CONTROLLED ATMOSPHERE TEMPERATURE TREATMENT SYSTEM (CATTS): A HISTORY AND SUMMARY OF TREATMENTS FOR APPLES AND STONE FRUITS

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In 1992 the U.S. EPA decided to phase out the use of methyl bromide. Since methyl bromide was commonly used as a fumigant to treat apples and sweet cherries to meet export quarantine requirements, alternative treatments needed to be developed. It was determined to pursue non-chemical quarantine treatments to meet the needs of the tree fruit industry..

Many non-chemical quarantine treatments include the use of temperature extremes or controlled atmospheres. However, the use of high temperatures was not considered possible for deciduous tree fruits until ground-breaking research emerged from Israel on the use of high temperatures to control superficial storage scald and maintain firmness in apples (Klein 1994, Klein and Lurie 1992, Klein et al. 1990, Lurie et al. 1990, 1991). Following the publication of this research I worked with scientists Elizabeth Mitcham and Krista Shellie and an engineer, Dan Black of Techni-Systems, to develop CATTS (Controlled Atmosphere/Temperature Treatment System) technology. This technology applies a short-term heat treatment under a low oxygen high carbon dioxide environment. The application of a controlled atmosphere to a heat treatment reduces the total treatment time by approximately half (Neven & Mitcham 1996). The reduction in treatment time also improves the chances that fruit phytoxicity will remain at a minimum.

We have developed postharvest quarantine treatments against codling moth, oriental fruit moth, and Western cherry fruit fly using CATTS technology (Neven 2005, Neven & Rehfield-Ray 2006a). These treatments have been shown to be effective in controlling these major apple and sweet cherry quarantine insect pests while maintaining commodity quality.

There are two sweet cherry treatments consisting of chamber temperatures of either 45 or 47°C under a 1% O_2 and 15% CO_2 atmosphere for 45 and 25 min, respectively. We have performed numerous quality assessments of sweet cherries using these treatments and have demonstrated that quality is equal to or better than methyl bromide fumigated fruit (Neven & Drake 1998, 2000a, Neven et al. 2001,

Shellie et al. 2001). Both treatments have been demonstrated through efficacy trials to control both codling moth and western cherry fruit fly.

Numerous treatments for apples have been developed (Neven & Drake 2000b), but only one treatment has been tested for quarantine treatment efficacy and confirmation. The CATTS treatment of apples using a heating rate of 12°C/hr to a chamber temperature of 45°C and core temperature of 44°C in 3 hours has been shown to control the most tolerant developmental stages of codling moth and oriental fruit moth in both research-scale and commercial-scale CATTS chambers (Neven & Ray, In Press). In collaboration with Guy Hallman (USDA-ARS Weslaco, TX), we have also demonstrated the usefulness of CATTS against plum curculio and apple maggot.

We have developed two CATTS treatments for peaches and nectarines (Obenland et al. 2005, Neven et al. 2006b). We have found that using heating rates of 12 and 24°C/hr we are able to control the most tolerant stages of codling moth and oriental fruit moth while maintaining overall fruit market quality. We have demonstrated that this treatment is effective in controlling moth pests through efficacy and confirmation tests (Neven et al. 2006b).

The technology has progressed beyond laboratory-scale research units to ½ and 2 ton commercial units. The development of these treatments and their effect on both insect mortality and commodity quality are discussed.

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