

## OBSERVATIONS ON PROTECTION OF AVOCADOS FROM COLD INJURY

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There are so many variable factors that may influence the time of firing and the effectiveness of heating avocado groves for protection from cold injury that no hard and fast rule can be given. Some of the variable factors are the following: the varieties or the type of the avocado trees, the size of the trees, distance and manner of planting, location with respect to altitude and slope, condition of the trees with respect to both the physical condition and the state of dormancy, the presence or absence of windbreaks, the amount, variation and velocity of the wind, as well as the degree of cold expected, and the general nature of the weather preceding a cold spell or freeze and that following it. These variable factors have caused many growers to state that no two cold spells are alike and it is extremely difficult to give instructions for prevention of cold injury.

It is known that West Indian varieties, such as the Trapp, Fuchs, and Pollock, will not stand as much cold as the Guatemalan varieties, such as Taylor and Nabal, or some of the hybrid varieties, such as Lula. For West Indian varieties, fires should be started at a somewhat higher temperature than for Guatemalans.

It is questionable if it is profitable to try to protect young avocado trees less than three years old by firing. They should be banked high with dirt, or covered up with straw, hay or litter, just prior to the freeze, and the banks should be removed as soon as the danger of that particular cold spell is over. It is a debatable question whether young avocado trees should remain banked for several weeks at a time, for new sprouts that may form under the bank, or the bark of the tree itself, will be more susceptible to sunburn or sunscald than if the banks are left up but a week or two at a time. The cost of banking is comparatively small, and I believe the additional cost of pulling down the banks immediately following a freeze, and putting them up again if necessary, is justified.

Large trees with dense foliage and trees planted rather close suffer less from cold than scattering trees or those in poor physical condition.

Good windbreaks are especially desirable if a grove is to be fired on windy nights, but they have some disadvantages also. On a still night or one comparatively still in which the temperature does not get quite cold enough to light the fires, there may be some frost damage adjacent to the break, while none may occur where there is a slight movement of air. Then too, windbreaks take some moisture from adjacent avocado trees, causing slower growth and lighter crops of fruit on such trees. But when all the items are considered, I firmly believe that windbreaks are quite desirable and should be maintained.

Perhaps a description of the actual firing of my avocado and lime groves at Avon Park would be more interesting than a general discussion of grove firing. The main block of avocados fired was one 20-acre block of trees ranging in age from 10 to 17 years and planted 70 trees per acre. The grove was surrounded on the north, west and south sides by a closely planted windbreak of Brazilian oaks (*Casuarina lepidophloia*), which are about 50 feet high. The east side was open. The grove is planted largely to Lula, Taylor, Nabal, Collinson and Winslowson trees, with a few trees of other varieties. The trees were in a strong, vigorous condition, and the Taylor and Nabal trees were carrying a heavy crop of fruit. All Lulas and some of the Taylors had been picked prior to the freeze. It was extremely desirable to save all of the fruit as well as the trees, hence my superintendent was instructed to start fires in the grove somewhat earlier than normally would have been done. Fires were to be started when the thermometers reached 31°, providing that occurred before 2:00 A. M., or at 30° if that temperature was not reached until near 5:00 A. M. Thermometers in shelters at various parts of the grove were read and the temperatures recorded hourly during the first part of the night, and each half hour as the danger point approached until time for starting of the fires.

Fat pine wood or light-wood was used for firing. A pile of three sticks was laid in the center of each check on the northwest side of the tree, the pile being shaped like a V, with the point of the V pointing southeast. A piece of rosin-batting cross the size of the fist was placed at the point of the V between the sticks, and this was lighted with a safety torch, using a mixture of three-quarters kerosene and one-quarter gasoline. From five to seven additional sticks of wood had been placed by each tree or near each fire.

After firing was started, the thermometers within the grove were watched, but very little time was spent in watching thermometers outside the area being fired, and temperatures inside the grove were not recorded at definite intervals. If the temperature fell below 30° at any place, the fires were built somewhat larger. This was done by shoving the sticks forward, or bumping them forward with an axe, which caused them to burn faster, and by adding another stick of wood when necessary.

Either two or three lines of fires were lighted first on the north and west sides of the groves, and then each fourth row thereafter was lighted from west to east throughout the grove. If such fires did not hold the temperature up to 30°, the row in the middle between the rows of fires was lighted and then when necessary, the last fires were started. The avocado groves and lime groves were fired for four nights during the cold spell, but the fires were burned in every check only two nights, namely, Saturday and Sunday nights, January 27th and 28th, the coldest time being early the following morning. The other two nights, it was not necessary to light all of the fires to hold the temperature to 29° or 30°. The temperature on the outside of the groves reached 21° to 23° at various thermometers during each of the last two nights, while the temperature inside the groves varied from 28° to 33° at different times during the firing. At no time in the avocado grove surrounded by windbreaks did the temperature go below 29°, but in the lime groves without a windbreak on the west, the temperature dropped to 26° for short periods during gusty spells. There was no damage whatever to foliage by fire in the avocado grove with windbreaks, as the fires burned steadily and the heat and smoke drifted slowly through the foliage, whereas in the lime grove without a windbreak on the west a large percentage of the trees had the foliage and twigs damaged by the

flames which whipped about. It was necessary to have larger fires to hold the temperature up in the lime groves, as the trees were smaller and the wind constantly blew the flames in various directions, carrying the heat away.

During the January freeze we fired part of four nights and burned nearly 400 cords of wood, with a total cost for labor and materials of over \$3000, but we saved the foliage, fruit and bloom wood of our citrus nursery, all of our Valencia oranges, limes and avocados, and the fruit alone which has been sold during February and March, has brought over \$10,000 net on the tree. Our last avocados were shipped in March, two light pickings of limes have been made since February 15th, and a tremendous bloom has been secured on all oranges, grapefruit and limes, and a good bloom is coming on our avocados.

In our young avocado groves which were not fired, the trees were killed to the banks, and one small grove of three to five year old avocados which were not fired, the damage to all limbs was so severe that no bloom will be secured this year and some of the trees were killed to the main trunks. Our grove firing was a very decided success.

Other avocado groves in Highlands and Polk Counties which were not fired were so severely damaged that no fruit will be produced in 1940 and a small crop in 1941 may result.

The following observations were made and conclusions were drawn from results secured in firing our avocado groves in the freeze of 1934-35 and again in January, 1940:

- (1) A number of reliable thermometers should be placed under shelters at strategic locations for properly checking temperatures.
- (2) A responsible man should be detailed to read thermometers regularly when a freeze is expected, and keep a record of such readings.
- (3) All wood should be laid for fires before the freeze arrives.
- (4) All flashlights, lanterns and lighting torches should be checked prior to night of firing to see that everything is in readiness. Have an ample supply of all these and of axes and shovels.
- (5) Where good, fat lightwood is used for firing and where the sticks are large enough so that 120 or 130 sticks of 4-foot wood make a cord, the three sticks of wood in the original fire will burn three hours and one additional stick per fire is required for each subsequent hour. This averages about one large stick per hour for each fire.
- (6) If 60 fires are used per acre, then 1% cords of wood per acre are used in laying the original fires, and if 6 sticks are placed near each fire, an additional 3 cords per acre are required.
- (7) For real protection, at least 6 cords of fat wood per acre should be stacked at convenient places near or within the groves to be fired.
- (8) Hold in reserve one reliable and experienced man for supervising the re-laying of fires the next morning after firing.

(9) An adequate supply of batting dross should be on hand for starting the fires. From one-half to three-quarters pound of batting dross is usually used to start a fire. It is chopped into pieces with an axe and placed in the proper place as the wood is laid for the fire. Strainer dross is not nearly as satisfactory as batting dross, as it readily falls apart, and in the event the fires are not lighted, it is hard to salvage in the spring for another season.

(10) If batting dross is not available, then strainer dross or fat pine splinters should be prepared ahead of the time of firing.

(11) Fuel enough for three nights firing in succession is essential for proper protection. For a more prolonged freeze, the grower may be able to get some additional fuel.

(12) Keep the fires burning until the temperature outside the grove reaches 33" or until indications are that it will reach 33° in a short time. Putting out fires too soon may result in damaged fruit or trees.

(13) Put out fires promptly at the proper time and thus save fuel. Re-lay the fires as soon as possible after they are put out so as to be ready for the following night.

(14) Prior to laying the wood for fires in the early winter, all dry litter such as cover crops, grass or leaves should be disked into the soil or otherwise disposed of so it will not catch fire.

(15) In the spring when all danger of cold is past, gather up and store the batting dross, stack wood near tree trunks out of the way, or haul it to selected locations, and store thermometers and other equipment until the following winter.

Unless and until a grower is willing to go to the expense of properly preparing for a thorough job of firing, and will give close personal attention to all details and be ready to work extremely hard for long hours, under very trying circumstances, and with a determination to win at all costs, he had better leave grove firing to someone else, letting Mother Nature take her course and saving himself the loss of sleep, comfort, money and the qualms of conscience which may come from a job poorly done.