Table 6. Quality of 'Tommy Atkins' mangos fumigated with phosphine at 21°C for 48 hr and stored at 13°C for 14 days.[z]

Maximum phosphine concn (mg/liter)	Color[y]	Percent decayed fruits[x] Anth	Percent decayed fruits[x] SER	Percent injured fruits[w]	Percent acceptable fruits[v]
0	4.3	0	0	0	100
800	1.8[u]	6[u]	28[u]	72[u]	11[u]

[z]Each figure represents the average of 3 cartons of size 12 mangos.
[y]Skin color rated on percentage ripe color development as 1 (0%), 2 (up to 25%), 3 (25-50%), 4 (51-75%), and 5 (76-100%).
[x]Percent decayed fruits includes only those with moderate and severe decay. Anth = anthracnose and SER = stem-end rot.
[w]Symptoms appeared as scalded areas of skin.
[v]Acceptable fruits are those at the soft-ripe stage with no unsightly injury and either free of decay or with no more than slight decay.
[u]Significantly different from control at 5% level.

injury and chemical residue, but avocados fumigated with MB must also be checked for increased susceptibility to decay organisms. Thus, decay can be used as an index of fumigation injury. Methyl bromide does not appear promising as a fumigant under the conditions of this study. Phosphine, on the other hand, only shows promise for avocados if the maximum concn was not much more than 500 mg/liter to avoid phytotoxicity. A maximum concn of 475-600 mg PH_3/liter kills Caribbean fruit fly larvae in infested grapefruit (7). Additional research is needed to determine the tolerance of all commercial cultivars of avocados.

Methyl bromide does not appear promising as a fumigant for mangos since the concn of MB (16 mg/liter for 2 hr) which was not toxic to mangos is probably insufficient to control fruit flies in mangos. Phosphine is also too toxic as a fumigant for mangos under the conditions used. Thus neither MB nor PH_3 can be recommended as a substitute for EDB to fumigate mangos.

Results reported here emphasize the sensitivity of avocados and mangos to fumigants, such as MB and PH_3, and the need to find fumigants that have low toxicities for plants and animals. No evaluations were made of effect of fumigants on flavor, but taste tests would be necessary before a fumigant could be approved for use.

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ETHION, MALATHION AND SUPRACIDE RESIDUES ON MANGOS[1]

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Abstract. **Mango trees ('Keitt' variety) were sprayed with ethion, malathion and Supracide for the control of oleander scale. Samples of mango fruit were taken at 7, 14, 21 and 28 days following application for residue analysis. Peel and pulp were analyzed separately using flame photometric gas chromatography and thin layer chromatography. Residues declined with time following application. Each of the insecticides appear to have activity against scale in mango.**

Oleander scale is a pest of mango in Florida. Tests were run to determine the effectiveness of ethion, malathion and Supracide (methidathion) in controlling the scale with plans to obtain registration if results were promising. This report deals with the residues of these compounds on mango.

Materials and Methods

Mango trees (cv. 'Keitt') were sprayed on June 16, 1976 with the insecticides plus oil as indicated in Table 1. Plots were single trees with 4 replicates of each treatment and 4-5 gallons of spray were applied per tree. Samples were taken 7, 14, 21 and 28 days following treatment. Five fruit were picked from each tree on the sampling date and frozen whole. At a later date the fruit was partially thawed and 2 of the fruits were peeled. These peels were chopped in a Hobart food chopper, repackaged and the pulp from this fruit was discarded. The pulp and peel of the remaining 3 fruit were separated from the seed, chopped and repackaged; the seeds were discarded. All samples were placed in a freezer immediately after being repackaged. 20-25 g samples were extracted for 30 seconds using a Polytron ultrasonic blender (Brinkman Instruments). Acetone (100 ml) was the extraction solvent for ethion and Supracide treated samples, and chloroform (100 ml) for malathion treated samples. Acetone extracts were partitioned three times with 50 ml portions of benzene which were combined, passed through 200 g of sodium sulfate and concentrated to

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10 ml for analysis by flame photometric gas chromatography. Chloroform extracts were concentrated to 5 ml after filtering through 50 g Celite 545 and 100 g sodium sulfate for G.C. analysis. Gas chromatographic columns were coiled glass 4'x1/4" packed with 3% DC-200 for ethion, 4'x1/4" packed with 1% Reoplex 400 for malathion and 2'x1/4" packed with 10% OV-1 for Supracide. All coatings were on 80/100 mesh Gas Chrom Q. Operating parameters of the Hewlett-Packard 5700 Gas Chromatograph were injector 200°, column oven 190° (195° for Supracide), Flame Photometric Detector 200°; Nitrogen carrier gas flow 60 ml/min (55 ml/min for Supracide); oxygen, air and hydrogen detector gas flows of 10, 50 and 200 ml/min, respectively. In addition to parent insecticides, the monoxone and dioxone of ethion was quantitated using similar chromatographic conditions. The oxone metabolite of Supracide (GS 13007) was quantitated using the fly head cholinesterase thin layer chromatography procedure of Mattson et al (1969).

Table 1. Treatment of Mango (cv. 'Keitt') for oleander scale control.

Treatment Number	Treatment	Active ingredient per 100 gal.
1	Check	—
2	Ethion, 4E + 0.5% oil	6 oz
3	Ethion, 4E "	12 oz
4	Supracide, 2E "	4 oz
5	Supracide, 2E "	8 oz
6	Malathion "	16 oz
7	Malathion "	32 oz

4 to 5 gal spray applied per tree
Single tree plots, 4 replicates, designated A, B, C, D

Results and Discussion

The recoveries of the insecticides from fortified control samples averaged from 80-90%. Residues found in mangos are shown in Tables 2-4 and represent amounts of the compounds that would be present after treatment with the recommended application rate (x) and twice the recommended rate (2x). Although the efficacy of the insecticides against oleander scale in mango is not the subject of this paper, all of the insecticides were effective in control with Supracide giving the best control.

Table 2. Ethion and ethion monoxone residue (ppm) in mangos in relation to harvest interval and rate of application.[z]

	Days	7	14	21	28
		Peel			
Ethion	x	4.20	3.75	3.43	2.91
	2x	6.71	4.05	5.65	2.72
Ethion monoxone	x	0.07	0.08	0.10	0.15
	2x	0.20	0.19	0.30	0.16
		Whole			
Ethion	x	1.06	1.16	1.03	0.34
	2x	2.47	1.76	1.10	1.34
Ethion monoxone	x	0.02	0.04	0.03	0.02
	2x	0.06	0.05	0.07	0.07

[z]No ethion, monoxone or dioxone found in control samples

Table 3. Malathion residues (ppm) in mangos in relation to harvest interval and rate of application.[z]

	Days	7	14	21	28
		Peel			
x		0.015	.012	tr[y]	tr
2x		0.043	.011	.049	tr
		Whole			
x		tr	tr	tr	tr
2x		0.017	tr	tr	nd

[z]No malathion residue found in control samples.
[y]tr = less than 0.01 ppm.

Table 4. Supracide and GS 13007 residues (ppm) in mangos in relation to harvest interval and rate of application.[z]

	Days	7	14	21	28
Supracide					
		Peel			
x		0.228	0.080	0.029	0.029
2x		0.450	0.147	0.038	0.023
		Whole			
x		0.041	0.025	0.016	0.006
2x		0.062	0.026	0.025	0.005
GS 13007					
		Peel			
x		0.012	0.015	0.002	0.002
2x		0.032	0.022	0.006	0.005
		Whole			
x		0.007	0.002	nd[y]	nd
2x		0.018	0.001	nd	0.005

[z]No Supracide or GS 13007 residues found in control samples.
[y]None detected.

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