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TREE HEET FOR FROST PROTECTION OF PEACHES

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Abstract

A test was made using Tree Heet for frost protection in a young orchard of 'Early Amber' peaces on February 19, 1969. The peace orchard was divided into 2 identical 2¼ acre plots. The southern plot was heated while the plot adjoining it to the north was the unheated control. One package of Tree Heet per pree was lit in the test block at 8:45 p.m. and this produced an immediate temperature rise in this plot. A second package of Tree Heet was lit at 10:45 p.m. which produced a second, smaller rise in temperature. An average temperature differential of 2 degrees was maintained between the 2 plots throughout the test period. The value of this protection was proven by the fact that the test plot bore peaches while the fruit was killed in the unheated plot.

Introduction

To grow peaches successfully in Florida "enough but not too much" cold weather is required. Horticulturists have found that peach varieties require a varying amount of chilling (temperatures at and below 45°) in order to obtain a good break of dormacy and fruit set (2). The average number of chilling hours in Florida ranges from less than 100 in the extreme southern portion to more than 600 in the panhandle. These amounts may vary greatly from year to year (1). The required chilling should be satisfied by the end of January in central Florida and by February 10th in the north portion (8). Peach flower buds will withstand temperatures as low as 20°F at the time they begin to swell while open blossoms are damaged at about 26°-28° After petal fall temperatures of 28° will usually kill the young fruit. There is no area in Florida with less than a 25% probability that frost or freezing temperatures will occur during the time peaches are vulnerable to frost damage (7). The risk can be greatly reduced, however, by the selection of a warm site. A hilltop location or a slope would be a preferred site temperature-wise for a peach orchard and low pockets should be avoided. Since the risk of frost cannot be entirely eliminated the peach grower should be prepared to employ measures to protect his crop.

A fuel that shows some promise for frost protection of peaches is manufactured by the Mobile Oil Company and marketed under the trade name of Tree Heet. The fuel is sold in 4 pound packages. Each package contains 2 petroleum coke based bricks about the size of ordinary building bricks. They are capped with a special igniter pad, wrapped in waxed paper and sealed in a polyethylene bag.

Methods of Procedure

A 4½ acre orchard of one-year-old 'Early Amber' peaches at the University of Florida horticultural unit northwest of Gainesville was divided into 2 identical 2¼ acre plots. The south plot was heated while the one adjoining it to the north was the unheated control. The orchard terrain was nearly smooth but with a gentle

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north-south slope, having about a six foot fall from the north to the south boundary. The trees were planted in rows 20' x 20'.

Each plot was instrumented with 10 thermocouples mounted in the trees 3 to 4 feet above the ground. Nine thermocouples in each plot were attached to leaves so as to obtain leaf temperatures. Thermocouples number 5 in the test plot and 16 in the control plot were mounted in blossoms (Fig. 1.). Six minimum thermometers were mounted in weather bureau approved shelters. Temperatures were recorded by an L&N 24 point recorder set up temporarily in a truck which was parked at the north boundary of the test plot. At the time of this test, the night of February 19-20, 1969, the trees were in full bloom. Leaflets were coming out but few had attained full size. Tree Heet packages were placed on the north and west sides 2 feet away from the tree trunks. Two packages were placed by each tree. At 8:45 p.m. on February 19 when temperatures in the orchard reached the 40° mark the 2 packages at the outside rows and one package at each of the remaining trees were lit. The lighting was completed at 9:00 p.m. This test had a dual purpose: that of evaluating the performance of Tree Heet as well as protecting the fruit; therefore, the Tree Heet was lit at 40°, well above the critical temperatures for peaches. The second package was lit at 10:45 p.m. This made 2 packages per tree throughout the orchard (no additional packages were lit in the outer rows).

Weather Situation

A cold air mass moved into the Florida peninsula on February 17 followed by clearing skies and subsiding northerly winds. On the

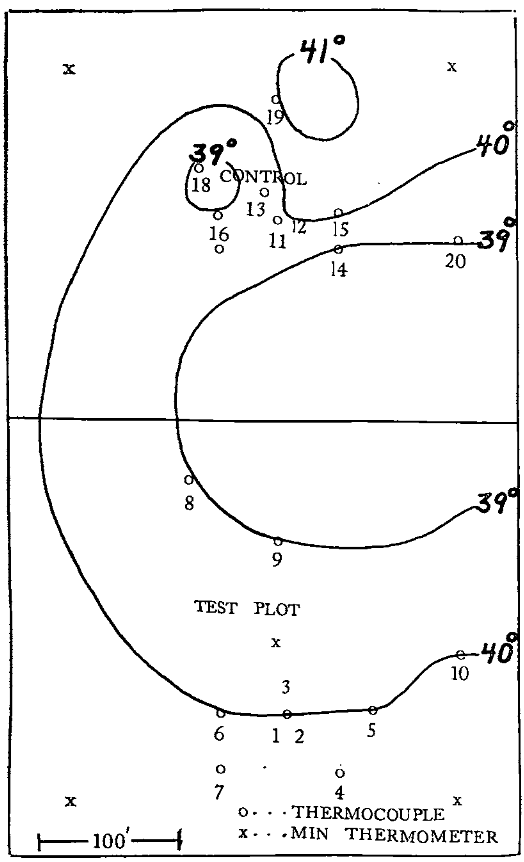

Fig. 1. 8:40 pm, before lighting.

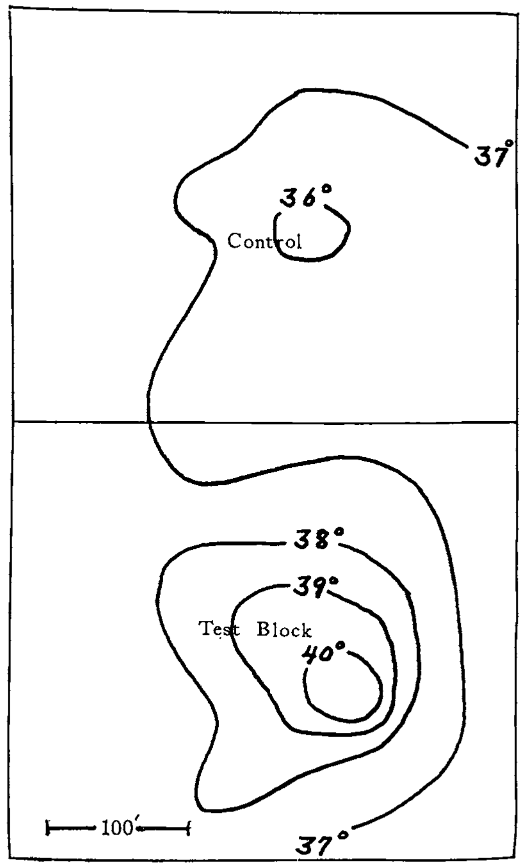

Fig. 2. 9:40 pm, 20 minutes after lighting first package of Tree Heet.

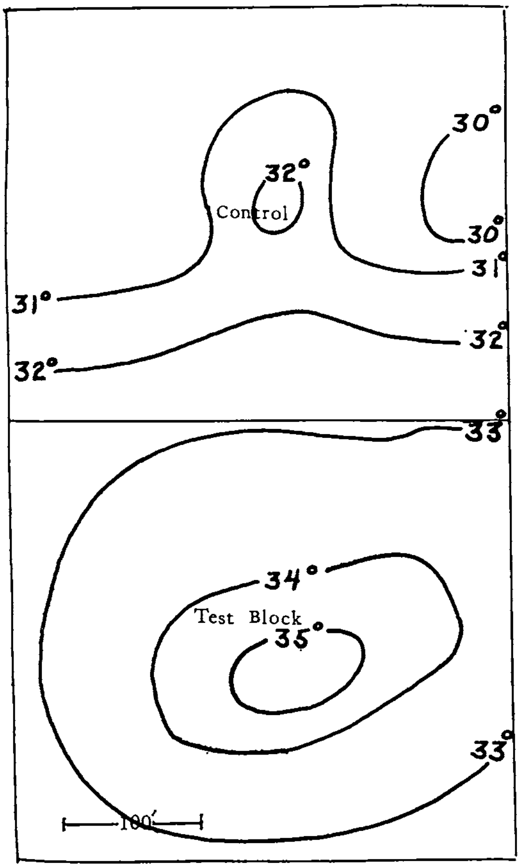

Fig. 3. 10:30 pm, 1 hour and 10 minutes after lighting first package of Tree Heet.

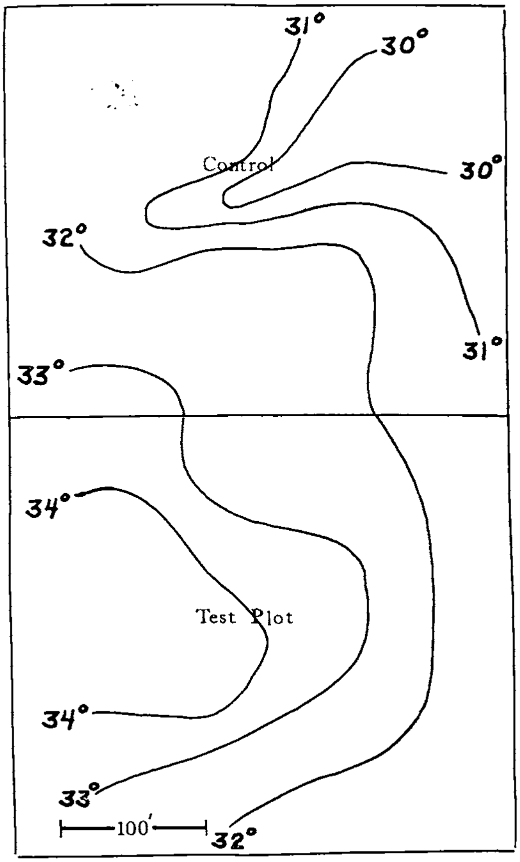

Fig. 4. 11:00 pm, showing the effect of momentary increase in wind speed.

night of the 19th and the morning of the 20th a ride of high pressure extended from Hudson Bay southward into the eastern Gulf of Mexico. A weak pressure gradient indicated light northerly winds with periods of calm. The top soil was moist for more than 2 inches of rain that occurred on the 15th but the soil surface was dry. Conditions were favorable for strong nocturnal radiation cooling with frost and freezing temperatures. Also the near calm conditions were favorable for successful heating operations.

Results and Discussion

The temperature response to the lighting of the first package of Tree Heet was immediate as can be seen from Figs. 2 and 3 of the temperature field in the orchard before lighting and 20 minutes after lighting, respectively. Fig. 4 shows the effect produced by a momentary increase in wind velocity; northeast about 10 mph. This occurred occasionally during the night, but calm conditions and light northerly winds (less than 5 mph) prevailed. Fig. 5 shows the temperature field 35 minutes after lighting the second package. This produced a temperature rise in the test plot but not as great as expected. The northward bulging of the isotherms indicated that a considerable amount of heat spread into the control plot. Figs. 4 and 6 also show this effect so it appeared that increasing the number of lighted blocks tended to distribute the heat over a larger area rather than to produce a large rise in temperature. The temperature at the center of the heated plot was 4-5 degrees warmer than temperatures in the unheated plot and the average temperature in the heated plot was 1.95 degrees warmer than that of the unheated plot. The "heat center" shifted

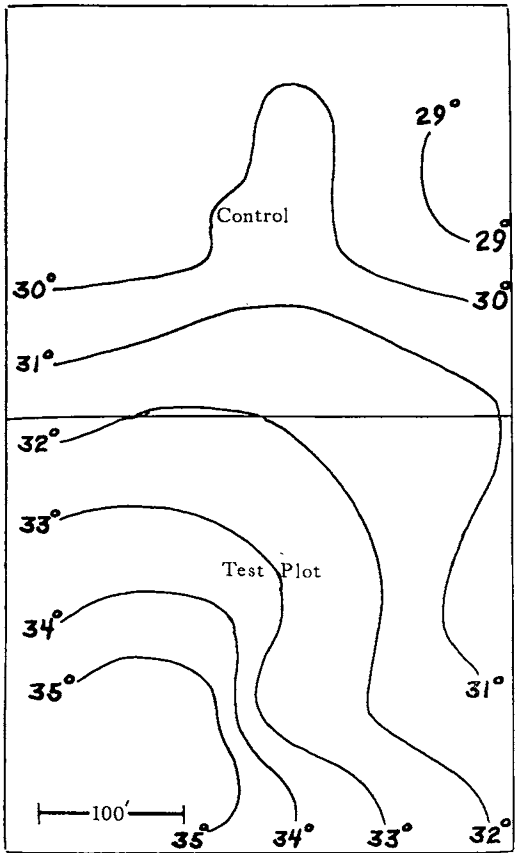

Fig. 5. 11:20 pm, 35 minutes after lighting second package of Tree Heet.

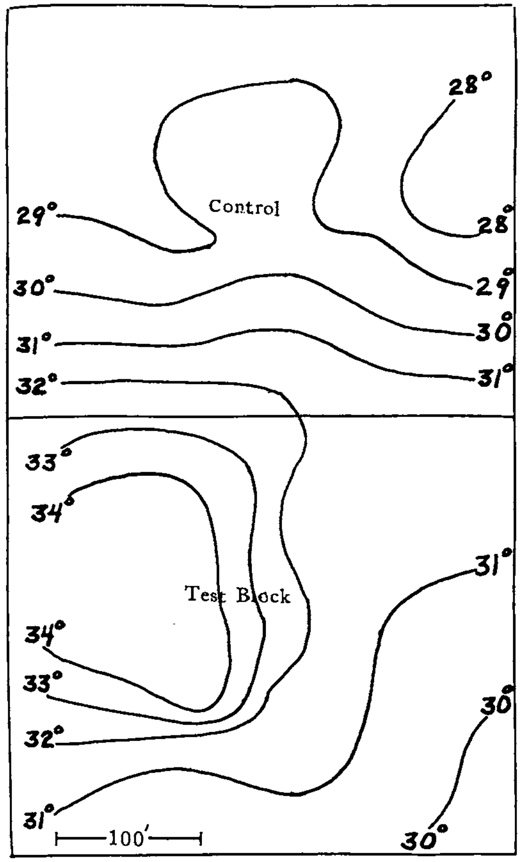

Fig. 6. 12:50 am. Note the effect of easterly winds on the position of the "heat center."

about somewhat with the fluctuations in the wind direction and speed. In any test using small plots such as these, it is obvious that there is a large border zone. Kepner (6) observed after performing heating tests with various sized plots that the "border effect" extends inward for 10 to 15 rows. This is greatest, of course, on the windward side and the size of the border zone depends upon the wind speed (6). Thus, it is obvious that a large orchard can be heated more effectively than a small one. It is also more economical on a cost per acre basis considering that additional heat units are needed around the perimeter of the orchard. Fig. 8 shows the variations in temperatures in the heated and control plots during the test period. Minimum temperatures in the 2 plots are shown in Fig. 9. Thus, at 4:00 a.m., 5 hours after lighting the second package, Tree Heet continued to produce a significant amount of heating.

The value of heating with Tree Heet was demonstrated by the fact that the trees in the heated plot bore fruit while all of the fruit was killed in the unheated plot. Only a few peaches were harvested as the trees were only one-year-old, but even the trees in the outside rows bore some fruit. This protection was accomplished under difficult conditions because young trees, and especially deciduous trees, with their almost complete lack of a leaf canopy during the blooming period, are extremely difficult to heat. Perhaps the greatest advantage in Tree Heet is the fact that there were no heaters to buy, adjust, refuel, store, or repair. Tree Heet can be stored outdoors indefinitely as the packages are moisture proof. It lights easily with a flambeau torch. The 4-pound packages are easy to handle and sufficient Tree Heet for several cold nights can

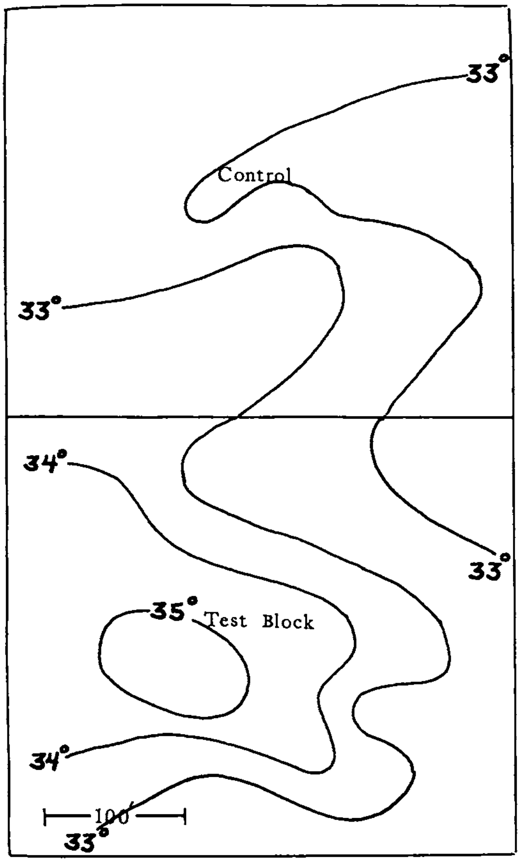

Fig. 7. 1:20 am, 1 hour and 30 minutes after lighting second package of Tree Heet.

be placed around the trees at one time, thus saving in labor costs. The heat output of Tree Heet is 8,000-10,000 BTU per hour per package. This is considerably less than that of conventional heaters so more units per acre must be

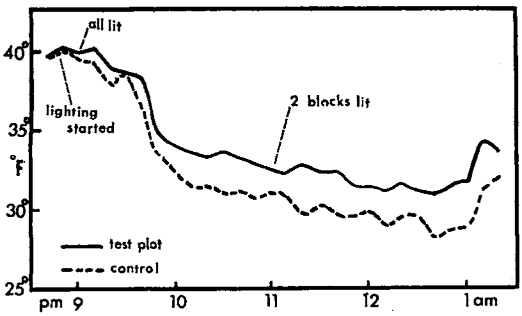

Fig. 8. Temperature variations in the heated and control blocks during the test period.

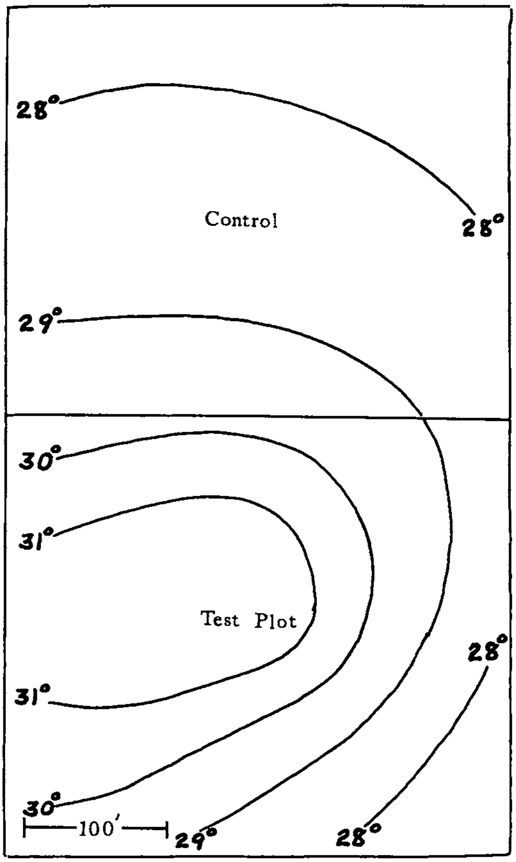

Fig. 9. Temperature field at 4:00 am at the time of the minimum temperature.

used. This is good, however, because many small fires make more efficient use of heat than a few large fires, and Tree Heet tends to heat a layer closer to the ground than conventional heaters (3).

Tree Heet has some disadvantages. The rate

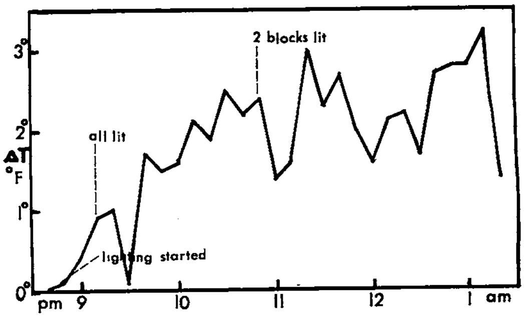

Fig. 10. Protection provided by Tree Heet.

at which it burns cannot be changed. Most of the heat is released in the first 4 hours. After this the protection is very small even though hot, glowing embers remain. If temperatures remain below damaging levels for more than 4 hours, 2 lightings will be required. Once Tree Heet is lit, it cannot be extinguished. Conventional oil fired heaters can be regulated, extinguished and they will burn for 8 hours.

The cost of Tree Heet is greater than oil if more than 8 hours of heating are required per year.

Tree Heet has been used successfully as a supplement to wind machines (5) and can be used in conjunction with other heaters. It is very clean burning and no residue is left in the field to be removed after heating.

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EFFECT OF CHILLING ON ETHYLENE PRODUCTION, SENESCENCE, AND ABSCISSION IN LEAVES OF EVERGREEN AND DECIDUOUS FRUIT TREES

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ABSTRACT

Ethylene production induced by chilling and related to the development of senescence and leaf fall were similar in the leaves of the deciduout trifoliate orange and peach. The exact timing of increased ethylene production in relation to development of senescence is not clear in these experiments, although they occurred close together. Chilling did not promote ethylene production nor senescence in the leaves of the evergreen trees. The low levels of ethylene detected in the leaves of the evergreen plants may be largely a wound effect from detaching the leaves from the stems.

INTRODUCTION

In evergreen trees we have progressive or sequential senescence in which the lower leaves senesce first, and more leaves entering senescence as new leaves develop at the apex. If senescence and growth proceed at the same pace, the plant may always bear the same number of leaves as it grows.

In deciduous trees all the leaves develop typical coloring and abscission coincident with the onset of chilling temperatures in the autumn. This synchronous senescence is so distinct in timing and control from sequential senescence in evergreen trees as to suggest some basic difference in the process.

It has long been known that ethylene causes leaf abscission (4). Recently, Cooper et al. (3) reported increased ethylene production by leaves of the deciduous trifoliate orange (*Poncirus trifoliata* Raf.) at the onset of cool nights in the late autumn. The present paper describes experiments in which ethylene production was measured in several deciduous and evergreen fruit trees subjected to various chilling temperatures in programmed climate chambers.

METHODS AND MATERIALS

These studies involved the following plants: 'Maygold' peach (*Prunus perisica* L.), 'Haden'