

Frost Protection of Strawberries

In the Strawberry Patch

Strawberry plants bravely bloom in early spring. This often occurs before the last frost of the season. At this point the strawberry plants are covered with blooms that are lying close to the ground. Most North Carolina farmers use plasticulture to hold in heat but it doesn't provide enough heat for growing plants during a frost event. Farmers have to use methods to protect their crop from frost injury. Frost occurs when the temperature around the plant drops below 0°C (32°F). Frost can kill flowers outright, or injure them enough to cause misshapen berries. When a flower is injured by cold, the pistils are killed first. If killed after pollination, then embryos do not develop.

Critical Temperatures

Scientists have studied critical temperatures of strawberries based on stage of development (Perry and Poling, 1985). These temperatures are listed in the table shown below at each stage of development.

Stage of Development	Approximate Critical Temp.
Dormant Plants	-10 (15 F)
Tight bud	-5.5 (22 F)
“Popcorn” (closed but visible flower)	-2.2 (26 F)
Open blossom	-1.1 (30 F)
Fruit	-2.2 (28 F)

The temperatures listed are plant tissue temperatures, and are a degree or two lower than the critical air temperature in the plant canopy. There are many variables that affect the actual critical temperature for a given plant and the amount of injury.

- Duration of cold
- Growing conditions prior to the cold event
- Cultivars: (because of plant habit, or avoidance, rather than genetic differences)
- Stage of development
- Super cooling (in the absence of ice nucleation points, plant sap can cool below the freezing point without forming ice crystals)
- Soil type and condition (moist dark soil holds more heat than dry light soil)

Symptoms of Frost Injury

A seedy spot on the berry forms, with hollow seeds. Sometimes fruit cracks at the bottom. Leaves can also be injured by the frost, especially when they are growing vigorously and very tender. The edges or tips of leaves blacken, and then dry out.



Protection Measures of Strawberries

The measures strawberry growers take to protect their plants from frost are determined by several factors besides temperature. These include:

- Stage of growth of the plants (flowers are more susceptible than other parts of the plant).
- Number of flowers on the plant (percentage of crop at economic risk).
- Time of year (even if a plant is flowering in January, there is no point protecting those flowers, as they are likely few in number and will also ripen before any buyers are ready for them.)
- Farm capability – Does the farm have row covers and, if so, is enough labor available? Does the farm have overhead irrigation? Is enough water available? In a drought year, growers may forgo early frost protection so they can be sure to have enough water in their ponds for critical later freezes.
- Economics – Does the potential loss of strawberries from weather events justify the labor expense?

Bloom and flower parts are most susceptible to freezing temperatures. Each bloom will become a strawberry; therefore, farmers have to protect the blooms to preserve their potential crop. So, does the potential loss of strawberries from weather events justify the labor expenses incurred? In January, the blooms may not be worth protecting but if plants are blooming in March, it is close enough to the start of the season it may justify the expense.

Irrigation for Frost Protection

Activity 1

Most growers rely on overhead irrigation for frost protection. The process of water turning to ice releases enough heat to insulate the flowers from freezing temperatures. Farmers will stay up all night checking sprinkler heads to make sure they are working properly. Once temperatures climb above 33 degrees Fahrenheit, farmers will start turning off sprinklers.

Farmers must use sprinkler heads designed for frost protection. These have low output nozzles, made of metal rather than plastic, and the spring is covered to prevent freeze-up. Sprinkler rotation should be rapid, at least 1 revolution per minute. The back nozzle should be plugged. The sprinkler system must have the capacity to irrigate the whole field at one time. Also, farmers need enough water on hand to irrigate the growing plants for several nights in a row to provide protection. For example: For 1 acre, you need about 60 gallons per minute, to irrigate 0.125 inch/acre/hr. This is 3600 gallons per hour. If irrigation is required for 10 hours, you need 36000 gallons per night. Plan to irrigate for several nights in a row.



Row Covers

Farmers can also use row covers for frost protection. Row covers reduce evaporative cooling and the rate of cooling under the cover. According to vendor's information, the heavier weight covers (1.5-2 oz/yd²) used to cover the strawberry plants can hold in heat 4-6 degrees warmer than the outside temperature, but this varies both with weight and between manufacturers. Row covers can be helpful in buying time on a frosty night.

Some farmers use overhead irrigation and row covers in unison. When using both methods, the farmer needs to know the plant temperature under the cover. The farmers will start when temperatures under the cover drop to 0.6 - 1.1°C or below 33°F. They will irrigate right over the cover. When temperatures start to climb above 33°F the farmer will stop irrigation. Farmers can use digital soil thermometers inserted in the flower buds for successful protection with covers.



Credits

http://www.omafra.gov.on.ca/english/crops/facts/frosprot_straw.htm Photos and information used from this source.

Additional Links

<http://www.farmzone.com/> This website will bring better understanding and awareness to dew points and weather events related to agriculture.