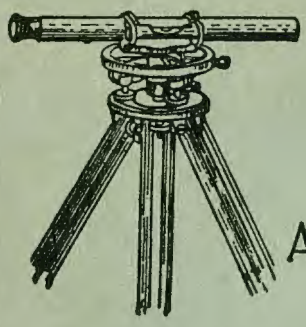

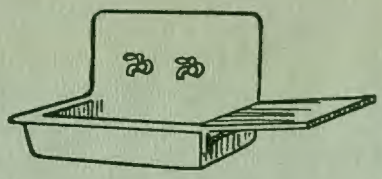

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CONTROL OF SUMMER FROSTS ON PEAT LANDS

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Temperature records of the Division of Agricultural Engineering, University of Minnesota, show that frosts may occur during any month of the year on the low-lying peat areas near the Twin Cities. This fact presents a very serious problem since a large part of this land is devoted to the production of expensive truck crops. The frost hazard shortens the growing season at both ends, thus depriving the grower of the best market, and occasionally frost does great damage even in mid-summer.

Peat soil, being a poor conductor of heat, does not store heat from the sun's rays in the daytime and radiate it into the layer of air immediately above the ground at night, thus stabilizing the air temperature, as does the mineral soil. On a still evening the cold air settles into the low areas having poor air drainage where the peat soil is found. Here it continues to lose heat to the upper air by convection. On this account frosts occur more frequently and more severely on peat lands than on the mineral soils. Various methods of frost control are practiced in different parts of the country. The two most important of these, heating by use of smudge pots and protection by overhead sprinkler irrigation have been used in Minnesota and are discussed in the following paragraphs. Use of irrigation other than by sprinkling will aid to some extent in warding off frost but is not nearly as effective as where the plants themselves are kept wet. Improving the air drainage of the field, where this is possible, is very beneficial. Keeping the soil well compacted improves its ability to conduct heat and in this way has been shown to be of some definite value in preventing frost injury. Stirring the air by mechanical means as a method of frost protection has been claimed by some to be effective but sufficient experimental data is not available to justify further consideration of this method here.

Smudges for Frost Protection

In the fruit growing sections of the West smudges or heaters are used effectively for frost control in orchards. This method was also tried out for vegetables on peat lands in Minnesota. Two gallon pails were placed uniformly over the field at the rate of about 200 pails per acre. Fuel oil was burned in these pails when the temperature reached freezing. It was found, however, that the heat from these burners rose rapidly away from the ground leaving the mantle of cold air still around the plants. While this condition is satisfactory for orchards it did not protect the low-growing truck crops and sometimes plants only six feet away from the burners were frozen. This method is expensive and requires much hard and disagreeable labor. Homes in the immediate neighborhood are fouled with soot when smudges are burned. For these reasons this method is judged unsatisfactory for vegetable crops on peat lands. Therefore its use for this purpose is not recommended.

Protection by Overhead Irrigation

Protection against summer frosts by overhead sprinkler irrigation has proven very satisfactory both in experimental tests by the University and also on the farms of some commercial growers in Minnesota. The initial cost of an overhead irrigation system is high; hence, except for a few specialized crops it does not usually pay to install one for frost control alone. However, a great many of the truck farmers already have systems installed for supplemental irrigation. These systems may be used for frost control with very little additional expense.

Dew is Nature's method of frost protection. Owing to the heat liberated by the freezing water the descending temperature of the plants on a frosty night is arrested at 32 degrees F. until all of the dew which settles on them is changed to frost. Then the temperature continues falling and drops below 32 degrees. If the dew is light this takes a relatively short time. If the dew is heavy the temperature stands at 32 degrees for a longer period of time and sometimes injury to the plants is thus prevented. The plants are not injured until a temperature slightly below 32 degrees is reached because the freezing point of plant juices is lower than that of water. Some plants stand lower temperatures than others because of the greater concentration of the solution of their plant juices. Obviously if either the plant, or the coating of ice on the plant, is kept wet the temperature will not drop below 32 degrees and the plants will not be injured even though the temperature of the surrounding air is considerably below freezing. (A temperature of 26 degrees F. has frequently been protected against and in our experience tomatoes have been sufficiently protected at 22 degrees F. so that they continued to bear.) In the event of a light frost where the plants are not protected more damage is done by the rapid, uneven thawing under the bright sun following the frost than by the freezing itself. For this reason sprinkling before sunrise after a frost, resulting in slower, more uniform thawing, will often save a crop. When plants are sprinkled during a period where the temperature is several degrees below freezing a coating of ice will accumulate on the leaves and stems. If the sun comes out brightly next morning the sprinkling should be continued until all of the ice has disappeared.

Where an overhead irrigation system is used for frost control the automatic oscillator or turnmotor is essential as all the plants must be wetted frequently. It is also desirable, altho not essential, to have a temperature controlled alarm to awaken the attendant when the temperature reaches the danger point. If the pump is electrically operated the thermostat may easily be arranged to start the pump motor directly. An automatic self-starter on a gasoline engine powered system may be actuated in the same way but is more expensive and less reliable. In any case there should be an alarm system to warn the attendant in case the system fails to function when it should.

Standard nozzles in a sprinkler system are usually spaced three feet apart. However, it has been found that nozzles of this type which throw a concentrated stream should be spaced only two feet apart adequately to cover the plants in between the streams. This setup increases the rate of application and will protect against a lower temperature than the standard spacing but it is sometimes objectionable in that it causes a waterlogged condition of the soil sooner than where the three-foot spacing is used. Ordinarily it would seem advisable not to increase the rate of application of water from the standpoint of frost control, but rather to use a type of nozzle which will spread the stream of water more, giving a more uniform distribution at a three- or four-foot spacing.

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