Influence of weather on the harvesting of high elevation CHRISTMAS TREES

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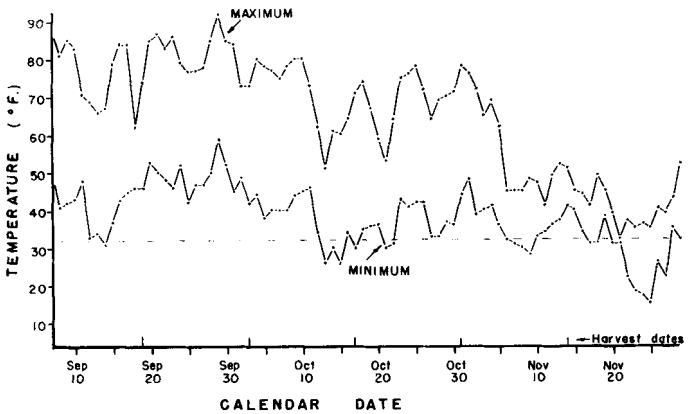


Fig 1. DAILY TEMPERATURE, HARVEST AREA, 1966

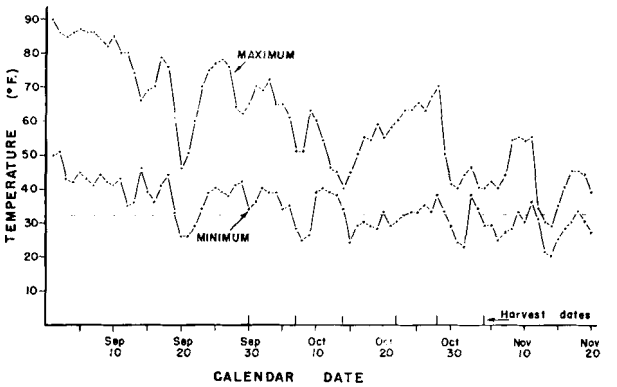


Fig 3. DAILY TEMPERATURE, HARVEST AREA, 1968

OVER FOUR MILLION FAMILIES in California enjoy fresh evergreen trees in their homes every Christmas. Few people realize what efforts have gone into producing a tree that will maintain a vigorous, healthy appearance over the long Christmas holidays. Thousands of acres of trees are thinned, pruned, sheared and fertilized before harvest. Approximately a million of these trees are thinned annually from the high elevation forests of California. Large timber companies and other forest landowners have given long-term management and harvesting leases to Christmas tree operators to insure an annual income from their forest lands. Many forest landowners also manage and harvest trees from their lands on a sustained yield basis. The success of the Christmas tree industry and its $20 million payroll depends on the high quality of properly harvested trees. The date a Christmas tree operator selects to start harvesting, plays an important role in determining freshness.

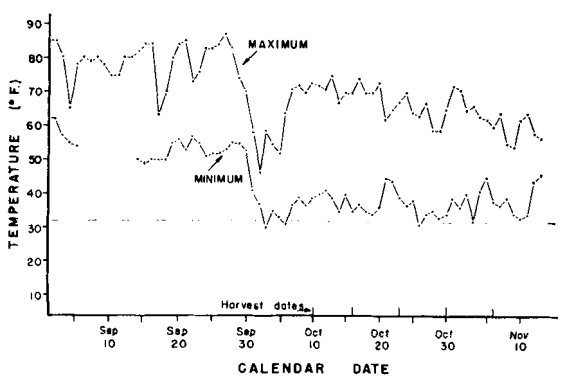


Fig 2. DAILY TEMPERATURE, HARVEST AREA, 1967

The tree cutters' timing problem is not a small one. Annually, they must "read" the weather in two important ways. First, they must cut trees before deep snows and frozen conditions stop harvesting equipment, or storms and cold weather cause snow to freeze on the trees. At best, harvesting under heavy snow conditions is expensive and may result in an incomplete harvest. Second, cutters must recognize the influence of weather on the keeping quality of the harvested tree.

In the past Christmas tree cutters have relied on "rule of thumb" methods for determining the time to start harvesting. As a result, trees are often cut before they have reached a dormant condition, thus resulting in loss of quality and freshness. This study in Plumas County shows that the optimum harvest time for white fir Christmas trees depends on the number of hours of temperatures below 40°F.

The harvest site selected for the 1966 and 1967 studies had an easterly exposure and an elevation of approximately 4,500 ft. The 1968 site had a northerly exposure at a slightly higher elevation. Both study areas were mixed conifer stands with white fir the predominant species. Only white fir trees were harvested.

During August of each year, one hundred trees possessing similar growth and foliage characteristics were selected and marked. A recording thermograph and maximum-minimum thermometers, accurately calibrated, were installed in a weather shelter located in the approximate geographical center of the harvest plot. Charts were changed weekly with the weekly maximum and minimum temperatures recorded to assure the accuracy of the daily temperature readings. Harvest dates were arbitrarily selected over a period long enough to insure at least one harvest before and one after the commonly accepted harvest period. At each harvest date 10 randomly chosen trees were harvested. Each tree was graded according to the foliage characteristics set forth in the grading rules established by the California Christmas Tree Growers.

Data indicate that at least 140 hours of fall season air temperature below 40°F is needed prior to white fir (Abies concolor) harvesting to insure desired keeping quality of Christmas trees.

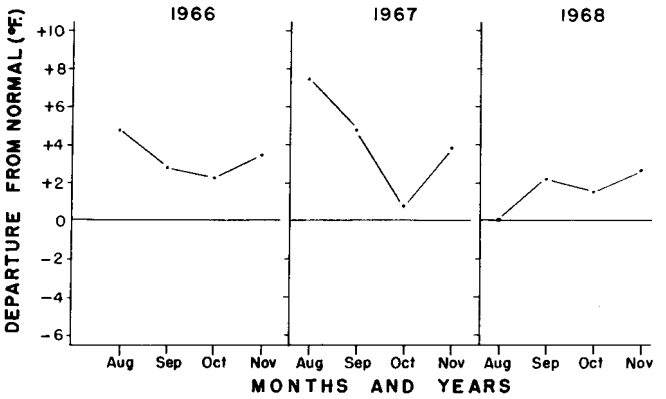


FIG. 4. MEAN TEMPERATURE DEVIATION FROM NORMAL MONTHLY MEAN TEMPERATURE, 1966–1968, QUINCY, CALIFORNIA

Harvesting white fir under ideal conditions.

Trees were transported to a storage area on the valley floor away from the cutting site. The 1966 storage area had the most adverse conditions possible. It was an open area with a southwestern exposure. Direct sunlight fell on the stockpile throughout the day. The storage sites during 1967 and 1968 had more desirable conditions; the stockpiles were in moderately dense to dense shade. Trees were removed from the stockpiles in early December. They were graded for freshness, color, and needle retention.

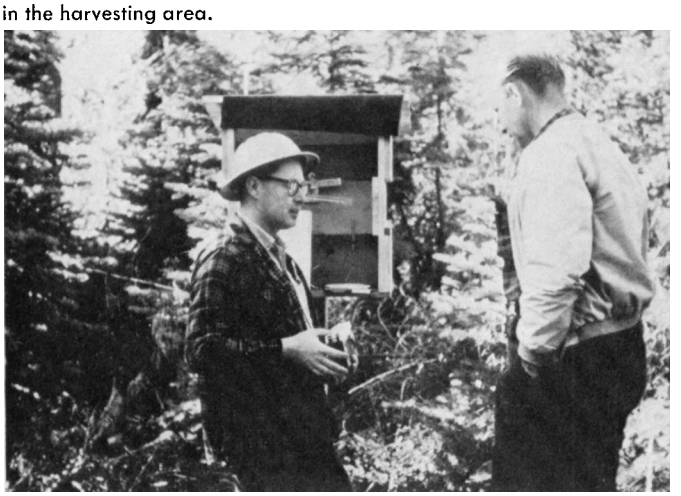
During and immediately after the study period, temperature data were extracted from the thermograph charts. Daily maximum and minimum temperatures were noted (see graphs 1, 2, and 3) as well as the number of accumulated hours of temperature below 45°, 40° and 32°F after September 1. All of these were evaluated to establish a reliable field guide in timing the harvest season. The number of hours below 45° and 32°F were exceedingly variable and showed no trend toward correlation with date of harvest or marketability of trees. Hence these criteria were discarded.

Figure 4 shows the deviation between the monthly temperatures in the three years in which the trials were conducted and the normal monthly mean temperatures. These data were obtained from the official U. S. Weather Bureau records taken at a site approximately seven miles from the harvest area. Figure 4 indicates the years 1966, 1967, and 1968 were warmer than normal. The zero line represents the long-term normal mean temperature for the months of August through November, while the individual points represent the deviation from the normal for the respective months and years. For example: August 1966 was about 5° above normal whereas September was 3°, October 2°, and November 3½° warmer than normal. Figure 5 indicates that there was a similar deviation from normal in precipitation during the same three-year period. In all three years, the months of August through October were warmer and drier than normal.

White fir test trees harvested during the months of September, October and November of 1966, 1967 and 1968 were evaluated to determine marketability (see table). The factors considered were: freshness, color, and needle retention.

Maximum marketability (100 per cent) occurred with trees harvested October 31, October 30, and October 14 in 1966, 1967, and 1968 respectively. Thus 100 per cent marketability in 1968 was achieved 16 to 17 days earlier than 100 per cent marketability in 1966 and 1967. Similarly, the point of 140 hours of temperatures below 40°F was achieved 20 and 22 days earlier in 1968 than in 1966 and 1967. This discrepancy could be due to the arbitrary selection of harvest dates.

Data on the weather for these tests were collected at weather stations in the harvesting area.



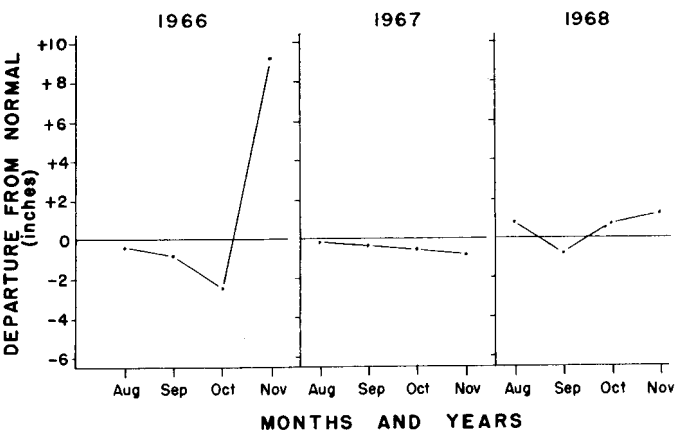


FIG. 5. MONTHLY DEVIATION FROM NORMAL MONTHLY PRECIPITATION, 1966–1968, QUINCY, CALIFORNIA

Three years of field data suggest a direct relationship between the number of accumulated hours below 40°F field temperatures and the marketability of stored white fir Christmas trees (graph below). Regardless of calendar date, test trees that were exposed to 140 to 180 hours of air temperatures below 40°F before cutting, were all judged marketable after field storage.

Maximum marketability may have been attained earlier in 1966 and 1968 if trees had been harvested immediately after 140 cold hours below 40°F had been reached. For example, using 140 hours below 40°F as a base the point of high marketability in 1966 was reached on October 28 and on October 9 in 1968.

The total fall environment acts on living trees to gradually slow down growth. Eventually the trees become dormant for the winter. When this occurs, harvested trees should remain fresh during the Christmas season. The three years of data indicate that proper time of harvest can best be determined by hours of exposure to temperatures below 40°F. Other indicators tested and discarded included needle moisture content, sugar-starch relationships, and nights of severe frost immediately prior to harvest.

The total cold hour factor is an important guide for Christmas tree operators to use in determining when to start harvesting white fir. The operator will still need to consider management factors influencing his harvest program, such as labor force, equipment status, storage site, and contract commitments, before deciding when he will begin harvesting white fir.

During the 1969 season, harvesting will be established on the basis of hours below 40°F. To refine the data and to verify the hypothesis that 140 to 180 hours are needed, harvesting will be accomplished when 80, 100, 120, 140, 160, and 180 hours are reached in the harvest site.

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CHRISTMAS TREE HARVEST AND COLD HOUR DATA
PLUMAS COUNTY—1966, 1967, 1968

1966 STUDY

In 1966 the following results were obtained:

Harvest Dates	Marketable trees	Cold hours below 40°F at harvest site
	%	no.

1967 STUDY

Harvest Dates	Marketable trees	Cold hours below 40°F at harvest site
	%	no.
Oct. 10*	60	62
Oct. 16	60	76
Oct. 23	70	103
Oct. 30	100	142
Nov. 6	100	169

* Harvesting was not started in 1967 until October 10, because of the unfavorable experience with early harvest in 1966.

1968 STUDY

Harvest Dates	Marketable trees	Cold hours below 40°F at harvest site
Sept. 30	40	75
Oct. 7	80	117
Oct. 14	100	180
Oct. 22	100	294
Oct. 28	100	
Nov. 4	100