# ORGANIC QUARANTINE TREATMENTS FOR POME AND STONE FRUITS

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Non-chemical quarantine treatments for organically produced pome and stone fruits have been developed using the CATTS, Controlled Atmosphere/Temperature Treatment System technology. Two treatments have been developed against codling moth (*Cydia pomonella*) and western cherry fruit fly (*Rhagoletis indifferens*) in sweet cherries. One treatment is a rapid heating in a 47°C controlled atmosphere chamber under 1% $O_2$, 15% $CO_2$ environment for a total treatment time of 25 minutes. The other treatment consists of a rapid heating in a 45°C controlled atmosphere chamber under the same atmospheres, but for a 45 minute duration. The most tolerant immature stage of each pest to CATTS has been determined, along with varietal tests, dose response, and comparative efficacy. Efficacy tests consisting of 5,000 of the most tolerant stage of each species to each treatment were killed with no resulting survivors. Quality work showed that sweet cherries could withstand the treatment and maintain market quality for over three weeks of cold storage.

Two CATTS treatments were developed against codling moth and Oriental fruit moth (*Grapholita molesta*) in peaches and nectarines. One treatment is a linear heating of 12°C/hour to a final chamber temperature of 46°C under a 1% $O_2$, 15% $CO_2$ environment for a total treatment time of 3 hours. The other treatment consists of 24°C/hour to a final chamber temperature of 46°C under a 1% $O_2$, 15% $CO_2$ environment for a total treatment time of 2.5 hours. It was determined that the $4^{th}$ instar of both species was the most tolerant to the treatments. Dose response tests indicated that codling moth was more tolerant than Oriental fruit moth to the CATTS treatments. Confirmatory tests, consisting of 30,000 insects killed with no survivors, were performed against codling in peaches and nectarines for the two CATTS treatments. Efficacy tests against Oriental fruit moth were also performed for the two CATTS treatments. Market quality of yellow and white flesh peaches and nectarines showed that the fruit responded well to the treatments and could be stored for 3 weeks following treatment.

A total of four CATTS treatments were developed against codling moth in apples and pears, and Oriental fruit moth in apples. These treatments were also tested against plum curculio (*Conotrachelus nenuphar*) and

apple maggot (*Rhagoletis pomonella*). Treatments consist of linear heating of fruit, 10 and 12°C/hour, in a controlled atmosphere chamber, 1% $O_2$, 15% $CO_2$, to final chamber temperatures of 44 or 46°C for durations of 6 to 3 hours. Again, the 4$^{th}$ instar of both Lepidoptera species were determined to be the most tolerant to the treatment. Determination of the most tolerant stages of apple maggot and plum curculio were determined to be the egg and 5$^{th}$ instar, respectively. Limited varietal tests indicated no differences in mortality of the insects in respect to the variety tested. Efficacy tests of these treatments against codling moth and Oriental fruit moth are progressing and planned to be completed this winter. Quality assessments of CATTS treated apples and pears indicate that not only do the fruit tolerate the treatment, but in many aspects, quality is better than untreated fruits. In general, CATTS treated fruit maintain firmness during storage, show a reduction in superficial storage scald, have a slightly higher soluble solids to titratable acidity ratio (i.e. sweeter taste), and show a delay in ripening. In some situations, decay is also reduced over untreated control fruits.

The first commercial scale CATTS chamber has been constructed by TechniSystems of Chelan, WA and is in operation at PacOrganic in George, WA. Although CATTS is not approved as a quarantine treatment by any importing country, it is being used to reduce storage scald and maintain fruit firmness of organically produced apples and pears this season. Comparisons of CATTS treatment costs to conventional methyl bromide fumigation indicate that CATTS will be overall less expensive. Estimated costs of CATTS is in the range of $0.06 per pound or $1.34 per metric ton. Conventional methyl bromide costs run approximately $9.40 for sweet cherries and $10.15 for apples. CATTS treatments have progressed from the laboratory to the industry, and hopefully will be used in the near future to meet quarantine restrictions for U.S. organic fruits to various importing countries.