Growth responses of 15-year-old avocado trees following cutting back, 1936-1938  
Highlands County, Florida

Variety	Classification of trees cut back 1935-36			Trunk or main branches <sup>1</sup>			Total tree height <sup>2</sup> ft.			Length of new growth since cutting back av. ft. (by difference)		
	Class	No. of trees in each class	Class range Height, ft. (after cutting back)	Average diameter in.			1935-36	1936-37	1937-38	1936-37	1937-38	Total <sup>4</sup>
				1935-36	1936-37	1937-38						
Lula .....	A	1	0.5 - 3.4	3.7	4.7	4.7	3.0	8.5	11.5	5.5	3.0	8.5
	B	9	3.5 - 6.4	6.8	8.0	8.0	5.0	12.0	15.8	7.0	3.8	10.8
	C	8	6.5 - 9.4	6.2	7.5	7.5	7.2	15.7	20.1	8.5	4.4	12.9
	D	1	9.5 - 16.5	10.9	10.9	11.8	9.5	19.0	22.0	9.5	3.0	12.5
	Control	10	-	10.2	10.6	10.6	27.0	27.8	25.5	0.8	-2.3	-1.5
Winslowson	A	1	0.5 - 3.4	5.5	5.8	5.8	3.3	10.0	14.0	6.7	4.0	10.7
	B	14	3.5 - 6.4	5.3	5.9	6.1	4.7	12.0	14.1	7.2	2.1	9.3
	C	5	6.5 - 9.4	5.2	5.7	5.9	6.9	13.6	15.5	6.6	1.9	8.5
	Control	3	-	6.3	6.9	7.0	21.5	22.3	21.6	-0.8	-0.6	1.4
Collinson ..	A	6	0.5 - 3.4	4.6	5.5	5.6	1.4	7.7	9.3	6.2	1.6	7.8
	B	2	3.5 - 6.4	7.6	8.3	9.4	5.3	13.5	16.0	8.1	2.5	10.6
	C	1	6.5 - 9.4	4.4	4.9	5.1	7.0	14.0	17.0	7.0	3.0	10.0
	Control	None <sup>3</sup>	-	-	-	-	-	-	-	-	-	-
Simmonds	B	2	3.5 - 6.4	5.8	6.6	6.6	4.3	12.0	13.2	7.7	1.2	8.9
	C	4	6.5 - 9.4	5.5	6.2	6.3	7.4	13.2	14.1	5.8	0.9	6.7
	Control	None <sup>3</sup>	-	-	-	-	-	-	-	-	-	-

<sup>1</sup> Trees usually branched very close to ground so that consistent measurements of base diameters were not found feasible; average of two or more main branches.

<sup>2</sup> Average height of two or more main branches.

<sup>3</sup> None available.

<sup>4</sup> Total for the two years.

PLATE 1. Rejuvenation of 15-year-old avocado trees, Highlands County, Florida. FIGURE 1 shows unpruned Lula tree; FIGURE 2, a similar tree in the third year after cutting back; FIGURE 3, type of growth on unpruned trees with twigs dying back; FIGURE 4, luxuriant foliage on pruned trees.



FIGURE 1.

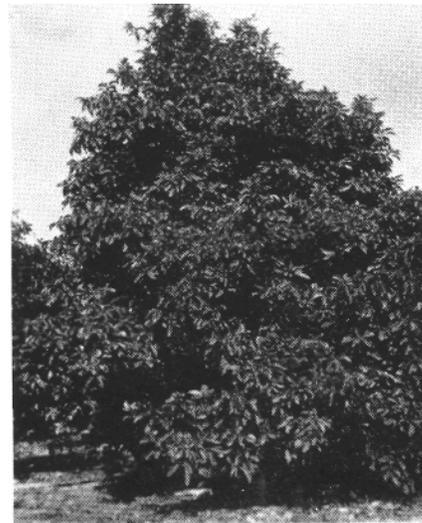


FIGURE 2.



FIGURE 3.



FIGURE 4.

As a rule, the control trees were characterized by spindling tops with scanty foliage, as shown in FIG. 1, which illustrates a typical Lula control tree in the Highlands County grove. This is in sharp contrast to the vigorous condition of the typical rejuvenated Lula tree, shown in FIG. 2 that had received the Class C degree of pruning (cut back approximately to 7 ft.). The type of fruiting wood of the controls and of the rejuvenated trees is also in sharp contrast, as shown in FIGS. 3 and 4. FIG. 3 shows that the fruiting wood of the controls consists of spindling, pendulous, and partly bare branches with scanty foliage, with some twigs dying back (also seen in FIG. 1). This contrasts markedly with the upright, vigorous, well-foliated fruiting branches of a rejuvenated Lula tree as shown in FIG. 4.

The type of fruiting wood for classes A, B, and C degrees of cutting back was apparently the same, and the degree of pruning (class C) that leads to the most rapid development of maximum fruiting wood should apparently be preferred. However, such avocado varieties as Lula, Taylor, and Winslowson, make undesirable upright, tall trees with most of the fruiting wood far from the ground as contrasted with such varieties as Linda and Trapp that have a spreading growth habit. With such varieties as Lula and Taylor that have this undesirable tall, upright growth habit, the effect of degree of pruning in lowering the heads of the trees to a desirable height should also be considered. In such cases it might be desirable to choose either class A or B degree of pruning in order to achieve this object.

With light pruning (class D 10-12 feet) the rejuvenation as manifested in the fruiting type of new growth is chiefly confined to the upper portion of the tree, leaving a large part of the tree in a potentially senescent condition.

The tree condition as regards previous care and vitality has a direct effect on the response of the trees cut back. Thus, it will be seen that recovery was most rapid with normally nourished trees as compared with devitalized trees, but even in the latter case adequate feeding after the experiment was begun has proven capable of bringing about substantial rejuvenation within a period of years.

Owing to factors beyond our control it was not possible to keep detailed records of the yield of fruit from the trees under test. Observations, however, at blooming time and

during the season showed that in the second year after cutting back the pruned trees bloomed and set normal crops of fruit in nearly all cases; also that the fruits borne on such trees were full sized and free from blemishes due to sun scald in contrast with the undersized and often unsightly sun-scalded fruits borne on the unpruned trees, a large part of which were unsaleable.

## SUMMARY

The results show that avocado trees made a rapid recovery when cut back severely. The condition of the trees at time of cutting back has a direct bearing on the amount of growth. Even devitalized trees having good root systems, when given proper feeding and care at the time of cutting back, made a satisfactory growth response with every prospect of being transformed into normal bearing trees.

All of the degrees of pruning from severe to light, classes A, B, C, and D, gave growth responses characterized by a desirable type of fruiting wood, vigorous and well foliated, as contrasted with the poor type of fruiting wood on the controls, pendulous, with scanty foliage and with some of the twigs dying out.

Of the methods under consideration, the intermediate degrees of cutting back, classes B and C, gave the maximum responses in terms of total bearing surface during the time of the experiment.

The severest degree of pruning class A, which as a rule gives less rapid responses, may be desirable in case of varieties with an undesirable upright growth habit.

The light degree of pruning in case of devitalized trees, class D, apparently is less desirable since the lower part of tree is not rejuvenated.

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