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PREDICTING MINIMUM TEMPERATURES FOR FROST PROTECTION.

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The question of protecting fruit and truck crops from frost damage by building fires of oil, coal, or wood, is receiving considerable attention in Ohio and some 40 to 50 of the most progressive fruit and truck men are now practicing orchard heating.

The United States Weather Bureau has encouraged these efforts by establishing special frost-fruit stations for the purpose of studying local temperature conditions and for giving information as to the probable temperatures that may be expected on nights when frost damage is likely.

It is known that fruit buds will stand lower temperatures at some periods of their growth than at others and that the minimum temperature will vary greatly under different topographic conditions. The ability to determine approximately the lowest temperature for any night when fruit buds or truck crops are in a critical condition will determine whether plans must be laid for starting the fires.

The officials of the Weather Bureau by studying the approaching weather conditions from the daily weather maps and by a knowledge of the average daily range in temperature, the dew point temperature, and the varying temperature under different elevations makes very close temperature forecasts and sends this information to a large number of places in the State where heating is practiced.

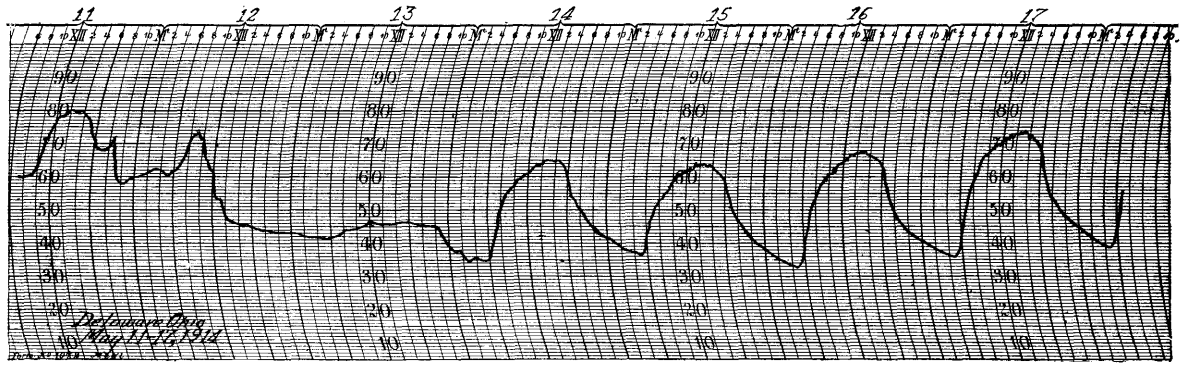


Fig. 1. Record made by a self recording thermometer at Delaware, Ohio, May 11 to 17, 1914.

It seems important, however, that some plan be devised whereby a fruit man not in touch with the Weather Bureau and its maps and forecasts can closely estimate the probable lowest temperature at critical periods.

In investigating this point in connection with our special fruit service in Ohio, we have found that the prediction of the minimum temperature from the time of the average afternoon median temperature gives very close results.

Figure 1 is a copy of the temperature record made by a self recording thermometer at Delaware, Ohio, from May 11 to May 17, 1914. This shows a rapid fall in temperature beginning at about 10 a. m. of the 12th. This was due to a shift of the wind to northwesterly and the small change that occurred in the temperature from the afternoon of the 12th to the early morning of the 14th was because of continued northerly winds and rainy weather.

Beginning on the 14th, however, and continuing through the balance of this week and most of the following week, there was a period of clear and comparatively still weather when an area of high barometer pressure was centered over this district. Under these conditions the temperature rises high during the daytime under strong sunshine, and then falls quite low at night under free radiation. It is under conditions of this kind that frosts may be expected in the spring and fall. It will be noticed that the rise in temperature is rapid in the early forenoon and that the thermograph curve has a decidedly convex shape.

The highest temperature will be reached at about 3 o'clock in the afternoon. The temperature will fall slowly for two or three hours, then there will be a rapid fall in the evening and a slower fall until the lowest point just before sunrise. The afternoon curve has a decided concave shape. There is a marked similarity in the curves during these days when frosts threaten.

This being true the question was raised whether the half way point in the temperature fall from the maximum of one day to the minimum of the next morning might not occur at about the same time each evening.

A study of available records showed that in May the half way temperature occurred at Delaware on an average at 7:36 p. m. and that the variations on either side of this time was less than 20 minutes in either 1913 or 1914.

For example the highest temperature at Delaware on May 14, 1914, as shown by the thermograph record in Figure 1, was 65. The temperature at 7:36 p. m., the average time of the median, was 51. Subtracting this from the maximum leaves 14. If we take 14 from 51 then we shall have 37 as the predicted minimum temperature during the coming night, by this method. The lowest temperature that actually occurred was 36 or only 1 lower than estimated.

On the 15th the predicted temperature would be 34, while the thermometer reached 33. On the 16th and 17th the exact minimum would have been predicted.

Rules to follow. The average time of this median hour will vary under different weather conditions, at different seasons of the year, and in different localities. Outside of the cities, in central Ohio, under conditions of clear skies and comparatively still air, it will be close to the following.

April, 7:15 p. m.; May and June, 7:30 p. m.; September, 6:30 p. m.; October and November, 6 p. m. In July it is about 7:30 p. m., and in August, 7 p. m.

If a strong wind is blowing in the afternoon or if the afternoon is cloudy or partly cloudy, and the wind goes down and it clears off in the night the time of the median temperature will be from 30 to 45 minutes later than the average given.

If it should cloud up during the night after a clear afternoon and evening the minimum temperature will not be quite so low as is indicated by the median.

In cloudy and stormy weather, or when strong southerly winds prevail, or if the wind is high from the northwest the time of the median varies so much that no attempt should be made to make predictions from it.

This is especially true when after a period of warm weather the wind shifts to northwesterly and the temperature begins to fall rapidly. This indicates the approach of a cool area and the only way to estimate the probable minimum temperature is from the daily weather maps.

But after the windy front of this cool wave has passed by and the air is clear and still and the days are warm and the nights cool and frosts threaten then the plan can be used.

Reliable maximum and minimum thermometers should be obtained and exposed in a lattice work shelter where the air circulates freely and the sun will not strike the instruments.

The difference in temperature between that at the average half-way or median hour should be subtracted from the highest during the day and the difference subtracted from the reading at the half way hour. The remainder will show the approximate lowest temperature during the coming night.

Records that are at hand indicate that the average time of median will be slightly later in the valleys than at higher elevations, but each man interested should be able to determine his own median hour by careful records of the temperature.

The Weather Bureau office at Columbus will continue its study during the coming year at a larger number of stations than were in operation last year.