OBSERVATIONS ON PROTECTION OF PAPAYAS FROM COLD

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Probably the sole excuse for my talking to anybody on the technicalities of frost protection is that I did come through the January freeze with a commercial Papaya plantation that is still alive. It is my hope, of course, that this was not a mere matter of accident but the result of the application of the principles I am about to discuss here as modified by a number of factors that will be also discussed.

The matter of frost protection is more complicated by far than most people, even those who fight frost, realize. The reason for this is the multiplicity of factors involved in any given frost problem and the necessity for modifying the methods used in the field from hour to hour to suit the changing conditions.

The factors in a frost problem are as follows: advance information in the form of weather maps, the frost forecast of the day before, the physical character of the land involved, the kind of crop involved and very often the variety of the crop, the material used as a source of heat, the mechanical equipment used, and even the character of labor.

Now under the head of Advance information, let us first discuss the daily weather maps that appear in some of the larger newspapers. I have, during the past two years, been following the maps in the Tampa Daily Times because that is the paper available to me. Now Florida is so situated that a weather condition that may lead to frost usually announces itself four days in advance. It behooves the grower to keep an eye on the north west corner of the United States from November 1st to March 15th and to regard with a jaundiced eye any high pressure area of steep gradient that appears in that territory. He should then follow it systematically as it develops and moves eastward. It will take several seasons, but in time the grower will learn to evaluate the character and probable severity of each freeze as it advances.

Then there is the matter of the daily forecast by the frost service. Allow me to suggest that if you have something to protect from frost, you stay as close as possible to the frost service forecaster for your district. Remember first, he is making a forecast, not a statement of fact and he is giving you the best idea he can form of what will happen on a given night from the scientific facts in his possession. If you will regard his forecasts intelligently and guard yourself and your crops accordingly, you will have few losses. But remember this, the forecaster can not be responsible to you for the vagaries of the weather behavior on your particular piece of ground after his forecast is made. You should attempt as each cold wave advances to form an opinion as far in advance as possible of what the character and severity of the cold will be from the daily maps and then tie your idea together with the forecast that comes out at 11 o'clock each day. Don't be an optimist; regard each cold spell from the standpoint of the worst that could happen on your particular piece of ground under that particular weather set-up and get ready for it. Then you will not be caught napping.

The physical character of the land involved and its immediate surroundings are, of course, important. A good slope that allows for air drainage is always easier to handle than land that is flat. Cold air flows exactly as water does and is subject to the same physical laws with the exception that it is not as heavy and therefore its velocity of flow is less. A body of water on the north or west or both sides is usually a tremendous help. Land of sandy character does not frost as easily as, for instance, muck land or a dark black loam. This is almost entirely a matter of color. The black or blackish land loses temperature much more rapidly than the lighter colored soil. Land that is moist clear to the surface at the time a frost occurs does not frost as readily as dry soil. This is a matter of the relative humidity of the atmosphere immediately above the soil and the consequent difference in dew point.

Then, of course, there is the matter of kind of crop involved, how much temperature your particular crop will stand. There is also often the matter of the variety of the kind of crop involved. There is sometimes a considerable difference in the point of temperature at which damage will occur in different varieties of the same kind of crop.

Now comes the matter of the material used as a source of heat and the equipment, if any, used to burn that material. The general principle behind the choice of material and equipment seems to be this — clear radiant heat that will strike off in straight lines and be absorbed by the crop is far superior to a heat situation under which a very hot blue flame heats a volume of air. The difference is that heated air simply rises off of the crop and does little or no good. Radiated heat moves through the atmosphere in almost perfectly straight lines and is absorbed by the plants or trees. This in turn enables the plants or trees to give up more heat to the air without being chilled to the danger point.

Under Florida conditions what we call fat wood seems to be the best source of heat at the moment, both from the standpoint of economy and physical efficiency. Fat wood is ordinarily used without heaters of any sort. My experience in this freeze seems to indicate that that is a mistake; more effective use of fat wood can be made with a comparatively simple and cheap piece of equipment such as this bucket.

If distillate or oil of any kind is used as a source of heat, it is a waste of time and money to use it in anything but a scientifically devised heater that will become red hot and return a high percentage of radiant heat, for the oil consumed. Oil burned in open cans or pots makes very little radiant heat but heats a lot of air that promptly rises away from the crop.

The character of the labor involved is important from one specific angle; damaging temperatures usually occur towards morning and there is always the problem of how rapidly it is going to be possible to assemble the labor and have the work commence effectively. Here is something again for which every grower must be responsible to himself— he must always allow time enough for stirring out his crew and getting them to work.

There is a saying that there is no fertilizer like the footsteps of the owner for a grove; It is also true that there is no substitute for the observation and judgment in the field on frost nights of the owner himself. As an example I spent 12 nights out of 14 in January on my feet in the Papaya plantation checking temperature, getting a picture of the rate of fall, checking the development of the cold with what I already knew of the weather maps of the previous days and Mr. Ellison's forecast of that particular day. Now out of those 12 nights I only fired four times; two of those nights I only lighted a few fires, the last thing in the morning to stir up a draft. Now here is another help in gaging the development of a cold spell during the night it occurs. It will have to be used cautiously until we know more about it. During the last two winters it has saved me a lot of money because of the number of times that I did not fire even though ground frost occured. The forecaster usually says something like this: frost will occur after two hours of a temperature of 35 or 38 or even lower, as the case may be. Now he is talking about the temperature in a standard weather bureau covered shelter, or what is spoken of as the true air temperature, and the relationship to the dew point.

Take for instance the night on which the forecaster has said frost will occur after two hours at 35; watch the temperature of a sheltered thermometer in the immediate area involved. When the temperature reaches that point, look for frost on boards in a low spot or actually arrange boards at ground level, and at 2, 4 and 6 feet above the ground. The period between the time that frost forms on a dry board on the ground and then begins to form on a dry board two feet above the ground is an additional help in determining the rate of fall of temperature and the rate of development of the conditions under which frost will occur on plants.

The Papaya will not stand the formation of frost on the leaves. I have found in the past two winters, however, that it will stand 32° for considerable period so long as frost does not actually form on the leaves themselves. This is a tricky feature; lots of money can be saved by mastering it and applying it to your own particular situation. A crop can easily be lost by misgaging the speed of development of the freezing situation.

Now to get down to my experience in this particular freeze. I have approximately 12 acres of Papaya at Babson Park planted on 9½ ft. centers. Half of this plantation is 20 months old and just previous to the freeze was 15 to 18 feet high and carried tops 12 feet across; the other half of the plantation was four months younger, and smaller out of all proportion to the disparity in age. The plants were 7 to 10 feet tall and 5 to 8 feet across the tops. This difference in the width of tops and the consequent difference in the degree of over-head cover turned out to be the controlling factor under the conditions of this particular freeze.

During this particular freeze I fired the Papaya plantation four nights. Thursday night toward morning I lighted a few rows of fires on the upper side of the plantation; this was a radiation frost, with practically no wind, and no damage was done. Friday night and Saturday morning another radiation frost occured and we lighted about half of the fires or 60 to the acre; no damage was done. Saturday night and Sunday morning we started firing at 8:30 and rapidly increased the fires until all of the 120 fires to the acre were burning. Along toward morning a condition developed under which the temperature was 26 and the wind blowing off the lake was 25 miles per hour. I had been prepared for this condition's occurring by long distance telephone call three days before to a friend of mine at Weslaco, Texas. The fires along the lake short were blown flat, and in spite of the firing three to five rows of plants along the West side lost their tops, had their buds killed, and about half of the fruit was frozen on the exposed side of the plants. Further back inside the plantation there was very little apparent damage next morning to the six acres of plants with large tops. The six acres with small tops, however, were a different story — they were frozen to within two feet of the ground regardless of firing. Now this combination of low temperature and wind was something I had never experienced before. I did not consider the lake shore the exposed part of the plantation at all. If I had, there would have been a windbreak there — and there will be next winter.

For the purpose of growing Papaya it is possible to grow alternate hills of Napier grass and pigeon peas and make a windbreak 12 feet high as rapidly as you can grow a Papaya plantation. In the light of this experience I would say that henceforth a windbreak all the way around is indicated for Papaya in central Florida. Now mind you, a windbreak entirely around a Papaya plantation will necessitate the lighting of a few fires just inside the windbreaw on radiation frost nights when it would not be necessary to fire if the windbreak were not there. I am still going to grow the windbreak because in this last freeze a windbreak would have saved me three to five thousand dollars worth of fruit that I lost. Suppose I had, as a result of having windbreak in that position, to light a few small fires three or four times this winter when none were lighted without the windbreak; I still say Windbreak.

Then there is a matter of the number of sources of heat. Under the conditions here and in the Rio Grande Valley in Texas it has been customary to use up to 65 fires or heaters to the acre. I used 100 smaller fires to the acre in March 1930 in a Papaya planting in the valley. This winter's firing was done with 120 smaller fires to the acre; next winter's firing will be done with one of these buckets in the center of each square — 486 very small fires to the acre. The specific reason for this is that I want radiated heat to strike all sides of every plant. I see no reason to believe at the moment that there would have been any loss to this particular Papaya plantation under the conditions of this freeze if there had been a windbreak and a multiplicity of small fires.

Another factor in the protection of crops against cold is, of course, the capacity of the individual varieties from within the species to resist cold and we have something for consideration on that score with regard to the Papaya. In the crop of Blue Solos of 1936 grown south of Miami, a single segregate plant appeared. In sex character it was female and for that reason would not have been considered as a source of seed ordinarily. This Blue Solo strain has been built entirely on selections and seed stock from hermaphroditic or perfect flowered individuals. This particular plant, however, was a segregate or throw-back toward the female ancestor in the last cross — the Solo variety from Hawaii.

The fruit were unusually heavy shouldered and thick fleshed, so that they weighed nearly 35% more for the same dimensions as the standard Blue Solo fruit. For this reason solely, seed was saved from two fruits and 400 seedlings grown off and planted in the field. Now this was done with the full knowledge that this particular plant, being a female and therefore requiring pollen from another plant, would be pollinated by everything in sight with the result that its seedling would vary enormously; they did. Some 60 plants, 30 of them perfect flowered and 30 female, turned up with the fruit character of the immediate female ancestor modified by the pollen from the perfect flowered Blue Solo plants about it. These plants are shorter and wider topped than the standard variety and set tremendous crops of short, blocky, thick fleshed fruit. The outstanding factor, however, did not show until fall. These plants show a definite resistance to the disease called Papaya Leaf Spot.

When freezing weather came, they showed a very definite resistance to cold. As near as I can calculate, the exact point they will take is about 3½ degrees lower temperature than the standard Blue Solo without damage. This seems to mean that we now have the beginning of some 30 varietal forms in the 30 hermaphroditic plants that are first generation hybrids. These Solo segregate female and perfect flowered seedlings adhere to a certain general pattern of plant and fruit character. Now some 18 years previous experience indicates that it will be possible to take each of these perfect flowered first generation hybrids and from them in the course of three generations build a new strain by selection and self fertilization of seedlings in single plant progenies; that these new strains will have the plant and fruit character patterns of each selected individual first generation seedlings; and that after three generations they will come out at approximately 65% perfect flowered seedlings and to that extent they will be very closely in line with the new pattern. 34% of female and 1% male will not adhere to the pattern as to plant character, and their fruit character can not be determined. I believe we are on the verge of developing a new race of Papaya that will be, to a marked extent, disease resistant and to a certain extent cold resistant. I don't need to tell you Papaya minded people how important both of these things are.