

Jet -Ag fogging trial

In California and other arid citrus production areas, early season navel and mandarin oranges are harvested and treated with ethylene gas for two or more days in humidified ‘degreening’ rooms at 20°C to accelerate the degradation of chlorophyll to enhance the orange color of the fruit rind. These environmental conditions are optimal for the development of green mold, caused by *Penicillium digitatum*, and blue mold, caused by *P. italicum*. Beginning about 2000, bin drenching with fungicides such as thiabendazole or imazalil before degreening was introduced in California. A consequence of these treatments is that the ethylene treated fruit are now treated protected by these fungicides, so this adds the additional risk that fungicide resistant isolates will develop and contaminate the degreening rooms, storage facilities, and packing equipment. Particularly when degreening is prolonged to 3 days or longer, decay of the fruit during degreening is common and contamination becomes severe. Periodic disinfection of the rooms by fog or mist applications, when the fruit are absent, is done to decontaminate them. Formalin solution, which contains formaldehyde as an active ingredient, has long been used for this purpose, but a replacement is needed. Formaldehyde cannot contact the fruit or be used more than twice yearly, and the maximum rates of formaldehyde use decline progressively as the proximity of inhabited dwellings or schools approaches these facilities.

A dense suspension of conidia from a 2-week old colony of *P. digitatum* cultured at 24°C on potato dextrose agar was collected on a fine-haired brush and immediately applied onto one side of each of 20 to 24 craft wood sticks, 10 cm in length and 0.5 cm wide, and they were dried in air one day before use. About 1 hr before the sanitizer was applied, thirteen craft wood sticks were attached throughout the commercial citrus storage rooms where the sanitizers were to be applied, and six were placed in an identical untreated room. They were distributed at equal intervals along both walls and at the back of the room and placed either at low or high levels from the floor; half were placed about 50 cm in height from the floor, and half were placed 200 cm in height from the floor. The rooms were humidified for about 1 hr before the sanitizers were applied and the relative humidity was not less than 85% and the temperature was 20 to 22°C.

The disinfectant was added into the room at a rate of 3.5 fluid ounces of Jet-Ag™ (Jet Harvest Solutions, Longwood FL, 32791) hydrogen peroxide 26.5%, peroxyacetic acid 4.9%) into 1000 cu. ft of room volume. The citrus degreening room volume was approximately 36,500 cubic ft. Two methods of application were used. In method one (“low water volume thermo fogger”), one gallon of Jet-Ag was added to 3 gallons of water. The equipment used in the application of Jet-Ag™ is a proprietary new thermo fogger (Group AG, Rexburg, ID 83440) that uses heat to create a very small droplet size fog (<0.5 microns). In method two (“high water volume air assisted atomizer fogger”), one gallon of Jet-Ag was added to 100 gallons humidification water. The equipment used in the application of Jet-Ag™ was a proprietary air-assisted fogger (FGS Packing Services, Exeter CA) that used compressed-air assisted nozzles placed within a 1 meter diameter fan to disperse a fog (droplet size 10 to 15 microns). Delivery of the entire disinfectant volume required 3 to 4 hour period and the fog was allowed to remain in the room until it dissipated. The room was sealed as to not allow any of the fog to escape. After 24 hr, the room was opened, aerated for about 1 hr, and the craft wood sticks were retrieved. Each was placed in a sterile test tube, a small volume of 0.1% wt/vol Triton TX-100 was added, it was vortexed briefly, and a 20 µL volume containing 200 to 500 conidia was placed on PDA. After 18 hr at 20°C, the number of germinated conidia was counted at 200X with a compound microscope. By using commercial facilities, both the potency and homogeneity of the distribution of the materials within the existing commercial rooms could be assessed under practical conditions in a single test.

The Jet-Ag™ formulation of hydrogen peroxide and hydrogen peroxide was effective and practical for room sanitation purposes. Although the more sophisticated low water volume thermo fog was significantly more effective than the simpler high water volume air assisted atomizer fogger, both methods of application were excellent choices to sanitize storage rooms.

Treatment	Method	Germination (% , ±SD)	Range (%)
Control	...	93.3 (±5.5)	(85.0 – 98.0)
Jet-Ag™	high water volume air assisted atomizer fogger	2.0 (±2.6)	(0.0 – 8.3)
Jet-Ag™	low water volume thermo fogger	0.0 (±0.0)	(0.0 – 0.0)