

Cold Fogging

for the Future

By Thomas Meyer

In European greenhouses, conventional spraying with output quantities of 500-1,500 liters, or even more, of spraying liquid per 2½ acres is still widely used. But scientific advances, practical experience and increasing awareness of environmental concerns are leading to an emphasis on integrated pest management. The target is to conserve natural resources and avoid stressing the environment with chemical preparations and unsuitable application technology.

A reduction of the spraying quantity per unit area in a greenhouse is only possible by a uniform space treatment, which can optimally cover all leaf surfaces. The determining factors for the choice of the best application technology are, therefore, the achievable biological effect with the related environmental, economic and organizational advantages.

Application and Technical Aspects

Since the late 1980s, cold fogging technology has grown in importance in greenhouse cultivation. Experience shows that suitable cold fogging machines will achieve a more effective use of chemicals and savings of water and energy. With this technology, highly concentrated plant protection preparations (with the same concentration of active ingredient or formulation) are used with water as a carrier, and the total application quantities are approximately 2-6 liters/10,000 square feet. This quantity depends on the height and leaf masses of the crop and on the specific application situation, such as the degree of infestation.

Cold fogging is also defined as a ultra-low-volume (ULV) application, which produces extremely fine droplets (1-50 µm) for optimal penetration and coverage.

The following droplet sizes are relevant for

- flying insects: 10-30 µm
- leaf nematodes: 20-40 µm
- fungus diseases: 30-50 µm

Most machines on the market use a pneumatic method of droplet preparation, with an electric motor driving a compressor which produces an airstream. The fogging solution is conveyed by pressure (Venturi effect) and atomized into fine aerosol droplets at the nozzle system. There are also units using a high-pressure system for generating the droplets and, finally, others that "produce" droplets through spinning disk systems. Usually, the droplets produced by the aforementioned systems are transported by a controlled airstream driven by a fan installed on the unit. The droplets are distributed evenly within the greenhouse by horizontal and vertical air circulation. During application, the greenhouse must be sealed to avoid any losses caused by leakages or open vents.

Advantages of Cold Fogging Technology

Cold fog generators that are technically up to date offer many benefits.

Application. Fogging causes no dripping losses or spraying stains. Thanks to the long persistence of the fog, insects are exposed for a longer time than with a conventional spray. The fog also achieves optimal penetration, distribution, coverage and adhesion on the surface of the leaves.

Labor. These machines also are usually fully automatic, so contact between operator and chemicals is minimized — it's only necessary if someone needs to fill the solution tank. The workload of fogging, compared with the time and labor required for conventional spraying, is low. Each grower should calculate first how much time and labor cost he is spending when applying conventional spraying, and then he can estimate the payoff period of the unit from the saved labor cost. The work organization can be optimized because the unit can be used after normal working hours in the greenhouse.

Convenience. Noise level is reduced compared to motor-driven sprayers or thermal foggers. Optimal and even distribution of the chemical ingredients is achieved within the greenhouse, especially when you use a small amount of stabilizers such as emulsifiable crop oil or polyethyleneglycole. This stabilizer keeps droplets from evaporation too quickly and keeps them airborne for longer.

Available for nearly 20 years, cold fogging technology continues to develop and can act as a greenhouse workhorse for integrated pest management — with an eye toward sustainability.

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Considerations for Purchase and Use

Growers considering cold fogging machines should examine the following criteria before making their final decision:

- Can the unit work fully or

semiautomatically and, therefore, be left alone during application?

- Is the solution tank of the unit large enough to treat the total surface of the greenhouse?
- Can the unit also apply wettable powders without a problem?

If it's a high-pressure system, how does it prevent clogging?

- Does the unit control air circulation and the reach of the droplets over a long distance, such as by a system design that incorporates an additional built-in stator? Large

fans do not always indicate high performance. Normal fans installed with a nozzle system can cause turbulence in the emitted air stream and lead to uneven distribution and reduced reach of the droplets.

- Is the unit equipped with a continuous agitating device to keep mixtures in suspension over a longer time period?
- Does the unit provide sufficient post-ventilation for a prolonged circulation of the airborne droplets?
- Is the right droplet spectrum produced for the intended target application?
- Does the unit provide automatic or semiautomatic flushing after the application?
- If the unit is equipped with a compressor, is it enclosed and oil free to avoid damage to the plants by losses or leakages?



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Let the unit fog about 12-24 inches above the plants or into a main pathway.

Application Advice

Once you purchase a unit, here are some basic issues to address:

First, ensure a sufficient quantity of water as a carrier. With low crops such as potted plants and most cut-flower varieties, that's at least 2 liters of water/10,000 square feet including chemical and stabilizer. The greater the quantity of water, the more droplets will be produced, thereby increasing the uniformity of coverage and even distribution to "hit the target."

The use of stabilizers is necessary, and it will determine whether you succeed or fail. If the humidity in the greenhouse during application is above 90 percent, adding 5 percent, as calculated from the total mixture, is recommended. If the humidity is below 90 percent, add 10 percent as calculated from the total mixture.

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The more droplets that are produced, the better also the critical under-leaf coverage. Experience has shown that the ratio of coverage on the surface of the leaf compared with the under-leaf coverage is approximately 1 to 8. By increasing the number of droplets by applying more water, the absolute number of droplets covering the bottom side of the leaves is also increased.

Never let the unit blow directly into the plants. Let it fog 12-24 inches above the plants, or let it fog into a main path, to avoid damages caused by an excessive concentration of chemicals. The circulation of the "fogging cloud" or aerosols should be freely dispersed and without obstacles.

Always ensure correct dosage and mixture. In each case, clean and tepid (68-86° F) water should be used to prepare the mixture.



Nearly all chemicals suitable for conventional spraying with water can also be used for cold fogging. Follow local laws and regulations and use only chemicals that have passed registration, and pay attention to the application advice of the chemicals manufacturers. Experiences of other growers should also be considered.

The advantages of cold fogging machines (or ULV aerosol generators) would surely justify a further market penetration in greenhouses throughout the world. The broad spectrum of machinery covering various capacities makes it possible to apply cold fogging technology in almost all sizes and types of greenhouses.

In the recent past, more and more biological insect control measures, such as the use of predators, have been implemented success-

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fully. But in the case of a severe infestation, sometimes the only solution is the application of chemicals. In this case, cold foggers can act as an "emergency task force." If chemicals are to be applied, they should always be used rationally

— and for this, cold fogging technology is ideal. 

Thomas Meyer is general manager of Swingtec GmbH, a Germany-based manufacturer of fogging machines. He can be reached at

info@swingtec.de. For more information, visit www.swingtec.de.

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