COOLING SYSTEM FOR ORCHARDS AND VINES

ISSUE 16 | 27 JULY 2022

Rising temperatures are one of the major consequences of climate change which have harmful effects on agriculture and particularly on fruit crop production. The impact of this change on orchards and vines is likely due to its detrimental effects on duration of crop growth.

Some changes affect fruit crops and vines at different phases of growth and development. Extreme heat during summer and autumn can affect fruit quality through sunburn damage, poor blush development, rapid fruit ripening, increased sugar contact, reduced fruit growth and low fruit yield.

The temperature effect on any single crop is difficult to predict since fruit trees are perennial in nature and mitigation measures after the orchards or vines have developed are difficult to implement. Adopting new technologies, managing existing technologies properly or some variation of these to suit the changes are therefore the key measures to overcome these effects on fruit production and quality.

Determining exactly when the impacts of warming temperatures will affect production is difficult because of uncertainty in climate projections, seasonal climate variability and variability within orchard or vine crops themselves. Growers can make short-term predictions about likely climate change impacts in their own groves using seasonal climate records together with orchard data.

Above canopy misting system reduces leaf and fruit temperatures at the maximum air temperature with the highest radiation and evaporative demand.

An orchard in Washington featuring an "Above Canopy Misting System" by the method of applying low-flow foggers to cool the fruit trees.

DIG'S EXL FOGGERS OFFER AN EFFECTIVE COOLING SYSTEM

Sunburn management, a major issue for apple growers in Washington state, has been worsening because of higher summer temperatures. Many growers installed overhead sprinklers to cool the orchard canopies, but tree growth chemistry showing less nutrients to the fruit along with increasing energy costs and water demand have growers looking for other options.

Orchard cooling systems use low-flow micro sprinklers or foggers. The relative contribution of each is dependent on climatic conditions, water application rates, application uniformity and system operating cost. One of the most effective cooling systems currently in use, with over four million foggers installed in the last three years, is DIG's EXL Series Low-Flow Foggers mounted in an upright position above the tree canopies.

DIG's EXL foggers provide better cooling effect due to very fine droplets, lower flow rate and a blanket misting coverage design over the orchard for a very effective cooling system. Due to the fine droplet size, the cooling mechanism effect is a decrease in air temperature from evaporation of water from the air, followed by removal of the water vapor deposit on fruit skin surface by air movement, leading to overall lower temperature for better yield.

The EXL Foggers incorporate a vortex design that swirls water droplets into a fine mist.

CHALLENGES OF FRUIT PRODUCTION

One of the existing technologies used today to cool fruit crops is a **misting system**. Research has shown that the main effect of an above canopy misting system is reducing leaf and fruit temperatures at the maximum air temperature with the highest radiation and evaporative demand.

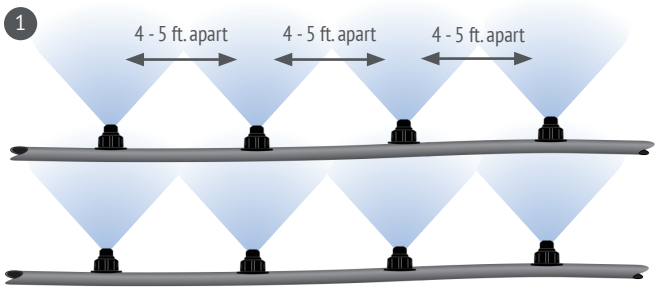
DIG'S EXL SERIES LOW-FLOW FOGGERS

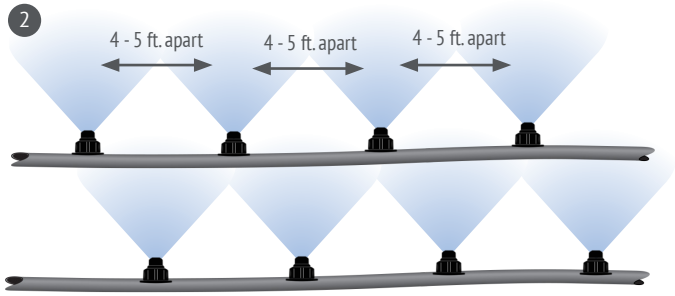
COOLING SYSTEM FOR ORCHARDS AND VINES

DIG's EXL Series Low-Flow Foggers operate at a nominal pressure range of 50 PSI (3.5 bar) to produce micro-sized droplets which evaporate quickly, leading to cooling conditions that reduce the surrounding air temperature. DIG's misting system lowers plant canopy and fruit skin surface temperatures compared to other systems with lower flow rates, leading to increased productivity. Each fogger's vortex design spins incoming water into a very fine mist, with higher incoming pressure supporting smaller and finer droplets.

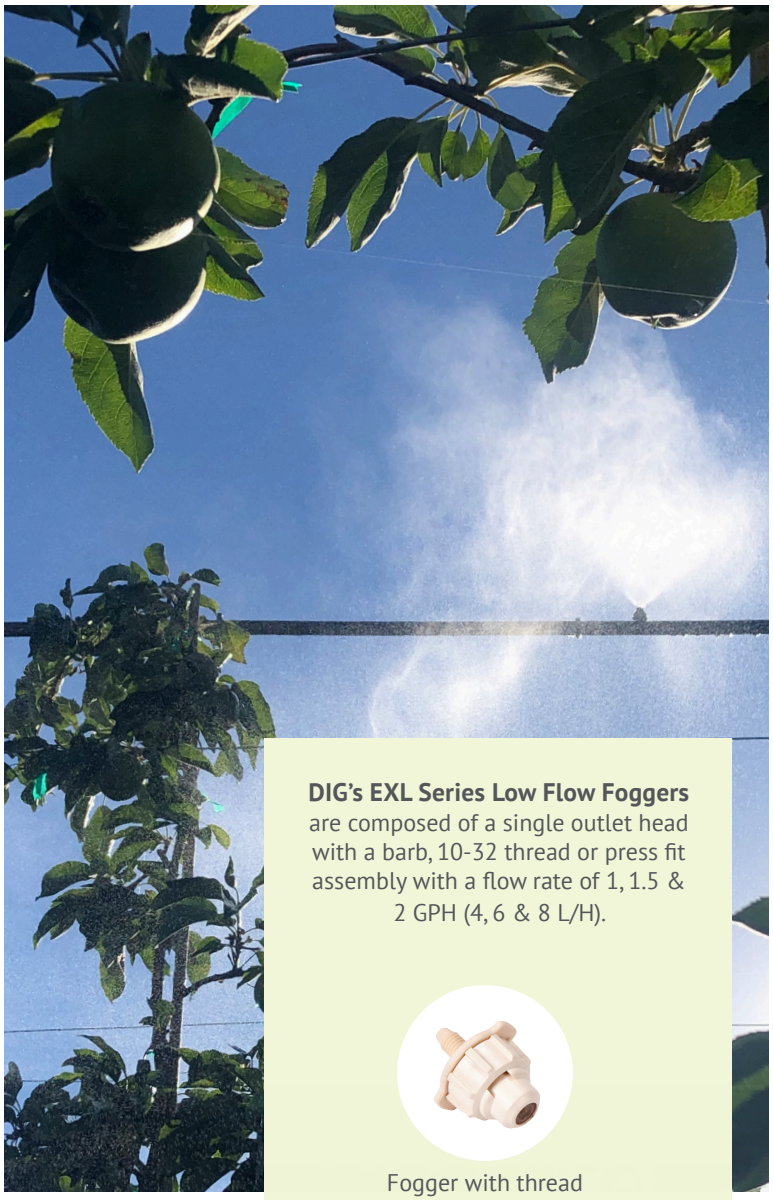
SPACING LAYOUT

Recommended spacing for the fogger heads is 4' to 5' (1.2 to 1.5 m) apart with total flow per acre of 18 to 24 GPM (68 to 91 L/M), depending on flow rate and spacing, for total misting blanket coverage and better cooling effect with lower light transmission.





The EXL foggers can influence canopies, foliage, and fruit skin surface by decreasing temperatures up to 20°F (6.6 °C). They deliver optimal cooling or humidifying conditions by reducing temperature and increasing humidity.



DIG's EXL Series Low Flow Foggers are composed of a single outlet head with a barb, 10-32 thread or press fit assembly with a flow rate of 1, 1.5 & 2 GPH (4, 6 & 8 L/H).

Fogger with thread

Fogger with barb

Fogger with press fit assembly

References

Evans, R. 1999. Over tree Evaporative Cooling System Design and Operation for Apples in the PNW
https://www.ars.usda.gov/ARSUserFiles/21563/Overtree%20Evaporative%20Cooling%20System%20Design.pdf

Cooling Mechanisms for a Tree Fruit Orchard
http://treefruit.wsu.edu/cooling-mechanisms-for-a-tree-fruit-orchard/

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