orchards showed the effect of their lack of diligence in a few days.

Trickle irrigation, predictably, afforded no frost protection under the prevailing conditions of this freeze, although there has been some evidence that under a frost of short duration it has given a certain measure of protection. Observations of many growers concur that young plantings of avocado and lime with trickle recuperated faster from this freeze than has been the case in the past without this type of irrigation. The ground water in South Florida remains at a constant 74° F during the winter. In spite of this, in some cases water froze in the hoses, stopping the system altogether.

Table 4. Evaluation of hardy Florida avocado cultivars which matured a crop after the freeze of Jan. 1977.

Most tolerant 1	2	3	Least tolerant 4
Brogdon[z]	Choquette	Booth 1	Booth 2
	Connor	Camp	Booth 3
	Hall	DeBedts	Booth 4
	Lula	Goering	Booth 5
	Marcus	Hickson	Booth 6
	Shaff	Kampong	Booth 7
	Taylor	Major	Booth 8
	Turner		Booth 9
	Vero		Booth 10

[z]The cultivars are grouped in 4 categories in descending order of tolerance. Differences between categories are minor but they are detectable in degree of injured foliage, flower production and particularly in yield of fruit normally matured.

Conclusions

1. The most important factor influencing susceptibility to cold in avocado cultivars is *racial ancestry*. Other factors are: a) size and age of tree, b) general vigor, c) occurrence of cold during or after heavy crops, d) presence of disease, such as Cercospora spot, e) location of orchard in relation to protective structures or water, and f) presence or absence of a ground cover.

2. There is no discernible difference among 'Tahiti' lime clones, all appear to be equally susceptible to injury.

3. There are significant differences among Florida avocado cultivars in tolerance to cold (Table 4).

4. Cold damage appears to be associated with severity of pruning. Thus, plants from which much foliage and branches have been removed can be seriously hurt by cold even several months after pruning.

5. Sprinkler irrigation, within certain recommended parameters, can protect avocados and limes even under the severest of cold conditions in South Florida. However, branch breakage due to ice accumulation can be a serious problem with avocados. On the other hand, trickle irrigation does not give sufficient cold protection to be considered of practical value during freezes of long duration.

6. In view of the virulence of citrus melanose on young growth and fruit of 'Tahiti' lime after a freeze, it appears advisable to remove and dispose of all dead wood from trees as soon as convenient. In this way, sources of spore production will be eliminated also.

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EFFECT OF BRANCH GIRDLING ON YIELD OF SEVERELY PRUNED 'BREWSTER' LYCHEE TREES[1]

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Abstract. **Mature 'Brewster' lychee (Litchi chinensis Sonn.) trees, severely pruned (hat-racked) in early February, failed to bloom the first season after pruning either on branches girdled the fall following pruning or on ungirdled branches. Adjacent unpruned trees of comparable size bloomed moderately well and set a fair crop on girdled branches, while ungirdled branches produced substantially less bloom and fruit. The second season after pruning, fruiting performance of girdled branches on pruned trees was better than that of ungirdled branches on unpruned control trees. Girdling improved flowering and fruiting on both pruned and unpruned trees. The third year after pruning, top height and spread of pruned trees were roughly half that of unpruned control trees. Light intensity was favorable for flowering on approximately as much bearing surface of pruned as unpruned trees, but the pruned trees tended to remain vegetative. They bloomed and fruited less than unpruned control trees.**

After becoming well established in the field, 'Brewster' lychee trees increase rapidly in size under favorable conditions in Florida. Trees planted at spacings ranging from

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around 20 to 30 ft often have interlocking branches at about 15 years of age, especially on deep sandy and muck soils. The resulting crowding causes a decrease in flowering and fruiting except in the upper parts of the canopy because of reduced light intensity. Pruning back the periphery of the tree after harvest to increase light intensity on the sides and interior is of little benefit because new growth fills in the space before they flower again. Sufficiently severe pruning to provide adequate light for satisfactory flowering for several years is generally followed by one vegetative flush of growth after another at the expense of flowering for a year or more. Bloom on 'Brewster' lychee is produced from buds of flushes developing during the summer and fall (1). Branch or trunk girdling in the fall, when done sufficiently ahead of the vegetative flush, has been found to increase flowering and fruiting on 'Brewster' lychee in Hawaii (2) and in Florida (3). To be effective, girdling apparently must be done before initiation of the growth flush and gridling will not stop or retard the flush once it has started.

The effectiveness of branch girdling in increasing flowering and fruiting of severely pruned (hat-racked) 'Brewster' lychee trees was examined in Florida for the first 2 seasons following pruning. This is a report of results obtained.

Materials and Methods

The trees were in commercial groves on light, sandy soil (Astatula series) at DeSoto City and on Merritt Island. Each planting was about 27 years old. The trees at DeSoto City were planted on the square at 30 x 30 ft.[2] On Merritt Island, they were planted 20 X 25 ft on the diamond plan. In both groves the lower peripheral branches were interlocking by a distance of 2 to 3 ft or more. There was overhead sprinkler irrigation at DeSoto City, but no irrigation on Merritt Island. Moderate fertilization (by citrus standards) was practiced at DeSoto City. On Meritt Island, fertilization was at a low level. Both locations were relatively warm. No freezing weather occurred while this investigation was being conducted, although temperatures of 40° F or lower occurred in both groves several times each season.

Only trees showing considerable vegetative activity, and therefore likely to bloom poorly that season as compared with more dormant trees nearby, were selected for pruning. They were hat-racked at an average height of about 12 ft in early February 1973. Bark sunburn is not a serious problem when pruning is done at that time of year. By late summer, all branches of pruned trees were well covered by vigorous new growth. Girdling was done by running a pruning saw to wood once around the branch so as to completely sever the cambium. Two branches, ranging from about 2 to 7 inches in diameter at point of girdling, were girdled on each of 10 trees at each location in mid-October 1973. For each girdled branch, an ungirdled control branch of comparable size, and as near the same physiological condition as could be determined by visual inspection, was selected and marked at this time on the same tree. The girdling and selection of ungirdled control branches were duplicated on comparable but unpruned trees nearby.

In 1974, 20 branches were girdled each month in September, October, and November on trees hat-racked in February 1973. Forty-eight of these were distributed among 20 trees at DeSoto City and 12 among 10 trees on Merritt Island. An ungirdled control branch was selected on the same tree as in 1973. Again, the girdling and selection of ungirdled control branches were duplicated on unpruned trees nearby. The range in branch sizes was approximately the same as used in 1973.

The 20 branches on 10 pruned trees at each location which were girdled in 1973 were regirdled in 1974. One branch on each tree was regirdled about mid-September and the other about mid-October.

The response to girdling was evaluated both seasons by a performance rating for bloom and yield on girdled and ungirdled branches on pruned and unpruned trees. The bloom rating was made near the end of bloom opening when fruit set was well along. The rating scale ranged from zero for no bloom to 10 for bloom on a large majority of shoots, the full potential. This figure was roughly weighted to adjust for variations in size and vigor of the panicles. Yield ratings were made after fruit had fair to good red color, but before picking started. The scale of zero to 10 carried the same values as for bloom. No girdling was done in 1975, but the bloom and yield for the entire tree on each pruned and unpruned control tree in the study were rated as for branches.

Results and Discussion

The response to girdling was similar at the 2 locations. Therefore, in summarizing the results (Tables 1 and 2), averages of the 2 locations are given. No bloom was produced on either girdled or ungirdled branches on hat-racked trees the first season after pruning. They remained highly vegetative throughout the season. Although the adjacent unpruned control trees showed some vegetative activity at bloom time, they bloomed moderately well and set a fair crop, with girdled branches producing substantially more bloom and fruit than ungirdled branches.

Branches girdled on hat-racked trees the second fall after pruning produced about the same amount of bloom and considerably more fruit the following season than ungirdled branches on unpruned trees (the normal condition), but not as much bloom or fruit as girdled branches on unpruned trees. Bloom and yield were very light on ungirdled branches of hat-racked trees. Time of girdling (September, October, November) made no important difference, on the average, in bloom or yield on pruned or unpruned trees (Table 1).

Branches on hat-racked trees girdled for the second time in September or October of the second year after pruning flowered and fruited about the same the following season as girdled branches on unpruned trees. They flowered and fruited better than branches on pruned trees girdled only the second year or ungirdled branches on pruned and unpruned trees. September and October girdling were about equally effective.

By the third year after pruning, top height and spread of pruned trees averaged approximately half that of unpruned control trees, or a top surface of roughly one-quarter that of unpruned trees. However, because of shading of the lower portions of unpruned trees, light intensity probably was favorable for flowering on approximately as much bearing surface of pruned as unpruned trees.

No branch girdling was done the third year. Bloom and yield were rated for the entire tree for both pruned and unpruned control trees in the same manner as for branches (Table 2). Pruned trees tended to remain vegetative and their bloom and yield ratings were somewhat lower than for unpruned trees.

The generally higher ratings, especially for bloom, the third year for entire trees than for branches the first and second years, regardless of pruning and girdling treatment, was partly due to the generally better flowering on the upper portions of the trees than on the lower branches where much of the girdling was done. Also, lychee bloom was generally better in Florida in the third than in the

[2]For metric conversion see Table near the front of this Volume. Ed.

Table 1. Bloom and yield ratings for branch girdling on severely pruned and unpruned 'Brewster' lychee trees (avg. of 2 locations).

Pruned 1973 or not pruned	Girdled or not girdled	When girdled	No. of branches	Average rating (Scale: 0 to 10 = zero to full potential) Bloom	Yield	Year
Pruned	Girdled	Fall 1973	40	0	0	1974
Pruned	Not girdled	—	40	0	0	1974
Not pruned	Girdled	Fall 1973	40	4.4	3.2	1974
Not pruned	Not girdled	—	40	2.6	1.6	1974
Pruned	Girdled	Fall 1974	60[z]	3.8	3.2	1975
Pruned	Not girdled	—	60	1.0	0.9	1975
Not pruned	Girdled	Fall 1974	60[z]	6.3	3.8	1975
Not pruned	Not girdled	—	60	4.1	2.4	1975
Pruned	Girdled	Fall 1973[y] Fall 1974	40	5.5	3.8	1975

[z]20 branches girdled in Sept., 20 in Oct., and 20 in Nov.
[y]Branches girdled in 1973 regirdled in 1974.

Table 2. Bloom and yield rating for 'Brewster' lychee trees 3 years after severe pruning and for unpruned control trees (avg. of 2 locations).

Treatment	No. of trees	Average rating (Scale: 0 to 10 = zero to full potential) Bloom	Yield	Year
Pruned Feb. 1973	30	6.4	3.5	1976
Not pruned	30	7.2	4.6	1976

first and second seasons because of very favorable weather early in the third season. The lack of irrigation and the low level of fertilization on Merritt Island, as compared with DeSoto City, apparently had no effect on incidence of flowering. However, a dry spell in the third season well after fruit set reduced the crop considerably on Merritt Island and lowered the average yield rating for 1976.

From this study it is evident that if 'Brewster' lychee trees are severely pruned as late as February, they will be out of production for at least a year. They cannot be induced to bloom the season following pruning by branch girdling. Perhaps better results could be obtained if pruning was done immediately after harvest of the grove, or even earlier on trees that failed to bloom that season. Then the trees might be less vegetative in the fall at time for girdling. Sunburn of bark of scaffold branches could be reduced by whitewashing branches immediately after pruning.

Beginning the second year after pruning, yields can be increased substantially by branch girdling, and possibly even better results can be obtained by girdling the same branch for at least 2 consecutive years. Caution should be exercised and no regirdling done on branches that appear to be weakened. By the third or fourth year after pruning, fruit set on pruned trees might approach that on unpruned trees, especially if branch girdling was practiced. Because of their smaller size, and consequently easier and more thorough job of picking, actual amount of fruit harvested from pruned trees might be greater than from larger, unpruned trees.

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