SEMI-COMMERCIAL SCALE ULTRA-LOW OXYGEN STORAGE FOR DISINFESTATION.

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Refrigerated, ultra-low oxygen has been researched as a technology to disinfest grapefruit of Mexican fruit fly in cooperation with TransFresh at the ARS Weslaco, TX facility since 1995. Commercial scale trials of a disinfestation treatment regime were conducted, in cooperation with the Texas Produce Association and Rio Grande Valley Citrus Growers, during the 1998 citrus season. The atmosphere and temperature required to provide quarantine security against the Mexican fruit fly were maintained inside a fully loaded, commercial sea freight container. Atmosphere inside the 24 ft. sea container was maintained using an Electrochemical Oxygen Control (EOC) system. The objective of this research was three fold: (1) maintain an ultra-low atmosphere of oxygen at a specific temperature for a specific period of time (days) in a commercial-scale container, (2) verify mortality of third instar Mexican fruit fly larvae after treatment in a commercial scale container, and (3) verify maintenance of fruit market quality after treatment under commercial-scale conditions.

Seventeen pallets of red-fleshed, 'Rio Star' grapefruit, choice grade were donated by three Rio Grande Valley citrus growers in March and in April of 1999. The pallets were loaded into a 24 ft. sea container, and stored at the ARS facility in Weslaco. A free standing Electronic Oxygen Control system was connected to the container. Atmosphere inside the container was targeted for 500 ppm, at a temperature of 14C. Fruit were stored inside the container for 21 days. Three boxes from each pallet of grower's product (27 and 24 cartons in rep 1 and rep 2, respectively) were evaluated for fruit quality (decay (%), visible disorders (%)) after removal from 21 days of treatment and again after 14 additional days of storage in air at 10C. Four cartons, each containing 24 fruit infested with third instar, Mexican fruit fly larvae, were each placed on top of a pallet in four different location inside the container. After 21 days of treatment, these infested fruit were washed and larvae/pupae collected. Adult emergence was evaluated after three weeks storage under ideal rearing conditions.

In the first replication, no fruit fly larvae survived the low oxygen treatment (Table 1). In the second test, oxygen concentration was less controlled, and 60 pupae survived the treatment. Treated and control grapefruit had similar incidence of decay when the treatment was terminated (Table 2). However, after 14 additional days of storage in air at 10C, the treated fruit had twice as much decay as the control group. Grapefruit exposed to ultra-low oxygen had a higher incidence of visible disorders, consisting of darkened, sunken areas on the fruit surface. It is unclear whether this damage is attributed to fluctuating levels of oxygen, deleterious volatiles produced during treatment, or a sensitivity of the fruit to low oxygen. Much of the decay in treated fruit was caused by compression damage. Control fruit were not palletized and therefore not subjected to compression damage.

- **Advantages**: A postharvest commodity treatment applied in transit eliminates handling bottlenecks. No chemical residue.

- **Implementation Problems**: Fruit hydrocarbons impair atmosphere control system.

- **Research Needs**: Fruit quality. Atmosphere control system.

Table 1. Results of infested grapefruit.

	% Fruit with Pupae[z]		Total No. Pupae		Avg. No. Pupae/infested fruit		% Emergence of infested fruit	
	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
Control	93	97	2807	1750	100.3	60.3	NA	87.9
Treated	0	15	0	60	0	4.3	NA	71.1

[z] Each rep had 30 infested untreated, control fruit and 96 (4 boxes of 24 fruit each) infested, treated fruit.
NA means Not Available.

Table 2. Fruit market quality after removal from refrigerated, ultra low oxygen storage.

	% Decay		% Visible disorders	
	After treatment	+ 14 days	After Treatment	+ 14 days
Control	5.8	5	0	1.5
Treated	5.9	11	3	4