BIN SANITATION:
AN EFFECTIVE WAY TO REDUCE CODLING MOTH AND FUNGAL DECAY SPORES

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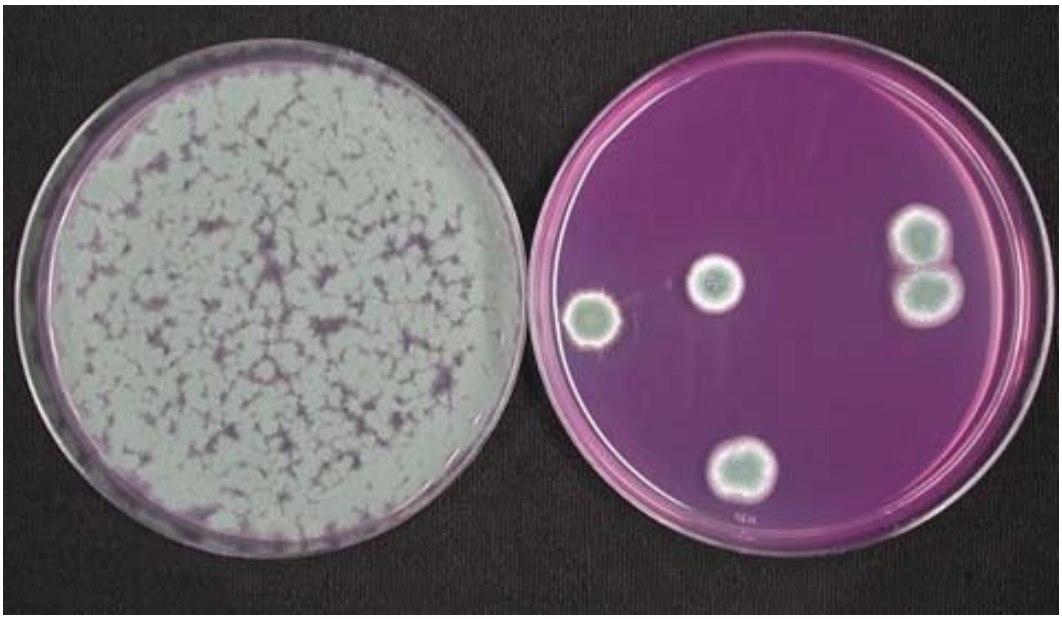
A major challenge in codling moth management is the reintroduction of moths in empty bins containing overwintering (or diapausing) larvae. The scientific literature shows that as many as twelve codling moth adults can emerge from a single wooden bin. If diapausing codling moth larvae could be eliminated from these containers, then control strategies would be more effective. Also, it is believed that bins may recycle blue mold (*Penicillium*) spores between the packing houses and orchards, providing spores from affected fruit to inoculate other fruit during the packing process.

Van Doren Sales and Auvil Fruit Company fabricated and tested a new type of sanitizer for apple bins designed to reduce the viability of both codling moth and decay spores. The bin sanitizer heats water to 170 °F and the bin is immersed for approximately 30 seconds. The system was evaluated at Auvil Fruit Company, Orondo, Washington, last spring by U.S. Department of Agriculture—Agricultural Research Service entomologist Jim Hansen and Washington State University –Tree Fruit Research and Extension Center plant pathologist Chang-Lin Xiao. The results are very promising.

Hot water dips may be a suitable method for treating larvae-contaminated bins. The effect of the heat need not be immediate. Heat-damaged larvae may not survive to become adults.



This photograph shows the difference in the number of *Penicillium* spores sampled from plywood bins before (left) and after the sanitizing treatment.

Mortality Rates

At the Yakima Agricultural Research Laboratory in Wapato, Washington, Hansen conducted a series of tests to determine the mortality rates of diapausing larvae due to heat. All larvae were killed when submerged in water heated above 122 °F. However, because diapausing larvae frequently overwinter in cracks and corners of wooden bins, treatment efficacy was determined by simulating this environment by placing the cardboard strips containing diapausing larvae between two wooden strips. Fewer than 16% of the larvae survived to adults when these wooden sandwiches were dipped into 176 °F water for 30 seconds. This provided a target temperature for a potential bin treatment.

Efficacy tests were conducted at Auvil Fruit Company using a unit built by Van Doren Sales for sterilizing wooden bins. Diapausing larvae in wooden sandwiches were held in sleeves attached to three locations inside empty bins: top, middle, and bottom. The bins moved along a track, submerged for 20 seconds in a 176 °F water bath within an enclosed structure, and then emerged on an open track, taking about 2.5 minutes to complete the cycle. When the larvae were allowed to continue development in the lab, only one adult emerged from among the 662 treated larvae, which represents 99.8% chronic efficacy.

This packing house demonstration clearly showed that diapausing codling moth larvae can be quickly controlled while residing in empty bins. The wooden bins hold heat after they leave the bath, which extended the actual treatment time. The treatment enclosure also retained heat, which further aids in the process, and the actual exposure was extended because of the time it takes to move the bins.

Blue Mold

Blue mold, caused by *Penicillium spp.*, primarily *P. expansum*, is a major postharvest disease on apples and pears. Because this fungus has developed resistance to thiabendazole (TBZ, Mertect), the product often fails to control blue mold when it is applied as a prestorage drench or on-line spray during packing. Resistant strains of *P. expansum* develop on decayed fruit during storage in the packing houses. Thus, it is necessary to sanitize bins before they are returned to the orchards.

Two tests were conducted at Auvil Fruit Company to evaluate the effectiveness of the hot water-dip treatment in sanitizing bins, particularly in eliminating spores of *Penicillium spp*. The first test was conducted using commercial wooden bins. Five replicate bins were wet prior to the hot water treatment. Three 8 x 8 cm areas on each replicate bin were swabbed with cotton Q-Tips before and after the hot water treatment. The Q-tips were placed in sterile water to make solution samples, which were then plated on an agar medium in the laboratory to quantify spore numbers. After about a 20-second immersion of bins in the hot water, the spore load on the bin surface was reduced by 89%.

In the second test, pieces of plywood (each 2 x 2 cm) were inoculated with *P. expansum* seven days before the test. Plywood pieces with abundant spores of *P. expansum* were placed in mesh bags and stapled on the bins. Bins were then subjected to the hot water dip treatment. Approximately 99.9% of the spores on plywood pieces were killed after the hot water treatment. The test results indicated that the hot water dips killed the majority of *Penicillium* spores on the surfaces of wooden bins, though it did not completely sterilize bins.

Our tests demonstrated that the hot water dips were beneficial in eliminating both codling moth larvae and *Penicillium* spores from bins. Although tests were not performed on plastic bins, it is

known that codling moth will overwinter in plastic as well as wooden bins. A question was raised about the ability of plastic bins to withstand the heat of the drench. Joe Johnson, technical services manager for Macro Plastics, stated:

> *The immersion of empty MacroBins in 170 °F water for three to four minutes will not damage our bins.*

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