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UNITED STATES DEPARTMENT OF AGRICULTURE Agricultural Research Administration Bureau of Entomology and Plant Quarantine Division of Fruit Insect Investigations

University of California

Hawali Agricultural Experiment Station

Territorial Board of Agriculture and Forestry

Pincapple Research Institute

Hawalian Sugar Planters' Association Experiment Station.

ORDENTAL FRUIT FLY INVESTIGATIONS

QUARTERLY REPORT

July 1 - September 30, 1951

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WORK PROJECT I-0-5 - Commodity Treatments - J. W. Balock, Project Leader

#### SUMMARY

Low Temperature Studies. --Sixty-four tests were completed at 30°-37° F. using 6,196 field-infested papayas, tomatoes, and cucumbers with an estimated fruit fly population of 64,552 eggs and larvae. Since November, 1949, when this work was started over 40,000 fruits and vegetables containing nearly onehalf a million fruit fly eggs and larvae have been tested. The populations tested at each temperature level and the exposure where no survivors were recorded were as follows:

Temperature	Fruit fly	Days exposure
્યરુ	populations tested	for non-survival
30	99,937	9
31	48,253	8
32	68,012	9
<b>3</b> 3	47,329	9
34	61,721	9
35	48,515	9
36	62,435	12
37	45,240	12
	481,442	

Mortality curves constructed for <u>dorsalis</u> and <u>cucurbitae</u> and compared with curves on <u>capitata</u> from data of '36 and '37 by Mason and McBride in the same temperature range indicate that <u>dorsalis</u> is more susceptible to low temperatures than <u>cucurbitae</u> and <u>capitata</u>. Temperatures in the range of 30-35° F. produced very similar effects with a noticeable change at 36 and 37° F.

<u>Testing of New Fumigants</u>.—Thirty-three materials were screened to determine their fumigating value. The most effective were propylene chlorohydrin, and 1,2-dibromobutane against third-instar larvae and n-amyl and n-butyl iodide against eggs.

Funigation Tests with Ethylene Dibromide. In Tests with naked eggs of D. dorsalis, D. cucurbitae, and C. capitata it was found that capitate eggs were most resistant to EDB near the end of their development. At this stage they were much more resistant than eggs of <u>dorsalis</u> or <u>cucurbitae</u>. In the early stages of embryonic development <u>dorsalis</u> eggs are more resistant than the other two species, but with <u>dorsalis</u> resistance increases only slightly with embryonic development, and with <u>cucurbitae</u> it remains the same.

There was an indication that at certain levels carbon tetrachloride when diluted with EDB exerts a slight depressing effect on the mortality. It was found that at temperatures of 75-Sl° F. only 32 per cent as much EDB was required for LD-50 on <u>capitate</u> eggs as at 70° F. For <u>dorselis</u> eggs the amount was 43 per cent. Further evidence was obtained that ethylene dibromide at a dosage of 1/2 pound/1000 cubic feet for 2 hours at 70° F. is adequate only for fruits packed in open, unlined boxes without wrapping or packing material. At this dosage and exposure 27 apparently normal puparia were recovered out of a population of 47,116 in papayas wrapped in corrugated paper sleeves before fumigation. In paper-lined boxes 20 survivors were recovered from a population of 2,896. However, only 2 adults emerged from the 47 puparia recovered from these tests. From naked fruit in unlined boxes fumigated under otherwise similar conditions there were no survivors from a population of 7,969.

Infestation Indices in Fruits and Vegetables.-Sixty-two lots of Grade A fruits and vegetables were held to determine the degree of infestation. In the past three years 358 collections of 13 kinds of fruits and vegetables weighing 23,662 pounds have been used in these studies. As a rule, the melon fly hosts have higher infestation indices than oriental fruit fly hosts.

#### Line Project I-0-5-1. Investigations to Develop Mortality-Time-Temperature Curves Under Vapor-Heat Sterilization.

#### INACTIVE

#### Line Project I-0-5-2. Investigations to Develop Mortality-Time-Temperature Curves Under Low Temperature. (Balock and Kozuma)

(A) Current data.

Sixty-four low temperature experiments (Nos. 312-375) at temperatures from 30 to 37° F. were completed during the quarter with field-infested papaya, cucumber, and tomato. These experiments were made to fill in mortality points lacking for the construction of mortality curves, primarily for <u>D. dorsalis</u>, and in the case of <u>D. cucurbitae</u> to get some data for comparison with <u>D. dorsalis</u>. Shortage of labor and fruits made it necessary to suspend these studies in the middle of August. The fruits tested and estimated fruit fly populations were as follows:

# <u>27111203111-001-004-004</u>	No. of	Estimated fruit fly	PE	RCENTAGE	**************************************
Fruit	fruits	population	D. dorsalis	C. cucurbitae	Parasites
papaya	2,730	35,305	98.2	1.8	4.32
tomato	2,390	10,163	0	100.0	Ó,
cucumber	1,176	19,059	0	100.0	0.92/
Totals	<b>6,1</b> 96	64,552			

1/ 0. oophilus

2/ <u>0. fletcheri</u>

The data for the current quarter are presented in tables 1 to 9. In these tables, the temperature variations shown are extremes. Except for short periods the temperature control was for the most part <u>10</u> F. The abbreviations <u>dor</u> refers to <u>dorsalis</u>, <u>cuc</u> to cucurbitae, and <u>Q.o.</u> to <u>Opius cophilus</u>. The percentages of <u>dorsalis</u> and <u>cucurbitae</u> were calculated from the total emergence of both species of parasites.

(B) Summary of Low Temperature Experiments Over the Period November 1949 through September 1951.

During the past two years a fairly large amount of data has been accumulated on the effect of temperatures in the range of 30 to 37° F. on the immature stages of <u>D</u>. <u>dorsalis</u> in naturally infested fruits such as papaya, guava, kamani, and mango. At the same time some work was done with <u>D</u>. <u>cucurbitae</u> in tomato and cucumber mainly for direct comparison with the effect on <u>dorsalis</u> and to supplement studies reported by A. C. Mason from this laboratory in 1936 and 1937 (Hawaii Lab. Repts. 35, 36, 40 and 45.) These studies have been temporarily suspended, and it would seem appropriate at this time to summarize and evaluate the data so far accumulated in order to determine the need for continuance of this work.

Table	1Mortality	7 of ′	the	immature	stages	of	D.	<u>dorsalis</u>	and	D.	cucurbitae	in	fruits	and	vegetables	held	at
	30° F. (	(Curr	ent	Quarter)											0		

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Expt. No.	Date started 1951	Days held	Temp. range of.	Kind of fruit	No. of fruits	Estimated population	No. of survivors	Dor.	Emergence Cuc.	0, 0,	Par cent mortality
343 348	7/13 7/17	9. 9	29-31 29-36	papaya	140 140	1,176 1,961	0 0				
Totals	- 2 Expts.	9			280	9,137	0				

Table 2.--Mortality of the immature stages of D. <u>dorsalis</u> and D. <u>cucurbitae</u> in fruits and vegetables held at 31° F. (Current Quarter)

Expt.	Date started	Days	Temp. range	Kind of	No. of	Estimated	No. of	]	Emergence		Per cent
- NO.	1901	nera	P.C.	ITUIC	ITUIUS	population	survivors	Dor.	Cue.	0.0.	mortality
335 353	7/6 8/1	3 3	28-31 30-33	n n n	120) 100) <sup>220</sup>	1,296) 1,627) <sup>2,923</sup>	212) 0)212	113) 0)113	·		
336 354	7/6 8/1	5 5	28-31 30-33	19 17	120) 100) <sup>220</sup>	1,296) 1,627) <sup>2,923</sup>	13) 0 <b>)</b> 13	9) 0)9			
331	6/29	8	31-34	11	150	2,503	0	- /			
Totals	- 5 Expts.	3-8			490	8,349	225	122			
322 323 324 361	6/15 6/15 6/15 8/7	3 5 7 7	30-32 30-39 30-39 29-31	tometo n n	140 140 140) 140) 280	364 364 364) 365) 749	17 45 0) 0)0		12 33		
362	8/7	8	29-31	n	140	385	0				
Totals	- 5 Expts.	3-8			700	1,862	52		45		
356 357	8/2 8/2	7 8	31-32 31-32	cucumbər n	140 140	1,081 1,081	0				
Totals	- 2 Expts.	7-8		•	280	2,162			·	****	

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Table 3. -Mortality of the immature stages of <u>D</u>. <u>dorsalis</u> and <u>D</u>. <u>cucurbitae</u> in fruits and vegetables held at 32° F. (Current Quarter)

Expt. No.	Date started 1951	Days held	Temp. range oF.	Kind of fruit	No. of fruits	Estimated	No. of survivors	Dor.	Emergence Cuc.	0,0,	Per cent Mortality
349 344	7/17 7/13	10 11	31-34 31-34	papaya n	70 140	980 1,176	0 0				
Totals	- 2 Espts.	.10-11.	•		210	2,156					

Table 4. --Mortality of the immature stages of <u>D</u>. <u>dorsalis</u> and <u>D</u>. <u>cucurbitae</u> in fruits and vegetables held at 33° F. (Current Quarter)

Expt.	Dato	Deva	Tomp.	Rind of	No. of	Eatimated	No of		Bandoneo		
No.	1951	held	्मू०	fruit	fruits	population	survivors	Dor.	Cuc.	0.0,	rer cont mortality
337 338 355 332	7/6 7/6 8/1 6/29	3 5 5 8	31-33 31-33 32-35 34-35	n n n n	120 120) 100) <sup>220</sup> 150	1,296 1,296) 1,627) <sup>2</sup> ,923 2, <b>503</b>	89 13) 0)13 0	60 9) )9			
Totals	- 4. Expts.	3∞8			490	6,722	102	69		••••••••••••••••••••••••••••••••••••••	
363 365 364 325 327 328 327 328 326 329 330 Totals	8/7 8/7 6/15 6/22 6/22 6/22 6/22 6/22	1 2 3 4 6 7 8 10 1-10	33 33 33-34 33 33-34 33 33-34 33 33-34 33 33	tomato n n n n n	140) 140)280 140 140 100 100 140 100 100 100	385)770 385) 385 364 283 283 364 283 283 283 3,015	0) 0) 10 65 0 0 0 75		6 32 38		
312 360	5/28 8/2	3	33	cucumber	70 140	2,090	131		83		
359 358 313	8/2 8/2 5/28	567	32-35 32-35 33	17 - 12 17	170 170 70	1,081 1,081 2,090	201		97		
Totals	- 5 Exot.	3-7		·	560	7,423	332		180		

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Expt. No.	Date started 1951	Days held	Temp. range •F.	Kind of fruit	No. of fruits	Estimated population	No. of survivors	E	mergence Cuc.	0,0,	Per cent mortality
345 350	7/13 7/17	9 10	30-36 34-35	papaya n	140 140	1,176 1,961	0 0				
Totals	- 2 Expts.	9-10			280	3,137					

Table 5. --Mortality of the immature stages of <u>D</u>. <u>dorsalis</u> and <u>D</u>. <u>cucurbitae</u> in fruits and vegetables held at 34° F. (Current Quarter)

Table 6.-Mortality of the immature stages of <u>D. dorselis</u> and <u>D. cucurbitae</u> in fruits and vegetables held at 35° F. (Current Quarter)

Expt.	Date started 1957	Days	Temp. range	Kind of	No. of	Estimated	No. of		Energence		Per cent
339 340 333	7/6 7/6 6/29	3 5 8	34-37 34-37 33-36	n babaàs Linro	120 120 150	1,296 1,296 2,503	130 0 27	88 10	<u> </u>	<u></u>	MOF GELL CY
Totals	- 3 Expts.	3-8			390	5,095	257	୍ୱରୁଞ	alfa editad dira da anyo a Jender a ganda ang	nadiji in anton na	
366	8/7	2		tomato	140	385	0				
369 370 372 314 374 315 316 317	8/16 8/16 5/28 8/16 5/28 5/28 5/28 5/28	12334578	33-35 33-35 33-35 33-35 33-35 33-35 33-35 33-35 33-35	cucumber n n n n n n n n n	70 70 70)140 70) 70 70 70 70 70	86 86) 2,090) <sup>2</sup> ,176 86 2,090 2,090 2,090	98 108 87) 223 136) 30 451 287 0		72 60 46)128 82)128 18 153 160		
Totals	- 3 Expis.	1-8			560	8,704	1,197		591		

Expt.	Date started	Days	Temp. range	Kind of	No. of	Estimated	No. of		Emergence		Per cent
No.	<u>    1951    </u>	həld	•F	fruit	fruits	population	survivors	Dor.	Cuc.	0.0.	mortality
346	7/13	8	36-37	papaya	70	588	0				
347	7/13	9	36-37	- n	70	588	0				
352	7/17	10	35 <del>-</del> 37	tt	70	980	0				
351	7/17	11	35-37	đ	140	1,961	0				
Totals	- 4 Expts.	8-11			350	4,227					

Table 7. --Mortality of the inmature stages of <u>D</u>. <u>dorsalis</u> and <u>D</u>. <u>cucurbitae</u> in fruits and vegetables held at 36° F. (Current Quarter)

Table 8. --Mortality of the immature stages of <u>D</u>. <u>dorsalis</u> and <u>D</u>. <u>cucurbitae</u> in fruits and vegetables held at 37° F.

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Expt.	Date started	Days	Temp. range	Kind of	No. of	Estimated	No. of		Emergence		Per cont
NO.	1951	held	the the	<u> </u>	1 ruits	population	survivors	lor.	Cuc.	0.0.	mortality
341 342	7/6 7/6	3 6	<b>36-39</b> 36-39	papaya "	120 120	1,296 1,296	235 8	137 3			
Totals	- 2 Expts.	3-6			240	2,592	243	140			
367 368	8/7 8/7	1 2	36-39 36-39	tomato	140 140	385 385	0 0		4		
Totals	– 2 Expis.	1-2			280	770					
371	8/16	2	38-39	cucumber	70	86	1.5		20		
373	8/16	3	38-20	1	70)	861	40		<i>3</i> 0	•	
318	6/13	2	27	11	60(130	1 160/1,253	,40,239		19/137		
375	8/16	1	38-30	1	70	44 44	エププノ				1
310	6/13	45	277	17	60	00 11279	50 07		30		
320	6/13	7	37	8	60	1,101	70 70		10		
321	6/13	ģ	37	n	60	1,167	19		12		
Totals	- 7 Expts.	2-9			4.50	4,,926	389	· · · · · · · · · · · · · · · · · · ·	219		

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Table	9 Infestations	of fruit fly in check fruits used for estimating populations in low temperature	
	experiments.	(Current Quarter)	

Tilomes	Deto	Kind of	No of	No. Of fruit fly		Emergence	•	F	ercentage	
No.	1951	fruit	fruits	puparia	Dor.	Cuc.	Par.	Dor.	Cuc.	0.0.
331-34	6/29	papaya	120	2,002	1,097	0	251/	100	0	2.3
335-42	7/6	11	120	1,296	531	0	74	100	0	1.3
343-47	7/13	n	140	1,176	593	18	53±/,	97.05	2.95	8.0
348-52	7/17	11	140	1,961	567	34	514/,	94.3	5.7	7.8
353-55	8/1	19	100	1,627	719	13	· 24	98.2	1.8	3.2
Totals		****	620	8,062	3,507	65	1601/	97.9	1.8	4.3
322-26	6/15	tomato	140	364	0	197	0	0	100	
327-30	6/22	n	100	283	0	174	0	0	100	
361-68	8/7	tt	280	770	0	584	0	0	100	
Totals		<u></u>	520	1,417	0	<b>95</b> 5	0	0	100	
372-17	5/28	cucumber	70	2,090	0	1,081	0	0	100	
318-21	6/13	<b>(†</b>	60	1,167	0	498	0,	0	100	
356-60	8/2	17	140	1.081	0	487	202/	0	96.06	3.942/
369-75	8/16	tt	70	86	Ó	66	0	0	100	
Totels		<u></u>	340	4,424	0	2,132	202/	0	100	

<u>Opius oophilus</u> <u>Opius fletcheri</u> 1/2/

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Four reconditioned navy surplus reafer boxes,  $11^{\circ}$  7" x 7' 5-1/2" x 6' 2-1/2", were used in these studies. The fruits and vegetables were randomized in shallow trays with quarter-mesh screen bottoms. The number of fruits per tray varied depending on size, papayas and cucumbers averaging 5 to 7, and tomatoes 10 to 15 per tray. One tray in every 5 was set aside as a check for estimating fruit fly populations. Exposure time was calculated from the time the fruits reached desired temperatures. This pre-cooling period varied somewhat but was usually less than 6 hours, and for convenience 6 to 8 hours was used for all tests. Fruits were thus placed in the reefers between 8:00 and 10:00 a.m., and the time of exposure was calculated from 4:00 p.m. of the same day so that removals could be made always at the same hour.

Fruit temperatures were recorded daily with fruit thermometers, usually at 8:00 a.m. and 4:00 p.m., and continuous record of the air temperature was kept by means of a hygrothermograph. Temperature control was maintained usually within  $\pm 1^{\circ}$  F., but due to power and mechanical difficulties fluctuations up to  $\pm 12^{\circ}$  were occasionally recorded for short periods. Such deviations had no noticeable effect on the mortality. Mason and McBride- in studying the effect of low temperatures on the Med. fly made a similar observation when fruits once cooled were removed to temperatures 3-4° higher for varying periods from 6 hours to 5 days and then returned to the original temperature.

The studies reported here involve 375 separate tests centered at degree intervals in the range 30 to 37° F. The majority of these were conducted with papayas and a few with mange, kemani and guava, all of which are predominately infested by <u>D. dorsalis</u>. The total number of these fruits tested, excluding the checks, totaled 27,671 with an estimated fruit fly population of 361,797. The number of cucumbers and tomatees tested was 13,014 with an estimated 119,735 eggs and larvae of <u>D. cucurbitae</u>. It is worth noting that in the <u>dorsalis</u> hosts not one Medfly was recorded although these fruits had been recorded as excellent hosts of the Medfly prior to the introduction of <u>dorsalis</u> in 1946.

The data are recorded in tables 10 to 17 and the mortality data are separated for <u>dorsalis</u> hosts and <u>cucurbitae</u> hosts. Figures 1 to 4 present the data graphically. For most temperatures the mortality lines are fairly well defined for <u>dorsalis</u>. The data for <u>cucurbitae</u> are not quite so extensive. At 30, 31, and 32° the mortality points for both species run fairly close together, but at the higher temperatures from 33 to 37° there appears rather a pronounced difference with the melon fly showing considerably more resistance. The slopes of the mortality lines for <u>dorsalis</u> in the range from 30-35° F. are very similar. They all cross probit 9 at approximately 9 days. The curves for 36 and 37° F. are slightly flatter indicating that at these temperatures a change in the mortality trend occurs.

Mason, working with both the Medfly and melon fly in this laboratory in 1936 and 1937, reported results at 32, 33, 34.5°, and 36.5° F. Table 18 will serve to compare our recent results on <u>dorsalis</u> and <u>cucurbitae</u> with Mason's data on the Medfly and <u>cucurbitae</u>.

<sup>1/</sup> Mason, A. C., and O. C. McBride. 1934. Effect of low temperatures on the Mediterranean fruit fly in infested fruit. Jour. Econ. Ent. <u>27(5):897-902.</u>

Table 10. Cumulative data for low temperature studies at 30° F.

Days	Kind of	No. of	Estimated	No. of	Morta	litv
<u>held</u>	fruit	fruits	population	survivors	d'a	Probit
1	papaya Kanani	37 40	1,189 159	484 27	an a	
_l-Tot	<u>als</u>		1,348	511	62.1	5+31
2	pepsys koman i	111	2,450	502		
	manon	40	1277	ブ		
_ 2-Tot	als	3.78	2.748	<u></u> 558	70.77	5 83
3	CTP EMP EMP	377	3 700			
	kamani	27	1.50 150	145		
3-7.0t	als	77.	1.348	378	80.0	6.00
				1979 - 1979 -	6940	0.0
- <b>4</b>	pepeya kamanj	111	2,450	235		
	Mango	27	120	11		
1-Tote	3lg	1.78	2.7/8	246	97.0	6.34
		یر پر پر پر میں میں میں میں میں کا انداز کا ان				<u> </u>
5	papayo.	237	9,659	175		
ACC	kamani	700	2,612	1		
5-100	als	937	12,272	1.76	98.57	7.19
6	papaya	161	4,442	35		
	mango	202	338	U Je		
6-Tota		203	7,420	<u> </u>	00 65	177 For Th
C)	()-(1-1	E. shares			77402	1010
7	papava	217	7,517	2	99.97	8.43
8	papaya	861	22,824	5		
8 Pate	<u>nango</u>	27	<u></u>	0		0.50
C)=10.61	RAD	000		<u>&gt;</u>	<u> </u>	8.52
9	DR.DAVA	594	10,595	0	1.00.0	> 8.72
10	papaya	162	2,675	0		
10-Tote	17.9	25	<u> </u>	<u> </u>	100.0	
	6443	Sist Sec.	<u> </u>	<u> </u>	3.00 a0	
<u> 11</u>	Depaya	14	1.54	0	0.00%	««۲»
12	papaya	162	2,675	0		
12-Tote	indugu As	216	2,953	<u> </u>	100.0	<b>648</b> 2/3
GRAND TO	PTAIS	4,036	81,814			

(A) Fruits predominately infested by D. dorsalis.

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#### Table 10 cont'd

# (B) Fruits predominately infested by D. cucurbitae.

Days	kind of	No. of	Estimated	No. of	Mortal	ity
held	fruit	fruits	population	survivors	\$	Probit
			•			
2	tomato	24	285	285		
	cucumber	4.3	572	34.9		
2-Totels	-	- 67	857	634	26.02	4.35
,	*	m (	005	50		
<i>6</i> 27	COMPLEO	643-44 4 10	202	70		•
	cucumper		272	<u> </u>	and a win	(
-1074.8		<u> </u>	607	.70	57023	6+39
<b>,</b>	<b>?</b>	10	<b></b>	-	60 <b>60</b>	E 06
<u> </u>	oucumper	60	359	70	13(1 + 50	2.00
6	tomat a	581	003	03		
U	ou cumbom	202	975	4.J 7 E		
Tatala	<u>Gueumas</u>	203 72017	20 //0	<u></u>	00.61	7.60
		107	200 <u>5</u> 6 6 5 7	<u>_</u> 70	77 * V#¢	7007
8	tomato	24	285	0		
•	Gumber	13	572	õ		
-Totals	<u>URCUREDOX</u>	57	857	<u> </u>	100.0	> 8.04
10	tomato	48	570	0		
	cucumber	86	1,144	0		
-Totals		134	2.724	0	100.0	>8.24
30	<b>*</b> ~ <b>*</b> ~ <b>*</b> ~	10	11 trim	0		
A.Z.	COLLARO	40	570	0		
	cucumber	86	1.164	0		
-lotals		134	2.724	0	2.60+0	90 UP
AND TOTA	TE .	7. 236	18.508			
التلكرين والمتهمة	<b>#</b> *	فريجان تعليا فترجن	د يو تو م يو ماه د			

Table 11.-Cumulative data for low temperature studies at 31° F.

Deys	kind of	No. of	Estimated	No. of	Morte	litz
hold	fruit	fruits	population	SULLIVOURS	%	Probit
1	papaya	20	9	9		
	guava	28	28	22		
1-F0581	<u>50</u>	<u>96</u>	5319	ever der	16.22	holin
-						
2	pedene	62	190	60	٠	
	gueve.	133	271	77		
2milo tol	8	<u> </u>	1.37	NGT <u>P</u>	70-66	5.54
3	papaya	330	3,404	212		
	guava	28	28	2		
3-2048.1	8	358	3,332	234	93.76	6.53
		*****	ana na mangangan kana kana kana kana kana kana k			
4	papaya	162	1,283	50		
•	guava.	133	277	8		
1Total	3	294		$-\frac{\pi}{L_1^*/\lambda}$	96.28	5. 753
			and the second s		2129843	<u> </u>
5	nana.va	340	1.027	13		
	631/3759	28		 0		
5. 10 31	ng waa v co	208			CiO _ 6-6	F2 . 1973
				در بر به ۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (۲۰۰۰ (	الاياني ( الما الي الي 	
6.	718 732 779	60	730	5		
V	Property of a	722		2		
6. Becchielle	<u> </u>			<u> </u>	<u>09 05</u>	
					70070	
7	110 ma 110	00	1 20L	a ·		•
Ø	anomo Scolvelaes	20	19604	ž		
2. Poiz le	PLUESACE	<u> </u>		<u> </u>	60 73	772
I - Caral Madrid	/		ala A di si	jr Herender	27 8 17 18 19 19 19 19 19 19 19 19 19 19 19 19 19	1 3673
8	TRATA	1,072	76.172	0		
	Curator For the former	- p - defa 7 1.17		Å		
Sen Proticille	- Been ago			<u> </u>	766 6	NG 68
an an an the state of the state	** <del>1911 - Sund General III - 1910 - 1910 - 1910 - 1910</del>	ing days in	state ge g tall p	<i>ب</i> ر ا	11.1000	10.00
70		304	<b>a</b> £-	<i>•</i>		
.10	papaya	204.	262	U		
	guava	210	498	0		
U-lovel(	ч р	<u></u>	760	()	100.0	¢43649
7 ~		<b>.</b>		_		
TS.	papaya	304,	262	0		
	guave	2:10	498	0		
2-201218	9	<u> </u>	760	0	200.0	•Man
a synamic and a second		المرادين بر				
ATTE REVEN	V7.H	5 94.D	- CO 2 14.			

(A) Fruits predominately infested by <u>D</u>. <u>dorsalis</u>.

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## Table 11 cont'd

(B) Fruits predominately infested by D. cucurbitee.

Days	Kind of	No. of	Estimated	No. of	Mortality		
held	fruit	fruits	population	survivore	Z.	Probit	
ว	*~~~*~	00	-		•		
6	6002260	74 50	313	94			
2-Totel.a	CUOUMOR	<u> </u>	<u> </u>	236	76.00	6. 193	
		······································		5-10-10-10-10-10-10-10-10-10-10-10-10-10-	10406		
3	tomato	140	364	37			
	cucumber	60	1.841	320			
3-fotels		200	in the second	337	84.72	6.02	
					· · · · · · · · · · · · · · · · · · ·		
4	tomato	92	313	66			
	enemper	<u>58</u>	671	91			
-TOBLE		150	932	7.57	84.s04.	5.89	
E	the same to -	<b>7 / A</b>	~~ · `				
7	CULTUO	340	324	4.5			
1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	cucumber	00	Local	123	00.00	100 Ct 4	
ALTE COLLIN		KOU	<u> </u>	<u></u>	<u> </u>	Tally	
6	100020	02	212	5			
0	anamhar	76 5 <b>2</b>	549	2			
-106216	wer ward of	350		8	99.19	7.20	
		·····				5 (C 10.5 B)	
7	tomato	380	3,443	0			
	cucumber	200	2,922	0			
-lotals		58D	N. 2 53 5	0	3.00.0	> 8.67	
¢	sharman ta a	990	3 000	•			
U	OU SHEVU	))/ 100	1,277	0			
8-Totela	Guguillogr	<u>470</u> 400	2 (121)	<u> </u>	300.0		
		فماشتين كع	-121-641	······	200 90	:192(03)	
10	tomato	184	626	0			
	cucumber	116	1,339	õ			
.ü-Iotala		300	2,965	0	100.0	ಳುಕ್ರಿ	
	•						
12	temeto	184	626	0			
	cucumber	116	1,339	0			
-101219		<u>900 (</u>	1,965	. 0	100.0	1917622	
ANT GODA	74	0 660	3 G . 6451				
الأثار المقالبت	640		15.1332				

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Table 12.---Cumulative data for low temperature studies at 32° F.

- -

Days	Kind of	Kind of No. of		No. of	Mortality		
held	fruit	fruits	population	Survivors	×.	Probit	
_					•		
1	papaya	37	1,189	615			
	kamani		159	56			
1-Rotals		77	2,543	377	50+22	5.01	
•		<b>4</b> 49	0 150	ക്രില			
2	pepeye	111	2,250	823		•	
	nango	27	139	43			
	kamani		159				
2-20 08258		1.76	2,143	5904	<u>97855</u>	Jahan .	
2		257	7 790	370			
2	Torney a	- 10	25207	417 10			
W Bartes T	KAUAMAA.	<u>AN</u>	1 316	0000	THE 26	L: 17(*)	
Jan 2012225		<u> </u>	<u> </u>	239	100 ( 10) ( ( 10) (100 ( 10) (	2019	
· 4	Dadava	212	2.450	304	•		
•	mango	27	139	60			
	kamani	20 -	159	0			
-Tetals		17/3	2.74/3	36%	86.75	5.12	
مر			0 ( 70	500			
5	papaya	251	9,099	1.10			
	kemeni.	700	2,612	3	60.00		
		937	32,272		98:09	70.19	
6	na Dava	161	6.612	22			
•	mongo	27	120	0			
		~ r dn		ñ			
5-10032.8	ACEW REALA.	200	4,600	<u></u>	99-55	7.63.	
~							
7	pengya	217	7,517	8	99.89		
¢		<i>6</i> 67	· 76 607	22			
o	Lesberger	<b>J</b>	20,072	26			
	nemeo		140	22	40.63	72. 50	
0142.03712.05		جرابيا في 	2.080.00		3 7 28 24	1007	
10	Da Dava	432	6,403	0			
	mango	54	278	0			
9-Notals		486	6,683	Ô	2.90 m	>6d>	
				•	81117 14		
<u> 11</u>	papeya	154	1,330	0	10000	() u j	
12	DEDEVA	162	2.675	0			
	mango	54	278	Ō			
2-101/11/3		220	2,953	Ō	100.0	tet-as	
		· · · · · · · · · ·	·····	······		······································	
CAMP 167361	7.62	n ny ny	17 M (3-3)				

(A) Fruits predominately infested by D. dorsalis.

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## Table 12 cont'd.

(B) Fruits predominately infested by D. cucurbitae

Days	kind of	No. of	Estimated	l No. of	Mortality		
hald	L'EULE	fruiks	population	SUEVÍVORO	\$	Probit	
~	tomoto	21	785	361			
κũ	വരുത്താണ്	214 23	572	191			
2-Totela	ULIVE	67	857	1.55	16.91	4.092	
	tomato	24	225	65			
кţ.	cumper	13	572	68			
4-fotals		87	857	1.33	84.48	- 6.02	
6	tomato	24	285	0			
•	cucumber	103	931	2]		1	
6-Fotols		3.277	1,23,6	27	98.27	7.21	
8	tomato	24	285	0			
•	cucumber	203	9.456	2			
8Totals		227		X	99 <b>-9</b> 79	<u>8.5%</u>	
70	tomato	18	577	0			
	cucumbar	86	1.144	ŏ			
0-Sovels		3.34		0	0.60.5	A1940 B2	
12	tomato	48	570	0		٠	
	cucumbar	86	1,144	0			
2-Totals		I.34	1,774	0	300.0	54CBF	
native grupa		17.8. E.	15 000				

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Table 13 .-- Cumulative data for low temperature studies at 33° F.

Days	Kind of	No. ol	Estimated	No. of	Morta	lity
held	fruit	fruits	<u>population</u>	survivors	Å	Probit
	•					
12	papaya	17	22	24,		
	guava	28	28	13		
1-Totals		4.5	50	37	26.00	4,036
		·····		ليتحديثها مدالة والمتحد فللمساغل مشبهو بالم		·····
2	ng ng 179	55	177	9/		
	້າວາວ	122	377	770		
2. Totals	Gensees	1.88	7.52	100	63.44	5.34
3	210 230 377-	2217	7 500	162		
فمر	La La La	675 00	Lg 770			
· .	guava	<u></u>	28		CO CA	
84.20701m		205	1,8.13	182	67.82	0.27
lę.	papaya	155	1,270	64		
	guava	133	277	33		
-Totala		288	2,547	- 97	93.73	6.53
5	papaya	347	4,050	17		
	guava	28	28	0		
-Totels		375	4,073	271	99-58	7.29
6	Parava	105	1.355	20		
-	eneva	133	2771	õ		
المتحدث والأسر		295		20	38.77	7.25
	<u></u>					
7	<b>713 713 77</b> 5	207	2,802	2		
•	Guiding Freeheeling	10	10	ñ		
7-11-12-1-1-1	<u> </u>	3.9	2.071	<u> </u>	<u> 68.85</u>	8.70
ليرود والمراد المراد المراد			الماليكراني فواند	64	75878	1. P 45 7
6		<b>pr</b> 2 m	0.000	^		
ö	papaya	242	ソッレンし	U		
5 Mar	guave	<u>7</u>	291	<u> </u>	1100 00	50 000
-101219	····	<u> </u>	<u> 29522</u>	;; 	AUU SU	s 15070
-				<i>a</i> .	****	
9	papava.		5,560	0	100.0	ad to
			-			
10	papaya	90	336	0		
	guava	210	498	0		
)-Totals		360 1	8 <u>%</u>	· ()	100+0	ant i bija
11	09.09.Va	34	26	0	3,00.0	statio
12	na.na.ma	90	336	0		
******	0739733 L. L. G. W.	ວາດ	202	õ		
-intais	IS ULO VCC	200	<u></u>		700.0	
y detter trinigentit		، د د م <sup>و</sup> م	مان کې سرو مېرې کې کې د مېرې د مېرې کې		2227 V CAR	
	TC	يتعريع فتوجه الأو	00 000			
AU11124 440 6-2-14						

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(A) Fruitz predominately infested by D. dorsalis.

# Table 13 cont'd

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C

Days	Kind of	Nociof	Estimated	No. of	Mortal	167
held	fruit	fruits	population	survivors	B	Probit
1	tonatoes	292	845	15		
	cucumber	.10		59		
l-Intals		302	1,055	74	92.99	6.47
	4 <b>b</b>	000	100	<b>*3 • #</b>		
2	tomato	220	623	14,1		
	ouenmbor	48	461			
2-Totals	د «می در این این این مین می	288	1,084	260	<u>76.01</u>	5072
2	-tomoto	150	120	10		
2	COLLEG UC	-1)R 100	427	47		
2. Thesiers 7 -	cucumost.	320	<u>69.2000</u>	<u></u>	gin na	6.00
-LOUELS	an a	6.76		<u></u>	67470	12827
L	tomato	2.80	521	91		
~~	cucurabar	188	1.512	211		
-Toisla	~~~~~	358	2.063	355	89.96	5.98
,				می فی کمید		
5	tomato	12	75	2		
-	cucumber	150	1,291	203		
milovol.c		TE	2,366	20%	85.07	6.04
Pala a tarra a						
6	tomato	180	521	0		
-	cumubar	188	1.5/2	20		
-Totals		368	2,063	20	99.03	7.33
7	tomato	112	769	0		
	cucumber		500	0	المرافقة فالباط ومراكبته والمراجبين والمراجب	
Motels		<u>192</u>	1,269	0	<u> </u>	2900
<b>a</b>	ð e me de e	2 60	000	هې دې		
0	60112160	<b>T</b> CO	754	22		
Detain	CUCUMDAR	84	461	0	<u> </u>	<u> </u>
Sent Office 13		<u>e</u>	<u> </u>	22	20030	9017
9	tomato	2/	750	n		
	anannos	20	120	õ		
-10191.5		Lib.			700-0	1797 <i>6</i> 3
-				******		
10	tomato	260	759	0		
	cucumber.	96	922	0		
-Totals		356	1,631	C	1.00.0	ateriza
				e ver mentigen van genaar Pakiskering en fan de pe		***
22	tomato	24,	150	0		
· · · · · · · · · · · · · · · · · · ·	cucumber	20	420	n air		
-lotels		hij.	570	<u> </u>	300.0	Koninza -
10	de a merce de co	9 × 10	هبادة	~		
12	Tomago	160	4.70	Ū		
0 80.45-7	cucumber	<u> </u>	922	0	200.2	
Sertons.18		620	4,390	<u> </u>	()_o()	4127 D
പെല്ലം അവതം പ	75	6 D. D. D. D. D.	the state of the state			
CONV. SULT	202	2,020	213232			

# (B) Fruits predominately infested by D. cucurbitae.

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Table 14.-Cumulative data for low temperature studies at 34° F.

(A)	Fruits	predominately	infested	by	D.	dorsalie.
• •			•	•		

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Dave	Kind of	No. of	Estimated	No. of	Morta	lity
held	fruit	fruits	population	eurvivors	Þ	Probit
	#146000000000000000000000000000000000000	RÖMINGEN FRANKRIGEN VERSTER FRANK				
1	Dabava	37	1.189	900		
	kamani	10	159	74		
1-Totals		77	1,348	977	27.74	4.67
				ومستحدا المرتب بالمرتب فلين المطلب ويسببه مستهما		<u> </u>
2	63.05.VA	111	2.450	1.159		
~	kamani	40	1.59	70		
	mango	27	139	69		
2-Totals		1.76	2.738	1.298	52.77	5.07
3	<b>na na 1</b> 91 <b>79</b> .	37	1.189	- 249		
	komanî	20	159	58		
2-llosa in	ALC/MILOS LOS		1.348	307	7723	5.75
,		<b>7</b> 47	2 150	1 8777		
4,	papaya	<u></u>	~,47U	4;11 A		
	KEIMI	40 40	722	<i>v</i>		
1 174 4 - 7 -	mango		<u></u>	<b>27</b>	683 64	i, an
4-10 HLLS		2.78	- 5 1140	249	0000	1000
-			~ 200	و مر		
5	pepaya	37	1,189	24		
	kamani	130	318	0	the second second	6.00
>-101818		1.1.7	الومى المرور ال	2.5	-20+62	0.050
		~ *** *	70 000	365		
6	papaya	3.1.1	10,920	130		
	kemeni	700	2,612	1		
	mango	27	139	0		
6-Totals		1,098	3.3,673		99.04	7+33
				•	00.01	24m. At 18
7	papaya	117	1,292	7	9900L	40 AD
8	papaya	291	8,778	1		
<b>6</b>	nango	27	139	0		
8-Totals		37.8	8,927	:!-	99.989	S.70
9	papaya	474	9,904	0	0.005	52 Co
10	papaya	302	42637	0		
	mango	54	278	0		
10-Totals		356	4.83.5	0	100.0	·
				,,,,		
11	papaya	14	15%	0	200.0	دولي ويني
12	dedaya	162	2,676	0		. •
	mango	54	278	0		
12-Totels		215	2.95%	Ô	100.0	at Byt . to
	n a vindige Maria (1922 a sole of 14 of 14 of 14 of 14 of 14					
GRAND TOTA	<u>T</u> S	3,160	54,506			

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# Table 14 cont'd.

# (B) Fruits predominately infested by <u>D. cucurbitae</u>.

Darra	Kind of	No. of	Estimated	No. of	Mortality	
pola	Pm13%	fruits	nonulation	survivors	8	Probit
100-244	A& (AL. U					
2	tomato	24	285	119		
<b>F</b> *	cucumber	43	572	217		
2-Totals		67	857	336	60.79	5.27
<b>19-19-19-1-19-1</b> -19-1-19-19-19-19-19-19-19-19-19-19-19-1						
4	tomato	24	285	52		
-	cucumber	43	<u> </u>	157		P de
4-Totals		67	857	209	75.61	5.69
Ê	tomoto	21	285	n		
0	GOILLE GO	42	572	277		
6 Vinter	<u>CUCUMOBL</u>	<u> </u>	240	57	96.25	6.35
0-10/870		0,	د ل <u>را</u> ناً	<u> </u>		<u> </u>
7	oucumber	60	359	46	87,39	6.14
<b></b>						
8	ofenof	24	285	0		
	cuchanber	43	572	0		
8-Totals		67	857	0	<u> </u>	<u> 28.04.</u>
10	tometo	48	570	0		
<b></b>	cucumber	86	1,144	0		
D-Toyals		124	1.,712,	0	100.0	\$\$140-1
			<i>e</i> n0	0		
12	TOMETO	40	7.0	0		
() ()-()-()-()-()-()-()-()-()-()-()-()-()-(	CUCIMDOR	<u> </u>	Louiste	<u> </u>	300.0	
L2~100318		2.34	1.7 1 1.14	<u>v</u>	AUV RU	<b>D</b> .47
BAND TOTA	18	<u>596</u>	7.215		•	

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Table 15. Cumulative data for low temperature studies at 35° F.

No. al	C Estimated	No. ol	Mor	tality
<u> Truit</u>	population	SUEVIVOTE	\$	Probit
	_			
10	9	24		
23		13		
30	377	377	<u></u>	-
60	300			
52	190	141		
273	662	90		
		237.	72.89	5.61
220	ייעיזעי צ	310		
<u></u>	20 N 1500		<u></u>	
8:20	N. 5 2019	Sta	91.59	<u> 8.36</u>
162	1.289	90		
7.22	لايلايلان	20		
	T ELA	<b>96</b> 17 21	6.3 8.1	بلي ور مر
- Andrew Contraction	<u> </u>		09.94	0.28
21,0	2.410	3		
28	28	õ		
268	2.744	?	59.33	8-02
9.42 °C (1944) 1940 - 1940 - 1940 - 1940 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 1940 - 19			ور و	while a
112	1,368	16		
133	2777	0		
245	1.545	36	. 99.03	7.33
<b>10</b> / 10		_		
υp	2 <b>,37</b> 3	2		
		0		
312	2,413	2	99,92	8.16
የታገጥ	10 066	<b>∧</b> P1		•
102	10,200	21		
	294	0		
84.9	3.0, 557	27	99.7%	7.79
330	7,628	n	700-0	SR. Gr
				- 19 9 (Ja)
3,04	362	0		
270	198	ò		
1. X	 _:::1	<u>ť</u> 1	300.0	
	الهاري الاين المستقلينية بالمستقلينية والمستقلينية المستقلينية المستقلينية والمستقلينية المستقلينية المستقلين المستقلين المستقلين		and the	*~2(3
204	362	0		
210	198	õ		
<u> </u>	260	0	100.0	678475
بر ا	<u>104</u> 210 214 314 314	<b>104 362</b> 210 498 204 860 308 90,657	104         362         0           210         498         0           20.4         260         0           20.4         260         0           20.4         260         0	104 362 0 210 498 0 204 260 0 100.0 108 20,657

(A) Fruits predominately infested by <u>D. dorsalis</u>.

## Table 15 cont'd.

# (B) Fruits predominately infested by <u>D</u>. <u>cucurbitae</u>.

Days	kind of	No. of Estimated		No. of	Mortality		
hald	fruit	fruits	population	survivore	ø	Probit	
1	ancompar	<i>יז</i> רי	<b>\$</b> 6	26	n		
418 	- Oucountros				<u> </u>	#27 \$.ut	
2	tomato	92	313	100			
	cucumber	<u>128 '</u>	757	395			
2-Totals		220	1,070	495	53.74	5=09	
•	•						
	cucumber	1/0	2,176	223	89.75	<u> </u>	
4	tomato	92	ગાય	52			
<b>T</b>	cucumber	128	757	1.2.4			
L-Totals		850	3.,070	, 14.96	53.64	5.09	
5	Cucumber	70	2,090	451	78.12	5.79	
	A 4	~~		-> -d			
0	LOIDELO	92	313	8			
Restand -	CUGUNDEF	<u>58</u>	<u>671</u>	31	or ex		
P-1078322			and the second sec	39	90.04	0.15	
7	come.to	120	617	0			
-	cucumber	70	2,090	287			
		790	2,731	237		6.25	
8	tomato	212	954	32			
-	cucumber	128	2.761	0			
-Totals		340	3,725	32	99.24	7.38	
חד	tomoto	781	626	0			
<b>ما</b> مله	സമാധാന്നിര്ന	176	1 2/2	0			
)-Totals	GRACIALINGS.	300	1,908	0	100.0	ę31 <b>4</b> 4	
12	tomato	184	626	0			
-Tatola	cucumber	200	1342	0	5055 P		
		السالعة التي	3. 9. V (P)	U	ふふじゅし	4/112 ga	

Ι.

Table 16. Cumulative data for low temperature studies at 36, F.

Days	Kind of	No of	Estimated	No. of	Morta	lity
<u>həld</u>	fruit	fruits	population	survivors	×	Probit
1	papaya	37	1,189	1,189		
	kamani	40	1.59	129		
1Totals		177	1.348	1.313	2.23	2,99
<b>619</b>						
2		333	2 /50	7 760		
6	here's a	20	750	202		
	KENNELLL	40	3.27	77		
1. Mostelle	mango	108	2.39	123	10.61	1 00
2-10 0372		2.0	29160		2070014	4077
^		~~~	7 7 40	000		
3	papaya	-31	79703	283		
	kamani	<u>40</u>	159	52		P 170
3-Tovals			1.9 45		<u></u>	5-13
4	papaya	111	2,450	501		
	kamani	40	159	0		
	mango	27	139	59		
4-Totals		178	2,743	560	79.62	5.83
<u></u>						
5	DaDava.	37	1,189	112		
÷	kamani	80	318	Ö		
5-Fotals		137	3.507	172	92.57	6.11
6	na nava	777	2.150	10		
v	leanoni	20	້າງຊ	-0		
		27	120	ň		
6 8 4 - 7 -	manito.	61	<u>, 202</u>	0	0.3 61	77 LA
C-TOTALS		2.35	2,007	201	24.20%	7.004
-		~~~	30 70	26		
7	pepaya	207	10,700	20		
<b></b>	kanani	620	2,294	<u> </u>	<b>A () () ()</b>	
7-103915		867	3.3,054		<u>939-80</u>	7.88
8	papaya	211	4,349	0		
	mango	27	139	0		
8-10-119		238	4,270	e	120.0	8.54
<b>4</b> 2				· · · · · · · · · · · · · · · · · · ·		
9	papava	120	2,580	0	100.0	*****
			and the second		*****	
10	Dapava	602	15.317	4.		
	mando	51.	278	a a		
10-Totale	Miller SV	655	75 204	<u>/</u>	00.07/	\$ 17
And the state of t		0,0	-10 1 9 3 8 . C	cp	119714	
77	<b>200 00170</b>	251	1.111	0		
	LOST CP	<u> </u>			· · · · · · · · · · · · · · · · · · ·	
10		760	n LARE	•		
24	hertera	202	در 017 مصح	v c		
12 Pasala	OSTRATICO	<u></u>	0.060	<u>v</u>	700 0	
TT TO CETE		43.0	2,923	<u> </u>	LUU-U	*1(m
004300 000245	7 <b>B</b>	1 196	<i>«к</i> 000			
GRABD TUTA		0 في الم	المجرم ورو			

(A) Fruits predominately infested by <u>D</u>. <u>dorsalig</u>.

(

Table 16 cont'd.

C

(B) Fruits predominately infested by <u>D</u>. <u>cucurbitae</u>.

Dava	Kind of	ind of No. of		No. of	Nortality		
held	fruit	fruits	population	survivore	B	Probit	
2	tonato	24	285	258			
	cucumber	43	572	259			
2-Totals		67	<u> </u>	577		4.0.14	
,	tomoto	24	285	53			
4		244 1 2	573	55			
(motale	cucumpar	<u> </u>	<u></u>	108	87.15	6.15	
ep-av venad		<u> </u>					
6	tonato	24	285	0			
-	cucumber	43	572	35			
6-fotals		0î	85;	35	95.92	0.74	
¢	tomata	21	285	0			
J		103	027				
8-Totals	Carominea.	127	1,216	iş.	99.67	7.72	
10	tomato	48	570	0			
	cucumber	86	1.144	0			
10-Totals		1.34	3,734	0	1.00=0	>8.24	
• •		10	<b>E00</b>	Ô			
15	tomato	40	270	ő			
	cucumber	<u> </u>	Lallila	<u> </u>	703.0	18.21	
12-Totals		1.34	Jo fills	<u> </u>	200.00	JUDRAS	
TRAND TOT	ata .	596	7.21.5				

Table 17. Cumulative data for low temperature studies at 37° F.

Days	kind of	Kind of No. of Est		No. of	Mortality		
held	fruit	<u>fruits</u>	population	survivors	\$	Probit	
1	papaya	10	9	9			
	guava	28	28	16			
1-Totals		38	37	25	32-43	14.514	
	•						
2	papaya	62	190	103			
	guava	133	277	70			
2-Totals		1.95	4.67	173	62.96	5.33	
,					······································	<u>-</u>	
3	papaya	230	1.777	235			
-	guava	28	28	5			
3-Totals		258	1,805	240	86.70	6.11	
······							
k.	nanava	162	1,283	80			
- <b>V</b>	0110.170	133		75			
4-Totals		295	3.,360	155	90.06	6.28	
5	DADAVA	170	2,283	62			
-	PIIATA	28	28	0			
5-Totals		1.98	2,311	62	97.32	6.93	
<b></b>		······					
6	Danava.	232	2.611	8			
-	anave.	133	2777	ō			
6-Totals		365	2.941	<u>ě</u>	\$9.73	7.78	
			and the second s				
<b>6</b> 7		200	0.015	0			
1	hanala	<u>ل</u> ېرو	3,343	0			
17 Martin To	Euava	42	<u>42</u>	<u> </u>	300.0		
1-2018.18		2.32	3,307	<u> </u>	TODali		
¢	<b>110 1101 110</b>	550	6 700	0			
9	haraa	226	002eU	0			
Q Bak-2-	Entra	<u> </u>	6 186	<u> </u>	100 0		
0~1063.:8	·····	099	U <sub>2</sub> 1370	<u>v</u>	20000	10440)	
0		140	/ 1000	•	200.0		
	D3D61AS	100	49.570	<u> </u>	20040	<b>C</b> #445	
10	199201	201	2 550	٦			
70 20	hahaya Nahaya	204	occec box	· •			
0_Potol c	<u>Kuava</u>	 511	<u>470</u>	<u> </u>	00.02	2.87	
0-206219		224	OCU <sub>64</sub> 3	<u>.</u>	77670	0034	
10		301	0/0	•			
75	papaya	104	302	U			
Patele	guava.	<u>210</u>	498	<u> </u>			
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		J' Laby	עניין	<u> </u>	217000	427-94	
A THE MARK OF	70	0 060	07/ 07/0				
ARAND TUTA	Ca1	٥٥٠زوز	613710				

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(A) Fruits predominately infested by D. dorselis.

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Table 17 cont'd.

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(B) Fruits predominately infested by <u>D</u>. <u>cucarbitae</u>.

Dava	Kind of No. of Estimated		No. of	Mortality		
held	fruit	fruits	population	SUEVIVOES	Ø.	Probit
			_	_	500 D	
1	tomato	140		. 0	.103.0	Q+1¥.#
<b>L</b>	A A	000	600	วธร		
2	tomato	232	070	275 293		
1 Patola	cucumbar-	250	3,455	762	16.25	1.093
15 LU UGLAT						
3	cucumber	130	1,253	239	80.93	5.87
£		and a second				
4	tomato	92	31.3	89		
•	cucumber	128	757	549		
4-Detals		rest ()	1,076	638	62.25	2.32
			•			:
5	cucumber	60	1,7.67	21	98.20	7.10
					•	
6	tomato	92	313	81		
	cucumbar	<u>58</u>	671	136		
ordotels		3.50	984	23.3	89-03	6.23
<b>77</b>	***	100	617	n		
7	COULEUO	40	1 760	10		
7-Totela	CUGAMICIOL	280	1.806	70	98,95	7.97
				and a second		
8	tomato	92	31.3	4		
-	cucumber	58	671	17		
-Totals		. 150	<u>1984</u>	27	07.87	7.03
		<b>.</b>	<i>4</i> .m			
9 ·	tomato	120	641	12 .		
	cucumber	60	1,107	0		
9-lotals		180	3,808	12	59.34	7.48
י <b>ס</b> ו	tometo	184	626	G		
nh₩.	വവത്തിന്	116	1.342	ŏ		
0-Totelas		300	1,968.	Ū.	100.0	38.29
12	tomato	184	626	0		
	cucumber	116	1,342	0		
12-200419	•••••••••••••••••••••••••••••••••••••••	200	1,938	0	<u>100-0</u>	29942
14 8% E4045 - GAMPIN		0 020	517 ( <i>ift</i> )		•	

These same data are shown graphically in figures 5 to 8. In these figures the mortality curves are fitted by eye to Mason's data which are much more extensive than our more recent 1950-1951 data. The points for the latter are included merely for convenience in comparing both sets of data on <u>cucurbitae</u> and to show the agreement with <u>dorsalis</u> and <u>capitata</u>. At all temperatures where it is possible to make comparisons it seems evident that <u>dorsalis</u> is slightly less resistant to cold than is <u>cucurbitae</u> or <u>capitata</u>, both of which have quite similar responses. In table 19 are listed the exposures where last survivors were obtained. It is quite evident that temperatures in the range of 30 to 35° F. produced very similar effects with slightly increased survival times apparent above  $36^{\circ}$  F.

Baker 1/, using the data of Mason and McBride, discussed the probit mortality logarithm of time transformation as a method of determining treatment requirements to assure non-survival of fruit flies. For this purpose Baker suggested the use of the exposure coordinated with a probit of 9, representing a mortality of 99.9968. With this as a basis his socurity requirements for <u>capitata</u> called for 12 days at 32° F., 13 at 33° F., 14 days at 34° F. 15 days at 35° F., and 16 at 36° F. Such a recommendation would seem to be ample for both <u>cucurbitae</u> and <u>dorsalis</u>.

With the possible exception of bell papper and snap beans low temperature sterilization has little practical application for Hawali as shown by the following list of potential Hawalian export crops with their low temperature storage thresholds:

Comm	odity	Temperature °F.	Storage Period
Pineapples	(mature green)	50-60	3 to 4 weeks
11	(ripe)	40-45	2 to 4 weeks
Papaya	(mature green)	55	2 weeks
tt -	(1/4 ripe)	45	1 to 2 weeks
13	(1/2 to 3/4 ripe)	4.5	3 weeks
Banana	(green)	56	
Ħ	(ripe)	56-60	1 wask to 10 days
Avocado	- <b>w</b> ·	40	4 to 8 weeks
Tonato	(mature green)	- 55	3 to 5 weeks
tr	(ripe)	40	1 to 2 weeks
Cucumbers	-	45	2 weeks
Zucchini sc	luash	40	3 veoks
Bell pepper	•	• 32	4 to 6 weeks
Snap beans		32	2 to 4 weeks

Except for papaya the above figures are from the U. S. Dept. of Agr. Circ. No. 278, The commercial storage of fruits, vegetables, and florists' stocks by Dean H. Rose, et al.

<sup>1/</sup> Baker, A. C. 1939. The basis for treatment of products where fruit flies are involved as a condition for entry into the United States. Circ. No. 551, U. S. Dept. Agr.

	181	50-151 d	ata (32° )	F.)	Mason	Mason's '36-'37 data (32° F.)				
Exposure	Pe	er cent	Mortality		. P	er cent	Mortality	7		
Days	dors	<u>alis</u>	cucur	bitae	cucur	bitee	capit	tata		
		prohit		probit		probit	}	probit		
1	50.2	5.0			22.5	4.2	48.2	4.9		
2	67.1	5.4	46.9	4.9	38.0	4.7	60.2	5,3		
3	78.6	5.8		•	76.4	5.7	77.5	5.8		
4	86.8	6.1	84.5	6.0	78.0	5.8	89.6	6.3		
5	98. 59	7.2	<b>676</b>		93.7	6, 5	97.3	6.9		
6	99.55	7.6	98.3	7.1	95.7	6.7	99.19	7.4		
7	99.89	8.1			98.1	7.1	99.8	7.9		
8	99.81	7.9	99.98	8.5	99.07	7.4	99.93	8.2		
9	estitate		43 (Jie		99.94	8.2	99 <b>.</b> 98	8.5		
10	100		1.00	10000	100	-	<b>99.98</b> 8	8.6		
	100	680) 					100			
Populations tested	52,0	103	16,0	099	63,8	385	118,6	588		
		33° F.				339	F.			
2										
Ţ	26.0	4.4	93.0	6.4	3402	4.6	45.9	4.9		
2	. 0.5.4	5.3	76.0	5.7	55.6	5.1	57.0	5.2		
5	02.0	0.3	85.8	6.1	65.6	5.4	77.7	5.8		
4 5	75.7	0,7	83.8 85.8	0.0	82.1	5.9	92.5	6.4		
6	97° 70 08 77	1.2	07°T	0.0	89.8	し。う	97.1	6.9		
<b>7</b>	70° 11 00 05	6.7	300	103	92°T	0.7	98.5	7.2		
8	77072 700	0.0	06 NS	60	90.13	7. L	99.70	7.8		
ğ	100	479.82	100.01	0.0	97.43	7.7	99.89	8°T		
10	100	42424	100	director 10	39.50	0.1	77.70 700	8,3		
		ويرود يدفعان المراجع ويرون وروان مراجع			1 200		100			
tested	30,0	78	17,2	251	41,	550	69,3	63		
		359	্ষ			34。	5° F.			
1	• .		•		32 77	1.6	210	1 2		
2	72,9	5.6	53.7	5.7	63 8	400 51	160	403		
3	91.6	6.4	89.8	6.3	72.5	5.6	40° 7 65 1	407		
4	89.9	6.3	53.6	5.1	87.9	5.0	88.6	6.2		
5	99.9	8.0	78.4	5.8	95.0	6.8	95,9	6.7		
6	99.0	7.3	96.0	6.8	97.5	7.0	99.02	7.3		
7	99.9	8.2	89.5	6.3	98.59	7.2	99.74	7.7		
. 8	99.7	7.8	.99.14	7.4	99.94	8.2	99.94	8.1		
9	100		40120	400 MG	100	-	100			
10	100		100	WG7830	ticas actin	\$28.62P	100			
Populations tested	30,6	57	17,8	358	25,8	92	49,9	80		

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lable	18Mortalities of D.	dorsalis and C. cucurbitae in low temperature	
	studies conducted	in 1950-51 compared with mortalities of	
	D. cucurbitae and	C. capitata in similar studios by A. C. Mason	
	in 1936 and 1937	in the range 32-37° F.	

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Ta	ble	18	(cont	'd)

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Exposure	P #	0-151 d	ata (32º	F.)	Mason	Mason's '36-'37 data (36, 5°F.)			
Days	dorselis		CUCU	cucurbitao		bitae	capitata		
1	32.4	4.5		<u> </u>	40.5	4.8	32.7	4.6	
2.3	63.0 86.7	5.3 6.1	46.3 80.9	4.9 5.9	63.5 76.6	5.3 5.7	39.6 60.7	4.7 5.3	
4 5	90.1 97.3	6.3 6.9	62.3 98.2	5.3 7.1	79.4 93.4	5.8 6.5	· 76.2 86.7	5.7	
6 7	99.7 100	7.8	89.0 98.9	6.2 7.3	98.8 99.8	7.2 7.9	95.2 98.0	6.7 7.1	
89	100 100		97.9 99.3	7.0 7.5	99.9 99.8	8,0 7,9	99.0 99.5	7.3 7.6	
10 11	99.98	8,5	100	674.03 672.03	100		99.8 99.98	7.9 8.5	
Populations	100	6113	100	e	100	<b></b>	100		
tested	27,9	70	17,	,270	31,0	618	81,	,245	

m	Days Exposura							
Temperature	D. dorsalis	C. capitatel	D. cucurbitae <sup>2/</sup>					
30	8	9	6					
31	7	10	7					
32	8	10	9					
33	7	9	9					
34	8		7					
34. 5		8	8					
35	8		8					
36	10		8					
36.5		11	9					
37	. <b>10</b>		9					

Table	19 Maximum	periods	of	exposure	to	temperatures	of	30 <del>~37</del> °	F.	where
	survivoi	s were l	last	recorded	1.					

1/ Data of A. C. Mason and O. C. McBride from this laboratory during 1936-37.

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2/ Data of Mason and McBride ('36-'37) included with '50-'51 data.



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-271-



-272-



Figure 5. -Mortality curves comparing the effect on D. dorsalis, D. cucurbitee, and C. capitata held at 32° F. dorsalis '50-'51 0 X \_\_\_\_\_X capitata, Mason's data, '36-'37 A \_\_\_\_\_A cucurbitae, Mason's data, '36-'37 cucurbitae, '50-'51 63 9 A Prophy of Nortelity 0 B A 0 0 0 2 A 1 1 Q 

1

-2740


-276-





#### Line Project I-0-5-3. To Develop Time-Dosage-Mortality Curves Under Methyl Bromide Fumigation.

(INACTIVE)

## Line Project 1-0-5-4. To Test New and Previously Untried Fumigants for Use in Commodity Treatments.

(A). Screening of materials to determine their toxicity to naked eggs and larvae of <u>D</u>. <u>corsalis</u>. (Kinnan)

Thirty-three materials were screened as funigants against naked eggs and larvae of <u>D</u>. <u>dorgalis</u>. Preliminary tests had been made previously with many of these materials by Balock (Quarterly Report of Jan.-Mar. 1951, pp. 645,646). Total number of compounds tested to date is 102.

Table 20 presents the results.

Propylene chlorhydrin and 1,2-dibromobutane were the most effective against lervae, killing 95% or more with less than 10 mg./L. Propylene chlorhydrin was not very effective, however, against the eggs. N-amyl iodide killed all eggs at the lowest dosage used, 0.0025 ml./L. N-butyl iodide killed all eggs at 0.005 ml./L. Both materials were fairly effective against larvae.

Seventeen or approximately half of the materials killed less than half of either eggs or larvae at a dosage of 0.1025 ml./L. (approx. 3/4 gal. per 1000 cu. ft.).

Certain tentative generalizations may be made on the basis of the compounds so far tested. The primary n- monohalides tested have given better kills than the corresponding iso, secondary, or tertiary compounds; in fact the iso, sec.-, and tert.- bromides have all given poor kills. These results are the opposite of those obtained by Roark and Cotton in tests with the rice weevil in wheat (U.S.D.A. Tech. Eul. 162). They obtained the poorest kills with the n- monohalides and the best with the tert- compounds. In our tests the n-butyl and n-amyl bromides and iodides gave better kills than the corresponding n-propyl materials. Boark and Cotton found that the n-propyl gave better kills of the rice weevil than the n-butyl bromides and iodides.

The straight chain primery monohalides have shown some toxic effect when containing up to 8 carbon atoms; beyond that the toxicity has been slight in the materials tested. N-monyl bromide and n-decyl bromide, chloride, and iodide were all ineffective. N-octyl bromide was ineffective against larvae but killed eggs at a lower concentration than any of the other normal monobromides.

None of the fluorine compounds tested so far have been effective.

p

Table 20.--Materials screened as fumigants against naked eggs and third-instar larvae of Dacus dorsalis.

	T		1				Mortalities (%) at high			
	Eg	<u>58</u>	<u> </u>	Le	urvag		dosag	e tested (0.1025		
				Examin	ned after	8	nls.	per L., approx. 3/4		
Watariala			24	Hours	48	Hours	gal.	per 1000 cu. ft.)		
THE VOI TOTO	10-50	10-95	1D-50	LD-95	LD-50	LD-95		Larvae		
	Mg./L	Mg./L	Mg./L	Mg./L	Mg./L	Mg./L	Eggs	After 48 Hrs.		
Bromides-							1	· ·		
Tribromomethane	42	190	>305	>305	>305	>305	98	0		
l-bromo-l-propene	>1.35	>1.35	>135	>1.35	>135	>135	0	2		
1,2-dibromobutane	5₌5	8.7	6.5	12.1	4.1	7.8	100	100		
2 ethyl hexyl bromide	206	>106	>106	>106	>106	>106	0	0		
n-octyl bromide	12.5	21.4	2113	>113	2113	>113	100	2		
n-nonyl bromide	2110	>110	2110	>110	011<	110	37	0		
n-decyl bromide	2109	>109	>209	>109	>109	>109	14	9		
n-tetradecyl bromide	>97	>97	>97	>97	>97	>97	0	Ó		
cetyl bromide	296	>96	>96	>96	>96	>96	4	3		
Chlorides-										
Ethylene chlorhydrin	27	>100	8.3	15	7.2	11.5	100			
Propylene chlorhydrin	58	>100	6.6	10	5.2	8.9	91	100		
Mathyl banzyl chloride	9	27	-	-	17	43	100	100		
Bromochlorides-										
Bromodichloro methane	>201	>201	>201	>201	>201	>201	17	38		
Dibremochloro methane	>240	>240	>240	>240	>240	>240	34	39		
1-bromo-3-chloro butane	17.5	29	16.5	25.5	12.5	18.5	100	100		
Tetramethylene chlorobromide	>230	>230	>230	>230	170	>230	4	64,		
Iodides-										
n-propyl iodide	2.0	5.5	26	42	19.5	35	100	100		
n-butyl iodide	24.14	< 4.0 14	19.3	68	11	22	100	100		
isobutyl iodide	6.4	16	29	95	16	45	100	100		
n-anyl icdide	< 3.88	< 3.88	10.7	63.0	9.3	20.2	100	200		
isoamyl iodide	7.5	14	17.5	41	14.5	31	100	100		
n-decyl iodide	K128	<128	<128	<1.28	< 1.28	<128	3	2		

# Table 20 (cont'd)

C

	Eg	ga		La Exemin	rvae ed after	8	Mortalities (%) at highe dosage tested (0.1025 mls. per L., approx. 3			
Materials			24	Hours	48	Hours	gal.	per 1000 cu. ft.)		
	LD-50	LD-95	LD-50	LD-95	LD-50	LD-95		Larvae		
	跑。/九	Mg./L	Mg./L	Mg./L	Mg./L	Mg./L	Eggs	After 48 Hrs.		
Fluorides-										
Cyclohexyl fluoride	>89	>89	>89	>89	>89	>89	9	0		
Benzotrifluoride	>1.22	>122	>122	>122	>122	>122	8	0		
bis-(trifluoro methyl) benzene	>132	>132	>132	>132	>132	>132	0	0		
1-fluoro-1,2,2-trichloro ethane	90	220	110	165	-		83			
1,1-difluoro-2,2-dichloro ethane	>143	>143	>143	>143	>143	>14.3	0	. 2		
1.1-difluoro-2.3-dichloro-2-propene	110	>183	>183	183د	>183	>183	73	12		
p-chlorobenzotrifluoride	>128	>128	>128	>128	>128	>128	50	15		
o-chlorobenzotrifluoride	>132	>132	7132	>132	>132	>132	27	2		
m-chlorobenzotrifluoride	>132	>132	>132	>132	>132	>132	10	43		
m-nitrobenzotrifluoride	>137	>137	>1.37	>137	>137	>137	3	0		
m-aminobenzotrifluoride	>124	>124	>124	>124	>124	>124	10	0		

## (B) Tests with ethylene dibromide. (Balcck, Hinman, and Kozuma)

1. Egg development in <u>D.</u> <u>dorsalis</u>, <u>D.</u> <u>cucurbitae</u>, and <u>C.</u> <u>capitata</u> and its relationship to fumigation with ethylene dibromide.

In the last quarterly report (April-June 1951, pp. 814-817) tests conducted with naked eggs and larvae of <u>D</u>. <u>dorsalis</u>, <u>D</u>. <u>cucurbitae</u>, and <u>C</u>. <u>capitata</u> showed that the susceptibility to ethylene dibromide was in the following order:  $1 - \underline{cucurbitae}$ ,  $2 - \underline{dorsalig}$ , and  $3 - \underline{capitata}$ . This was true of both eggs and larvae although the data on eggs of <u>cucurbitae</u> were very meager. The tests previously reported were conducted in the 5-gallon tins used for funigant screening studies held at room temperatures which varied from 75 to 81° F.

The present series of tests was conducted first to complete the information on eggs of <u>cucurbitae</u> and also since eggs of <u>C</u>. <u>capitata</u> had shown a great increase in resistance to EDB in the latter stages of embryonic development it was decided to determine whether resistance to EDB varied in the same manner with the other two species. It was previously reported by Dr. Lindgren and the writer that the effect of EDB on young and old eggs of <u>D</u>. <u>dorsalis</u> was the same. (Quarterly Report Apr.-June 1950, p.48)

Method of testing was similar to that previously reported except that temperature during fumigation was kept at 70° F. by holding the fumigation tins in the temperature-controlled fumigating chamber. To obtain direct comparisons, young and old eggs of all 3 species were exposed in the same container, young eggs 3-1/2 to 7 hours old in one petri dish and older eggs in another. Fifty to 100 eggs of each age and species were fumigated at one time. To obtain older eggs in approximately the same stage of embryonic development (approximately 80-90%), <u>cucurbitae</u> were held up to 23 1/2 hours after oviposition, <u>dorgalig</u> 28 1/2, and <u>capitata</u> around 50 hours. This was based on first observed hatch at temperatures then prevailing which was approximately 24 hours for <u>cucurbitae</u>, 32 hours for <u>dorgalis</u>, and 54 hours for <u>capitata</u>. Technical EDB (Dow Chemical) diluted with CCl<sub>4</sub> (C.F. Dow) to make a 2 per cent solution of EDB by volume was used in these studies. Dosages per tin (19.6 liters) ranged from .05 ml. to 0.7 ml. which were equivalent to 0.11 to 1.56 mg. per liter of technical EDB, and were applied by means of a micro-burette graduated to 0.05 ml.

The results presented in table 21 and figure 9 reveal some very interesting information. The order of susceptibility of the three species is the same as that previously reported, with <u>cucurbitse</u> the most susceptible followed by <u>dorsalig</u> and <u>capitata</u>. This is true only of eggs nearing completion of embryonic development. During the early portion of development <u>dorsalis</u> eggs are more resistant than capitata, but whereas resistance increases only slightly with embryonic development with <u>dorsalis</u> (LD-50 = .72 mg./L. for young eggs and .92 mg./L. for old eggs), embunts of EDB required for <u>capitata</u> eggs increased from 0.42 mg./L. for young eggs to 1.7 mg. for eggs nearing complete development. No values are available for LD-95 for the older eggs of either <u>dorsalis</u> or <u>capitata</u> because of a levelling off of mortality at the higher dosages used. This levelling off becomes apparent at around a dosage of 1.56 mg./L and might be attributed to the depressing effect of CCL<sub>A</sub> used as a diluent which at this point is equivalent to 55.8 mg./L. Reduction in toxicity

Table	21 Comparative	effect (	of ethylene	dibromide	on naked	eggs of D.	<u>dorsalis</u> , 1	D.	<u>cucurbitae</u> ,	and C.	<u>capitata</u>
	in varying	stages of	f developmen	aż.	•.					i	

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			A	Per cent	Dosage and Fer Cent Mortality (mg./L.)											
	Species	no. Oi Oggs	Age Hours	nente	0.11	0.22	0.33	0.45	0.56	0.67	0.78	0.89	1,00	1.11	1.33	1.56
<u>c</u> .	capitata	3,765	3 1/2-7	6.5-13.0	0	·11.2	25.9	59.1	<u>5</u> 7.6	89.6	97.8	99.6	100.0	100.0	100.0	
		4,670	24-30	44-55	15.2	11.2	8.3	6.0	12.9	39.2	59.1	61.1	84.8	70.1	91.9	60 60 40 60
		1,000	49 1/2- 51 1/2	92-95		7.5		7.5		2.5		8.4	a	16.8	29.1	28.4
D.	<u>dorsalis</u>	5,595	3 1/2-7	11-22	1.65	2.25	3.3	14.7	11.5	44.0	61.5	73.4	90.7	79.3	86.3	
		4 <b>,</b> 703	21 1/2 <b>-</b> 28 1/2	67-89		5.1		9.6		19.9	·	44.7		60.2	65.0	66 <b>.</b> 2
D.	cucurbitae	3,129	2 1/2-7	10~29	22.4	25.0	78.6	95.8	100.0	98.2	100.0	100.0	100.0	100.0	100.0	500 500 500 500
		2,446	19 1/2- 23 1/2	79-96		33.2		85.2		100.0		100.0		100.0	100.0	223
Ŀ	1/ Calculated from approximate mean time elapsed from egg deposition to first hatch at prevailing temperatures:															

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capitata - 54 hrs., dorsalis - 32 hrs., and cucurbitae - 24 hrs.

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Figure 9. --Effect of ethylene dibromide on eggs of <u>C</u>. <u>capitata</u>, <u>D</u>. <u>dorsalis</u>, and <u>D</u>. <u>cucurbitae</u> in various stages of development.

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of organic compounds mixed with CCl<sub>4</sub> has been previously reported by Shepard and Lindgren- and Jefferson but the effect was not nearly so pronounced, due perhaps to the greater dilution 49 to 1 in the present studies compared to 3 to 1. This phenomenon was not observed previously when the temperatures of fumigation were 5 to 11° higher (75-81° F.) compared to 70° F. in the present series. These differences in temperature were reflected in pronounced differences in fumigating effectiveness as can be seen by comparing the curves obtained at 75-81° F. (Report April-June 1951, p. 816) with those in figure 9 of this report.

		mg./1 of EDB	for LD-50
	<u>Species</u>	75-81° F.	70° F.
D.	<u>dorsalis</u>	0.40	0.92
<u>C</u> .	capitata	0 <b>。</b> 55	1.70

2. The effect of wrapping and packing material during funigation with EDB under 3/4 fruit load.

In the last quarterly report it was shown that fruit fly mortality might be affected if, before fumigation with EDB, fruits were enclosed in corrugated paper sleeves or wrapped in citrus tissue to prevent bruising. Six additional tests were conducted during the current quarter to get further information on this point.

The load for all 6 tests was maintained constant. Seventy-six field boxes were used in each test. The approximate weight of the fruit itself was around 1600 lbs. Papayas with or without wrapping were always packed in a single layer, 21 fruits to a box. Where it was necessary to supplement the load with other fruits or vegetables, these were packed in the boxes loosely to within about 2 inches of the top.

Five of the tests were conducted at 1/2 pound per 1000 cubic feet for 2 hours. In 3 of the tests the papayas were wrapped in a corrugated paper sleeve; in one test the papayas were packed naked in boxes lined with a single sheet of newspaper on the bottom and the four sides; and in the other test the fruit was fumigated naked in unlined boxes. A total of 27 apparently normal puparia were recovered from 4,704 wrapped fruits with an estimated prefumigation population of 47,116 fruit fly eggs and larvae. Only 1 adult dorsalis emerged from this number. In the experiment where papayas were packed in paper-lined boxes 20 puparia were recovered from 1,596 fruits containing approximately 2,896 fruit fly eggs and larvae. One <u>dorsalis</u> adult was reared from the recovered puparia. There were no survivors from 7,969 eggs and larvae in 1,596 naked fruit in unlined boxes.

From these data it seems quite evident that our present EDB recommendations of 1/2 lb./1000 cu. ft. are adequate only if the fruits are packed loosely in unlined boxes without the use of wrapping or packing material. Since survival where fruits were wrapped or boxes lined with paper may be due to added absorptive area and/or interference with gas movement, experiment 162 was planned to determine whether a 50% increase in time and dosage would offset these conditions. However, due to an extreme shortage of papayas as a result of recent storms it was impossible to test a full papaya load and it was necessary

- 1/ Shepard, Harold H. and David L. Lindgren, 1934. The relative efficiency of some funigants against the rice weevil and the confused flour beetle. Jour. Econ. Ent. 27(4):842-845.
- 2/ Jefferson, R. N. 1943. Influence of carbon tetrachloride on the toxic efficiency of certain volatile organic compounds. Jour. Econ. Ent. 36(2):253-259.

to supplement the load with field-infested guava and kamani. The fruit fly populations in the small load of papaya tested were too light for obtaining reliable information, but heavy infestations occurred in both guava and kamani and out of a total fruit fly population of 12,908 there were no survivors.

Further work will be required to determine fumigation requirements for fruits to be treated with packing material.

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Detailed data are presented in table 2%,

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Test No.	Dosage 1bs./1000 ft. <sup>3</sup>	Exposure Hours	Kind of fruit	No. of fruits	Method of packing and loading	Estimated population	Pup.2/	dor.	cuc.	Par.	Per cent mort. 2
157	1/2	2	papaya	1,512	Papayas wrapped individually in corrugated paper sleeve.	19,864	2(2)	0	0	0	99 <b>. 99</b>
			cucumbers	43 lbs.	72 field boxes-21 fruits	3,087	0	0	0	0	100.00
			snap beans	27 <sup>n</sup>	of cucumbers & string beans naked.	960	Ö	0	0	0	100.00
158	1/2	2	papaya	1,596	Bottom & 4 sides of field box lined with newspaper 1 sheet thick. Fruit naked in 76 field boxes.	2,896	206/	1	0	Û	99.31
159	1/2	2	papaya	1,596	Fruit naked in 76 field boxes-21 fruits each.	7,969	0	0	0	0	100.00
160	1/2	2	papaya	1,596	Fruit wrapped individually in corrugated paper sleeves & placed in 76 field boxes with 21 fruits each.	4,919	15(7)Z	1	0	14/	99 <b>. 70</b>
161	1/2	2	papaya	1,596	Same as 160	22,333	10(21) <sup>8</sup> /	′ o	0	0	99.96
162	3/4	3	papaya	147	Papaya wrapped in corrugated	23	× 0	0	0	0	100.00
			guava	702 lbs.	field boxes, 21 fruits ea.	3,688	0	0	0	0	100.00
			kamani	540 lbs.	18 lbs. per box. 39 boxes guavas, naked-18 lbs. per box.	• •		¢			
Trea	ted totals			8,043 papaya 1312 1bs misc.		74,936					

Table 22. -Fruit pack and load and its effect on fumigation with EDB at 70° F.

Table 22 (cont'd)

Data for Controls

Test No.	Dosage 1bs./1000 ft. <sup>3</sup>	Exposure hours	Kind of fruit	No. of fruits	Method of packing and loading	Estimated population	Pup. 2/	dor.	cuc.	Par.	Per cent hatch
157	controls		papaya	210		, 2,759	2,759	1195	72	265/	46.9
			cucumber	20 lbs.		1,436	1,436		816	0	56.8
			snap beans	13 "		471			258		54.8
158			papaya	280		503	508	225	17	105/	49.6
159			8	280		1,398	1,398	487	38	162/	38.7
260			Ð	280		863	863	479	6	115/	57.5
161			п	280		3,918	3,918	2011	7	95/	51.7
162			papaya	63		10	10	4	0	4,5/	80.0
			guava	150 lbs.		788	788	462	0	392/	63.6
			kamani	160	· .	2,732	2,732	1296	0	4715/	64.7

I/ The load in each experiment was approximately the same, approximately 1,600 lbs. of fruit in 76 field boxes, 10 stacks of 7 boxes and 1 of 6. Stacks were spaced 3/4" apart, and 3/4" between layers separated by means of 3/4 x 3" boards.

/ Apparently normal pupae (imperfectly formed pupae in parenthesis).

3/ dor=dorsalis, cuc=cucurbitae, par=parasites

4/ Opius longicaudatus

5/ Opius cophilus

6/ 10 larvae recovered from paper lining of boxes following fumigation. Very lively when recovered, 8 dead in 24 hrs. and 2 in 48 hrs.

1/ 67 live larvae recovered from floor of chamber immediately after fumigation, 60 dead in 48 hrs., 2 in 72 hrs.

8/ 13 live larvae recovered from floor of chamber 24 hrs. after fumigation. All dead on 8/20.

9/ Based on externally normal puparia recovered.

Line Project I-0-5-5. Investigations of Materials as Dips for Commodity Treatment.

(INACTIVE)

#### Line Project I-0-5-6. Application of Radiation to Commodity Treatments.

(INACTIVE)

### Line Project I-o-5-7. Investigations to Determine Infestation Indices in Hawaiian Fruits and Vegetables. (Balock and Kozuma)

Sixty-two lots of fruits and vegetables were collected and held to determine degree of fruit fly infestation. This brings the total collections over the past three years to 353 and a weight of 23,662 pounds, representing 13 kinds of fruits and vegetables, including practically every exportable commodity subject to fruit fly attack. As well as could be determined, the commodities were extremely sound and met with grade A requirements.

A brief summary of information on infestation indices is shown in table 23. More complete information on current as well as cumulative data are shown in table 24. There are many factors which influence fruit fly infestation. Some of them are variety, season, location, degree of maturity, and this information is included whenever possible.

As a rule, melon fly hosts have much higher infestation indices than oriental fruit fly hosts. Very little overlapping of species in hosts has been recorded. Infestation in fruits is almost entirely restricted to <u>dorselis</u> and in vegetables to <u>cucurbitee</u>. Pineapple with an index of 0.00047 larvae per pound and mature green papaya with an index of 0.009 are among the lowest recorded <u>dorsalis</u> hosts. Haden mango with an index of around 8.0 for onequarter ripe to ripe fruits has the highest index. Bitter melon with an index of 5.34 is the most heavily infested melon fly host.

Commodity	Degree of raturity	No. of collections	No. of pounds	No. of larvae	larvae per 1b.
A doncolia besta					
A. dorselits nosts	mature				
Avocado	green	41	1,535	117	0.076
Banana (Cavendish)	6	3	140	9	0.064
Papaya (Solo)	ព	5 <b>3</b>	7,093	70	0.009
<b>19</b>	1/4 ripe	34	2,516	55	0.022
17	1/2 ripe	27	1,803	558	0.309
Mango (Haden)	naturo green	4	. 11	17	1.55
8	1/4 ripe	4	15	119	7.93
	l/2 ripe- ripe	5	n	94	8.55
Pineapple (smooth (cayenne)	1/2 ripe-	68	4,292	2	0.00047
Wai chi (a tropical fruit)	ripə	2	16	0	0
<u>B. Melon fly hosts</u>					
Bell papper		27	1,116	270	0.241
Bitter melon		6	240	1,282	5.34
Cucumber		20	2,193	2,873	1.31
Egg plant (round)		9	162	0	0
Snap beans		17.	328	1,148	3.50
Tomato	nature green	20	1,110	804	0.72
	1/4 ripe	20	986	1,010	1.02
Zucchini squash		4	95	28	0.295

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Table 23 Summary of	information to date on fruit fly infestation i	indices
in Grade A	fruits and vegetables.	•

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1				2		FTU	ars	Lar	vae			_	٩	1
Fruit or		Degree of		1951			lbs.		' pər	L	F	more	ence	/
vegetable	Variety	maturity	Collection	Date	Locality	No。	Wt.	Total	<u>lb.</u>	dor	cuc	0.p.	0.0.	l Other
Avocado	Seedling Tanaka spec.	maturo groon n n	39 40 41	7/10 8/2 8/21	Wailua "	50 40 80	30 40 50	62 0 46	k 1 1 1 1	401	0	0	0	i O i
Totals-quarter Cumulative			3 <u>41</u>			170 1562	120 1535	103 117	0,90	77 80	0 0		0 0	0
Banana	Cavondish	11	123	7/10 8/2 8/21	Maunawili Kaneohe	300 140 150	60 30 50	0 9 0	1 1 1	6	0	0	0	0
Totalo-quarter Cumulative			9 3			590 590	140 140	9	0.064	ۍ ن	0 0		0 0	
Bell pepper	World Beater		24 25 26 27	6/29 7/10 8/2 8/21	Kailua	140 50 70 140	50 30 25 30	0000	     			;   ;   ]   ]		       
Totals-quarter Cumilative			- 27			400 4501	1 135 1116	0 270	0,243.	231	263	1 0	0	0
Bitter melon			3456	6/21 7/10 7/31 8/21	Kailua Ewa n n	160 100 160 150	50 25 60	875 0 208 5	e       		590 123 4		0	1 1 1 1
Totals-querter Cumulative			4			570 720	193   240	1088 1282	15.64 15.34	0' 0'	717 861		0 0	1
Cucumbər	Marketer H Denver		17 18 19 20	6/21 7/10 7/31 8/21	Kailua Waimanalo n	140 60 90 90	88 40 50 50	93 0 24 0	E F F		55 10		0	       
Totals-quarter Cumulative	TOUG BLOOM		20			380 3346	228	117 2873	0.51		65 1948		8	i j
Egg plant	Round type		7 8 9	7/10 8/2 8/21	Eve n n	50 70 30	30 40 40	0 0 0	   				i   	! ! !
Totals-quarter Cumulativo	*		39			150 220	110	0 0	10					1

Table 24.-Fruit fly infestation in Grade A fruits and vegetables. (Current and Cumulative)

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Table 24 (cont'd)

						Fru	uits	Ler	vae	T	*******			,
Fruit or		Degree of		1951			108.		l per	7	J	Energ	ence	/
vegetable	Variety	maturity	Collection	Date	Locality	No.	Wb.	Total	1 1b.	dor	cue	10. p.	10.0.	'Other
Mango	Haden	mature green	1 2 3	6/29 7/3 7/6	Alea Hts. n	526	   	15 2 0		12 2	0	0   0 	0	
Totals.			3			7.3	11	2.7	11,55	1 3%	i n	0	1 0	
Mango	53	1/4 ripe	1 2 3	6/29 7/3 7/6	11 11 13	12		76	1	39 38	0	0		1
Totals	1		3	<u> </u>		36	75	110	17.02	577			, 	;
Mango	11	1/2 to ripe	1 2 3	6/29 7/3 7/6	11 11	3		0 94 0	   	71	0	0		0
Totals			3			231	17	<u>Q</u> (	18.55	177	n	0	7	
Papaya	Solo	mature green	52 53	6/22 7/13	Kailua Waimanalo	60 <sup>1</sup> 401	63 50	0	1	     	اا ا			
Totels Cumiletivo			2 53			100	113 7093	() 70	0,009	32	ן נו	0	0	٥
Papaya		1/4 ripe	33 34	6/22 7/11	Kailua Waimanalo	601 401	69 45	0 9		6	0	0	1	0
Totels <u>Crumilative</u>			2	ļ		100 1934	<u>114</u> 2516	9 55	0,079	28	01 ()	0	11	00
Papaya		1/2 ripe	26 27	6/22 7/13	Kailua Waimanalo	60 40	64 38	18 0		14	1	0	0	0
Totels <u>Cumilative</u>			27 27			1001 13501	102 1803	18 558	0,176 0,309	14 261	2,	6	8   8	0
Pineapple	Snooth Cayenne	ratoon 1/4 to ripe	63	6/15	Hawn. Pine Waialua	161 1	61	0		•		   	. ]	
		plant crop " ratoon " plant crop	64 65 66 67 68	6/15 6/28 6/28 8/29 8/29	n n Havn, Pine Waipio n	17 16 15 16 16 17	77 57 53 35 60	0 0 0 0	•	1 1 1 1 1	1 1 1 1 1	         		
Totels Cumulativo			6 68			971 1294:	343 4292	0 2	0 0,00047	1	0	0	0	0

## Table 24 (cont'd)

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						Fru	uits	Iar	Vao	Baergera			1		
Fruit or		Degree of		1951			lbs.		per		H	Emergence <sup>1</sup> c ¦0. p.   0. o.  Othe		/ 	
vegetable	Variety	maturity	Collection	Date	Locality	10,	Wt.	Total	16.	der	cuc	0. p.	0.0.	lother	?
Snan beans			පි	6/2].	Kailua		20	27	1	0	23		1	!	
			9	7/10	π		20	13.	1	0	9		}	1	
	Inalualei		10	7/31	Waimanalo		20	647		0	522		ı i	Ì	·
	1		27	8/21	tî		50	301		0	159		1	1	
fotals			ly.				80	986	15-3	0	211			 	
Sumalative			1 ( 4				ن بر	U.LA.O 	3=2		h3.10	ا ہــــــ	 	, 	
Tomato		meture green	17	6/21	Weimenalo		52	O O						1	
			10	1/32	6	100	- 22 - 60	756			770	1		l	
			20	8/27	f2	7/0	- 50 - 50	0			المشتم	i		i I	Ì
finita a				100 Partie		600	315	236	075	5	1201	 			
Gumiladive			20			1202	5208	854	0.72	5 an (	336	;	1		
Transto		1/4 ripe	17	6/21	Waimanalo	110	52			0	11				
			18	7/12	п	320	110	29		C	16!		1	I	ļ
			19	7/31	11	130	30	153	1	0	92	1	i	•	
			20	8/22	13	120	40	0			1				
Totals			4			710	222	183	0.82	0	199				
<u>Oundativa</u>		\	id0			027	ويراب في	2.01.2.	3,007		1007		: اا		
Wai chi		ripa	l	7/2	Aica Hts.	220	9	0					ł		
			2	7/6	[]	112	7	0			1				
Totels			2			332	16	0	0	l		i	1		
Zucchini squash			3	7/10		50	20	0				(	i		
			4	8/2		120	30	0			1	۱ ۱ ۱			
Totals			2			170	50	0	0		1	Ì			
Cumulative			4.			28.	95	20	0.295	0	191	01		•	0

1/ dor=D. dorselis, cuc=D. cucurbitae, 0.p.=Oplus persulcatus, 0.o.=O. cophilus.

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#### HANALI AGRICULTURAL EXPERIMENT STATION

## Factors Affecting the Keeping Quality of Cut Flowers, Foliages, Ornamentals, Fruits, and Vegetables in Relation to Quarantine Sterilization Requirements for Export. (Ernest K. Akamine, Hildefield.

The following is a reason of the studies conducted by the Department of Plant Physiology, University of Havald Agricultural Experiment Station, during the period ending September 30, 1951 on the tolerance of the various commodities to treatments required for destroying the oriental fruit fly. Certain treatment, storage, and personnel facilities of Grant No. 5x of the Industrial Research Advisory Council, Territory of Hawali, were employed in these studies.

## Lich.

<u>Quick-freeze</u> treatment  $(-26^{\circ} \text{ and } -31^{\circ} C_{\circ})$ . Litchis stored for 16 1/2 months in deep freeze were still of merketable quality. This experiment had to be terminated due to mechanical failure of the freezers.

#### Pineapo e

Ethylene dibromide fumigation. Fruits of plant and ration crops (Fruit Fly Laboratory tests 11.7, 116) tolerated this gas at a decage of 3/4 lb./1.000 cubic feet for 3 hours at 70° F. Treated and untreated fruits when first stored at 55° F. for 6 days before storing at room temperature remained in a marketable condition for as long as 13 days (tests 50, 51).

#### Banana.

Ethylene dibrondic funigation. Different types of bananas were subjected to this funigant at a rate of 1/2 lb./1,000 cubic feet for 2 hours at 70° F. The ice crean (test 29) and apple bananas (tests 32, 33) were injured by this treatment. The skin turned brown followed by pot. The cooking banana (green type), however, tolerated the treatment (tests 30, 31). Chinese banana when funigated with this gas at a dosage of 3/4 lb./1,000 cubic feet for 3 hours \$2 70° F. was injured, the skin turning brown (Fruit Fly Laboratory Test 111) (test 35).

<u>Methyl bromide fumigration</u>. Bluefield banana tracted with this gas at a dosage of  $2 \frac{1}{4}$  <u>The/1,000</u> cubic feet for 6 hours at 60° F. was severely injured (test 34). Injury symptoms were shullar to those of othylene dimbromide.

#### Avecado

Ethylene dibromide fundgation. Three summer seedling variaties of avocados tolerated fundgation with this gas at a dosage of 1/2 lb./1.000 cubic feet for 2 hours at 70° F. (tests 35, 36, 37, 38). Another summer seedling variaty was subjected to this fundgant at a rate of 3/4 lb./1.000 cubic feet for 3 hours at 70° F. before storage at simulated shipping conditions (Fruit Fig Laboratory test 118). Although the treated fruits ripened about 1 day earlier than the controls, they were normal in other respects. (test 39)

#### and the stars

## String Bean (flat type)

Ethylene dibromide fumigation. Except for slightly reduced aroma, string beens subjected to this gas at a dosege of <u>3/4 lb./l.000 cubic feet for</u> <u>3 hours at 70° F.</u> were normal and remained in a marketable condition just as long as the controls at 55° F. (Fruit Fly Laboratory test 112) (test 17).

#### Gueunder

Ethylene dibromide funigation. Cumbers exposed to this gas at the rate of 3/4 lb./1.000 cubic feet for 3 hours at 70° F. and then stored continuously at 55° F. were no different from the controls (Fruit Fly Laboratory test 110) (test 39).

#### Bell Papper

<u>Ethylene dibromide funigation</u>. Bell peppers treated with this gas at the rate of 3/4 lb./1.000 cubic feet for 3 hours at 70° F. and then stored continuously at 55° F. became pitted and developed rot areas (Fruit Fly Laboratory test 109) (test 37).

## Italian Squash

Ethylene dibronide furigation. Italian squash funigated with this gas at the rate of 3/4 Rb./1.000 cubic feet for 3 hours at 70° F. and then stored at 55° F. were no different from the controls (Fruit Fly Laboratory test 115) (test 10).

#### Mongo

Ethylene dibromide funization. Haden mangoes subjected to ethylene dibromide at a dosage of <u>1 lb./?.000 cubic feet for 8 hours at 90° F.</u> and then stored at 55° F. for 6 days before holding at room temperature for ripening failed to color normalky (test lk). Green areas on the skin of the treated fruits burned unsightly green instead of turning yellow. Internally, however, they were ripe and normal.

#### Farava

Ethylene dibroride funigation. Whereas 1/4 ripe papayas were not injured by exposure to this gas at a desage of 3/4  $1b_{2}/1_{2}000$  cubic feet for 3 hours at  $70^{\circ}$  F. (Fruit Fly Laboratory test 114) (test 95), mature green fruits were severely scalled by this treatment (Fruit Fly Laboratory test 113) (test 96). The ripening and coloring processes were somewhat delayed by the treatment. Internally, however, the treated fruits were normal.

## Tomato

Ethylene dibromide fumigation. Tomatoes fumigated with this gas at a dosage of 1/2 lb./1,000 cubic feet for 2 hours at 60° F. and handled under simulated shipping conditions became scalded and water-logged (test 48).

Nothyl bromide funigation. Encept for delayed ripening, tomatoes treated with this gas at a dosage of  $2 \frac{1}{4} \frac{16}{1000}$  cubic feet for 4 and 6 hours at 60° F. and for 4 hours at 70° F. were not affected adversely (tests 48, 49, 50). In one test (test 49), the delay in ripening was approximately 3 days. In another test (test 50) after 6 days of storage at 55° F., there were 4.6 times more fully ripe fruits in the control than in the treated lot. Some fungus hyphae which appeared on the stem end did not extend into the fruit (test 49).

#### Shipment Report (IsR.A.C. Project 3, RMA 95-2)

These test shipments were planned and executed by Kenneth I. Hanson, Market Economist of the Agricultural Extension Service assigned to I.R.A.C. Project 3ax (RMA 95-2), in cooperation with Dr. Kobe Shoji, Assistant Plant Physiologist of the Hawaii Agricultural Experiment Station assigned to I.R.A.C. Project 5x. Papayas were shipped from Hilo (Hawaii) and Honolulu; and pineapples and cucumbers from Honolulu. Clarence Lyman, county agent of the Agricultural Extension Service, assisted with the shipment of papayas from Hilo. Dick Sumida of the Agricultural Extension Services assisted with the preparation of the shipment from Honolulu. The cooperation of the Matson Navigation Company, Calavo Grovers of California, and the several shippers in the Territory and receivers on the West Coast is gratefully acknowledged.

#### SHIPMENT REPORT

#### PAPAYAS

#### Hilo to San Francisco, Hawalian Pilot, Sept. 18

Thirteen cartons of papayas were treated with ethylene dibromide gas and packed at the N.S.K.K. plant in Hilo by Dr. Kobe Shoji and the writer on September 15. They use shipped to San Francisco on September 18 aboard the Hawaiian Pilot at a temperature of 45° F. Fruit was picked on September 12 and 13 from two locations on Hawaii---5 boxes from Farm No. 1, and 8 from Farm No. 2.

First inspection on arrival in San Francisco was made on September 28 and again on October 2. The shipment was held in San Francisco at approximately 65° F. for 5 days. Fruit from Farm No. 1 showed 7 per cent anthracnose decay on September 28 and 35 per cent on October 2. Stem-end decay was severe-30 per cent on September 28 and 35 per cent on October 2. Fruit from Farm No. 2 showed 23 per cent anthracnose decay on September 28 and 73 per cent on October 2. The area of infection was small on many of the fruit at first inspection but the entire surface was infected in some of the cartons by the second inspection. Stem-end decay was 22 per cent on September 28 and 44 per cent on October 2. It should be noted that the first inspection was made 17 days from picking, which is partially responsible for the high percentage of decay.

## Hilo to San Francisco, Hawailan Wholeselor, Sept. 23

Twenty-two cartons of papayas were preated with ethylene dibromide gas at the N.S.K.K. treating plant in Hilo on September 21 and shipped on the Hawaiian Wholesaler on September 23. The fruit was picked from two locations on Hawaii-9 cartons from Farm No. 1 and 13 from Farm No. 2.

Upon arrival in San Francisco on Catober 1, the papayas were taken to the Calavo, Inc. warehouse where they were inspected on October 2 and 5 by the writer. The fruit was shipped at 47° F. On September 25, 2 days after loading the average temperature inside the cartons was 51° F. and on the 26th it averaged 48° F. The temperature remained between 47° and 48° F. for the duration of the trip. Storage room temperature in San Francisco was between 63° and 65° F.

Inspection of fruit from Farm No. 1 on October 2 showed 7 per cent anthracnose infection on the surface of the fruit. On October 5 the infection had increased to 10 per cent of the fruit. Stem-end decay was not evident on October 2, however, inspection 3 days later showed 10 out of 56 fruit, or 18 per cent, decay.

Inspection of fruit from Farm No. 2 on October 2 showed 10 per cent anthracnose infection which had increased to 23 per cent on October 5. Stem-end decay was not serious-1 per cent on October 2 and 6 per cent on October 5.

#### Honolulu to San Francisco, Hawaiian Wholesalor, Sept. 25

Seven cartons of papiyas were obtained from the Oahu Farmers, Ltd. in Honolulu on September 24 and treated with ethylene dibromide in the I.R.A.C. Laboratory at the University of Hawaii. They were shipped on September 25 at a temperature of 47° F. Inspection in San Francisco on October 2 showed 3 per cent anthracnose decay which had not increased upon inspection 3 days later. Stem-end decay was noted in 1 1/2 per cent of the fruit on October 2. This had increased to 10 per cent 3 days later.

Coloring during transit was slow. Only 40 per cent of the fruit packed at the one-fourth-ripe stage turned one-half ripe and 32 per cent of the fruit packed one-half ripe turned three-fourths ripe to ripe.

#### PINEAPPLES

Two wirebound crates and three cartons of pineapples were treated with ethylene dibromide and packed in the DuR.A.C. laboratory on September 24. The fruit was shipped on September 25 at a temperature of 47° F.

In wirebound crate No. 1 (12 count, packed three layers of four pineapples each), the pineapples were wra ped with corrugated cardboard. Some side bruising was noted on the four pineapples on the bottom layer and on one pineapple of the top layer. No bruises were evident in the center layer.

In wirebound crate No. 2 (8 count) packed without corrugated wraps, side bruises were noted on three of the fruit in the bottom layer and on two of the fruit in the top layer. There was no noticeable difference in the amount of bruising between the two crates. However, the result is not conclusive as crate No. 1 was tightly packed and crate No. 2 was not.

The pineapples in carton No. 1, (5 count) packed with corrugated cardboard wraps, showed no bruising. The pineapples in carton No. 2, (5 count) packed without corrugated wraps, showed bruising of three pineapples on the bottom layer. In carton No. 3 (large size carton, 8 count) where the pineapples were tightly packed with corrugated cardboard wraps, three out of the eight were bruised slightly. From these preliminary results it would seem that the use of filler material of some kind in the corrugated boxes now in use is necessary to prevent bruising with or without the use of corrugated wraps.

#### CUCUMBERS

One lug box of cucumbers was treated with ethylene dibromide and packed at the I.R.A.C. laboratory on September 24. It was shipped at a temperature of 45° F. on the Hawaiian Wholesaler on September 25. The temperature inside the boxes reached 48° F. 28 hours after loading and remained steady throughout the voyage. The shipment arrived in San Francisco in marketable condition and showed only slight yellowing. The lug pack is acceptable on the mainland market.

## SWAMP CABBAGE (Un Choi)

Observations were made on transit temperatures and arrival condition of a commercial shipment of 10 boxes of swamp cabbage (un choi), made by George Tanabe of Waialua, Oahu, The cabbage was packed in orange crates lined with paper and had been shipped at a temperature of 47° F. The average temperatures inside the crates during the trip were as follows:

	Date	-	Tenperature <u>Desrecs Fabrenheit</u>	ļ	Dain	<u>.</u>	e	Degrees <u>Fahrenheit</u>
Sept.	25 8 26 8 26 8	pollo Sollo Pollo	66.7 54.7 51.2	Sept.	27 27 28 28	88888	e ello Pollo e ollo Dollo	49•3 47•9 47•8 47•4

The receiver reported the quality as good on inspection after arrival in San Francisco. He reported that quality varied a great deal with each shipment. This type of vegetable has to be sold immediately upon arrival. There is usually some loss due to drying of the outer leaves.

#### MARKET INFORMATION ON PAPAYA AND PINEAPPLE SUITMENTS

The San Francisco and Los Angeles markets are, at the present time, absorbing all the papayas and pincapples now being shipped. However, there is some loss of papayas due to decay both at the wholesale and retail levels.

Papayas: Anthracnose and stem-ond decay appear on some of the fruit before the retailer gets the fruit. Some of the fruit is repacked by the wholesaler. Many of the containers are opened by the buyer at the wholesale market. If decayed fruit is found it is replaced before delivery is made.

The retailer does not often accept fruit that has started to decay, particularly at the present high prices. The replacement of unselable fruit, often called shrinkage, must be taken into consideration by the shipper as he is the one who pays for it. Often about 20 per cent of the fruit in a shipment cannot be sold because of bruising and decay. The retailer soon tires of handling a product with which he encounters a great deal of trouble even if he is reimbursed for the losses due to decay. He often feels that customer satisfaction is more important and does not want to handle a commodity that does not have a reasonable shelf life.

West coast dealers stress the importance of some form of advertising and dealer service by the papaya industry before any substantial volume can be sold. At the present time no work of this kind is being carried on as shipments from Hawaii have been very light due to the severe storm in March, 1951. Some work along these lines is expected to be carried on by the industry at the retail level when shipments reach a substantial volume.

<u>Pineapples:</u> Pineapples are presently selling well in Los Angeles and San Francisco. <sup>P</sup>unigation of pineapple by ethylene dibromide gas and by vapor heat appears to be definitely better than funigation by the methyl bromide method. Losses to wholesalers and retailers have been reduced. The crown of the pineapple remains green for a Longer period of time and the fruit is more "alive" than formerly. However, the quality of the fruit varies greatly. The dealers say that there is too great a quality variation in the shipments. A uniform quality with all shipments is necessary to build up a market for fresh pineapples on the coast.

> (signed) Kenneth I. Hanson Market Economist

## <u>A Study of the Influence of Sterilization Treatments for the Oriental Fruit</u> <u>Fly on the Physiology, Handling and Marketability of Fresh Fruits, Vegetables,</u> <u>and Cut Flowers</u>. (L. L. Claypool, H. M. Vines) University of California

#### SECTION A. DECIDUOUS FRUITS

General Summary of Commodity Treatments with Deciduous Fruits

During the quarter ending September 30, 1951 tolerance tests were made on apples, apricots, strawberries, figs, grapes, nectarines, peaches, pears, and plums. The following fumigants in addition to vapor heat were used on part or all of these fruits:

Ethylene Chlorobromide	Methyl Iodide
Ethylene Dibromide	Propylene Bromide
Methyl Bromide	Trimethylene Bromide

Propylene bromide and trimethylene bromide had not given promising results in previous trials, but it seemed desirable to continue their use to cover additional fruit species. Trimethylene bromide resulted in serious off-flavors to most fruits even at a dosage of 1 pound for 2 hours. In many cases this off-flavor disappeared with time, but usually too late to make the fruit a marketable product. Furthermore, the aroma and flavor characteristic to the variety usually failed to develop in treated fruits. Propylene bromide was less injurious but did affect flavor and aroma. Usually the treated fruits returned to normal flavor by the end of the transit period, but since the flavor effects are more pronounced than with ethylene chlorobromide or ethylene dibromide and its insecticidal value is much less, it seems highly improbable that it could fit into a quarantine program for fresh deciduous fruits.

Methyl iodide has not been tested as extensively as ethylene chlorobromide, ethylene dibromide or methyl bromide because of its expense and corrosive action to metals. At 2 pounds, 4 hours it was usually injurious as indicated by surface or flesh browning, but at 2 pounds, 2 hours fruits were usually tolerant to it. It seems likely that at lower dosages it could be used with little risk. This information can be developed next season if entomological studies warrant it.

Fruit species have seemed more tolerant to methyl bromide during the 1951 fruit season than in any previous fruit season. Even at dosages of 2 pounds for 4 hours very little impairment to flavor was recorded. These results would indicate possible differences in tolerance of fruits to methyl bromide from year to year. However, since a considerable margin of safety is essential for a commercial fumigant, it is believed that methyl bromide may be classed as hazardous when used at dosages as high as 2 pounds, 4 hours.

Ethylene chlorobromide seems to have little or no physiological effect on deciduous fruit species when used at dosages of 2 pounds for 2 hours or less. At 2 pounds, 4 hours injury was very infrequent. The tolerance of fruits to this fumigant seems even better than to ethylene dibromide. A more complete evaluation of the insecticidal properties of ethylene chlorobromide would seem to be indicated on the basis of its relatively noninjurious effect on deciduous fruits.

Ethylene dibromide has continued to give excellent results in all fruit treatments and seems to be non-toxic even at concentrations of 2 pounds, 2 hours. The major problem with ethylene dibromide, so far as the fruit is concerned, is the objectionable flavor temporarily resulting from the treatment. This has not been serious at the dosage of 1/2 pound, 2 hours and has always been dissipated during the simulated transit period. Whether the fumigant will disappear from a large bulk of confined fruit such as would be the case in car-lot shipments to eastern markets is not known at this time. It would seem that such a shipment should be made to determine this point. Until that can be done it will be impossible to state with assurance that ethylene dibromide is a completely satisfactory fumigant.

Vapor heat has continued to give completely unfavorable results.

#### ETHYLENE CHLOROBFOMIDE

From the results of previous experiments the dosages were increased in an effort to obtain a tolerance limit. The selected dosages of 1#, 2 hrs., 2#, 2 hrs. and 2#, 4 hrs. were used.

All fruit was harvested at commercial shipping maturity unless otherwise specified and tests were conducted as soon after harvest as practicable, usually after one day during which time the fruit was brought to treatment temperature. The tests were conducted in a 252 cubic foot chamber, previously described, with the fumigant being atomized into the chamber at a temperature of 70° F.

After treatment the fruit was stored at 41° F. to Simulate transit conditions for the time specified in the following chart. The fruit was then moved to 68° F. for ripening and kept there for observation through its marketable period.

A discussion of the effect of treatment to the different species and varieties appears below. The appearance of the fruit was considered normal unless otherwise specified.

SPECIES		TREAS	IMENT	
<u>VARIETY</u>	LOCALTYY	PRE	POST	EFFECTS OF TREATMENT
<u>APPLES</u> Gravenstein	Sebastorol Harvested 8-6-51.	1 d @ 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs No effect to flavor or appearance.</li> </ul>
Gravenstein	Sebastopol Harvested 8-21-51.	9 68° 2 d	10 d 3 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Slight off-flavor the day after treatment which disappeared within 6 days.</li> <li>2#, 4 hrs Serious off-flavor after one day which disappeared within 10 days after treatment.</li> </ul>
APRICOTS Tilton	<b>Brentwood</b>	1 d @ 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance when checked 2 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 2 days after treatment and thereafter.</li> </ul>
BERRIES Strawberry	San Jose	ld @45°	2 d @ 41*	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Off-flavor that did not return to normal during a 4-day observation period.</li> </ul>

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## Ethylene Chlorobromide, Cont'd

SPECIES	<b>* ~~</b> 6 * <b>*</b> ***	TREA	rment	
BERRIES	LUCALITY	Pitti	PUST	EFFECTS OF TREATMENT
Strawbərry	San Jose	1 d @ 45%	2 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Off-flavor that did not return to normal during a 4-day observation period.</li> </ul>
<u>FIGS</u> Black Mission	Winters	1 d 3 680	3 d 0 410	<ul> <li>1#, 2 hrs No effect to flavor or appearance</li> <li>2#, 2 hrs Off-flavor that returned to normal within 2 days after treatment.</li> <li>2#, 4 hrs Serious off-flavor that returned to normal within 5 days</li> </ul>
Kadota	Merced	] d @ 68°	3 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Off-flavor that returned to normal within 5 days after treatment.</li> </ul>
<u>GRAPES</u> Red Malaga	Davis Harvested 8+24-51.	3 d @ 41°	5 d @ 41°	<ul> <li>1#, 2 hrs Slight off-flavor after 2 days that disappeared within 4 days after treatment.</li> <li>2#, 2 hrs Moderate off-flavor after 2 days that disappeared within 4 days after treatment.</li> <li>2#, 4 hrs Strong off-flavor that disappeared within 7 days after treatment.</li> </ul>
Rod Malaga	Davis Harvəsted 8-29-51.	2 d @ 68°	5 d 0 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance when observed 5 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when observed 5 days after treatment or thereafter.</li> </ul>

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## Ethylene Chlorobromide, cont'd

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SPECIES		TREA	THENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Ribier	Davis	None	5 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Slight off-flavor after 3 days that disappeared within 7 days after treatment.</li> <li>2#, 4 hrs Strong off-flavor after 3 days which disappeared within 7 days after treatment.</li> </ul>
Thompson Seedless	Imperial Valley Harvested 7—20—51.	6d @45°	3 d 9 <b>41°</b>	<ul> <li>1#, 2 hrs No effect to flavor or appearance 4 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 4 days after treatment or thereafter.</li> </ul>
Thompson Seedless	Fresno Harvested 8-10-51.	3 d @ 45°	5 d g <b>41</b> °	<ul> <li>1#, 2 hrs No effect to flavor or appearance 2 days after treatment.</li> <li>2#, 2 hrs Slight off-flavor after 2 days which disappeared within 7 days after treatment.</li> <li>2#, 4 hrs Strong off-flavor after 2 days which disappeared within 7 days after treatment.</li> </ul>
Thompson Seedless	Davis Harvested 9-5-51.	2 d @ 41°	5d 3410	<ul> <li>1#, 2 hrs No effect to flavor or appearance 4 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance 4 days after treatment.</li> <li>2#, 4 hrs Off-flavor 4 days after treatment, which disappeared within 6 days.</li> </ul>
Tokay	Lodi	1 d 0 68°	5 d @ 41°	<ul> <li>1#, 2 hrs Slight off-flavor after 2 days that returned to normal within 5 days after treatment.</li> <li>2#, 2 hrs Moderate off-flavor after 2 days that returned to normal within 5 days after treatment.</li> <li>2#, 4 hrs Strong off-flavor after 2 days that returned to normal within 5 days after treatment.</li> </ul>
White Malaga	Davis	Nons	5 d @ 4 <b>1</b> °	<ul> <li>1#, 2 hrs No effect to flavor or appearance 3 days after treatment.</li> <li>2#, 2 hrs Off-flavor after 3 days that returned to normal within 7 days after treatment.</li> <li>2#, 4 hrs Off-flavor after 3 days that returned to normal within 9 days after treatment.</li> </ul>

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## Ethylene Chlorobromide, cont'd

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SPECIES		TREA	TMENT	
VARIETY	LOCALITY	FRE	POST	EFFECTS OF TREATMENT
NECTARINES				
Dargonville	Winters	1d @ 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 8 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance 8 days after treatment.</li> </ul>
Gover	Winters	1d @68⁰	10 d @ 41°	1#, 2 hrs No effect to flavor or appearance 3 days after treatment. 2#, 2 hrs No effect to flavor or appearance 3 days after treatment.
Quetta	Stockton	1 d @ 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 6 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 6 days after treatment and thereafter.</li> </ul>
Stanwick .	Winters	1 d @ 66°	10 d © 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 5 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 5 days after treatment and thereafter.</li> <li>2#, 4 hrs No effect to flavor or appearance 5 days after treatment and thereafter.</li> </ul>
Tioga	Winters	1 d @ 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 5 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 5 days after treatment and thereafter.</li> <li>2#, 4 hrs No effect to flavor or appearance 5 days after treatment and thereafter.</li> </ul>
<u>FEACHES</u> Elberta	Winters	ld @68°	5d @ <b>41°</b>	<ul> <li>1#, 2 hrs No effect to flavor or appearance 6 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance 6 days after treatment.</li> </ul>
Fay Elberta	Winters Harvested 7-24-51.	1d @68°	5 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 5 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance 5 days after treatment.</li> </ul>

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Ethylene Chlorobromide, cont'd

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SPECIES		TREA	PMENT	
VARIETY	LOCALTTY	PRE	FOST	EFFECTS OF TREATMENT
Fay Elbərta	Davis Harvested 73051.	None	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 8 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 8 days after treatment and thereafter.</li> </ul>
Halo Haven	Winters	2 d @ 68°	10 đ @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 2 days after treatment or thereafter.</li> <li>2#, 2 'rs Slight foreign flavor noticed 2 days after treatment witch disappeared within 8 days after treatment.</li> </ul>
J. H. Hale	Winters	1 ત ગુ68°	5 d @ 41°	<ul> <li>1/4, 2 hrs No effect to flavor or appearance.</li> <li>2/4, 2 hrs Slight off-flavor (bitter) that returned to normal within 5 days after treatment.</li> </ul>
July Elberta	Winters	1 d @ 680	10 d 3 410	<ul> <li>1#, 2 hrs No effect to flavor or appearance 3 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 3 days after treatment or thereafter.</li> </ul>
Palora	Davis	Nonə	5 d @ <b>41</b> °	<ul> <li>1#, 2 hrs No effect to flavor or appearance 4 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 4 days after treatment or thereafter.</li> <li>2#, 4 hrs Slight off-flavor that did not return to normal during the observation period of 8 days.</li> </ul>
Rio Oso Gem	Winters	ી ત ૩ 68°	5 d @ <b>41°</b>	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 6 days or there- after although ripening seemed to be slightly delayed.</li> <li>2#, 2 hrs No effect to flavor or appearance after 6 days or there- after although ripening seemed to be slightly delayed.</li> </ul>
Sunbeam	Winters	ી તે @ 68°	3 d @ 410	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 2 days or thereafter.</li> <li>2#, 2 hrs Very slight off-flavor after 2 days that returned to normal within 6 days after treatment.</li> </ul>

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SPECIES		TREAT	MENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
PEARS				
Bartlett	Hood Harvested 7—17—51.	1d @ 80°	10 d @ 41°	1#, 2 hrs No effect to flavor or appearance as fruit ripened. 2#, 2 hrs No effect to flavor or appearance as fruit ripened.
Bartlett	Davis Harvested 82-51.	None	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 5 days or thereafter.</li> <li>2#; 2 hrs No effect to flavor or appearance after 5 days or thereafter.</li> <li>2#, 4 hrs No effect to flavor or appearance after 5 days or thereafter.</li> </ul>
Bartlett	Clear Lake Harvested 8-14-51.	1. d @ 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance throughout ripening process.</li> <li>2#, 2 hrs No effect to flavor or appearance throughout ripening process.</li> <li>2#, 4 hrs No effect to flavor or appearance throughout ripening process.</li> </ul>
Bartlett	Senta Clara Harvested 8-12-51	10 d @ 37°, 2 d @ 68°	10 d @ 41°	<pre>1#, 2 hrs No effect to flavor or appearance. 2#, 2 hrs No effect to flavor or appearance 2#, 4 hrs No effect to flavor or appearance.</pre>
Bosc	Folson	1 d 9 68°	10 d ७ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs No effect to flavor or appearance.</li> </ul>
Conice	Placerville	]. d ଡ ୧୫୦	10 d @ 4 <b>1</b> 0	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs No effect to flavor or appearance.</li> </ul>

Ethylene Chlorobromide, cont'd

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SPECIES	,	TREA	TMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Hardy	Placervill	e 1d 368°	10 d 3 41º	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs No effect to flavor or</li> </ul>
Winter Nolis	Davis	1d @68°	10 d @ 41°	<ul> <li>appearance.</li> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs No effect to flavor or appearance.</li> </ul>
<u>PLUMS</u> Becky Smith	Winters	1 d ⊛ 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 5 days or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance after 5 days or thereafter.</li> </ul>
Burbank	Winters	1d @68≎	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance after one day or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance after one day or thereafter.</li> </ul>
Climar	Davis	None	10 d @ 41°	<pre>1#, 2 hrs No effect to flavor or appearance. 2#, 2 hrs No effect to flavor or appearance.</pre>
Diamond	Vacavillo	1 d 0 68°	10 d 9 <u>41</u> 0	<pre>1#, 2 hrs loss of normal tart flavor with little juice in ripe fruit. 2#, 2 hrs Loss of normal tart flavor noticeable earlier in the ripening stage.</pre>
Duarte	Winters Harvested 7-11-51.	1d © 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance one day after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance one day after treatment and thereafter.</li> </ul>

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Ethylene Chlorobromide, cont'd

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## Ethylene Chlorobromide, cont'd

SPECIES		TREA	TMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Duarte	Auburn Harvested 8-13-51.	2 d 3 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 6 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 6 days after treatment and thereafter.</li> <li>2#, 4 hrs No effect to flavor or appearance 6 days after treatment appearance 6 days after treatment</li> </ul>
Gaviota	Auburn	1 d @ 68°	10 d @ 41º	<ul> <li>1#, 2 hrs No effect to flavor or appearance 4 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 4 days after treatment or thereafter.</li> </ul>
Giant	Auburn	1 d @ 42°, 1 d @ 68°, 3 d @ 41°	7 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance 2 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance 2 days after treatment or thereafter.</li> <li>2#, 4 hrs Suggested off-color noticed 2 days after treatment which disappeared as the color developed.</li> </ul>
Grand Duke	Aubum	2 d g 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 6 days or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance after 6 days or thereafter.</li> <li>2#, 4 hrs No effect to flavor or appearance after 6 days or thereafter.</li> </ul>
Kolsey	Newcastle	1 d @ 63°, 2 d @ 41°	7 d 9 410	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Flavor off after 2 days but returned to normal within 7 days after treatment.</li> </ul>
Wickson	Vacavillo Harvested 7-16-51.	1 d 9 680	10 d @ 41°	<pre>1#, 2 hrs No effect to flavor but ripening was retarded about 3 day as indicated by color development 2#, 2 hrs No effect to flavor but ripening was retarded about a wee as indicated by color development.</pre>

SPECIES		TREA	TMENT			
VARIETY	LOCALITY	PRE	FOST	EFFECTS OF TREATMENT		
Wickson	Auburn Harvested 7-26-51.	1 d @ 68°	10 d 3 41•	<ul> <li>1#, 2 hrs No effect to flavor and slight color retardation which eventually developed normally.</li> <li>2#, 2 hrs Off-flavor which returned to normal within 15 days after treatment, also retardation of color development which eventually developed normally.</li> </ul>		

### Ethylene Chlorobromide, cont'd

#### SUMMARY

A total of 154 tests were run using this fumigant. Of these there was no effect at any time to the flavor or appearance of the fruit in 116 tests with any dosage. In 38 tests the flavor was affected but returned to normal in a short time in every test except two (2#, 4 hrs. dosage).

This funigant offers considerable promise as a fruit sterilant when used in dosages of one and two pound concentrations for an exposure period of two hours. The four-hour exposure period seemed to be on the borderline for some fruits since some of the flavors did not return to normal. Ethylene chlorobromide has far less effect on flavor shortly after treatment than ethylene dibromide, so would offer a somewhat greater safety factor in the case of fruits that are to be marketed soon after fumigation. It would seem desirable on the basis of our results to determine the insecticidal value of this fumigant as completely as has been done with ethylene dibromide.



#### ETHYLENE DIBROMIDE

A selection of dosages was used with an increase in time of exposure on one axis and an increase in concentration of fundgant on the other axis using the following dosages:

> 1/2#, 2 hrs.; 1/2#, 3 hrs.; 1/2#, 4 hrs. 1#, 2 hrs. 2#, 2 hrs.

All fruit was harvested at commercial shipping maturity unless otherwise specified and the tests were conducted as soon after harvest as practicable, usually after one day during which time the fruit was brought to temperature.

All tests were conducted in a 252 cubic foot chamber, previously described, at a temperature of 70° F.

After treatment the fruit was stored at 41° F. to simulate transit conditions for the time specified in the following chart. The fruit was then moved to 68° F. for ripening and kept there for observation until the fruit reached marketability.

A discussion of the effect of treatment to the different species and varieties appears below. The appearance of the fruit was considered normal unless otherwise specified.

SPECIES		TREA	TMENT	
VARIETY	LOCALITY	PRE	POST	REFECTS OF TREATMENT
APPLES				
Gravonsioin	Sebastopol Harvested 8-6-51.	1 d @68°	10 d 941°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs No effect to flavor or appearance.</li> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Strong off-flavor when checked 5 days after treatment that disappeared between 7 and 13 days after treatment; no injury to appearance.</li> </ul>
Gravenstein	Sebastopol Harvested 8-21-51.	1 d @ 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs Off-flavor which disappeared within 7 days after treatment.</li> <li>1/2#, 4 hrs Off-flavor which disappeared between the 7th and 12th day after treatment.</li> <li>1#, 2 hrs Off-flavor which disappeared between the 7th and 12th day after treatment.</li> <li>2#, 2 hrs Off-flavor which disappeared between the 7th and 12th day after treatment.</li> <li>2#, 2 hrs Off-flavor which disappeared between the 7th and 12th day after treatment.</li> </ul>
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SPECIE		TREA	PMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
<u>APRICOTS</u> Tilton	Brentwood	1 d 36 <b>5</b> 9	10 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 3 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs Flavor flat but no foreign flavorppresent—returned to normal within 10 days after treatment.</li> <li>1#, 2 hrs Accentuation of bruises and a flat flavor which returned to normal within 10 days after treatment.</li> <li>2#; 2 hrs Flavor off and brown spotting on 80% of the fruit that would render the fruit unmarketable.</li> </ul>
<u>BERNIES</u> Strewberry	San Jose	1 d @ 45°	1 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Off-flavor and loss of strawberry aroma.</li> </ul>
<u>FIGS</u> Black Missie	on Winters	2 d @ 68°	2 d 9 410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs Slight off-flavor which returned to normal within 4 days after treatment.</li> <li>1#, 2 hrs Moderate off-flavor which returned to normal within 4 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor which returned to normal within 4 days after treatment.</li> </ul>
<b>Kadota</b> .	Merced .	2 d @ 68°	3 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs No effect to flavor or appearance.</li> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Off-flavor which returned to normal within 5 days after treatment.</li> </ul>
<u>GRAPES</u> Red Malaga	Davis Harvested 8-24-51.	None	5 d @4 <b>1°</b>	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Off-flavor that returned to normal within 7 days after treatment.</li> </ul>

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## Ethylene Dibromide, cont'd

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SPECIES		TREAT	rment	
VARIETY	LOCALTTY	PRE	POST	EFFECTS OF TREATMENT
Red Malaga	Davis Harvested 8-29-51.	1 d @ 68°	5 d 9 410	<ul> <li>1/2#, 2 hrs Off-flavor which disappeared within 5 days after treatment.</li> <li>1/2#, 4 hrs Off-flavor which disappeared within 5 days after treatment.</li> <li>1#, 2 hrs Off-flavor which disappeared within 5 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor which disappeared within 8 days after treatment.</li> </ul>
Ribier	Davis	1 d @ 68 <sup>0</sup>	5 d 0 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs Slight off-flavor which returned to normal within 6 days after treatment.</li> <li>1#, 2 hrs Moderate off-flavor which returned to normal within 6 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor which returned to normal within 6 days after treatment.</li> </ul>
Thompson Seedless	Imperial Valley Harvested 7-20-51.	6 d @45°	3 d @41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 4 and 6 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 4 and 6 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 4 and 6 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 4 and 6 days after treatment.</li> </ul>
Thompson Seedloss	Fresno Harvested 8-10-51.	3 d @45°, 1 d 068°	5 d 9410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs Off-flavor 24 hours after treatment which had returned to normal within 6 days.</li> <li>1#, 2 hrs Off-flavor 24 hours after treatment which had returned to normal within 6 days.</li> <li>2#, 2 hrs Off-flavor 24 hours after treatment which had returned to normal within 6 days.</li> </ul>

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# Ethylene Dibromide, cont'd

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SPECIES		TREA	FIAENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Thompson Seedless	Davis Harvested 9-5-51.	2 d @ 41°	5 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs Slight off-flavor which returned to normal within 6 days after treatment.</li> <li>1#, 2 hrs Moderate off-flavor which returned to normal within 6 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor which returned to normal within 6 days after treatment.</li> </ul>
Tokay	Lodi	2 đ @ 68°	5 d © 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 5 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 5 days after treatment.</li> <li>1#, 2 hrs Slight off-flavor which disappeared within 7 days after treatment.</li> <li>2#, 2 hrs Moderate off-flavor which disappeared within 7 days after treatment.</li> </ul>
Whito Malaga	Davis	1 d @ 68°	5 d 0 410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs Slight off-flavor 2 days after treatment which had disappeared within 6 days after treatment.</li> <li>1#, 2 hrs Moderate off-flavor 2 days after treatment which had disappeared within 6 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor 2 days after treatment which had disappeared within 6 days after treatment.</li> </ul>
<u>NECTARINES</u> Dargonville	Winters	1 d @ 68°	10 d @41°	<ul> <li>1/2#, 2 hrs No off-flavor detected when fruit was checked 5 days after treatment and again at its optimum eating ripeness.</li> <li>1/2#, 4 hrs No off-flavor detected when fruit was checked 5 days after treatment and again at its optimum eating ripeness.</li> <li>1.#, 2 hrs No off-flavor detected when fruit was checked 5 days after treat- ment and again at its optimum eating ripeness.</li> <li>2. hrs No off-flavor detected when fruit was checked 5 days after treat- ment and again at its optimum eating ripeness.</li> <li>2. hrs No off-flavor detected when fruit was checked 5 days after treat- ment and again at its optimum eating ripeness.</li> </ul>

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SPECIES		TREA	PMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Gower	Winters	1 d @ 68°	10 d 3 <b>41°</b>	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs No effect to flavor or appearance.</li> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs No effect to flavor or appearance.</li> </ul>
Quetta	Stockton	1 d @ 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs No effect to flavor or appearance.</li> <li>1#, 2 hrs Slight off-flavor which disappeared within 11 days after treatment.</li> <li>2#, 2 hrs Slight off-flavor which disappeared in 11 days but the fruit seemed somewhat more astringent than other treated lots.</li> </ul>
Stanvick	Winters	2 d @68°	10 d 9410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 4 to 13 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 4 to 13 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 4 to 13 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 4 to 13 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 4 to 13 days after treatment.</li> </ul>
Tioga	Winters	2 d @68°	10 d @41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 4 to 17 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 4 to 17 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 4 to 17 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 4 to 17 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 4 to 17 days after treatment.</li> </ul>

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SPECIES		TREAT	IMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
<u>PEACHES</u> Elberte	Winters	ld @68°	5 d @41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 6 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 6 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 6 days after treatment.</li> <li>2#, 2 hrs Slight off-flavor at the end of 6 days which disappearand within 10 days after treatment.</li> </ul>
Fay Elberta	Winters Harvested 7-24-51.	ld 068°	5 d @ 41⁰	<ul> <li>1/2#, 2 hrs Slight off-flavor on 2nd day which disappeared within 5 days after treatment.</li> <li>1/2#, 4 hrs Slight to moderate off- flavor on 2nd day which disappeared within 5 days after treatment.</li> <li>1#, 2 hrs Moderate off-flavor on 2nd day which disappeared within 5 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor that dis- appeared between 5 and 12 days after treatment.</li> </ul>
Fey Elberta	Davis Harvested 7-30-51.	Nons	10 d 0 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 8 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 8 days after treatment.</li> <li>1#, 2 hrs Slight off-flavor after 8 days which disappeared within 11 days after treatment.</li> <li>2#, 2 hrs Off-flavor which required between 11 and 16 days to disappear leaving a fruit of inferior flavor.</li> </ul>
Hale Havan	Winters	2 d @ 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance.</li> <li>1/2#, 3 hrs No effect to flavor or appearance.</li> <li>1/2#, 4 hrs Off-flavor after 2 days which disappeared within 8 days after treatment.</li> <li>1#, 2 hrs Off-flavor after 2 days which disappeared within 8 days after treatment.</li> <li>2#, 2 hrs Serious off-flavor after 2 days which disappeared within 10 days after treatment.</li> </ul>

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SPECIES		TREA	TMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
J. H. Hale	Winters	1 d @ 68°	5 d @ 410	<ul> <li>1/2#, 2 hrs Slight off-flavor after 2 days which disappeared within 5 days after treatment.</li> <li>1/2#, 4 hrs Slight to moderate off- flavor after 2 days which disappeare within 5 days after treatment.</li> <li>1#, 2 hrs Moderate off-flavor after 2 days which disappeared within 5 days after treatment.</li> <li>2#, 2 hrs Off-flavor still present after 5 days. Phizopus mold prevent further observations.</li> </ul>
July Elberta	Winters	1 d @ 68°	10 d 341°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 2 days after treatment or thereafter.</li> <li>1/2#, 3 hrs No effect to flavor or appearance when checked 2 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 2 days after treatment or thereafter.</li> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 2 days after treatment or thereafter.</li> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 2 days after treatment or thereafter.</li> <li>2 hrs No effect to flavor or appearance when checked 2 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 2 days after treatment or thereafter.</li> </ul>
Palora	Davis	1 d 368°	5 d @410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 3 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 3 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 3 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 3 days after treatment or thereafter.</li> <li>2#, 2 hrs Slight off-flavor after 3 days which disappeared within 7 days after treatment.</li> </ul>
Rio Oso Gem	Winters	1 d @68°	5 d @41°	<ul> <li>1/2#, 2 hrs No effect to flavor or eppearance when checked 6 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 6 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 6 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 6 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 6 days after treatment or thereafter.</li> </ul>

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Ethylene	Dibromide,	cont <sup>°</sup> d
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SPECIES		TREA	THENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Sunbean	Vintors	1 d @ 68°	3 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 2 days after treatment.</li> <li>1/2#, 4 hrs Slight off-flavor which disappeared within 3 days after treatment.</li> <li>1#, 2 hrs Slight off-flavor which disappeared within 4 days after treatment.</li> <li>2#, 2 hrs Moderate off-flavor which disappeared within 6 days but the normal peach aroma was lacking.</li> </ul>
PEARS		_	<b>.</b>	
Bertlett	Hood Harvested 7-17-51.	1 d @ 80°	10 d &1°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 14 days after the treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 14 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 14 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 14 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 14 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 14 days after treatment or thereafter.</li> </ul>
<b>Bartlett</b>	Nood Harvested 7-26-51.	1 d @ 68°	10 d @ 32°, 10 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 12 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 12 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 12 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 12 days after treatment or thereafter.</li> <li>2#, 2 hrs Suggested retardation of the normal ripening processes, however, the flavor was not affected.</li> </ul>
Bartlett	Hocd Harvested 726 <b>-51</b> .	7. d @ 68°	30 d @ 32°, 10 d @41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 43 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 43 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 43 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor; however, prominent lenticles slightly lowered the quality of the fruit.</li> </ul>

S	SPECIES		TREAT	MENT	
-	VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
	Bartlett	Clear Lake Harvested 8-14-51.	ld 368°	10 d 3 410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when chocked 13 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 13 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 13 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 13 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 13 days after treatment.</li> </ul>
	Bartlett	Santa Clara Harvested 8-12-51.	15 d @ 379 1 d 68°	10 d 9 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 13 days after treatment.</li> <li>1/2#, &amp; hrs No effect to flavor or appearance when checked 13 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 13 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 13 days after treatment.</li> </ul>
	Bosc	Folson .	2 d @ 68°	10 d @ <b>41°</b>	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 12 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 12 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 12 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 12 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 12 days after treatment.</li> </ul>
	Comice	Placervillo	1 d @ 68°	10 d @41.0	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 20 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 20 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 20 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 20 days after treatment.</li> <li>2#, 2 hrs Slight off-flavor which dis- appeared without ill effect to the fruit.</li> </ul>

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SPECIES		TREAT	PMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Hardy	Placorville	1 d @ 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 16 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 16 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 16 days after treatment.</li> </ul>
Winter Nelis	Davis	2 d @41°, 1 d @68°	10 d @41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 16 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 16 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 16 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 16 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 16 days after treatment or thereafter.</li> </ul>
<u>PLUMS</u> Bocky Smith	Winters	1 d @ 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 5 days after treatment.</li> <li>1/2#, 4 hrs Off-flavor after 5 days which disappeared within 8 days after treatment.</li> <li>1#, 2 hrs Flavor still off after 8 days but returned to normal within 12 days after treatment.</li> <li>2#, 2 hrs Flavor still off after 8 days but returned to normal within 12 days after treatment.</li> </ul>
Burbank	Winters	1 d ø68°	10 d 041°	<ul> <li>1/2#, 2 hrs Off-flavor after one day which returned to normal within 5 days after treatment.</li> <li>1/2#, 3 hrs Off-flavor after 1 day which returned to normal within 5 days after treatment.</li> <li>1/2#, 4 hrs Off-flavor after one day which returned to normal within 5 days after treatment.</li> <li>1#, 2 hrs Off-flavor after 1 day which returned to normal within 5 days after treatment.</li> <li>2 hrs Off-flavor after 1 day which returned to normal within 5 days after treatment.</li> <li>2#, 2 hrs Off-flavor after 1 day which returned to normal within 5 days after treatment.</li> </ul>

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SPECIES		TREA!	rment	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Clinar	Davis	None	10 d 3 <b>(10</b>	<ul> <li>1#, 2 hrs No effect to flavor or appearance when checked 6 days after treatment.</li> <li>2#, 2 hrs Off-flavor after 6 days which returned to normal within 10 days after treatment.</li> </ul>
Diamond	Vacavillø	1 d @ 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 7 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 7 days after treatment.</li> <li>1.#, 2 hrs No effect to flavor or appearance when checked 7 days after treatment.</li> <li>2.#, 2 hrs Foreign flavor which disappeared leaving a flat flavor.</li> </ul>
Duarte	Wintors Harvested 7-11-51.	1 d 3 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs Off-flavor after 1 day which had disappeared 5 days after treatment.</li> <li>1/2#, 3 hrs Off-flavor after 1 day which had disappeared 5 days after treatment.</li> <li>1/2#, 4 hrs Off-flavor after 1 day which had disappeared 5 days after treatment.</li> <li>1#, 2 hrs Off-flavor after 1 day which had disappeared 5 days after treatmen</li> <li>2#, 2 hrs Off-flavor after 1 day which disappeared within 5 days, but flavor recorded as flat. Flavor normal after 12 days.</li> </ul>
Duarte	Auburn Harvested 8-13-51.	1 d @ 68°	10 d 0 41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked the day after treatment.</li> <li>1/2#, 4 hrs Flavor off after 1 day which disappeared within 7 days after treatment.</li> <li>1#, 2 hrs Flavor off after 1 day which disappeared within 7 days after treatment.</li> <li>2#, 2 hrs Flavor off after 1 day which disappeared within 7 days after treatment.</li> </ul>
Gaviota	Auburn	1 d @ 68°	10 d @ 4 <b>1°</b>	<ul> <li>1/2<sup>#</sup>, 2 hrs Flavor normal when checked 4 days after treatment and thereafter</li> <li>1/2<sup>#</sup>, 4 hrs Flavor off slightly after 4 days but returned to normal within 7 days after treatment.</li> <li>1<sup>#</sup>, 2 hrs Flavor still off after 10 days but returned to normal within 12 days after treatment.</li> </ul>

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SPECIES		TREAT	IMENT		
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT	
Gaviota, co	nt'd			2#, 2 hrs Off-flavor that returned to normal after 10 days but there was some browning through the epidermal cells.	
Giant	Aubura	1 d 9 42°, 1 d 68°	10 d @ 410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 5 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 5 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 5 days after treatment or thereafter.</li> <li>2#, 2 hrs Serious off-flavor still present after 5 days which dis- appeared within 10 days after treatment.</li> </ul>	
Grand Duke	Auburn	1 d @ 68°	10 d @ 410	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 7 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 7 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 7 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 7 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 7 days after treatment or thereafter.</li> </ul>	
Kelsey	Nevcastle	1 d @ 68°	10 d @41°	<ul> <li>1/2#, 2 hrs No effect to flavor or appearance when checked 5 days after treatment or thereafter.</li> <li>1/2#, 4 hrs No effect to flavor or appearance when checked 5 days after treatment or thereafter.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 5 days after treatment or thereafter.</li> <li>2 hrs No effect to flavor or appearance when checked 5 days after treatment or thereafter.</li> <li>2#, 2 hrs Off-flavor still present after 5 days which disappeared within 10 days after treatment.</li> </ul>	
Wickson	Winters Barvested <b>7-13-51</b> .	2 d 8680	10 d 9410	<ul> <li>1/2#, 2 hrs Off-flavor present after 3 days which had disappeared within 8 days after treatment.</li> <li>1/2#, 4 hrs Off-flavor present after 3 days which had disappeared within 8 days after treatment.</li> <li>1#, 2 hrs Off-flavor present after 3 days which had disappeared within 8 days after treatment.</li> </ul>	

SPECIES		TREAT	MENT	•	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT	
Hekson,	cont'd			2#, 2 hrs Off-flavor present after 3 days which had disappeared within 8 days after treatment.	
Wickson	Vacavillo Harvostod 7-16-51	1 d @ 68°	10 d @ 41°	<ul> <li>1/2#, 2 hrs Slight off-flavor present after 2 days but disappeared within 7 days after treatment.</li> <li>1/2#, 4 hrs Moderate off-flavor present after 2 days but disappeared within 7 days after treatment.</li> <li>1#, 2 hrs Serious off-flavor present after 2 days but disappeared within 7 days after treatment.</li> <li>2#, 2 hrs Serious off-flavor present after 2 days but disappeared within 7 days after treatment.</li> <li>2#, 2 hrs Serious off-flavor present after 2 days but disappeared within 7 days after treatment.</li> </ul>	
Wickson	Auburn Hervested 7-26-51.	<b>1 d</b> ⊚ 68° ∙	10 d 341°	<ul> <li>1/2#, 2 hrs No effect to flavor of appearance when checked 10 days after treatment.</li> <li>1/2#, 4 hrs No effect to flavor of appearance when checked 10 days after treatment.</li> <li>1#, 2 hrs No effect to flavor or appearance when checked 10 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 10 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 10 days after treatment.</li> </ul>	

#### SUMMARY

A total of 199 tests were run using this funigant during the quarter. There was no effect noted at the time of the first observation to the flavor or appearance of the fruit in 116 tests with any dosage. In 79 tests the flavor was deleteriously affected for a period of 2 to 5 days but the objectionable flavor disappeared while the fruit was still at a transit temperature (41° F.) with no permanent 111 effect.

These findings are in agreement with those previously reported for other species and varieties (April-June Quarterly Report, 1951). The fruit was tolerant to dosages of 1/2#, 2 hrs.; 1/2#, 4 hrs.; and 1#, 2 hrs.; with the 2#, 2 hr. dosage appearing on the borderline with some fruits.

Sufficient tests with ethylene dibromide have now been completed to give reasonable assurance that fumigation is not physiologically harmful to various varieties and species of fruits, even at dosages somewhat greater than entomologists have found necessary to give complete kill of fruit fly eggs and larvae. Since these tests have all been made with limited quantities of fruits, there is as yet no complete assurance that the fumigant would be completely dissipated from carload lots of treated fruits during the transit period to distant markets. It seems likely that any gas liberated into the atmosphere would be removed by the circulation of air through the ice bunkers. However, a shipping test is considered the only safe way to determine this fact. It is hoped that such a test can be made during the next fruit season.

#### METHYL BROMIDE

The selected dosage of 2 pounds per thousand cubic feet for an exposure period of 2 and 4 hours was used.

All fruit was harvested at commercial shipping maturity unless otherwise specified and tests were conducted as soon after harvest as practicable, usually after one day during which time the fruit was brought to treatment temperature. The tests were conducted in a 180 cubic foot chamber at a temperature of approximately 70° F.

After treatment the fruit was stored at 41° F. to simulate transit conditions for the time specified in the following table. The fruit was then moved to 68° F, for ripening  $a_nd$  kept there for observation throughout its period of marketability.

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A discussion of the effect of treatment to the different species and varieties appears below. The appearance of the fruit was considered normal unless otherwise specified.

SPECIES		TREAT	MENT	
VARIETY	LCALTTY	PRE	POST	EFFECTS OF TREATMENT
APPLES Gravenstein	Sebestopol. Harvested 8-6-51.	1 d @ 68°	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Gravenstoin	Sobastopol Harvested 8—21—51.	1 d @ 68°	10 d @ <b>41</b> °	2#, 2 hrs No effect to flavor or eppearance. 2#, 4 hrs No effect to flavor or appearance.
<u>APRICOTS</u> Tilton	Brentwood .	1 d @ 68°	10 đ &1°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
<u>BERRIES</u> Stravberry	San Jose	1 d @ 45°	2 d @ 419	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
<u>FIGS</u> Elack Missio	n Winters	1 d @ 68°	3 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs External breakdown on all fruit and premature development of mold rendering the fruit intolerant to treatment.
Kadota	Merced	1 d @ 68°	3 d 3 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs External breakdown render- ing the fruit intolerant to treatment.

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SPECIES		TREAT	CMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
<u>GRAPES</u> Red Malega	Davis Harvested 8-24-51.	None	5 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or
Rød Malaga	Davis Harvested 8-29-51.	1d 3680	5 d 9 <b>41º</b>	appearance, 2#, 2 hrs No effect to flavor or appearance, 2#, 4 hrs No effect to flavor or
Ribier	Devis	None	5 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Thompson Seedless	Imperial Valley Harvested 7-20-51.	6 d @ 45°	3 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Thompson Seedless	Fresno Harvested 8-10-51.	3 d @ 450	5 d 3 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Thompson Seedless	Davis Narvested 9-5-51,	1 d @ 410	5 d 3 410	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Tokay	Lodi	1d 068°	5 d 3 410	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
White Malaga	Davis	None	5 र 0 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
<u>NECTARINES</u> Dargonville	Winters	1 d @ 68°	10 d @ 41°	<ul> <li>2#, 2 hrs Suggested retardation of the normal ripening processes; however, the flavor was not affected.</li> <li>2#, 4 hrs Suggested retardation of the normal ripening processes; however howsver, the flavor was not affected.</li> </ul>
Gower	Winters	1 d @ 65°	10 d @ 41°	2#, 2 hrs Suggested retardation of the normal ripening processes; however, the flavor was not affected. 2#, 4 hrs Suggested retardation of the normal ripening processes; however, the flavor was not affected.

SPECIES		TREAT	PMENT	
VARIETY	LOCALITY	FRE	POST	EFFECTS OF TREATMENT
Quotta	Stockton	1 d @ 68°	10 d 9 41º	2#, 2 hrs Suggested retardation of normal ripening processes; however, the flavor was not affected. 2#, 4 hrs Suggested retardation of normal ripening processes; however, the flavor was not affected.
Stanslek	Winters	⊥d @68°	10 d 3 410	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Tioga	Vinters	1d 0680	10 d 0 41 <sup>0</sup>	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
<u>PEACHES</u> Elborta	Winters	1d 368°	5d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Fay Elberta	Winters Harvested 7—24—51.	1d 368⁰	5 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Fay Elberta	Davis Harvested 7—30—51.	None	10 a @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Accentuation of bruises which did not show up until after the fruit had passed optimum marketability. The fruit appeared normal until this time.
Hale Haven	Winters	2 d @ 65°	10 d 9 41°	2#, 2 hrs Suggested retardation of the normal ripening processes; however, this disappeared by the time the fruit reached optimum marketability with no ill effect to the fruit. 2#, 4 hrs Suggested retardation of the normal ripening processes; however, this disappeared by the time the fruit reached optimum marketability with no ill effect to the fruit.
J. H. Hale	Winters	ld © 68°	5 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.

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Methyl Bromide, cont'd

SPECIES		TREA	TMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
July Elberta	Winters	1 d 3 680	10 d 3 41°	2#, 2 hrs Suggested retardation of the normal ripening processes which disappeared with no ill effect to to the flavor or appearance of the fruit. 2#, 4 hrs Definite retardation of the normal ripening processes which dis- appeared with no ill effect to the flavor or appearance of the fruit.
Palora	Davis	None	5 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Flavor very poor but no foreign flavor noted.
Rio Oso Gem	Winters	1 d 9 68°	5 d @ <b>41°</b>	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Sunbeam	Winters	1 d @ 68 <sup>0</sup>	3 d @ <b>410</b>	2 <sup>#</sup> , 2 hrs Retardation of the normal ripening processes which disappeared with no ill effect to the flavor or appearance of the fruit. 2 <sup>#</sup> , 4 hrs A more definite retardation of normal ripening processes which disappeared with no ill effect to the flavor or appearance of the fruit.
<u>PEARS</u> Bartlett	Hood Harvested 7-17-51.	ld 080°	10 d . @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Necrotic areas and improper ripening were evident near end of marketable period.
Bertlett	Hood Harvested 7-26-51.	ા ત @ 68°	10 d 0 32°, 10 d 0 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Accentuation of bruises but no effect to flavor.
Bartlett	Hood Harvested 7-26-51.	ld ⊋68°	30 d @ 32°, 10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Bartlett	Clear Lake Harvested 8-14-51.	1 d 3 63°	10 d 3 41°	<ul> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Suggested retardation of the normal ripening processes; hower this disappeared by the time the time fruit reached optimum market-ability with no ill effect to the fruit.</li> </ul>

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SPECIES		TREAT	MENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Bartlett	Santa Clara Harvested 8-12-51.	15 d @ 37°, 1 d 68°	10 d 9 410	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Bose	Folsom	1 d @ 68°	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Comice	Placerville	ld @68⊘	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Hardy	Placerville	1 d @ 68°	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Winter Nelis	Davis	ી તે ઉ 65°	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Suggested retardation of the normal ripening processes; however, this disappeared by the time the fruit reached optimum marketability with no ill effect to the fruit.
<u>FLUMS</u> Booky Smith	Winters	1 d @ 68°	10 d @41°	2#, 2 hrs Brown discoloration on al fruit covering 30% of the area and delay of normal color development. 2#, 4 hrs Brown discoloration on al fruit covering 30% of the area and a greater delay of normal color development than noted on the above test.
Burbank	Winters	1 d 965°	10 d @41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Suggested off-flavor when checked the day after treatment which disappeared within 5 days but flavor was somewhat inferior to that of the check.
Climer	Davis	None	10 d @ <b>41°</b>	<pre>2#, 2 hrs Retardation of the normal riponing processes that returned t normal without ill effect to the fruit. 2#, 4 hrs Retardation of the normal riponing processes that returned to normal without ill effect to the fruit.</pre>

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SPECIES		TREA!	<b>FMENT</b>	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Diamond	Vacavillo	1 d @ 68°	10 d 3 41°	2#, 2 hrs Slight retardation of the normal ripening processes with fruit eventually ripening normally. 2#, 4 hrs Moderate retardation of the normal ripening processes with fruit eventually ripening normally.
Duarto	Winters Barvested 7-11-51.	1 d @ 63°	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs A suggested off-flavor noted 1 day after treatment which disappeared within 5 days after treatment.
Duarte .	Auburn Harvested 8—13—51.	1d @ 68°	10 d 3 410	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Gaviota	Auburn	1 d @ 68°	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Possible accontuation of bruises and blamishes but no ill effect to flavor.
Gent	Auburn	1d 342°, 1d 68°	10 d @ 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Grend Duke	Auburn	1d @ 68°	10 d @ 41°	2#, 2 hrs Slight retardation of normal ripening processes which returned to normal with no ill effect to the fruit. 2#, 4 hrs Slight retardation of normal ripening processes which returned to normal with no ill effect to the fruit.
Kelsey	Newcastle	1 d @68°	10 d @ 41º	2#, 2 hrs. ~ No effect to flavor or appearance. 2#, 4 hrs. ~ Delay in color development and appearance of green spots about 1 mm. in diamster on the surface of the fruit which failed to color as fruit sipened.
Wickson	Winters Harvosted 7-13-51.	2 d @ 68°	10 d 3 41°	<ul> <li>2#, 2 hrs Slight retardation of the normal ripening processes and accentuation of bruises.</li> <li>2#, 4 hrs Flavor flat but no foreign flavor noticed and a more serious retardation of color development.</li> </ul>

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SPECIES		TREAT	FMENT			
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT		
Wickson	Vacavillo Harvested 7-16-51。	1 d @ 68°	10 d Ø 41°	<ul> <li>2#, 2 hrs Slight retardation of the normal ripening processes which returned to normal without ill effect to the fruit.</li> <li>2#, 4 hrs Slight retardation of the normal ripening processes which returned to normal without ill effect to the fruit.</li> </ul>		
Wickson	Auburn Harvested 7—26—51.	1 d @ 68°	10 d 3 410	2#, 2 hrs No effect to flavor or appearance of this more mature fruit. 2#, 4 hrs No effect to flavor or appearance of this more mature fruit.		

## SUMMARY

Of the tests reported here about two-thirds of the treated fruit lots were recorded as unaffected by the treatment. Where injury was noted it was in the form of impaired flavor or occasionally visible injury externally or internally. No injury was recorded from the 2 pound, 2 hour treatment to any fruit species except plums where a few varieties were damaged. Most fruits also seemed tolerant to the 2 pound, 4 hour treatment, but enough cases of injury were found that such a dosage is considered as unsafe.

Injury recorded this year is less extensive and less pronounced than in previous years tests. It is not certain to what these differences should be attributed. Chemical analyses indicate that the fumigation chamber retains the fumigant as effectively as previously. The most likely explanation would seem to be that seasonal climatic differences during the growing season may effect the tolerance of the fruit to methyl bromide. Another possibility may be that observations were not as critical as previously due to the large numbers of lots treated with fumigants that imparted very bad off-flavors to the fruit. In spite of these differences our results would indicate that methyl bromide cannot be considered as a safe fumigant when used at dosages as high as 2 pounds per 1000 cubic feet of space for 4 hours.

#### METHYL IODIDE

The selected dosage of 2 pounds per thousand cubic feet for an exposure period of 2 and 4 hours was used.

All fruit was harvested at commercial shipping maturity unless otherwise specified and tests were conducted as soon after harvest as practicable, usually after one day during which time the fruit was brought to treatment temperature. The tests were conducted in 5-gallon jars, previously described, at a temperature of approximately 70° F.

After treatment the fruit was stored at 41° F. to simulate transit conditions for the time specified in the following chart. The fruit was then moved to 68° F. for ripening and kept there for observation until the end of the marketable period.

A discussion of the effect of the treatments to the different species and varieties appears below. The appearance of the fruit was considered normal unless otherwise specified.

SPECIES		TREAT	PMENT .			
VARIETY	LOCALITY	PRE	POST	EFFEXTS OF TREATMENT		
APPLES						
Gravenstein	Sebastopol Harvested 8-6-51.	1 đ @ 63°	10 d @ 41°	<ul> <li>2#, 2 hrs No affect to flavor but necrotic areas on surface of fruit which appeared within 8 days after treatment.</li> <li>2#, 4 hrs No effect to flavor but necrotic areas on a greater per- centage of the fruit which appeared within 8 days after treatment.</li> </ul>		
Gravenstein	Sebestopol Harvested 8-21-51.	1 d 9 68°	10 d 3 41°	<ul> <li>2#, 2 hrs Flavor and appearance seemed normal until 12 days after treatment when slight browning and rot developed on the calyx end of 25% of the fruit. The damage got progress-ively worse as time after treatment continued.</li> <li>2#, 4 hrs Flavor and appearance seemed normal until 12 days after treatment when slight browning and rot developed on the calyx end of 75% of the fruit. The damage became progressively worse as time after treatment continued.</li> </ul>		
<u>APRICOTS</u> Tilton	Brentwood	1 d @ 68°	10 d @ 410	<ul> <li>2#, 2 hrs No effect to flavor but a definite retardation of normal ripening processes.</li> <li>2#, 4 hrs No effect to flavor but a definite retardation of normal ripening processes.</li> </ul>		

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13PEC IES		TREA	THENT	
VARIETY	LOCALITY	FRE	POST	EFFECTS OF TREATMENT
BERRIES			a lait fi beny ti Qualitat a fi fignad	
Strauberry	San Joso	1 d 3 450	2 d 3 41°	2#, 2 hrs A loss of normal strawborry aroma, but no effect to appearance.
FIGS				
Black Missi	on Winters	Nona	3 d @ 410	2#, 2 hrs Flavor flat and browning arcund seed coats. 2#, 4 hrs Flavor flat and browning around seed coats.
Kadota	Merced	1d @ 68 <sup>0</sup>	3 d @ 41°	2#, 2 hrs External browning on all fruit which appeared within 5 days after treatment. 2#. 4 hrs Foreign flavor noted within
CPADES				2 days after treatment and browning developed within 5 days.
Red Malaga	Davis Harvoated	Nonə	5 d @ 119	2#, 2 hrs No effect to flavor or
	8-24-51		C Strate	2#, 4 hrs Surface broakdown in the form of soft spots developed within 9 days after treatment.
Red Malaga	Davis Harvested 8-29-51,	None	5 d 3 4 <b>1</b> 0	2#, 2 hrs No effect to flavor or appearance.
Ribier	Davis	None	5 d @ 41°	<ul> <li>2#, 2 hrs No effect to flaver or appearance during the marketable life of the fruit.</li> <li>2#, 4 hrs Surface breakdown occurred within 9 days after treatment which allowed mold to develop on 60% of the fruit.</li> </ul>
Thompson Seedless	Imperial Valley Harvested 7-20-51.	6 d 9 45 <b>°</b>	3 d @ 410	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Thompson Seedless	Freano Harvostod 8-10-51.	3 d @ 45°	5 d @ 4 <b>1</b> °	<ul> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Slight browning on some of the fruit leading to brown rot and mold which occurred within 8 days after treatment.</li> </ul>
Thompson Seedless	Davis Harvested 9-5-51.	1 d @41°	5 d 3470	<ul> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Fruit normal 7 days after treatment but mold and browning of 50% of fruit occurred during the next 4 days.</li> </ul>

Methyl Iodide, cont'd

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SPECIES		TREA	IMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Tokay	Lodi	1 d @ 68°	5 d @ 410	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
<u>Dargonville</u>	Winters	1 d 3 68°	10 d 9 41°	<ul> <li>2#, 2 hrs No effect to appearance but flavor off.</li> <li>2#, 4 hrs No effect to appearance but flavor off.</li> </ul>
Quette	Stockton	1d @68°	10 d @ 41°	<ul> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Slight retardation of color development. After 5 days at 68° F. the flavor seemed poorer than the control but notnecessarily of commerical significance.</li> </ul>
Stanwick	Winters	1 d @ 68°	10 d © 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs No effect to flavor or appearance.
Tioga	Winters	1 d @ 68°	10 d 7 41º	<ul> <li>2#, 2 hrs No affect to flavor or appearance.</li> <li>2#, 4 hrs Retardation of normal ripsning processes, external browning and accentuation of bruises and breakdown of 30% of the fruit 4 days after removal to 68° F.</li> </ul>
<u>PEACHES</u> Elberta	Winters	1 d 3 68°	5đ 941°	2#, 2 hrs Normal flavor and appearance but retardation of color development 2#, 4 hrs Normal flavor and appearance but retardation of color development
Fay Elberta	Winters Harvested 7-24-51.	1d @ 68°	5 d @ 41°	2/, 2 hrs No effect to flavor or appearance. 2 <sup>#</sup> , 4 hrs No effect to flavor or appearance.
Fay Elberta	Davis Harvosted 7-30-51.	None	10 d @ 4 <b>1°</b>	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Fruit seemed normal until 15 days after treatment at which time necrotic areas, penetrating through the epidermis, appeared on all fruit.

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SPECIES		TREAT	MENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Hale Haven	Winters	2 đ @ 68°	10 d ⊕ 41°	2#, 2 hrs Early retardation of color development. Flavor was not affected 2#, 4 hrs Foreign flavor was noted 2 days after treatment and the color development was noticeably retarded. Color differentiation disappeared within 10 days and flavor returned to normal.
J. H. Helo	Winters	1 đ @ 680	5 d @ 410	2#, 2 hrs Normal flavor but some retardation of ripening. 2#, 4 hrs Normal flavor but some retardation of ripening.
July Elberta	Winters	1d 368°	10 d 0 41°	2#, 2 hrs Normal flavor but some retardation of ripening. 2#, 4 hrs Normal flavor but con- siderable retardation of ripening.
Palora	Davis	None	5 d @ 410	2#, 2 hrs No effect to flavor or appearance.
Rio Oso Gem	Winters	1d @68°	5 d @ 41°	<ul> <li>2#, 2 hrs Some retardation of color development and softening that disappeared. No effect to flavor.</li> <li>2#, &amp; hrs Some retardation of color development and softening that disappeared. No effect to flavor.</li> </ul>
Sundaem	Winters	1 d @68°	3 d @ 41°	<ul> <li>2#, 2 hrs No offect to flavor or appearance.</li> <li>2#, 4 hrs No effect to appearance but flavor is not as good as check. No off-flavor present.</li> </ul>
<u>PFARS</u> Bartløtt	Hood Harvested 7-17-51.	ld @ 80°	10 d 3 41º	<ul> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Flavor off and necrotic areas appeared on the external surface of the fruit as it approached full ripeness.</li> </ul>
Bartlott	Davis Hervested 8-2-51.	None	10 d @ 41°	2#, 2 hrs No offect to flavor or appearance. 2#, 4 hrs Internal breakdown and scald appeared during fruit ripsning and there was a loss of normal pear aroma
Bartlett .	Clear Lake Harvesied 8-14-51.	1 d © 68°	10 d 8 41°	2#, 2 hrs No effect to flavor or appearance. 2#, & hrs Retardation of the normal ripening processes but no off-flavor detected.

Methyl Iodide, cont'd

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SPECIES		TREAT	MEINT		
VARIETY	LOCALITY	PRE	FOST		EFFECTS OF TREATMENT
Bartlett	Santa Clera Harvested 8—12—51.	15 d @ 37°, 1 d @ 68°	10 d 9 41°	2#, 2#,	2 hrs No effect to flavor or appearance. 4 hrs Reterdation of color development and softening and accentua- tion of blemishes on all fruit. Flavor was not impaired.
Bose	Folsom	1 d ⊛ 68°	10 d 9 41°	2#, 2#,	2 hrs No effect to flavor or appearance. 4 hrs Retardation of the normal ripening processes with the pressure being & lbs. in comparison to 2.6 lbs. in the check fruit indicating about a 2-day delay in ripening. The flavor was not affected.
Comice	Placorville	ା ପ ଡ 68º	10 d 3 41°	2#, 2#,	2 hrs No effect to flavor or appearance. 4 hrs No effect to flavor or appearance.
Herdy	Placorville	1 d @ 65°	10 d 9 4 <b>1</b> º	2#, 2#,	2 hrs No effect to flavor or appearance. 4 hrs No effect to flavor or appearance.
Winter Nelis	Davls	1 d 2 68°	10 đ 0 41°	2#, 2#,	2 hrs No effect to flavor or appearance. 4 hrs Some retardation of ripen- ing but no effect to flavor.
<u>PLUMS</u> Becky Smith	Winters	1 d @ 68°	10 d 9 41°	2#, 2#,	2 hrs Brown discoloration which appeared within 8 days after treat- ment which would render fruit unmarketable. 4 hrs External discoloration on all fruit which appeared within 5 days after treatment and got progressively worse as time after treatment continued.
Burbank	Winters	] d @ 680	10 d 0 41°	2#, 2#,	2 hrs No effect to flavor or appearance. 4 hrs Accentuation of blemishes and flat flavor developed within 5 days after treatment and became progressively worse with time after treatment.

Methyl Iodide, cont'd

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SPECIES		TREAT	MENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Climax	Devis	Nonə	10 d 3 41°	<ul> <li>2#, 2 hrs Some retardation of color development but the fruit ripensd with normal appearance and flavor.</li> <li>2#, 4 hrs Definite retardation of color development and eventual scald and breakdown of the fruit rendering it unmarketable.</li> </ul>
Dianond	Vacavillo	<b>1 d</b> ગુઠ <b>ઙ</b> ૰	10 d 3 41°	2#, 2 hrs Definite retardation of color development. 2#, 4 hrs Definite retardation of color development.
Duarte	Winters Harvested 7-11-51.	1d 3680	10 d 3 410	<ul> <li>2#, 2 hrs Some retardation of ripen- ing but flavor was not affected.</li> <li>2#, 4 hrs Some retardation of ripen- ing but flavor was not affected.</li> </ul>
Duarte	Auburn Harvosted 8-1.3-51.	1 d 9 68°	10 d 3 41°	<ul> <li>2#, 2 hrs Some retardation of color development but flavor and appearance normal.</li> <li>2#, 4 hrs Retardation of color development and eventual browning in the non-blush areas followed by breakdown and mold development.</li> </ul>
Gaviota	Auburn	1 d 3 68°	10 d 3 41°	2#, 2 hrs Some retardation of the normal ripening processes which dis- appeared without ill effect to the appearance or flavor of the fruit. 2#, 4 hrs Accentuation of bruises appearing within 4 days after treat- ment, prevention of normal color development and premature mold.
Giant	Auburn	1 d 9 42°, 1 d 0 68°	10 d @ 41º	<ul> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Surface browning appeared within 5 days after treatment and accentuation of bruises with a retardation of normal color development.</li> </ul>
Grand Duke	Aularn	1 d @ 68°	10 d @ 41°	<ul> <li>2#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 4 hrs Some retardation of color development and softening. The flavor was normal for the ripeness of the fruit.</li> </ul>
Kelsey	Nevcastlo	1 d 3 680	10 d @ 41°	2#, 2 hrs Fruit was normal in appearance and flavor for 14 days after treatment.

Mathyl Iodide, cont'd

SPECIES		TREA	TMENT			
VARIETY	LOCALITY	FRE	FOST	EFFECTS OF TREATMENT		
Kelsey, co	nt'd			2#, 4 hrs Accentuation of blemishes appeared within 5 days after treat- ment followed by scald development that would render fruit unmarketable.		
Wickson	Winters Harvested '7-13-51.	2 d @ 68°	10 d ⊚ <b>41</b> °	2#, 2 hrs Slight rotardation of color development but no ill effect to the appearance or flavor of the fruit. 2#, 4 hrs Moderate retardation of color development but no ill effect to the appearance or flavor of the fruit.		
Vickson	Vacavillo Harvested 7-16-51.	ી તે ુ 68°	10 d 9 <b>41°</b>	<ul> <li>2#, 2 hrs Some retardation of color development but the flavor was not affected.</li> <li>2#, 4 hrs Some retardation of color development but the flavor was not affected.</li> </ul>		
Wickson	Auburn Harvested 7-26-51.	1 d 3 68°	10 d © 41°	2#, 2 hrs No effect to flavor or appearance. 2#, 4 hrs Considerable retardation of the normal ripening processes; however, the flavor was not affected.		

## SUMMARY

A total of 94 tests were run using this fumigant. Of these tests there was no effect to the flavor or appearance of the fruit in 36 tests with any dosage. In 53 tests the external appearance was affected. This damage was usually in the form of external browning and necrotic areas which progressed into internal breakdown.

In general, grapes, nectarines and peaches, pears and plums seemed tolerant to the 2#, 2 hr. treatment. However, the fact that injury occurred occasionally would indicate that the treatment was borderline and probably lacked a sufficient margin of safety for commercial use. A slight delay in ripening following treatment is not considered in itself as injurious. The 2#, 4 hr. dosage was injurious frequently enough to make its use very hazardous. It seems likely from the point of view of the fruit that methyl iodide could be used as a commercial fumigant at dosages approximating 1#, 2 hrs. This assumption is not based upon insecticidal characteristics or corrosive problems relative to its use.

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## PROPYLENE BROMIDE

The selected dosages of one pound and two pounds per thousand cubic fest for an exposure period of 2 hours were used.

All fruit was harvested at commercial shipping maturity unless otherwise specified and tests were conducted as soon after harvest as practicable, usually after one day during which time the fruit was brought to treatment temperature. The tests were conducted in 5 gallon jars, previously described, at a temperature of approximately 70° F.

After treatment the fruit was stored at 41° F. to simulate transit conditions for the time specified in the following table. The fruit was then moved to 68° F. for ripening and kept there for observation through the period of marketability.

A discussion of the effect of treatment to the different species and varieties appears below. The appearance of the fruit was considered normal unless otherwise specified.

SPECIES		TREAT	<b>IMENT</b>	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
<u>APPLES</u> Gravenstein	Sebastopol Harvested 8-6-51.	1 d 968°	10 d 941°	<ul> <li>1#, 2 hrs No effect to flavor or appearance with either dosage six days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance six days after treatment and thereafter.</li> </ul>
Gravenstein	Sebastopol Harvested 8-12-51.	1 d @68°	10 d 341°	<pre>1#, 2 hrs Slight off-flavor after 2     days disappearing within 12 days     after treatment. 2#, 2 hrs Serious off-flavor after 2     days disappearing within 12 days     after treatment.</pre>
APRICOTS Tilton	Brentwood	1 d 968°	10 d 341°	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Moderate off-flavor after 2 days that disappeared within 10 days but fruit never developed normal aroma.</li> </ul>
<u>BERRIES</u> Strawberry	San Jose	1 d 345°	2 d @4 <b>1</b> °	<ul> <li>1#, 2 hrs Fruit lacks aroma and is flat in flavor one day after treat- ment and thereafter.</li> <li>2#, 2 hrs Moderate off-flavor that disappeared after 3 days but fruit remained low in quality and lacked characteristic flavor and aroma.</li> </ul>

Propylens Bromido, cont'd

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SPECTES		TREAT	PMENT	
VARIETY	LOCALITY	PRE	FOST	EFFECTS OF TREATMENT
FIGS	ine and a sub- a sub- this to a sub- a sub-	area and an		
Black Mission	Wintors	Nons	3∂ @4 <b>1</b> °	<ul> <li>1#, 2 hrs Slight off-flavor that disappeared within 3 days leaving fruit of low flavor.</li> <li>2#, 2 hrs Strong off-flavor that disappeared within 6 days but resulted in fruit of very low inferior quality.</li> </ul>
Kadota	Merced .	1 d @ 63°	3đ j41°	<ul> <li>1#, 2 hrs Normal in flavor and appearance 2 days after treatment.</li> <li>2#, 2 hrs Fruit of very low flavor quality 2 days after treatment and thereafter.</li> </ul>
GRAPES				<i>n</i>
Red Malaga	Davis Harvested 8-24-51.	None	5 ત @ 41°	<ul> <li>1#, 2 hrs Off-flavor recorded after 3 days which returned to normal within 7 days after treatment.</li> <li>2#, 2 hrs Stronger off-flavor after 3 days which returned to normal within 7 days after treatment,</li> </ul>
Rod Malaga	Davis Harvested 8-29-51.	None	5 d 3 41°	<ul> <li>1#, 2 hrs Slight off-flavor noted after 2 days which disappeared within 9 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor noted after 2 days which disappeared within 9 days after treatment.</li> </ul>
Ribier	Davis	Nonə	5 d ⊚ <b>41°</b>	<ul> <li>1#, 2 hrs Off-flavor that returned to normal within 9 days.</li> <li>2#, 2 hrs Stronger off-flavor which returned to normal within 11 days but too late to allow for marketing of the fruit.</li> </ul>
Thompson Scedlass	Imperial Valley Harvested 7-20-51.	6 d 3 45°	3đ 0 <u>(1</u> 0	<ul> <li>1#, 2 hrs No effect to flavor or appearance.</li> <li>2#, 2 hrs Flavor slightly off after 4 days which returned to normal within 6 days after treatment.</li> </ul>
Thompson Seedless	Fresno Harvested 8-10-51.	3d 345°	5 d @ 41°	<ul> <li>1#, 2 hrs Moderate off-flavor after</li> <li>2 days returning to normal within</li> <li>7 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor after 2 days returning to normal within</li> <li>8 days after treatment.</li> </ul>
Theapson Seedless	Devis Harvested 9—5—51.	1 d 3410	5 G 9 410	1#, 2 hrs Strong off-flavor after one day that disappeared within 7 days after treatment, leaving a fruit of low flavor.

Propylene Bromide, cont'd

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SPECIES		TREAT	IMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Thompson Seedless, (	cont <sup>1</sup> d			2#, 2 hrs More serious off-flavor after 1 day that disappeared within 11 days leaving a fruit of poor quality.
Tokay	Lođi	1 d 3 689	5 d @ 41°	<ul> <li>1#, 2 hrs Strong off-flavor that persisted throughout observation period of 12 days.</li> <li>2#, 2 hrs More serious off-flavor the persisted throughout observation of 12 days.</li> </ul>
White Malaga	Davis	Nonə	5 d @ 41°	<ul> <li>1#, 2 hrs Strong off-flavor after 3 days that disappeared after 7 days leaving a fruit of inferior flavor.</li> <li>2#, 2 hrs More serious off-flavor that did not return to normal during the observation period of 11 days.</li> </ul>
<u>NECTARINES</u> Dargonville	Winters	ી તે ૩ 68°	10 d 3 41°	1#, 2 hrs Some loss of characteristic flavor but no off-flavor. 2#, 2 hrs Some loss of characteristic flavor but no off-flavor.
Quetta	Stockton	1d 368°	10 d 3 4 <b>1°</b>	<ul> <li>1#, 2 hrs No effect to flavor or appearance when observed 6 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when observed 6 days after treatment or thereafter.</li> </ul>
Stanwick	Winters	1 d 3 68°	10 d 3 4 <b>1</b> °	<ul> <li>1#, 2 hrs No effect noted to flavor of appearance when observed 5 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect noted to flavor of appearance when observed 5 days after treatment or thereafter.</li> </ul>
Tioga	Winters	1 d ) 68°	10 d 3 4 <b>1°</b>	<ul> <li>1#, 2 hrs No effect noted to flavor of appearance when observed 5 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect noted to flavor of appearance when observed 5 days after treatment or thereafter.</li> </ul>
<u>PEACHES</u> Elberta	Winters	ી તે ુ 6 <b>ઉ</b> °	5 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance when observed 6 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when observed 6 days after treatment and thereafter.</li> </ul>

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Propylene Bromide, cont'd

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SPECIES		TREAT	PMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Fay Elborta	Winters Harvested 7-24-51.	1 d 0 680	5 d 3 41°	<ul> <li>1#, 2 hrs Off-flavor after 2 days that disappeared within 5 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor after 2 days that did not return to normal during 12 days' observation period although the chemical flavor disappeared.</li> </ul>
Fay Elbərta	Davis Harvested 7-30-51.	Nona	10 d g <b>41°</b>	<ul> <li>1#, 2 hrs Slight off-flavor after 8 days that returned to normal within 10 days. Appearance was normal.</li> <li>2#, 2 hrs Slight off-flavor after 8 days that returned to normal within 10 days. Appearance was normal.</li> </ul>
Halo Haven	Winters	2 d 3 689	10 d 9 41°	<ul> <li>1#, 2 hrs Slight off-flavor after 2 days returning to normal within 8 days after treatment.</li> <li>2#, 2 hrs Moderate off-flavor after 2 days returning to normal within 8 days after treatment.</li> </ul>
J. H. Halo	Winters	1 d g 68°	5 d @ 41°	<ul> <li>1#, 2 hrs Slight off-flavor noted after 2 days returning to normal within 5 days after treatment.</li> <li>2#, 2 hrs Slight off-flavor noted after 2 days returning to normal within 5 days after treatment.</li> </ul>
July Elberta	Winters	1 d 2 68°	10 d 3 41°	<ul> <li>1#, 2 hrs Flat flavor but no foreign flavor noted after 3 days, returning to normal within 5 days after treat- ment.</li> <li>2#, 2 hrs Flat flavor but no foreign flavor noted after 3 days, returning to normal within 5 days after treat- ment.</li> </ul>
Palora	Davis	Nono	5 d @ 41 <b>°</b>	<ul> <li>1#, 2 hrs No effect to flavor or appearance noted 4 days after treat- ment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance noted 4 days after treat- ment or thereafter.</li> </ul>
Rio Oso Gem	Winters	ld 368°	5 તે ઉ 4 <b>1</b> °	<ul> <li>1#, 2 hrs No effect to flavor or appearance 6 days after treatment and thereafter.</li> <li>2<sup>n</sup>, 2 hrs No effect to flavor or appearance 6 days after treatment and thereafter.</li> </ul>

Propylene Bromide, cont'd

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SPECIES		TREAT	MENT		
VARIETY	LOCALITY	PRE	POST		EFFECTS OF TREATMENT
Sundean	Winters	1 d @ 68°	3-d 3-410	1#, 2#,	2 hrs Strong off-flavor after 2 days with foreign flavor dis- appearing within 6 days but flavor quality remained poor. 2 hrs Strong off-flavor after 2 days with foreign flavor dis- appearing within 6 days but flavor
<u>PEARS</u> Bartlett	Hood Harvested 7-17-51.	ld 380°	10 d 7 410	1#, 2#,	quality remained poor. 2 hrs Flavor good when fruit reached sating maturity 13 days after treatment and thereafter. 2 hrs Flavor good when fruit reached sating maturity 13 days after treatment and thereafter.
Bartlett	Davis Harvested 8251.	None	10 d 3 41°	1#, 2#,	2 hrs No effect noted 5 days after treatment or thereafter. 2 hrs No effect noted 5 days after treatment or thereafter.
Bartlett	Clear Lake Harvested 8—14—51。	2 đ <sub>3</sub> 68°	10 d @ 41°	]#, 2#,	2 hrs Flavor normal. 2 hrs Slight off-flavor noted 13 days after treatment that dis- appeared within 15 days after treat- ment.
Bartlett	Santa Clara Harvested 8-12-51.	15 d @ 37°, 1 d @ 68°	10 d 3 41°	1#, 2#,	2 hrs No effect noted to flavor or appearance 13 days after treatment and thereafter. 2 hrs No effect noted to flavor or appearance 13 days after treatment and thereafter.
Bosc	Folsom	1 d 3 680	10 d 9 41°	1∦, 2#,	2 hrs No effect to flavor or appearance 13 days after treatment and thersafter. 2 hrs Normal pear aroma developed late in the ripening process but no foreign flavor was ever noted.
Comice	Placerv1110	1 d 3 680	10 d 3 410	1#, 2#,	2 hrs No effect noted to flavor or appearance as fruit approached ripeness 18 days after treatment. 2 hrs No effect noted to flavor or appearance as fruit approached ripeness 18 days after treatment.
Hardy	Placerville	1 d @ 68°	10 d 3 41°	1#,	2 hrs No effect noted to flavor or appearance as fruit reached the eating ripe stage 17 days after treatment.

Propylene Bromide, cont'd

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SPECIES		TREA	TMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Hardy, cont	ď			2#, 2 hrs No effect noted to flavor or appearance as fruit reached the eating ripe stage 17 days after treatment.
Winter Nelie	5 Davis ,	1 d @ 68°	10 đ @ 41°	<ul> <li>1#, 2 hrs No effect noted to flavor or appearance as fruit approached eating ripe stage 20 days after treatment.</li> <li>2#, 2 hrs No effect to flavor or ap- pearance noted as fruit approached sating ripe stage 20 days after treatment.</li> </ul>
PLUMS Becky Smith	Winters	1 d ∞ 68∘	10 d @ 41°	<ul> <li>1#, 2 hrs Off-flavor noted 5 days after treatment which did not dis- appear during marketable period of fruit.</li> <li>2#, 2 hrs Strong off-flavor noted 5 days after treatment which did not disappear during marketable period of fruit.</li> </ul>
Burbank	Winters	ld ⊛63°	10 d 9 410	<ul> <li>1#, 2 hrs Slight off-flavor after one day that disappeared within 5 days after treatment.</li> <li>2#, 2 hrs Moderate off-flavor after one day that disappeared within 12 days after treatment.</li> </ul>
Climan	Davis	None	10 d 9 41°	<ul> <li>1#, 2 hrs No effect noted to flavor or appearance 6 days after treatment or thereafter.</li> <li>2#, 2 hrs Slight off-flavor after 6 days that disappeared within 10 days after treatment.</li> </ul>
Diamond	Vacavillo	1 d ∋68°	10 d 3 41°	1#, 2 hrs No effect to flavor or appearance. 2#, 2 hrs Flat flavor which dis- appeared within 10 days after treat- ment.
Duerto	Winters Harvested 7-11-51.	1 d @ 68°	10 d @ 410	<ul> <li>1#, 2 hrs Slight off-flavor after one day which disappeared within 5 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor after one day which disappeared within 12 days after treatment.</li> </ul>

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Propylene Bromide, cont'd

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SPECIES		TREAT	PMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Duarte	Auburn Harvested 8-13-51.	1 <u>38</u> @ 68°	10 d @ 4 <b>1°</b>	<ul> <li>1#, 2 hrs Strong off-flavor after one day that returned to normal within 10 days.</li> <li>2#, 2 hrs Strong off-flavor after one day that returned to normal within 13 days.</li> </ul>
Gaviota	Auburn	1 d ∅ 63°	10 đ 9 <b>41</b> °	<ul> <li>1#, 2 hrs Strong off-flavor after 4 days that returned to normal within 10 days. Fruit retarded in ripening.</li> <li>2#, 2 hrs Strong off-flavor after 4 days that returned to normal within 10 days. Considerable retardation of fruit ripening.</li> </ul>
Giant	Aubura	1d 042°, 1d 068°	10 d @ 410	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 5 days or thereafter.</li> <li>2#, 2 hrs Flat flavor noted 5 days after treatment which disappeared within 10 days after treatment.</li> </ul>
Grand Duko	Auburn	1d 9680	10 d 9 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 7 days and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance after 7 days and thereafter.</li> </ul>
Kelssy	Novcastlo	`1 ₫ @68°	10 d 9 41°	<ul> <li>1#, 2 hrs No effect to flavor or appearance after 5 days and thereafter.</li> <li>2#, 2 hrs Off-flavor which disappeared within 14 days after treatment.</li> </ul>
Wiekson	Vacavillo Harvested 7-16-51.	1 d @ 68°	10 d 3 41°	<ul> <li>17, 2 hrs Off-flavor which disappeared within 7 days after treatment, also slight retardation of color.</li> <li>2#, 2 hrs Off-flavor which disappeared within 10 days after treatment; however, flavor remained flat and a definite retardation of color development.</li> </ul>
Wickson	Auburn Harvested 7-26-51.	1đ 3689	10 d 3 41°	<ul> <li>1#, 2 hrs No effect to flavor or color development noted 10 days after treatment or thereafter.</li> <li>2#, 2 hrs No effect to flavor or color development noted 10 days after treatment or thereafter.</li> </ul>

Propylene Bromide, cont'd

## SUMMARY

In general, propylene bromide had an objectionable effect on the flavor of fruits. For the most part it would seem that the flavor resulted directly from the chemical absorbed by the fruit, since the off flavor usually disappeared with time. However, in a number of cases the treated fruit never attained the sating quality of the controls often because of the loss of their characteristic arona.

A comparison of these observations with those where sthylene dibromide was used indicates that propylene bromide is more likely to be injurious to fruit flavors during the marketing period at comparable concentrations per unit volume of space. Since the LD desages of propylene bromide are much higher than those for ethylene dibromide, it seems highly unlikely that propylene bromide will be an acceptable furigant when it also has such a potential effect on fruit flavors.

### TRIMETHYLENE BROMIDE

The selected dosages of 1 pound and 2 pounds per thousand cubic feet for an exposure period of 2 hours were used.

All fruit was harvested at commerical shipping maturity unless otherwise specified and tests were conducted as soon after harvest as practicable, usually after one day during which time the fruit was brought to treatment temperature. The tests were conducted in 5-gallon jars, previously described, at a temperature of approximately 70° F.

After treatment the fruit was stored at 41° F. to simulate transit conditions for the time specified in the following chart. The fruit was then moved to 68° F. for ripening and kept there for observation until it reached the end of the marketable period.

A discussion of the effect of treatment to the different species and varieties appears below. The sppcarance of the fruit was considered normal. unless otherwise specified.

SPECIES		TREA	rment?	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
APPLES	201120-201-001-002-00102-00102-00102-00102-00102-00102-00102-00102-00102-00102-00102-00102-00102-00102-00102-0			
Gravenstein	Sebastopol Harvested 8-6-51.	1 d 3 68°	10 d @ 41°	<ul> <li>1#, 2 hrs No effect to flavor when checked 6 days after treatment and thereafter.</li> <li>2#, 2 hrs No effect to flavor or appearance when checked 6 days after treatment or thereafter.</li> </ul>
Gravenstein	Sebastopol Harvested 8-22-51.	⊥d @68°	10 d 3 4 <b>1</b> 0	<ul> <li>1#, 2 hrs Flavor off seriously which disappeared within 12 days after treatment.</li> <li>2#, 2 hrs Flavor off more seriously which disappeared within 12 days after treatment.</li> </ul>
APRICOTS				
Tilton	Brentwood Harvested 7-16-51.	1 d @ 68°	10 d 3 41°	1#, 2 hrs The aroma and flavor was very objectionable when checked 2 days after treatment. The chemice aroma was somewhat dissipated there- after but continued to be serious enough to render fruit unmarketable. 2#, 2 hrs The aroma and flavor was
				nore objectionable then the above treatment. This off-flavor dissi- pated somewhat but continued to be serious enough to render the fruit unmarketable.
<u>BERRIES</u> Strauberry	San Jose	1 d	2 d	1#, 2 hrs Flavor very seriously off
		@ <b>45°</b>	0 410	with no offect to appearance. 2#, 2 hrs Flavor very seriously off with no effect to appearance.

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Trimethylene Bromide, cont'd

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SPECIES		TREAT	MENT	
VARIETY	LOCALITY	PRE	FOST	EFFECTS OF TREATMENT
<u>FIGS</u> Black Missio	n Winters	None	3 d 341°	<ul> <li>1#, 2 hrs Flavor seriously off when checked 2 days after treatment and continued to be off thereafter.</li> <li>2#, 2 hrs Flavor seriously off when checked 2 days after treatment and continued to be off thereafter.</li> </ul>
<u>GRAPES</u> Red Malaga	Davis Harvested 8-24-51.	None	5 d @ 41º	<ul> <li>1#, 2 hrs Slight off-flavor that continued throughout the observa- tion period of 10 days.</li> <li>2#, 2 hrs Serious off-flavor that did not disappear.</li> </ul>
Red Malaga	Davis Harvested 8—29—51.	None	5 d @ 41°	1#, 2 hrs Moderate off-flavor that did not disappear. 2#, 2 hrs Serious off-flavor that did not disappear.
Thompson Seedless	Imperial Valley Troated 7-26-51.	5 d 3 45°	3 d ⊚ 41°	<ul> <li>1#, 2 hrs Slight off-flavor that did not disappear.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear.</li> </ul>
Thompson Seedless	Fresno Treated 8-13-51.	3d 045°	56 @410	<ul> <li>1#, 2 hrs Moderate of 1-flavor when checked 2 days after treatment that disappeared within 8 days.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear.</li> </ul>
<u>NECTARINES</u> Dargonville	Winters	1d @68°	10 ત @ 41°	<ul> <li>1#, 2 hrs Loss of characteristic nectaring flavor but the appearance remained normal.</li> <li>2#, 2 hrs Slight off-flavor and loss of characteristic nectaring flavor but the appearance remained normal.</li> </ul>
Gower	Winters	ld © 68°	10 d 3 41°	1#, 2 hrs Slight off-flavor but the appearance remained normal. 2#, 2 hrs Slight off-flavor but the appearance remained normal.
Quetta	Stockton	] d I 699	10 c @ 41°	<ul> <li>1#, 2 hrs Flavor poor but no effect to appearance.</li> <li>2#, 2 hrs Flavor slightly off but no effect to appearance.</li> </ul>
Stanvick	Winters	1 d @ 680	10 d 3 41°	1#, 2 hrs Strong off-flavor that did not disappear. 2#, 2 hrs Strong off-flavor that did not disappear.
SPECIES		TREA	TMENT	
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VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Tioga	Winters	ા ત ા 68°	10 d 3 41°	1#, 2 hrs Strong off-flavor that did not disappear. 2#, 2 hrs Strong off-flavor that did not disappear.
<u>PFACHES</u> Elberta	Winters	1d ⊚68°	5 a 3 410	1#, 2 hrs No effect to flavor or appearance 6 days after treatment. 2#, 2 hrs Off-flavor but no effect to appearance.
Fay Elberta	Vinters Harvested 7—24—51.	1d 368°	5d 9410	1#, 2 hrs Strong off-flavor with no effect to appearance. 2#, 2 hrs Strong off-flavor with no effect to appearance.
<b>Fay</b> Elberta	Davis Harvested 7-31-51.	Nons	10 đ 3 41°	<ul> <li>1#, 2 hrs Strong off-flavor that disappeared 11 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor that disappeared 11 days after treatment. Ripening hastened by treatment.</li> </ul>
Hale Haven	Winters	2 d 9 680	10 d 3 <b>41°</b>	<ul> <li>1#, 2 hrs Strong off-flavor and chemical aroma which was seriously objectionable when checked 2 days after treatment and still noticeable after 15 days.</li> <li>2#, 2 hrs Strong off-flavor and chemical aroma which was very objectionable when checked 2 days after treatment and still noticeable after 15 days. This treatment was more damaging than the J#, 2 hrs. dosage.</li> </ul>
J. H. Hals	Winters	1 d 3 68°	5 d 3 <b>41°</b>	<ul> <li>1#, 2 hrs Strong off-flavor when checked 2 days after treatment that disappeared in 12 days leaving a flat flavor.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear.</li> </ul>
July Elberta	Winters	<u>1</u> đ 3 68°	10 d 9 <b>41°</b>	<ul> <li>1#, 2 hrs Strong off-flavor when checked 3 days after treatment that disappeared within 10 days leaving a flat flavor.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear.</li> </ul>
Palore	Davîs	Nono	5 d 3 410	<ul> <li>1#, 2 hrs Flavor poor but no effect to appearance.</li> <li>2#, 2 hrs Flavor off but no effect to appearance.</li> </ul>

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Trimethylene Bromide, cont'd

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SPECIES	TREATMENT			
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Rio Oso Gem	Winters	1d 068°	5d 3410	<ul> <li>1#, 2 hrs No effect noted to flavor or appearance.</li> <li>2#, 2 hrs Moderate off-flavor which disappeared within 10 days after treatment.</li> </ul>
Sunbeam	Winters	1 d 368°	3 d 3 &1°	<ul> <li>1#, 2 hrs Strong off-flavor and chemical aroma present.</li> <li>2#, 2 hrs Strong off-flavor and chemical aroma which became less serious as time after treatment increased.</li> </ul>
PEARS				
Bartlett (	Hood Harvəstəd 7—17—51。	1 d 3 80°	10 d 3 <b>41</b> °	<ul> <li>1#, 2 hrs No off-flavor noted until fruit approached eating rips stage when strong off-flavor developed but there was no effect to the appearance.</li> <li>2#, 2 hrs No off-flavor noted until fruit approached eating ripe stage when strong off-flavor developed but there was no effect to the appearance.</li> </ul>
Bartlett	Davis Harvested 8-2-51.	None	10 d 9 41°	14, 2 hrs No effect to flavor or appearance. 24, 2 hrs Slight off-flavor noticed 5 days after treatment that dis- appeared within 14 days or by the time the pears were sating ripe.
Bartlett	Clear Lake Harvested 8-14-51.	2 d .∋ 68º	10 d 3 4 <b>1</b> °	<ul> <li>1#, 2 hrs No chemical flavor but poor flavor and loss of normal pear arona. No effect to appearance.</li> <li>2#, 2 hrs Poor flavor and loss of norm pear arona but no effect to appearance.</li> </ul>
Bartlett	Santa Clara Harvested 8—15—51,	15 d 37°, 1 d	10 d 3 41°	1#, 2 hrs No effect to flavor or appearance. 2#, 2 hrs No effect to flavor or
Bose	Folson	9 00" 1 d 0 68°	10 d @ 410	<ul> <li>appearance.</li> <li>1#, 2 hrs Poor flavor with a loss of normal pear essence that would render fruit unmarketable.</li> <li>2#, 2 hrs Poor flavor with a loss of normal pear essence that would render fruit unmarketable.</li> </ul>
Comice	Placerville	1d 368°	10 d 3 410	<pre>3#, 2 hrs No effect to flavor or eppearance. 2#, 2 hrs No effect to flavor or enneerance.</pre>

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Trimethylene Bromide, cont'd

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SPECIES		TREAT	PMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Hardy	Flacerville	1 d 9 680	10 d 3 <b>41</b> °	<ul> <li>1#, 2 hrs Flavor inferior to that of untreated fruit but no foreign flavor noted.</li> <li>2#, 2 hrs Flavor poor but no foreign flavor noted.</li> </ul>
Winter Nelis	Davis	1 d 3 68°	10 d 3 41°	<ul> <li>1#, 2 hrs No affect to flavor or appearance.</li> <li>2#, 2 hrs Flavor poor but no foreign flavor noted.</li> </ul>
<u>PLUMS</u> Becky Smith	Winters	1 d ⊚ 68°	10 d 3 41°	<ul> <li>1#, 2 hrs Slight off-flavor which disappeared within 11 days after treatment.</li> <li>2#, 2 hrs Strong off-flavor which disappeared within 11 days after treatment.</li> </ul>
Burbank	Winters	1d @ 680	10 d @ 410	<ul> <li>2 hrs Strong off-flavor which diminished in intensity following treatment but did not disappear completely during marketing period.</li> <li>2#, 2 hrs Strong off-flavor which did not disappear.</li> </ul>
Climax	Davis	None	10 d Э <u>4</u> 1°	1#, 2 hrs Slight off-flavor that persisted during 10-day transit period but was normal 3 days later. 2#, 2 hrs Strong off-flavor that returned to normal only after 16 days following treatment which was after the end of the marketable period.
Diamond	Vacavillo	1d 368°	10 d @ 4 <b>1</b> °	1#, 2 hrs Slight off-flavor that did not disappear 2#, 2 hrs Moderate off-flavor that did not disappear.
Duarto	Winters Harvested 7-11-51.	1 d 3 68°	10 d ) 41°	1#, 2 hrs Strong off-flavor that dis- appeared but left a flat flavor. Re- tardation of color development noticed. 2#, 2 hrs Strong off-flavor that dis- appeared but left a flat flavor and a more pronounced retardation of color development which did not disappear.
Duarte	Auburn Harvested 8 <b>-13-</b> 51.	1 d 9 680	10 d 3 41°	<ul> <li>1#, 2 hrs Strong off-flavor that dis- appeared but left a flat flavor.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear.</li> </ul>

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## Trimethylene Bromide, cont'd

SPECIES		TREAT	MENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Gaviota	Auburn	1 d @ 68°	10 d © 41°	<ul> <li>1#, 2 hrs Strong off-flavor that did not disappear.</li> <li>2#, 2 hrs Very strong off-flavor that did not disappear.</li> </ul>
Gient	Auburn	1d 942°, 1d 968°	10 d @ 41°	1#, 2 hrs Mcderate off-flavor that did not disappear. 2#, 2 hrs Strong off-flavor that did not disappear.
Grand Duko	Auburn	1d @ 65°	10 d 3 41°	<ul> <li>1#, 2 hrs Moderate off-flavor that after 10 days disappeared leaving a poor flavor as compared to the control.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear.</li> </ul>
Kolsey	Nowcastle	1 d @ 68°	10 d 3 41°	<ul> <li>1#, 2 hrs Strong off-flavor that disappeared after 14 days leaving a poor flavor.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear during the marketable period.</li> </ul>
Wickson	Vacavillo Harvestod 7-16-51.	1d 368°	10 d 3 41°	<ul> <li>1#, 2 hrs Moderate off-flavor that did not disappear.</li> <li>2#, 2 hrs Strong off-flavor that did not disappear.</li> <li>Treatment retarded ripening in both lots.</li> </ul>
Wickson	Auburn Harvested 7-26-51.	1 d @ 68°	10 d 3 41°	<ul> <li>1#, 2 hrs Moderate off-flavor that persisted during 10 days at 41° F. but disappeared following 2 days at 65° F.</li> <li>2#, 2 hrs Strong off-flavor that per- cisted during 10 days at 41° F. but disappeared following 2 days at 68° F</li> </ul>

## SUMMARY

A total of 85 tests were run using this fumigant. Of these tests 10 showed no damage to the flavor or appearance of the fruit with any dosage while 73 tests resulted in off-flavor. This off-flavor was very serious in most cases and persisted throughout the observation period. Of the fruits tested pears seemed most tolerant to the fumigant, but even the tolerance was not considered sufficient to recommend trimethylene bromide as a safe fumigant.

We believe that sufficient tests have been made with trimethylene bromide to indicate definitely that it is not a safe funigent to use for any fresh fruit, at least at the dosages under which it was tested. No further studies with this funigent are contemplated.

## VAPOR HEAT

As previously reported, two vapor heat treatments were used. The first one involved bringing the fruit temperature to 110° F. as rapidly as possible in vapor heat held at 110° F. to 111° F. After reaching the desired temperature the fruit was held for 8 3/4 hours at 110° F. and then removed to 41° F. to simulate transit conditions for the time specified in the following table. The fruit was then moved to 68° F. for ripening and kept there for observation throughout the period of marketability. The second treatment involved bringing the fruit flesh temperature rapidly to 120° F. in 120° to 121° F. saturated air. As soon as this temperature was attained in the center of the fruit, it was removed from the chamber and handled in the same way following treatment as stated for the 110° F. lots.

A discussion of the effects of the treatments to the different species and varieties appears below. The appearance of the fruit was considered normal unless otherwise specified.

SPECIES		TREAT	PMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
<u>APPLES</u> Gravenstein	Sebastopol	]. d @ 68°	10 d 347°	110°F Accentuation of bruises and browning which penetrated to a depth of 10-15 wm. and a cocked flavor. 120°F Accentuation of bruises and scald present on all fruit and a cooked flavor.
GRAPES Tokay	Lcdi	6 d 041°, 1 d 368°	5d 341°	110°F Poor flavor much inferior to that of untreated fruit. 120°F Poor flavor inferior to that of untreated fruit.
Dargonville	Winters	3 d 041°	10 d 3 41°	<ul> <li>110°F Scald appeared on 30% of the area of all fruit which rendered fruit completely unmarketable.</li> <li>120°F Scald appeared on 60% of the area of all fruit which rendered fruit completely unmarketable. A prevention of normal color development.</li> </ul>
Quetta	Stockton	5 d @41°, 1 d 968°	5 d 7 420	<ul> <li>110°F Scald and necrotic areas appeared on 50% of the fruit covering 10% of the area. Flavor very poor which would render the fruit un- marketable.</li> <li>120°F Scald and necrotic areas appeared on 50% of the fruit penetrating to a greater depth than in the 110°F. treatment. Flavor very poor.</li> </ul>

Vapor Heat, cont'd

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SPECIES		TREA	TMENT	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Tioga Peaches	Winters	ર વ ુ 68°	10 d @ 41°	110°F Necrotic areas on all fruit and a poor flavor. 120°F Necrotic areas on all fruit and a poor flavor, more serious than in the 110°F. treatment.
Fay Elberta	Winters	1 d @ 68°	5 d @ 41°	110°F Scald and internal breakdown on all fruit. 120°F Scald and internal breakdown on all fruit.
Hale Haven	Winters	2 d 0 68°	10 d @ 41°	110°F Accentuation of bruises to brown oxidized spots; flavor poor. 120°F Necrotic areas and browning around the pit and a very bad flavor.
Rio Oso Gem	Winters	1 d @ 68°	5d @41°	110°F Scald on the spidermis and a flat flavor. 120°F Scald on all fruit covering from 10-25% of the area. Flavor and aroma similar to that of cooked fruit.
Sundarm	Winters	1 & @ 68≎	3 d @ 410	<ul> <li>110°F Necrotic areas penetrating into the flesh of the fruit. Flavor flat and of a cooked nature.</li> <li>120°F Necrotic areas covering a larger percentage of the area of the fruit. Flavor flat and of a cooked nature.</li> </ul>
<u>PEARS</u> Bertløtt	Hood	1 d @ 68°	10 d @ 41°	110°F Slight to moderate pitting; however, the flavor was not affected. 120°F Heavy pitting with fruit dry. Flavor was very flat.
Bartlett	Folsom	1 d @ 63°	10 d 3 41°	<ul> <li>110°F Scald noted on all fruit and a prevention of normal color dsvelopment rendering the fruit intolerant to treatment.</li> <li>1.20°F Scald and accentuation of bruises with a prevention of normal color development noted. Complete breakdown on 50% of the fruit occurred before the normal ripening processes were completed.</li> </ul>

Vapor Heat, cont'd

SPECIES		TREAT	WIEWT.	
VARIETY	LOCALITY	PRE	POST	EFFECTS OF TREATMENT
Comice	Placerville	9 2 d ⊚ 68°	10 d @ 41°	110°F Accentuation of all bruises and a very poor flavor with a loss of normal pear flavor. 120°F External and internal breakdown of all fruit with browning around the seed area.
<u>PLUMS</u> Clinear	Davis	None	10 d @ 41°	<ul> <li>110°F Necrotic areas on all fruit covering 15% of the area which rendered the fruit completely un- marketable.</li> <li>120°F Necrotic areas on all fruit cover- ing 50-75% of the area rendering the fruit completely unmarketable.</li> </ul>
Duarto	Auburn	1 d @ 68⁰	10 d @ 41°	<ul> <li>110°F Surface browning on all fruit with a prevention of normal color development.</li> <li>120°F Surface blemishes and prevention of normal color development with a very poor flavor.</li> </ul>
Kolssy	Newcastle	ld @68°, 2d @41°	7 a 3 410	<ul> <li>110°F Accentuation of bruises and dehydration of the fruit with pre- mature mold development.</li> <li>120°F More serious accentuation of bruises and browning on all fruit. Flavor poor and of a cooked nature. Mold prematurely consumed fruit.</li> </ul>

## SUMMARY

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There was a continuation of unsatisfactory results with vapor heat with apples, nectarines, peaches, and pears showing damage to flavor and appearance. No conditioning treatments in the approach period have been used with deciduous fruits because the severity of injury was so great as to make the success of such treatments highly improbable. These data and previous reports would indicate that this type of treatment has little or no promise as a fruit sterilant.