COMBINATION OF HIGH TEMPERATURE AND CONTROLLED ATMOSPHERES FOR DISINFESTING HARVESTED WALNUTS OF CODLING MOTH

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Walnuts become infested with codling moth, *Cydia pomonella*, in the field and must be disinfested prior to shipping to countries having a quarantine against this pest. Controlled atmospheres and high temperatures have been studied as potential alternative treatments for methyl bromide. Combining these treatments to reduce the treatment time for controlling codling moth and other insect pests appears feasible.

An initial test determined the mortality response of codling moth diapausing larvae (the least susceptible life stage) to 39, 41, 43 or 45°C and to these temperatures combined with 98% CO_2 in air, 0.5% O_2 in N_2, or 0.5% O_2 plus 10% CO_2 in N_2. All atmospheres were conditioned to 60% relative humidity. Results showed that the higher the temperature, the quicker the kill, and that 98% CO_2 was the most effective with the 0.5% O_2 atmospheres being intermediate and air the least effective. Time for 95% mortality (LT_{95}) was 2.9, 6.2, and 16.4 h, respectively, at 45°C.

Based on results from the preceeding test, a small scale treatment chamber was designed to treat bulk walnuts. The chamber consisted of a cylinder 6 feet high by 1 foot diameter with a high speed recirculating blower and inline heater that could rapidly heat the inshell nuts and then maintain the required heat at a lower flow rate for the test duration. With a 60 pound load (4 feet deep by 1 foot diameter) and a recirculation flow rate of 210 CFM, the nuts were heated to 43°C within 1 h. The flow rate was reduced to 50 CFM and the controlled atmospheres introduced and maintained for 45.5 h for the hot air treatment, 14.5 h for the reduced oxygen treatments and 5.2 h 98% for the CO_2 treatment. Nuts loaded with codling moth diapausing larvae were placed within the upper surface of the column of nuts. The upper surface nuts were the last to reach the treatment temperature during the heating phase. All codling moth larvae were killed by all tested atmospheres.

High temperatures are very promising for disinfesting inshell walnuts of codling moth with greatly reduced treatment times when combined with low oxygen or high carbon dioxide atmospheres. Further research, including large scale testing, is needed to determine the effects of these treatments on sensory and chemical quality of nutmeats.