EFFECTS OF ACETALDEHYDE ON FRUIT QUALITY AND TARGET PESTS FOR HARVESTED STRAWBERRIES

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Introduction

Acetaldehyde (Aa), a naturally occurring metabolite present in ripening fruit, plays a role in both flavor and aroma. Postharvest application of Aa has also been shown to have varied effects on quality parameters and has been demonstrated to have fungicidal and insecticidal properties. This study explored the possibility of using Aa for postharvest disinfestation of western flower thrips on harvested strawberries, including the effects of Aa fumigation in air or in a controlled atmosphere on fruit quality.

Materials and Methods

Strawberry fruit and western flower thrips were exposed to 1, 2, 3, or 4% Aa in air or Aa in 20% CO_2 for 2 h at 24°C in 5 gallon (19L) jars sealed with rubber stoppers. Liquid Aa was introduced into the jars by injection through a rubber septum onto filter paper. Samples were measured using gas chromatography.

Fruit was evaluated for quality 1h after treatment. Remaining fruit were then transferred into unsealed 2.5 gallon (9.5L) jars and one half of the jars were held at 68ºF (20°C) (RH 60%), and the other half held at 32ºF (0°C) (RH 95%). Subsamples of the fruit were evaluated for quality every 24 h for 4 days [32ºF (0°C)] or 2 days [68ºF (20°C)].

Results and Discussion

Aa treatments affected the quality of strawberry fruit, as indicated by calyx damage and altered volatile compound concentration. Calyx damage occurred at concentrations of Aa above 2% with an exposure time of 2 hours.

Fruit treated with Aa showed higher concentrations of Aa, ethanol and ethyl acetate. Although these volatiles were detected at higher concentrations in treated fruit for the initial evaluation and subsequent evaluations of fruit stored at 32ºF (0°C), concentrations of Aa and ethanol were comparable to the untreated fruit by day 2 in fruit held at 68ºF (20°C) (Figs. 1 and 2).

Others have reported that elevated CO_2 during Aa fumigation resulted in less phytotoxicity to strawberry fruit; however, our research did not concur. One hour after treatment, fruit exposed to 2, 3, and 4% Aa in the presence of 20% CO_2 showed slightly less calyx damage than fruit exposed to Aa in air. However, after 24 hours there was no difference in calyx damage between fruit treated with Aa in air or in CO_2. In addition, we found that elevated levels of CO_2 during Aa fumigation often resulted in a reduction in target pest mortality.

Western flower thrips were susceptible to Aa, and several treatments resulted in >95% mortality (Table 1). However, the level of control necessary to satisfy quarantine standards was not achieved.

Acetaldehyde is readily absorbed and metabolized by strawberry fruit (Fig. 3). Although Aa uptake may be variable among commodities, it was rapidly reduced to ineffective concentrations for control of target pests in the presence of strawberry fruit under the conditions of our experiments.
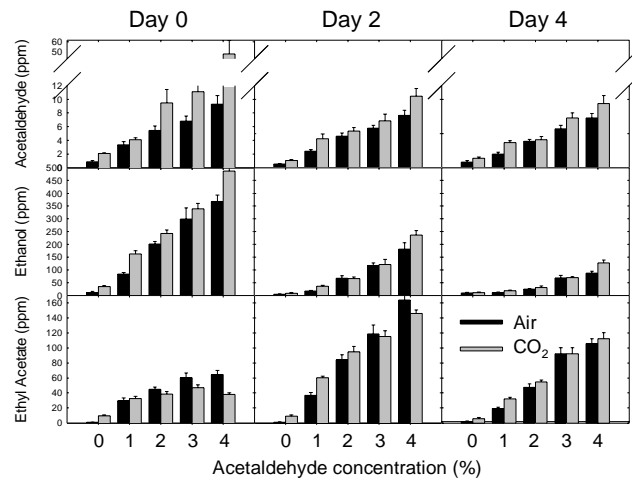
Day 0　　　Day 2　　　Day 4

Fig. 1 Volatiles detected in strawberry fruit juice samples after storage
at 32F (0C) for 2 or 4 days. Initial (day 0) samples taken 1 h after
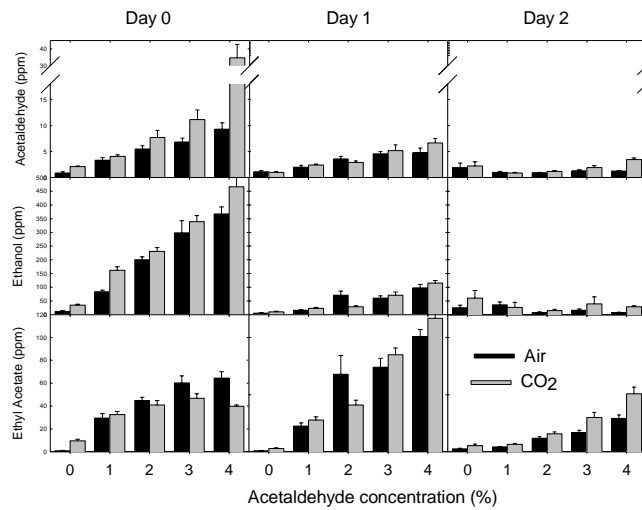exposure [70F (24C)].

Day 0　　　Day 1　　　Day 2

Fig. 2 Volatiles detected in strawberry fruit juice samples after storage
at 70F (20C) for 1 or 2 days. Initial (day 0) samples taken 1 h after
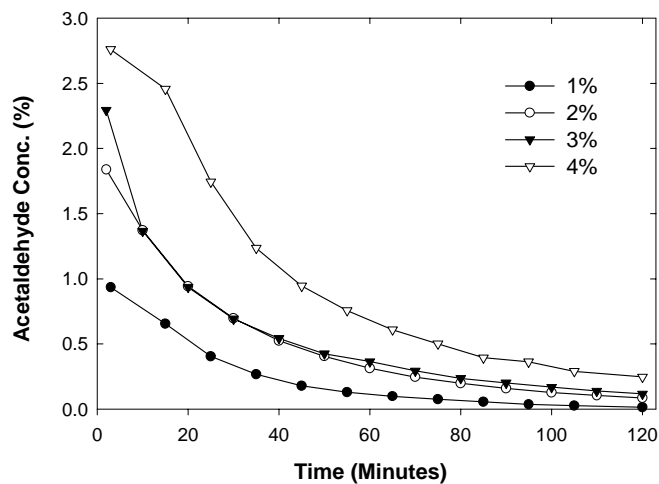exposure 70F (24C).

Fig. 3 Acetaldehyde concentration over time was monitored in 5 gallon (19L) jars filled with 4.7 lbs (2.1kg) of strawberry fruit (load factor 11%). Strawberry fruit were exposed to 1,2,3, or 4% acetaldehyde for 2 hours at 70F (24C).

Table 1. Percent mortality for western flower thrips exposed to acetaldehyde in the presence of strawberry fruit (load factor by weight 13%). Total exposure time, 2 hours. Treatment atmosphere contained air or 20% CO_2

Acetaldehyde concentration (%)	Air	20% CO_2
0	8.2 (4.5) a	9.9 (3.1) a
1	57.6 (6.4)b	75.8 (4.3) b
2	89.1 (3.6) c	89.5 (4.7)bc
3	95.1 (4.1) c	98.1 (0.1) c
4	98.1 (1.0) c	96.2 (2.6) bc