

Pome Fruits—Biology

What's Hot in Alternative Quarantine Treatments for Codling Moth in Apples and Pears

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The efficacy of employing heat treatments as a means of attaining quarantine security for apples and pears infested with codling moth larvae was assessed. Apples and pears were subjected to both moist and vapor forced air heat treatments at three temperatures of 44, 46 and 48°C to obtain heating profiles. Three apple and two pear varieties were tested in the six different temperature/humidity treatments. The recorded heating curves of the fruit were separated into 12 heating profiles. The heating profiles were used to program a computer controlled water bath in which codling moth fifth instars were treated and assessed for mortality due to heat treatment. Nine of the 12 heating profiles resulted in 100% codling moth mortality within the 4 hour treatment period. The least successful treatments represented profiles in which the fruit core temperatures did not reach 44°C. Subsequent research was carried out on the 1993 season crop of fresh fruit to assess the impact of heat treatments on fruit quality. Only two temperature/humidity treatments were tested, those of 48°C at 98% RH (moist) and 44°C at 100% RH (vapor). Both of these treatments were shown to cause 100% codling moth mortality in the water bath system. Following heat treatments fruit quality was assessed both directly after the treatment and following 30 days of cold storage. Initial results indicate that the treatments did not cause internal damage or significant scald. In all cases, the fruit exhibited higher firmness levels than non-treated controls. There were also no significant changes in acidity, soluble solids, or taste. Only Granny Smith apples showed a slight bleaching in surface color. Fruit were subjected to extended cold storage under controlled atmospheres following heat treatments. However, these fruit will not be assayed until the end of January 1994.

Long-term, slow ramping heat treatments prior to cold storage of apples have been shown to reduce superficial scald. Three time/temperature regimes have been used to this end. They are 38°C for 4 days, 42°C for 24 hours, and 46°C for 12 hours. These heat treatments were used to assess their effect on codling moth mortality. The 38°C and the 42°C heat treatments did not cause 100% mortality in fifth instars of codling moth. The 46°C treatment caused over 90% mortality. When these treatments were combined with 28 days of cold storage, both the 42 and the 46°C treatments resulted in 100% mortality. As previously demonstrated, cold storage following a heat stress causes an increased effect on mortality than either treatment alone.

Table 1. Description of heating profiles of apples and pears and their effect on fifth instar codling moth mortality.

Profile # type	Chamber temperature (°C)	End core temperature (°C)	Time to set temperature	Duration to 100% mortality
1-Moist	44°C	42.1°C	104 min	not reached
2-Moist	44°C	42.2°C	102 min	not reached
3-Moist	44°C	41.9°C	114 min	not reached
4-Moist	46°C	45.4°C	120 min	150 min
5-Moist	46°C	45.1°C	120 min	180 min
6-Moist	46°C	44.8°C	120 min	210 min
7-Moist	48°C	47.4°C	120 min	120 min
8-Moist	48°C	45.4°C	120 min	180 min
9-Vapor	44°C	44.2°C	106 min	226 min
10-Vapor	46°C	46.3°C	110 min	110 min
11-Vapor	48°C	48.4°C	109 min	109 min
12-Vapor	48°C	48.5°C	103 min	103 min

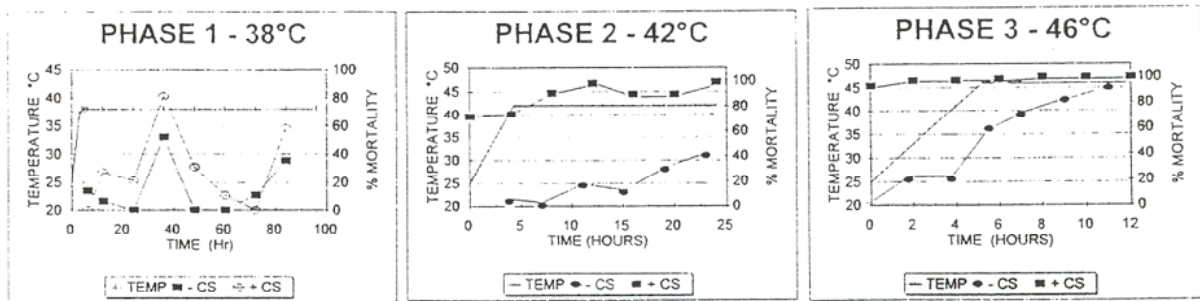


Fig. 1. Long-term heating profiles and the effect on codling moth mortality direction (-CS) and in combination with 28 days of cold storage at 0°C (+CS).