

Using Overhead Sprinklers for Effective Frost Protection in Orchards and Vineyards

Achieving effective frost protection in orchards and vineyards depends on having the right equipment and resources available to combat frost's effects.



The severity of a frost event depends on several factors including the type of frost, rate of temperature change, relative humidity, wind, soil conditions, topography, and crop sensitivity.

Overhead sprinklers are a proven safeguard and can provide a reliable, pollution-free, low-labor, and economic solution for protecting developing buds, flowers and fruits during radiation frost events. Just one radiation freeze event, where temperatures drop below 24° F, can result in up to a 90% loss.

This report focuses on the core principals of overhead sprinkler frost protection and three key performance requirements to be considered when selecting overhead sprinklers.

Key Performance Requirements

Choosing the right sprinkler for your application can mean the difference between effective frost protection and crop loss. Achieving successful frost protection using overhead sprinklers is highly dependent on three variables.

- 1. Fast and consistent rotation time**
- 2. High Distribution Uniformity and large droplet size**
- 3. Reliable cold temperature operation**



The Principles of Overhead Frost Protection

Use Water to Make Ice to Insulate Plants at 32°F

The primary objective of frost protection using overhead sprinklers is to maintain a temperature of 32°F on the surface of the plant. This is achieved by applying water to form a thin layer of ice on buds, flowers, or fruits to insulate them from even colder air as temperatures continue to drop. It may sound counterintuitive to use ice to prevent freezing, but buds, flowers, and fruits are not made purely of water, so their freezing point is slightly lower than water. Thus, it is possible to create a layer of ice on the surface of the plant without freezing the plant itself. Frost protection with overhead sprinklers harnesses the same effect we see in bodies of water where an ice layer forms on the surface and insulates the water beneath and prevents it from reaching colder temperatures. Continual application of water is needed when air temperatures are 32°F (0°C) and below to maintain the thin layer of ice and frost protection benefits.

Requirement 1

FAST AND CONSISTENT ROTATION TIME

- **Water must be applied at regular and rapid intervals** to maintain a thin, insulating layer of ice on the surface of buds, flowers and fruits. To do this, you will need to select a sprinkler with a sustainable rotation time of less than 30 seconds across a wide range of pressures, temperatures, and flow rates.
- **Be careful with sprinklers that use liquid silicone** as a braking mechanism because silicone becomes more viscous as temperatures drop which can significantly slow down rotation time.
- **Rotors using an encapsulated impact drive mechanism are a safer choice** and provide robust and consistent performance even in the coldest conditions.

Requirement 2

HIGH DISTRIBUTION UNIFORMITY AND LARGE DROPLET SIZE

Consistency is vital for effective frost protection. Two critical factors to maintain are:

- **High Distribution Uniformity (DU)** – The measure of how uniformly water is applied to the area being watered.
- **Large droplet size** – The larger the droplet emitted from a sprinkler, the more effectively it reaches its target. Larger droplets have more mass and inertia to prevent them from being blown adrift by the wind which accompanies cold weather.



Requirement 3

RELIABLE OPERATION IN COLD TEMPERATURES

- Sprinklers must be able to withstand the elements and perform reliably in cold temperatures.
- Exposed drive mechanisms on traditional impact sprinklers can be compromised by ice buildup that slows or stops operation in inclement weather.
- The encapsulated drive mechanism in Rotors shields susceptible parts from ice buildup making them more durable and reliable in harsh weather.

Rotor sprinklers with an encapsulated impact drive mechanism are the best choice for overhead frost protection.



Rain Bird LF Series Sprinklers feature an encapsulated impact drive mechanism that uses very few moving parts to provide consistent rotation and smooth operation regardless of changes in water pressure and temperature. This helps to maintain fast rotation and regular, rapid watering intervals.

CASE IN POINT



Apple Orchards | April 2021 – France

Rain Bird LF Sprinklers were recently put to the test in April of 2021 in Sisteron France when record cold reached 25°F (-4°C). Our sprinklers did not fail when others did, despite harsh weather conditions, and successfully saved an Apple Orchard.