SILICONE-BASED SURFACTANTS TO CONTROL PESTS ON HARVESTED CALIFORNIA CHERRIES

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Introduction

A variety of insects and mites are found on the surface of harvested fruit crops. These pests may have no economic significance for production of the fruit crop, but may become an issue for exported products. Sweet cherries are currently fumigated with methyl bromide prior to shipment to Australia and Japan due to the presence of various arthropod species. For a percentage of shipments, surface pests are found on arrival resulting in re-fumigation with methyl bromide. Methyl bromide fumigation reduces the postharvest quality of sweet cherries, and a second fumigation has a greater negative effect. Sweet cherries shipped to Japan have long been fumigated for control of codling moth. If recent efforts to prove the non-host status of sweet cherry for codling moth are successful, and methyl bromide fumigation is no longer required, the presence of mites may then become a greater issue.

Objectives:

- Determine the tolerance of fruit to immersion in various silicone-based surfactants or defoamers at several concentrations.
- Determine the effect of fruit immersion in various silicone-based surfactants or defoamers at several concentrations on the removal and survival of surface insect pests.

Materials and Methods

Mite Removal and Mortality

Cherries were artificially infested with laboratory-reared two-spotted spider mite, *Tetranychus urticae* Koch, placed in 200ml of solution (defoamer or surfactant), gently agitated in the solution for 1 minute, then removed and placed on dry paper toweling. The remaining solution was poured off onto a perforated buchner funnel with filter paper completely sealing the perforations. A slight vacuum was applied until all the liquid was eliminated, leaving the eggs and mites that had been removed from the cherries. Mites and eggs remaining on the filter paper were counted. Eggs present on the cherries after treatment were counted and removed, eliminating the possibility of recording eggs laid by mites that remained on the cherries and survived the treatment. Mites remaining on the cherries after treatment were assessed for mortality after 48 hours. Only mites remaining on the cherries after treatment were used to calculate mortality. Mites (and eggs) that were removed during treatment were not assessed since they would no longer be present on the cherries at pack-out.

Fruit Quality

'Bing' sweet cherries were harvested and sorted for major defects such as decay or cracking. Fruit were held at 0°C (32°F) overnight before treatment, then dipped for 1 minute with slight agitation in defoamer or surfactant diluted in tap water at 0°C. For treatments that required a rinse after exposure to the defoamer or surfactant, cherries were transferred to a tap water bath (0°C) and rinsed with slight agitation for 1 minute. Fruit were evaluated after storage to simulate either air [2 days at 5°C (41°F)] or sea shipment [13 days at 0°C (32°F)] to overseas markets, both followed by 15 hours of shelf-life at 20°C (68°F). Berries were subjectively evaluated for berry browning, stem color, pitting, cracking, and decay with a rating scale of: 1 (none), 2 (slight), 3 (moderate) or 4 (severe).

Results and Discussion

Mite Removal and Mortality

The most efficacious treatments for mite removal (other than eggs) were Silwet L-77 at 0.3% and Agrinse 7 at 2% with 89% and 82% removal, respectively (Fig. 1). Surfactant and defoamer treatments were less effective at mite egg removal and the most efficacious treatment was Surfactant 'A' at 0.5% with 75% removal (Fig. 1). Most other solutions removed <50% of eggs. Mortality was highest for mite lifestages (the egg stage was not evaluated) treated with Surfactant 'A' and Agrinse 7 (Fig. 2). Overall, mite mortality was higher in all defoamer or surfactant treatments than in the water only control; however, due to high variability, results were not statistically significant.

Fruit Quality

Cherries were assessed for berry browning, stem color, cracking, decay (data not shown) and surface pitting. The main effect on cherry quality was surface pitting. Differences were detected in the other cherry quality parameters but these were minor and were not consistent between simulated storage times. The higher concentrations of Silwet L-77 (0.5% and 1.0%) had significantly higher pitting (Figs. 3 and 4) after simulated air or sea shipping. Pitting scores were slightly higher for simulated sea shipment compared to simulated air shipment in both tests.

Conclusions

The materials tested had no significant impact on cherry quality with the exception of the higher concentrations of Silwet L-77 (0.5% and 1.0%). The most promising material proved to be Agrinse 7, due to the rate of mite removal and high mite mortality. Future plans include tests that would simulate a shower system similar to that used in commercial hydrocoolers or tests on a commercial packing line to evaluate mite removal under real-world circumstances and assess potential issues with foaming. We also plan to determine the effect of surfactant and defoamer treatments on mite egg mortality and test removal and mortality of thrips.

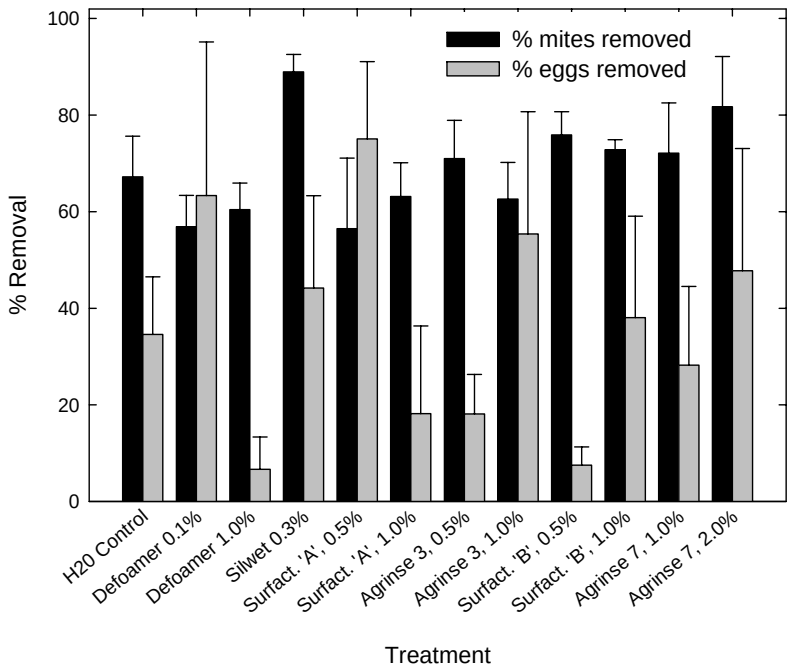

Fig. 1. Two-spotted spider mite removal (egg or active stage) from artificially infested cherries treated with various surfactants or a water only control (SE).

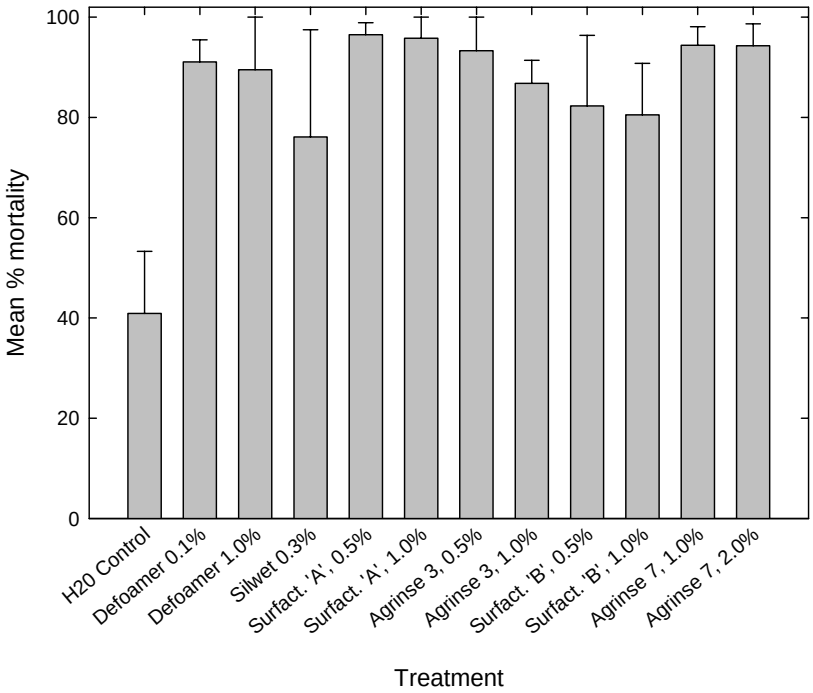

Fig. 2. Two-spotted spider mite mortality (active stages) on artificially infested cherries treated with various surfactants or a water only control (SE).

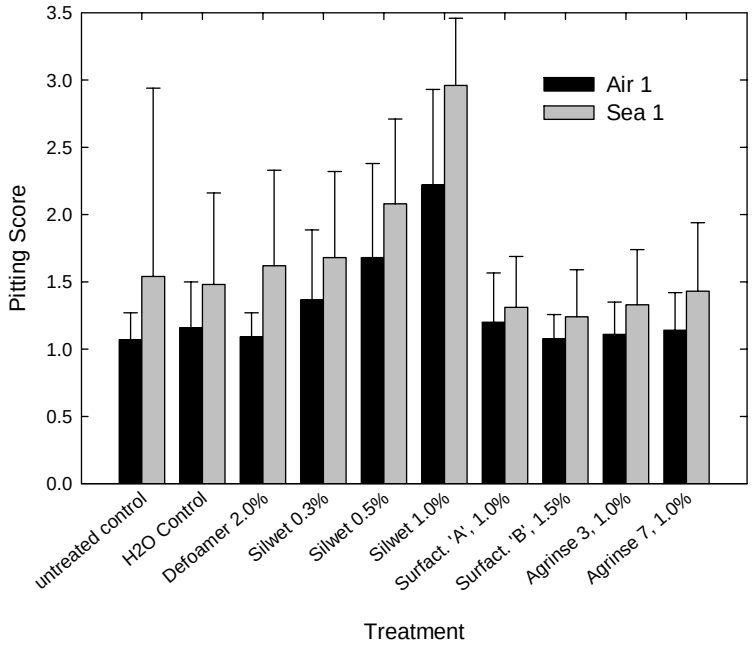

Fig. 3. Pitting scores for California 'Bing' sweet cherries exposed to a range of defoamers and silicone-based surfactants at low concentrations followed by simulated air or sea storage (SE). Rating scale: 0, none, 1, slight, 2, moderate, 3, severe.

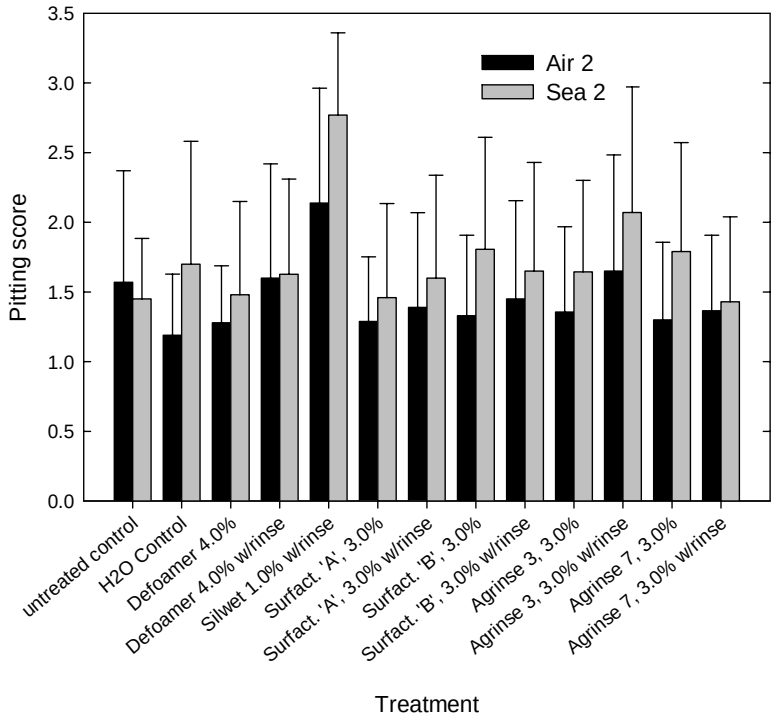

Fig. 4. Pitting scores for California 'Bing' sweet cherries exposed to a range of defoamers and silicone-based surfactants at higher concentrations with or without a water rinse after treatment, followed by simulated air or sea storage (SE). Rating scale: 0, none, 1, slight, 2, moderate, 3, severe.