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Project Researcher: Davis

SUMMARY OF 1979 ALMOND INTEGRATED PEST MANAGEMENT TRIALS

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1979 STATEWIDE ALMOND IPM SUMMARY

The Almond IPM project was started in 1978 to develop and demonstrate guidelines for improved orchard management of pests. The trials were continued in 1979 with 6 cooperators participating in the various almond growing districts of the state. Each grower provided an 80 to 100 A. orchard where specific chemicals and cultural practices were used during the growing season. Populations of Navel orangeworm, Peach twig borer, Oriental fruit moth, phytophagous and predator mites were monitored. This summary describes each trial conducted during 1979, separately. Several of the concepts, ideas and problems are unique to each individual ranch and some of the ideas have developed following the growing season after careful analysis of data. These ideas are written as conclusions to each individual ranch. Besides the 6 major plots conducted statewide, a trial was conducted at Arbuckle on Peach twig borer dormant control using various materials. A separate trial was also conducted at Mc Farland on ground applications of various spray chemicals for ant control, a trial at Chowchilla using various dormant treatments and other summer chemical treatments and at Chico using the chemical Supracide in comparison with the present recommended chemicals. The trials not presently written in this summary will be reported at a later time.

Sanitation

Graph 1 shows the relationship of three orchards statewide where good sanitation practices (dormant clean-up of mummies) were practiced on some blocks and other blocks had no sanitation program. The graph shows the 3 ranches of Chowchilla, Chico and Blackwell giving 32%, 21% and 37% improvement, respectively,of NOW control from mummy nut removal in the winter. This 30% improvement occurred even though the plots were only about 10 A. in size and randomized with the uncleaned plots, and in spite of the NOW being quite migratory in habit. The question has been asked many times, "If my neighbor doesn't clean up, why should I?" How big an area does one need to clean to see any benefit from orchard sanitation? From these trials, orchards as small as 10 A. can show a definite improvement from orchard sanitation. Had the entire orchard or block been cleaned, the improvements from orchard sanitation would be much higher. One block at Chowchilla that had been cleaned during winter, had 5.3% NOW at harvest where it was next to a block that had not been cleaned and progressively had less NOW damage as one moved further away from the uncleaned block. The last area of this orchard sampled was 1/2 mile from the uncleaned block and showed a 0.3% infestation. Therefore, the true effects of orchard sanitation are much greater where larger areas are cleaned than where a single 10-acre block is cleaned as compared to an uncleaned area next to it.

Navel orangeworm

Table 1 shows the final harvest samples from 5 different orchards for both 1978 and 1979 and the percentage NOW damage that occurred in each orchard in each of the treated areas. It also shows the overall average

percent control that was achieved using the chemical sprays of Guthion, Sevin or both Guthion plus Sevin when compared to the unsprayed check. Guthion gave 47.5% in 1978 and 44.1% control in 1979, whereas, Sevin sprays gave 31.4% in 1978 and 41.2% control in 1979. Applying both sprays during the season gave control of 54.9% and 51.5%. Using the egg traps to time the spray was quite effective in applying the Guthion at the appropriate time. The Sevin spray in 1978 generally was applied between 5 and 10% hull split. Based on the egg deposition, the conclusion was reached that the application went on too late in most orchards in 1978. Therefore, the 1979 treatments were applied much closer to 1% hull split and a definite improvement in control was noted in the 1979 Sevin applications. An improvement in control both years was achieved by using both sprays over the use of either material alone. The improved control using both chemical sprays, though, was not as great as predicted by using either chemical spray alone. An additional 7.4% control in 1978 and 1979 was achieved from the Sevin spray over the control of Guthion alone. The multiple spray program does not appear to give additive benefits of NOW control based on 2 years data in 5 orchards.

When used correctly and timed according to egg trap catches or early hull split (1% or less), either chemical spray will give some control of NOW. It will not provide total control if the infestation of NOW is high. Graph 2 shows the harvest and preharvest dates when samples were collected from orchards sampled during 1979. The general trend of all the orchards correlates very closely to very low damage in early August and progressing to much greater damage by mid- to late September. This increased damage correlated very closely with the egg depostion on traps during August and September. A definite second brood occurs during the harvest season. Therefore, early harvest is also very necessary to provide an effective NOW control program.

Peach twig borer

Dormant spray applications using Parathion and oil were applied to 2 orchards in the IPM trials. These 2 orchards, one of which had very high populations of Citrus red mite and both orchards with some PTB damage in 1978 showed no Citrus red mite throughout the summer of 1979 and very low PTB populations throughout the summer of 1979; whereas, other orchards in the trials which received an application of Diazinon and oil in the dormant period had considerable PTB flights throughout the summer. Additional trials need to be conducted on the effectiveness of Parathion and oil, Diazinon and oil, Supracide or any other materials, including Imidan and oil, on their effectiveness during the dormant time in controlling PTB. The one trial conducted in the winter of 1978-79 where these various materials were applied for PTB control showed that Supracide and a new material, Celathion, gave better control of PTB than did either Diazinon and oil or Imidan and oil.

Ants

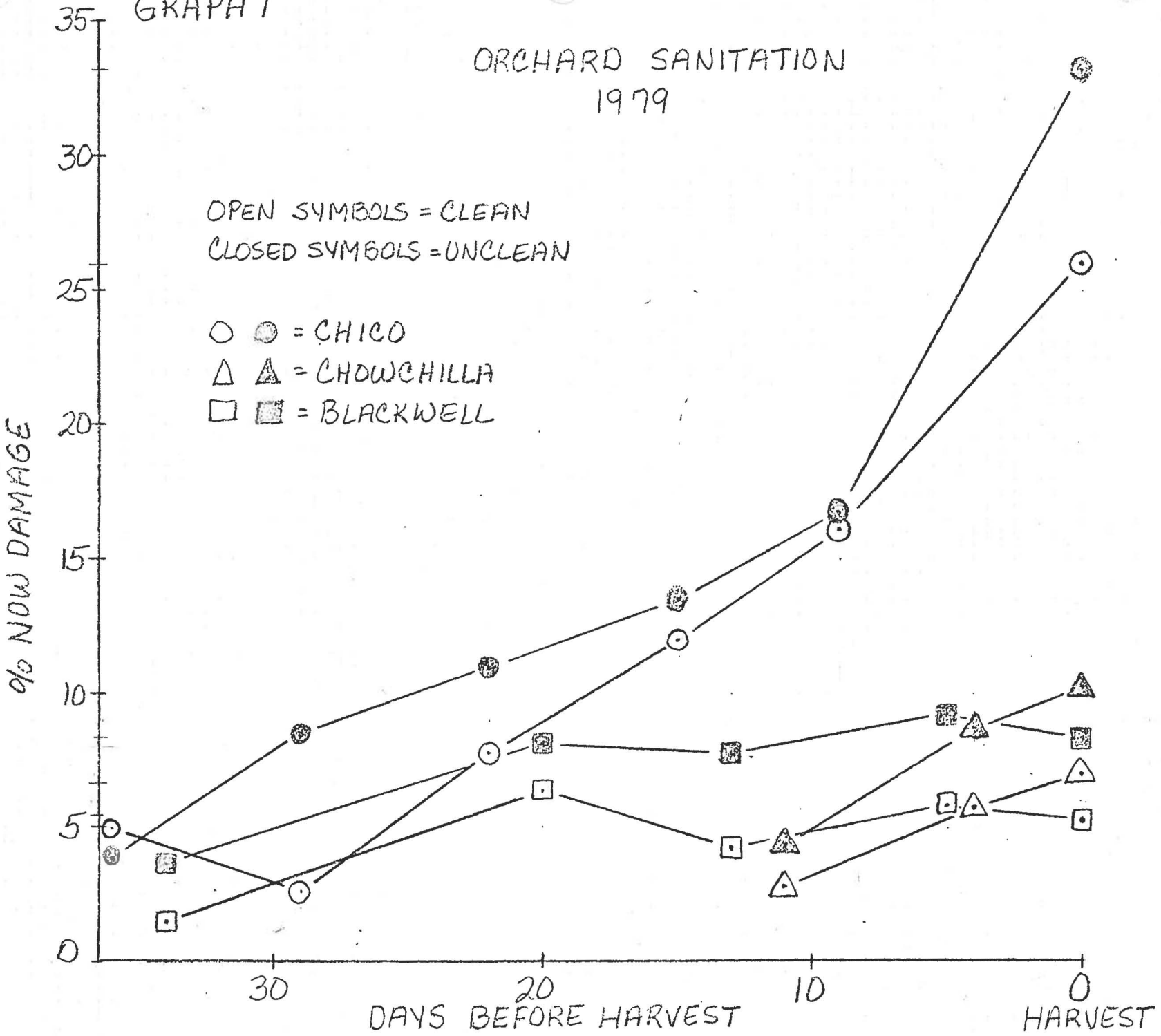
In 1979 ants continued to be a problem in one particular orchard and occurred in samples from several other orchards. Ground applications

of several chemicals that were tried gave only fair to no control. An effective material which can be applied to the orchard floor to control ants would be very useful in an IPM program.

Mites

A cooperative project with Marjorie Hoy was carried out in 3 of the orchards used in the IPM project this past year. This project was mostly releases of predator mites resistant to the various chemicals that were being applied for NOW control. Trial results appear promising for future trials and for releases. Various trials and releases will be continued in cooperation with Dr. Hoy.

GRAPH 1


ORCHARD SANITATION
1979
OPEN SYMBOLS = CLEAN
CLOSED SYMBOLS = UNCLEAN
○ ● = CHICO
△ ▲ = CHOWCHILLA
□ ■ = BLACKWELL
% NOW DAMAGE
35
30
25
20
15
10
5
0
30
20
10
0
DAYS BEFORE HARVEST
HARVEST

GRAPH 2

NONPAREIL NUTS INFESTED WITH NAVEL ORANGEWORM AT PREHARVEST AND HARVEST. 1979

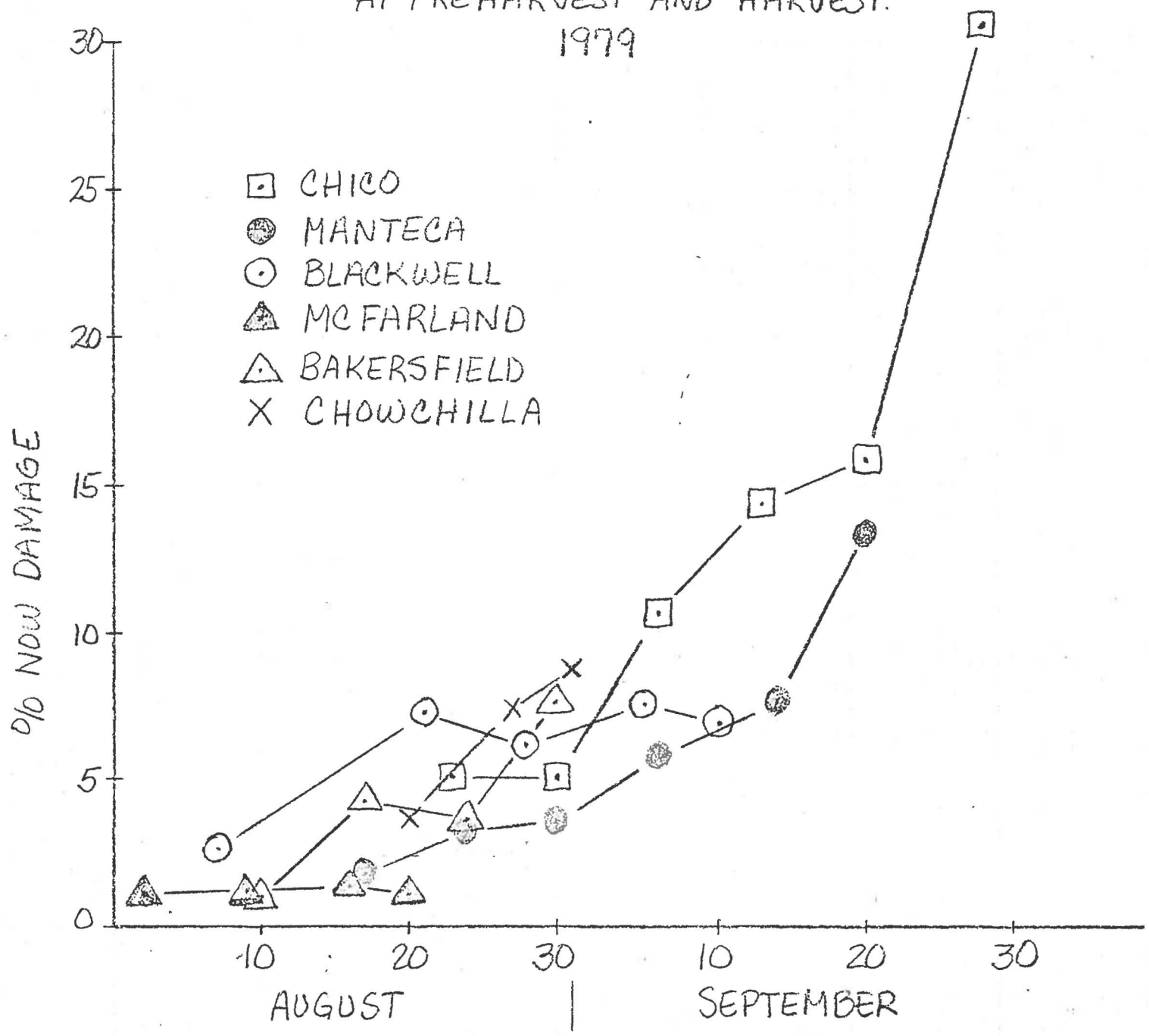


Table 1 - Nonpareil Harvest - % NOW Damage

1978

Orchard	Sprays Used			
	Guthion	Sevin	Guthion + Sevin	Check
	% NOW damage in nuts			
Bakersfield	10.7	20.6	13.1	18.9
Blackwell	10.5	12.5	11.9	12.6
Chico	28.6	27.4	21.2	42.9
Chowchilla	16.5	23.6	10.5	49.5
Manteca	5.6	9.8	5.0	13.0
Overall Average	14.4	18.8	12.3	27.4
% Control	47.5	31.4	54.9	0

1979

Orchard	Sprays Used			
	Guthion	Sevin	Guthion + Sevin	Check
	% NOW damage in nuts			
Bakersfield	6.4	8.5	6.5	9.0
Blackwell	3.3	4.5	2.8	17.1
Chico	26.1	30.3	22.1	43.8
Chowchilla	6.6	7.8	6.3	14.0
Manteca	14.5	9.0	11.6	17.9
Overall Average	11.4	12.0	9.9	20.4
% Control	44.1	41.2	51.5	0

Sample Grading

In 1978 the % NOW damage found in samples collected in the IPM trials was higher than the % damage grade the grower/cooperators received from delivery grade sheets. Therefore, a study was conducted in 1979 to compare the grades found in samples collected for the IPM trials and the grades these samples would receive from a buyer/processor.

Most of the difference is probably due to the type machinery used for cracking the nuts and the final examination of samples. The IPM trials used a roll type machine to soften and crack the shell. The machine was adjusted to crack only the shell. Over 90% of the kernals remained in the shell for careful inspection with the remaining 10% kernals intact. A hand lens was used to determine presence or absence of frass and insect feeding. The processor used a sheller which removed a large percentage of the shells. Some mechanical abrasion and chips occurred. Samples were generally examined without magnification.

A final difference between sampling techniques is between methods of computation. The IPM grades are based on % by number or count, whereas, the processor bases the grade on % by weight. Therefore, a nut that is 1/2 destroyed by feeding damage will weigh only 1/2 as much as the sound nuts. The IPM grade will count the nut as 1% damage in a 100 nut sample.

Table 2 shows results comparing the NOW damage reported in the IPM trials and the comparable samples as graded by the processor. Five of the 6 orchards reported show a definite difference between the 2 grades with the processor grade being much lower. The other ranch had very little damage and the grade showed a reversal. The overall percentage difference (IPM grade-processor grade/Processor grade X 100) was 62%. Therefore, the IPM samples averaged 62% higher than comparable samples run by the processor.

Another difference that might occur is that the IPM samples are collected in the orchard before the nuts are picked up or hulled. Samples were collected from the windrow before pickup, from the trailer after nut pickup, and from the huller after hulling. Data is summarized in Table 3. In this one trial 15.6% of the NOW damage was removed by the pickup machine and left in the orchard. No additional removal occurred at the huller.

TABLE 2. Comparison of NOW damage between the IPM hand-cracked samples and a processor's mechanical-cracked samples.

Treatment/Grader	Orchard					
	Bakersfield	Blackwell	Mc Farland	Chowchilla	Manteca	Chico
Guthion						
IPM	6.4	3.3	2.2	6.6	14.5	26.1
Processor	5.2	2.0	2.3	3.2	9.1	18.0
Sevin						
IPM	8.5	4.5	1.3	7.8	9.0	30.3
Processor	4.1	2.6	2.0	5.5	5.3	19.0
Guthion+Sevin						
IPM	6.5	2.8	1.1	8.8	11.6	22.1
Processor	3.0	1.2	0	2.8	3.2	12.2
Check						
IPM	9.0	17.1	0.6	14.0	17.9	43.8
Processor	6.3	10.1	2.0	5.8	10.2	27.7
Overall average						
IPM	7.6	6.9	1.3	8.7	13.2	30.6
Processor	4.6	4.0	1.6	4.3	6.9	19.2
%Difference $\frac{\text{IPM-Processor}}{\text{Processor}} \times 100$	65	72	-19	102	91	59

Overall average difference = 62%

TABLE 3. Comparison of Nonpareil almonds collected during 3 harvest operations showing differences in NOW damage and damage removed during harvest. 1979.

Operation/Grader	% NOW Damage*			Average
Orchard Windrow				
IPM**	30.6	32.0	34.4	32.3
Processor***	23.9	19.7	19.3	21.0
Nut Trailer				
IPM	27.7	26.7	29.0	27.8
Processor	19.5	17.7	17.8	18.3
Huller				
IPM	27.4	28.6	26.9	27.6
Processor	18.4	15.6	22.1	18.7

% NOW damaged nuts removed

Field	15.6
Huller	0

*20, 100 nut samples averaged in each reported figure.

**Cracked and examined by C. E.-IPM project personnel.

***Cracked and examined by a buyer/processor.

The 1979 Almond Integrated Pest Management (IPM) statewide project consisted of 6, 80-100 acre orchards located in Chico, Manteca, Chowchilla, McFarland, Bakersfield and Blackwell Corners. Each orchard had 8, 10-12.5 acre plots consisting of 2 replicates of check and chemical treatments. The different chemical treatments included Guthion in the spring, Sevin in the summer and a combination of Guthion (spring) plus Sevin (summer). The spring application of Guthion was timed to egg hatch after consistent egg deposition was recorded. Consistent egg deposition occurred when NOW eggs were laid on at least 50% of the egg traps during any 7-day period. The Sevin treatment during the summer was timed to 1% hullsplit provided there were eggs being laid on the egg traps.

Winter Mummy Sampling - Orchard Sanitation. During February and March counts were taken of the remaining mummies on the trees throughout each block. The mummies were counted on 10 trees from each 10-12.5 A. block of each variety. One hundred nut samples were also taken from each variety from each of the blocks and examined for alive, dead and parasitized NOW.

Weather Monitoring. A weather shelter housed a hygrothermograph which recorded temperature and humidity within each orchard throughout the season. The recorder was serviced weekly.

Monitoring Insects. Oriental fruit moth (OFM), Peach twig borer (PTB) and Navel Orangeworm (NOW) were monitored throughout the season, although in Kern Co., OFM was not prevalent. Pheromone caps were used to attract male OFM and PTB, whereas egg bait traps were used to attract female NOW to lay eggs. For each 10-12.5 A. block a total of 2 PTB traps, 1 OFM trap and 2 NOW traps were hung toward the center of the block at 2 different sites. Traps were hung in the northeast quadrant, 8-10' high and 1-2' in from the drip line of the tree. The OFM and PTB traps were cleaned each time, the sticky bottoms replaced when dirty or after approximately 250 moths were caught and the pheromone caps replaced after 6 weeks. The wheat bran-glycerin bait in the NOW egg traps was replaced each time after eggs were counted and removed. Data was taken at least once a week, usually twice a week.

Monitoring Mites and Predators. Leaf samples were collected biweekly. Ten leaves from 10 different Nonpareil trees within each 10-12.5 A. block represented a 100-leaf composite sample. A 100-leaf sample from each block was collected and taken to the lab to be brushed through a mite brushing machine onto a glass plate. With the aid of a dissecting scope the mites and predators were counted and recorded.

Preharvest and Harvest Sampling. Preharvest Nonpareil nut samples were taken at weekly intervals before harvest starting in August when NOW eggs were being deposited on traps. Four 100-nut samples were taken from 8 trees in the middle of each block. The nuts were poled from the tree and a representative sample picked up. Different trees were sampled each week so extra nuts were not collected from previous sampling periods. The hull and nuts were examined for NOW, PTB and other insect damage.

Harvest samples of Nonpareils consisted of 12-200 nut samples collected from 24 trees in the middle of each block. One hundred nuts from each of the 12 samples from all of the blocks were cracked and examined for NOW, PTB and other insect damage. The pollinizer harvest samples consisted of 4-100 nut samples each from 8 trees within each block. One hundred nut samples were also examined as above.

Chico Almond IPM Plot

The 1979 Chico Almond IPM Plot consisted of a total of 107 A. Besides the 80 A., an additional 20 A. were used to apply 2 different rates (high = 6 qts/A. and low = 3 qts/A.) of Supracide for observation only. Since the above 100 A. were cleaned (the overwintering mummies knocked and then chopped up on the ground), another 7 A. of trees adjacent to the block were left unclean and treated during the spring with Guthion which gave a comparison between clean and unclean Guthion treatments.

Monitoring Insects

Monitoring of Oriental fruit moth (OFM) and Peach twig borer (PTB) began on March 2, 1979, while Navel orangeworm (NOW) monitoring began a month later on April 3, 1979. Moth activity was not monitored in the 2 rates of Supracide.

NOW. There were 3 definite peaks in 1979 as observed from NOW bait trap egg counts. Egg deposition of the overwintering generation of NOW extended over a period of 2 months beginning April 16 until June 14 and peaked on June 1 with an average of 12.3 eggs per day. The first generation of egg deposition began July 2, peaked at 18.7 eggs per day on July 12 and ended on July 26. While the first generation of NOW eggs extended over a period of 3 weeks, the second generation, beginning August 1 and ending September 28, lasted over 8 weeks. This generation of eggs peaked August 27 with 16.6 eggs per day.

The effect of the Guthion treatment (timed to egg hatch after consistent egg deposition) applied on May 14 showed an increase in egg deposition in both the Guthion and Guthion plus Sevin treatments over the check and Sevin treatments in the first and second generations. The Sevin treatment was applied on July 14. Egg deposition in the second generation was highest in the Guthion treatment, followed by Guthion plus Sevin, the check and then the Sevin treatment. (See Graph 1.)

PTB. The May flight of overwintering PTB began April 30 and ended June 14 with a peak average of 20.1 moths per day on May 13. The July flight (July 9 to August 6) of the first generation had a peak average of 9.9 moths per day on July 19, while the August flight (August 6 to August 20) peaked on August 13 with 14.0 moths per day. The last peak monitored was September 6 (25.6 moths per day) and the flight ranged from August 21 to September 10. After the Guthion treatment (May 14), there was a reduction in moths in the Guthion and Guthion plus Sevin treatments compared to the check and Sevin plots in the overwintering brood flight. The Sevin treatment (July 14) also reduced the Sevin plot moth counts down to a little below the Guthion and Guthion plus Sevin counts in the second flight, leaving the check with a high of 24.3 moths per day. The third flight followed very much the same pattern as the second. But, in the last flight, the Guthion and Guthion plus Sevin had about 5 moths per day more than the Sevin and check plots.

OFM. Four peaks were recorded throughout the monitoring season of OFM. The overwintering brood's flight was March 5 to May 17 and had a peak average of 65 moths per day on April 3. The first generation (May 21 to June 21) and second generation (June 25 to July 26) moths had lower peak averages of 18.8 moths per day on June 1 and 14.1 moths per day on July 5, respectively, than the overwintering brood. The last brood (July 30 to October 4) had a peak average of 33.0 moths per day on September 6. A reduction of moths in the first generation after the Guthion treatment (May 14) was seen in the Guthion and Guthion plus Sevin plots compared to the Sevin and check plots. After the Sevin treatment (July 14), the Sevin and Guthion plus Sevin as well as the Guthion moth counts remained below the check until the last flight where the Guthion and Guthion plus Sevin had 10 and 5, respectively, moths per day more than both the Sevin and check.

Monitoring Mites and Predators

Leaf samples were collected biweekly from May 10 to August 16. Table 1 shows the findings. There was an increase of European red, Pacific and Two-spotted mites on June 7, but 1 week after the Plictran application on June 14, the numbers were greatly reduced.

Preharvest and Harvest Results

Preharvest Nonpareil nut samples were collected at 5 different intervals--8, 15, 22, 29 and 36 days--before harvest. Harvest samples of Nonpareils were taken on September 28 while those of the Ne Plus and Thompson were taken on October 5. The results are seen on Graph 4 and Table 2. All the preharvest samples had less NOW damage than the harvest samples. The check had the highest NOW damage throughout the sampling period followed by Sevin, Guthion and Guthion plus Sevin. At harvest all the chemical treatments had lower NOW damage than the check. The check had 43.8% damage, whereas the Sevin, Guthion and Guthion plus Sevin had 30.3%, 26.0% and 22.0%, respectively. Damage by PTB and ant was present throughout the preharvest sampling and at harvest.

The Thompson and Ne Plus pollenizer NOW damage followed a similar pattern as the Nonpareil damage. The Guthion plus Sevin had the lowest amount of NOW damage followed by Guthion, Sevin and then the check having the highest damage. The average NOW damages for the Thompsons were 15.2%, 16.5%, 21.7% and 26.7% for the Guthion plus Sevin, Guthion, Sevin and check, respectively. Whereas, the Guthion plus Sevin, Guthion, Sevin and check for the Ne Plus was 7.1%, 11.5%, 13.7% and 14.9%, respectively.

Orchard Sanitation

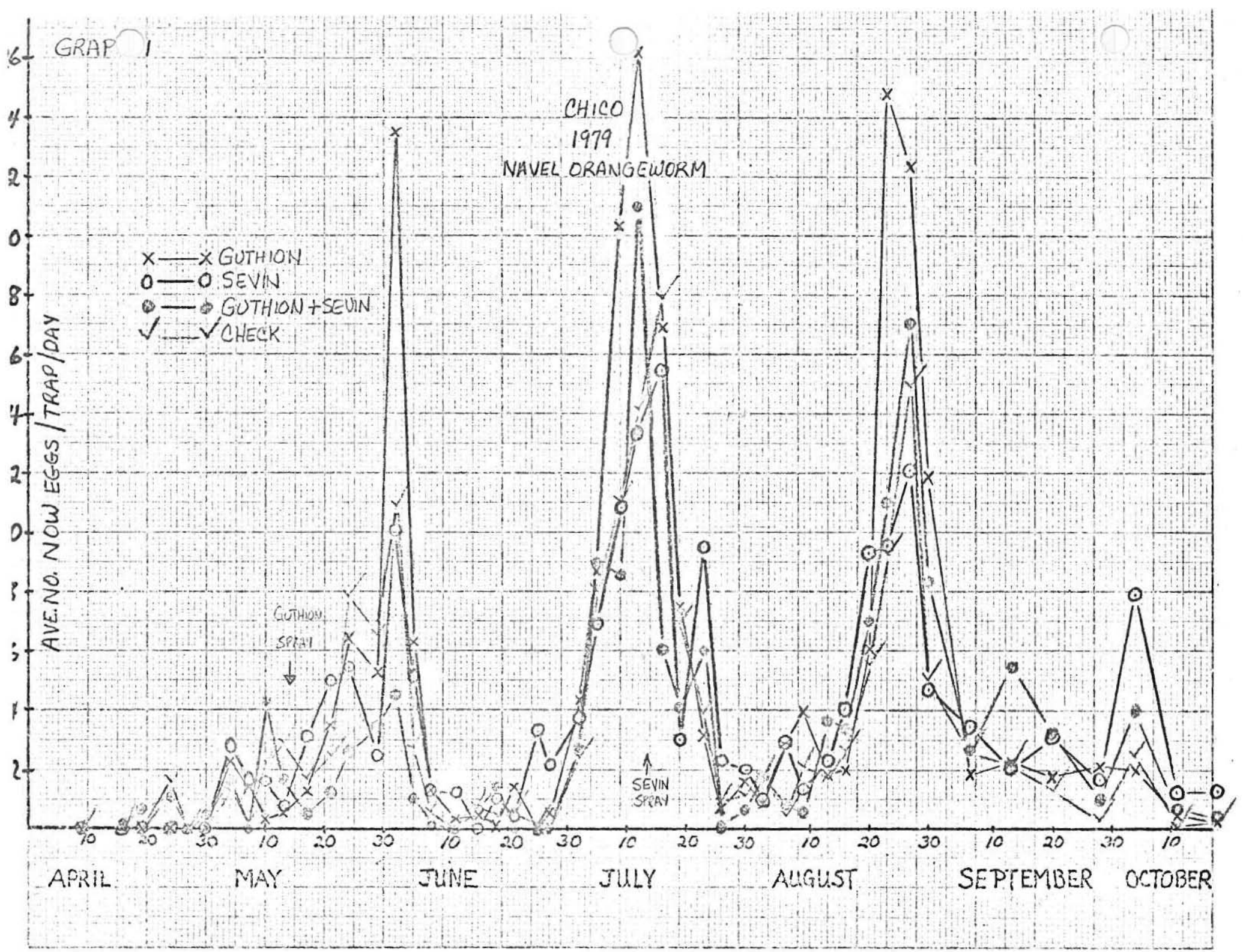
Towards the end of winter the entire orchard except for 7 A. was cleaned--the mummies knocked to the ground and chopped. During March counts were taken of the remaining mummies in the clean and unclean areas. While there was an average of 7.5 mummies per tree in the clean areas, the unclean area had an average of 93.9 mummies per tree. Such a large number of overwintering mummies might explain why NOW damage at harvest in the Guthion-unclean was 7% higher than the Guthion-clean.

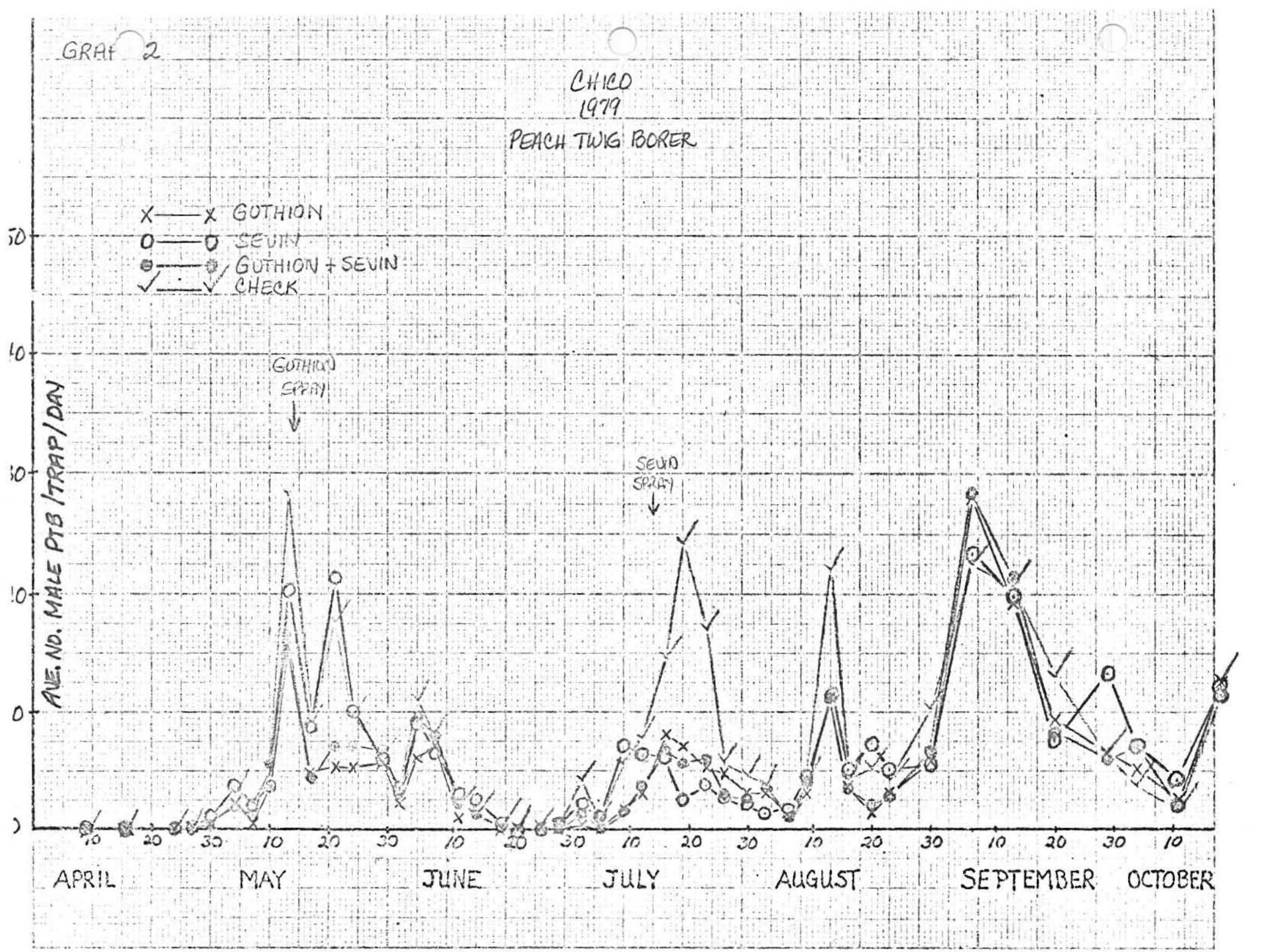
Conclusions

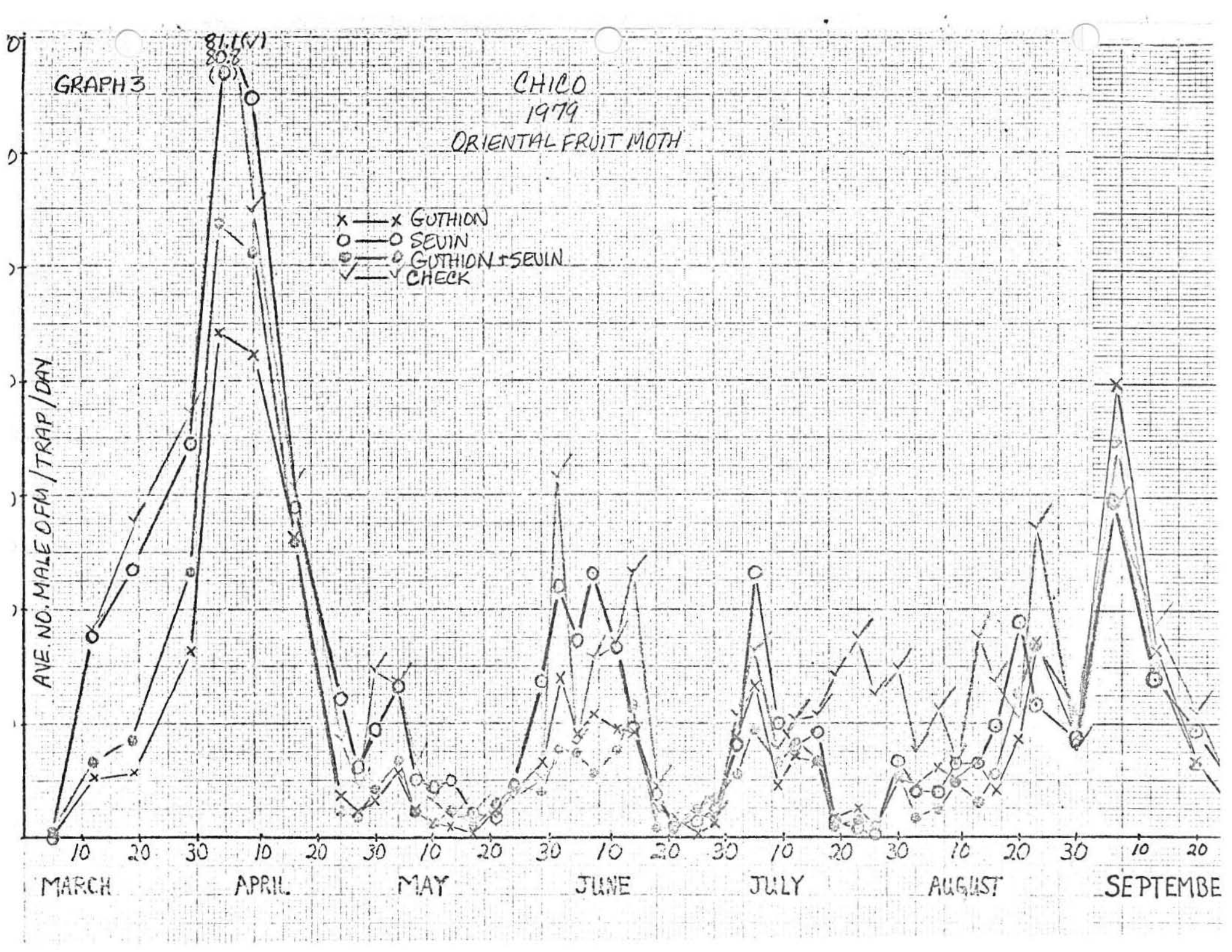
1. Orchard sanitation does help reduce NOW damage at harvest.

2. There are 3 definite egg-laying peaks to NOW during the season which can be used to time chemical treatments accordingly. Guthion (spring peak) and Sevin (summer peak) will reduce NOW harvest damage from the check but not as effectively as both chemicals together.

3. An early harvest can decrease NOW damage.


GRAP 1
CHICO
1979
NAVEL ORANGEWORM
GUTHION
SEVIN
GUTHION + SEVIN
CHECK
AVE. NO. NOW EGGS / TRAP / DAY
GUTHION SPRAY
SEVIN SPRAY
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER


GRAF 2
CHICO
1979
PEACH TWIG BORER
X——X GUTHION
O——O SEVIN
⊗——⊗ GUTHION + SEVIN
✓——✓ CHECK
GUTHION SPRAY
SEVIN SPRAY
AVE. NO. MALE PTB / TRAP / DAY
50
40
30
10
0
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER


GRAPH 3
CHICO
1979
ORIENTAL FRUIT MOTH
81.1(V)
80.8
(O)
x—x GUTHION
o—o SEVIN
GUTHION + SEVIN
✓—✓ CHECK
AVE. NO. MALE OFM / TRAP / DAY
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBE

GRAPH 4

NONPAREIL NUTS INFESTED WITH NAVELORANGEWORM

CHICO, 1979

CHICO - 1979

TABLE 1

MITES AND PREDATORS IN AN ALMOND ORCHARD*

Treatments	May 10			May 24			June 7			June 21			July 5			July 19			Aug. 2			August 16		
	E**	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀
Guthion																								
ERM***	0.01	0	0	2.2	0.04	0.02	5.5	0.4	0.1	7.0	0	0	0.5	0	0	0	0	0	0	0	0	0.01	0	0
PM & TSM***	0.8	0.2	0	1.7	0.6	0.1	0.8	3.0	0.2	0.5	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Predators****	0	0	0	0.01m	0	0	0.1m	0.03m 0.01t	0.03m	0.01m	0	0.02m	0	0	0	0	0	0	0	0	0	0	0	0
Sevin																								
ERM	0.6	0.01	0	5.2	0.01	0.02	28.4	0.9	0.7	18.9	0.1	0	1.2	0	0	0	0	0	0	0	0	0.02	0	0.01
PM & TSM	1.1	0.4	0.1	1.4	0.4	0.1	2.8	2.4	0.4	0.2	0.03	0	0	0	0	0	0	0	0	0	0	0	0	0
Predators	0	0	0.01	0.02m	0.02m	0	0.1m	0.1m 0.02t	0.01m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01t
Guthion & Sevin																								
ERM	0.1	0	0	1.1	0	0	8.1	0.5	0.2	3.3	0.1	0	0.3	0	0	0	0	0	0	0	0	0	0	0
PM & TSM	0.1	0.03	0.03	0.02	0.01	0	0	0.03	0.01	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Predators	0	0	0	0	0	0	0 0.01 lw	0	0.01m	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Check																								
ERM	0.1	0	0	2.8	0.01	0.01	13.7	0.5	0.3	7.2	0.3	0	0.3	0	0	0	0	0	0	0	0	0.03	0	0
PM & TSM	0.8	0.1	0	0.6	0.4	0.1	1.6	1.9	0.2	0	0	0	0.01	0.01	0	0	0	0	0	0	0	0	0	0
Predators	0	0	0	0	0	0	0.03m 0.01t	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supracide High																								
ERM	-	-	-	0.1	0	0	0.4	0.1	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM & TSM	-	-	-	0	0	0	0.02	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Predators	-	-	-	0	0	0	0	0.02t	0.02t	0.02m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supracide Low																								
ERM	-	-	-	0.1	0	0	0.5	0.02	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PM & TSM	-	-	-	0.1	0.2	0	0.1	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Predators	-	-	-	0	0	0	0	0.02t	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Average number per leaf of 200 leaves using a mite brushing machine.

**E = eggs; I = immatures and adult males; A♀ = adult females

***ERM = European Red Mite; PM & TSM = Pacific Mite & Two-spotted Mite

****m = predator mite (Metaseiulus occidentalis); lw = lacewing; t = six-spotted thrips

Guthion treatment - May 14; Plictran treatment - June 14; Sevin & Omite treatment - July 14; Supracide treatment - May 14

TABLE 2

CHICO - 1979

% NAVEL ORANGEWORM DAMAGE

	Nonpareil Preharvest					Nonpareil Harvest	Thompson Harvest	Ne Plus Harvest
Treatment	Aug. 23	Aug. 30	Sept. 6	Sept. 13	Sept. 20	Sept. 28	Oct. 5	Oct. 5
Guthion-c a	6.8	4.0	4.0	14.3	19.8	28.8 c	20.5	13.5
Guthion-c b	3.0	1.3	11.8	9.8	12.3	23.3 b	12.5	9.5
Guthion-u	3.8	8.5	11.0	13.5	16.8	33.1	15.3	10.8
Sevin a	4.3	6.5	12.5	19.8	16.3	29.3 c	26.0	17.0
Sevin b	4.3	3.8	14.5	12.8	16.5	31.3 c	17.3	10.3
G & S a	1.3	1.0	2.5	6.3	8.8	17.3a	15.3	5.8
G & S b	0.5	1.5	9.0	11.8	12.5	26.8 bc	15.0	8.3
Check a	9.3	10.8	13.3	21.3	22.0	46.8 e	32.0	17.5
Check b	11.5	11.5	17.5	19.5	18.5	40.8 d	21.3	12.3
Supracide H	7.8	7.0	15.3	13.3	18.0	40.7	24.0	12.8
Supracide L	8.5	5.0	14.0	20.8	20.3	37.3	-	-
Exp.	-	-	-	-	-	(36.7)	-	-
Overall Avg. (excl. Supracide)	5.1	5.0	10.6	14.4	15.8	30.5	19.5	11.7
Overall Avg. (incl. Supracide)	5.7	5.2	11.4	14.9	16.5	32.2	19.9	11.8

% DAMAGE

	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant
Guthion-c a	0	0	0	0	0	0	0	0	0	0.5	0.2	0	0	0	0	0
Guthion-c b	0	0	0	0	0	0	0	0	0	0.8	0.1	0	0	0	0	0
Guthion-u	0	0.5	0	0	0	0.3	0	0.8	0	0	0	0.1	0	0	0	0
Sevin a	0	0.3	0	0.5	0	0.3	0	0.3	0	0	0.1	0	0.3	0	0	0
Sevin b	0	5.0	0.3	0.8	0	0.8	0.3	2.3	0	3.0	0	0.5	0	0	0	0
G & S a	0	0	0	0	0	0.3	0	0.8	0	0	0.1	0	0	0	0	0
G & S b	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Check a	4.0	3.3	0.3	3.8	0.3	1.5	0	0.8	0	1.0	0.1	0.8	0	0.5	0	0
Check b	2.0	2.8	2.0	0.8	0.3	0.3	0	0.3	0	0.8	0.3	0.2	0	0	0	0
Supracide a	0.8	0.8	0	0.5	0	0.3	0.3	0	0	0.3	0.1	0.4	0.3	0	0	0
Supracide b	0	0.5	0	0.5	0	0	0	0.3	0	0.5	0.2	0.4	-	-	-	-
Exp.	-	-	-	-	-	-	-	-	-	-	0	(0.1)	-	-	-	-
Overall Avg. (excl. Supracide)	0.7	1.3	0.3	0.7	0.1	0.4	0.03	0.6	0	0.7	0.1	0.2	0.03	0.1	0	0
Overall Avg. (incl. Supracide)	0.6	1.2	0.2	0.6	0.1	0.3	0.1	0.5	0	0.7	0.1	0.2	0.1	0.1	0	0

Manteca Almond IPM Plot

The Manteca Almond IPM orchard consists of 80 A. of 15 year-old trees planted on Hanford loamy sand. The orchard is on level ground and flood irrigated. Weed control is accomplished by strip spraying the tree rows and cultivating the row middles. The trees are uniform in size except for a drier and less vigorous area of approximately 10-12 A. along the southern border. Pollinizers are Merced and Thompson which alternate between 2 rows of Nonpareils.

Winter Mummy Sampling - Orchard Sanitation

The 10 A. plots were originally designed to be half cleaned, where mummy nuts are knocked from the trees in the winter, and half uncleaned, leaving mummies which are the overwintering site of NOW. Due to time limitations the orchard could not be sufficiently cleaned to make this distinction. Nonpareils averaged 74.3 mummies/tree, Merceds 82.0 and Thompsons were highest with 97.3. These figures do not accurately reflect the potential NOW source in these varieties as mummy nut samples cracked out for NOW damage in February showed Nonpareils to have an average of 59.0 infested nuts per 100, while Merceds followed with 42.6 and Thompsons with 10.0.

Monitoring Insects

NOW egg traps were placed in the orchard on April 6 and removed on November 19. PTB and OFM traps were placed in the orchard on March 9 and removed on December 3 for PTB and on November 19 for OFM.

NOW. Overwintering NOW females began egg deposition on April 9 and continued until June 15 with a sharp peak in mid-April and lesser peaks in early May and early June. Consistent egg deposition occurred on April 18. The Guthion treatment was timed to the hatching of these eggs and was applied on May 2 and 3. The first generation of NOW was observed from June 18 to August 1 with a sharp peak in mid-July occurring about 1 week prior to the Sevin treatment. The second generation was spread out from mid-August to late September maintaining a high rate of egg deposition during the month prior to harvest.

PTB. Overwintering PTB males were caught in pheromone traps beginning April 16 and continued until June 18 with 3 moderate peaks. As the overwintering generation ended their flight, first generation males began to emerge. A sharp peak occurred on July 9 then tapered off. The first hulls split on July 13. Sevin was applied on July 18, 19 and 20 at approximately 1% hull-split. It should be noted that during this time period only one PTB shoot strike was observed. Flight of the second generation began in early August and continued at a moderate level until late September when the trap catch doubled. This high level was observed through mid-November.

OFM. Overwintering OFM males were caught in pheromone traps beginning March 9 when the traps were initially read. The flight continued until May 11 with two major peaks. Flight of the first generation began on May 14 and continued until June 11 with one peak in early June. As the first generation ended their flight, second generation males began to emerge. This generation lasted until June 30 with a broad peak in early July. Flight of the third generation began August 3, rose to a broad peak in mid- to late August and early September, then tapered off.

Effects of Insecticide Treatments

Guthion was applied on May 2 and 3. Activity of the overwintering generations of both NOW and PTB was lower in the Guthion areas. The overwintering and first generations of OFM were unaffected as this treatment was applied during a period of inactivity.

Sevin was applied on July 18, 19 and 20. First and second generation NOW egg deposition was greater in the Sevin areas which is consistant with 1978 records. PTB in both first and second generation flights appears to have been unaffected by the Sevin or the Guthion treatments. OFM second and third generations were lower in the Sevin areas with the third being delayed when compared to the Guthion and check areas.

Management of Phytophagous (Spider) Mites and Predators

Leaf samples were taken biweekly April 27 through September 24. Figures in Table 1a are the average per leaf for 200 leaves sampled from each treatment and the checks. The brushing technique is used to assess spider mite and predator mite populations. Other predators are present in the samples, but at such low numbers it is difficult to assess. Lacewing larvae, Stethorus and six-spotted thrips were observed in the orchard in fairly high numbers when they did not appear in brushing counts. Green and brown lacewing adults caught in PTB and OFM pheromone traps are summarized in Table 1b. It is possible that these figures are more indicative of the lacewing population present.

European red mite reached its peak in mid-June causing stipling of leaves but no defoliation. Predators were observed to play an important role in their control in one of the check areas. The Pacific mite two-spotted mite complex (mostly Pacific mite) reached its peak in August and September and in one area of the orchard caused defoliation in mid-September.

Omite was applied by ground with Sevin (40 A.) on July 18, 19 and 20 at 5 lb./A. and 2 lb./A. rates and applied by air on August 10 to the balance of the orchard (40 A.) at 5 lb./A. and 2 lb./A. rates with check areas. Results are summarized in Table 1a.

The 2 lb. rate of Omite appears to give control comparable to the 5 lb. rate applied both by air and by ground. When applied by air, coverage is incomplete, therefore the active spider mite population is suppressed and not eliminated. Both rates of Omite, when applied by ground, eliminated active stages of spider mites. The advantage of achieving less than complete control of phytophagous mites is that predaceous mites do not die off due to lack of prey.

Approximately 10 A. in a Sevin-treated plot were defoliated by Pacific mite feeding in mid-September. This area became water stressed in July which favored a mite buildup. Omite applied at both rates in July failed to prevent defoliation, whereas a well watered Sevin plot showed no damage at either rate of Omite.

Preharvest and Harvest Results

Nonpareil preharvest nut samples were collected 34, 27, 21, 14 and 6 days before harvest. Nonpareil harvest nut samples were collected on September 20 and the Merced and Thompson pollenizers on October 2. Results for both preharvest and harvest sampling are summarized in Table 2. NOW infestation of Nonpareil nuts was higher in the checks than in all treated areas during the preharvest period and at harvest. At harvest Sevin was shown to be the most effective insecticide treatment followed by Guthion and Sevin, and Guthion.

PTB damage was observed in the hull and kernal during the entire sampling period but was of little significance when compared to NOW damage. The masking effect of NOW on PTB damaged nuts was considered to be minimal in this orchard.

Overall, the Merced and Thompson pollenizers appeared to be somewhat resistant to NOW with damage at harvest being 5% less than in the Nonpareils. Insecticide treatments were of no benefit as harvest damage observed in all treated areas was no different than that in the checks.

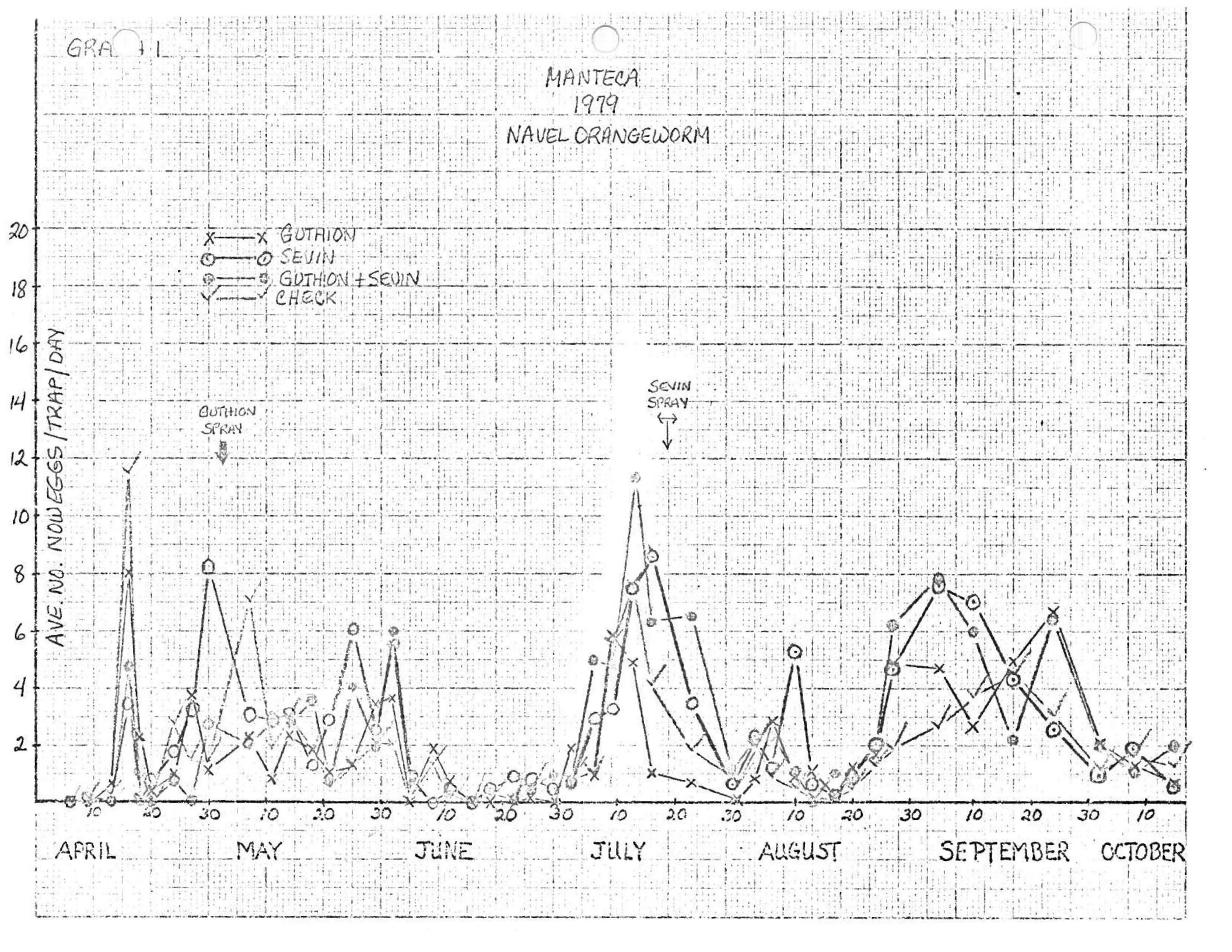
It was noted previously that second generation NOW peaked in early September. The increase in NOW damage the week before Nonpareil harvest (September 20) can be attributed to this flight. If the crop had been harvested 1 week earlier, NOW damage would have been 5.6% less overall.

Conclusions and Recommendations

1. Early harvest lessens NOW damage. Knocking nuts to the ground can be timed to avoid second generation NOW egg deposition.

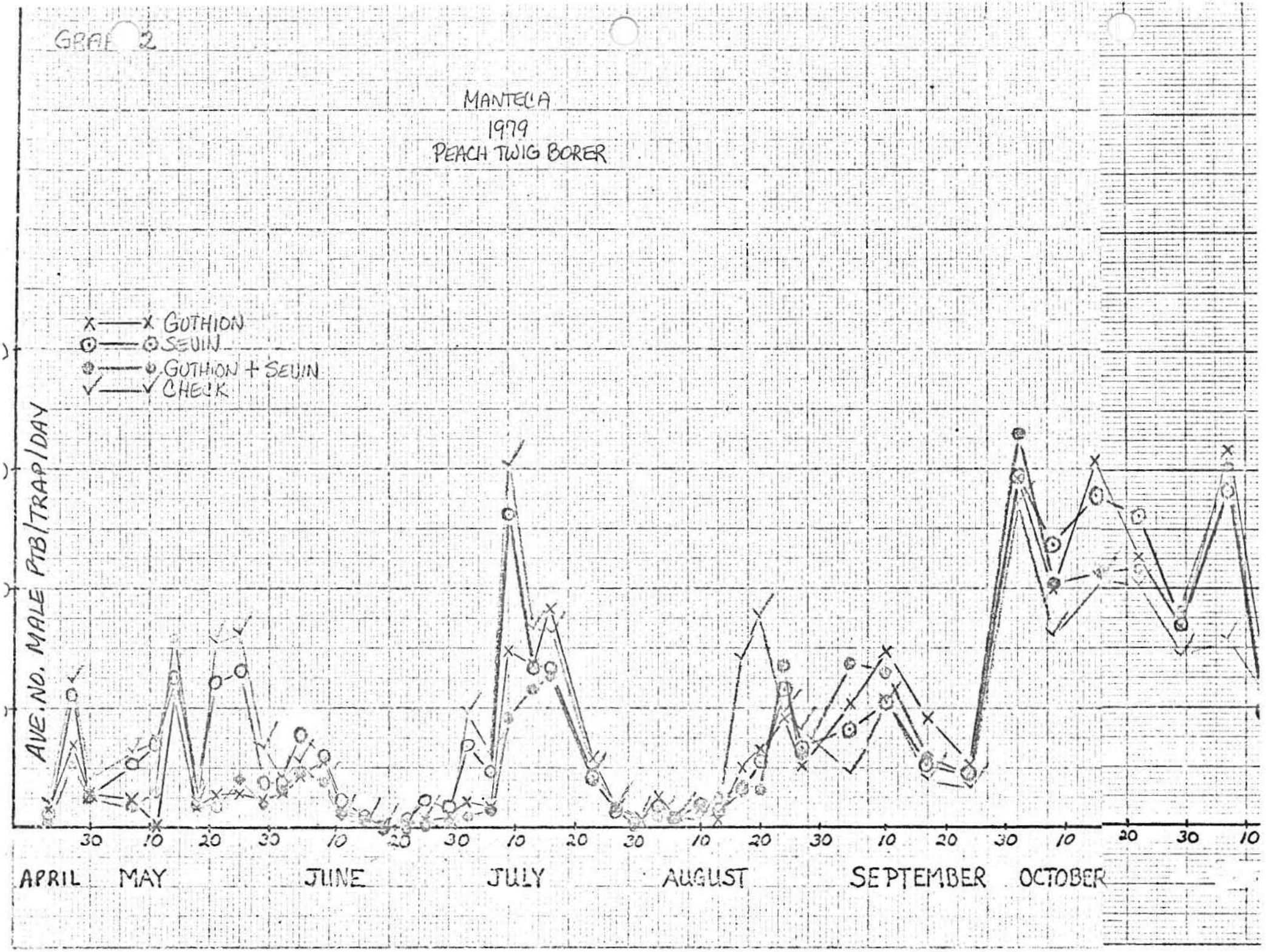
2. Lower application rates of Omite show promise in the management of phytophagous mites and their predators.

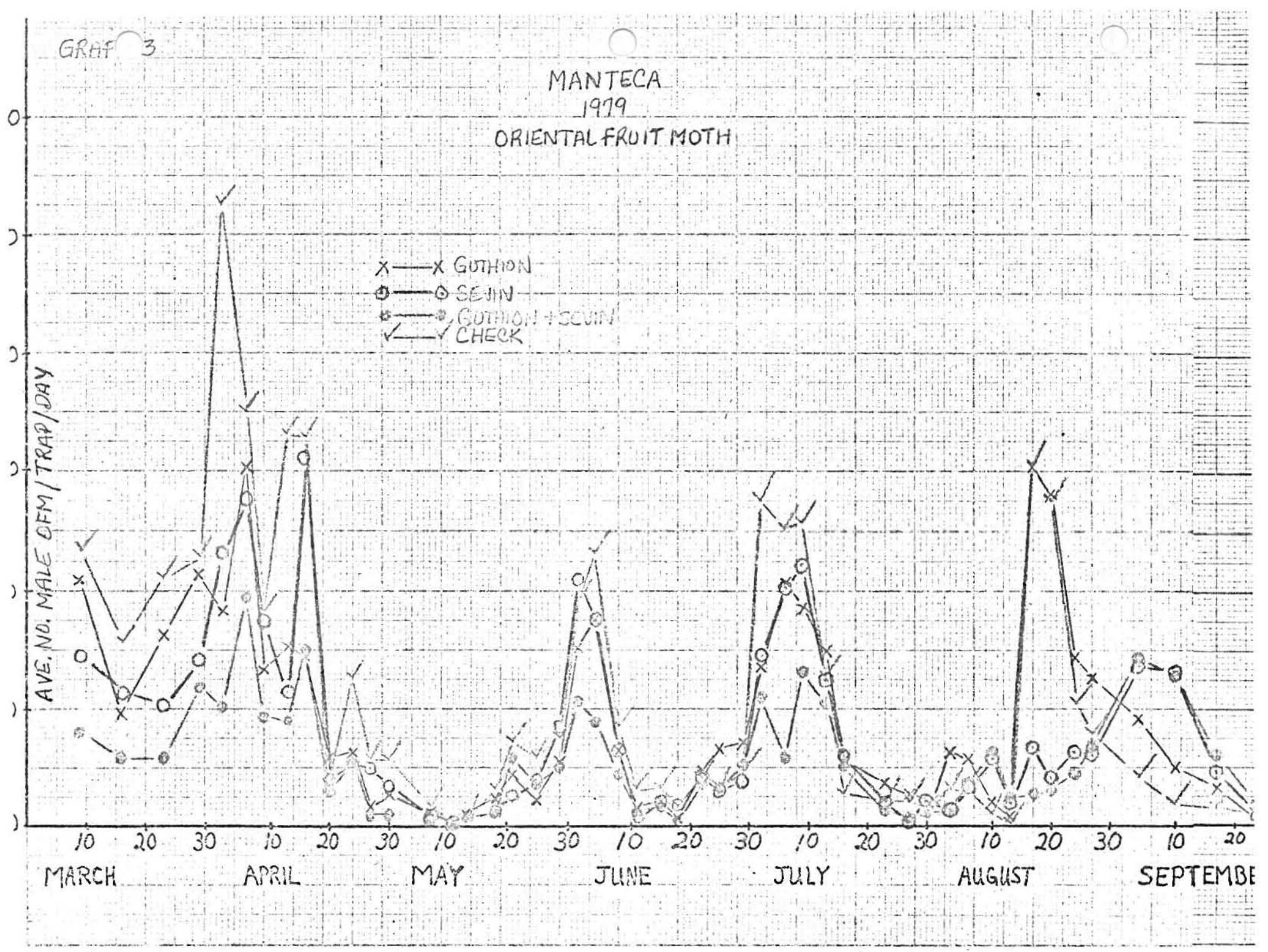
3. Water management is an important aspect of mite control. A dry orchard favors a mite buildup.


GRAPH 1
MANTECA
1979
NAVEL ORANGEWORM
GUTHION
SEVIN
GUTHION + SEVIN
CHECK
GUTHION SPRAY
SEVIN SPRAY
AVE. NO. NOW EGGS / TRAP / DAY
20
18
16
14
12
10
8
6
4
2
10
20
30
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER

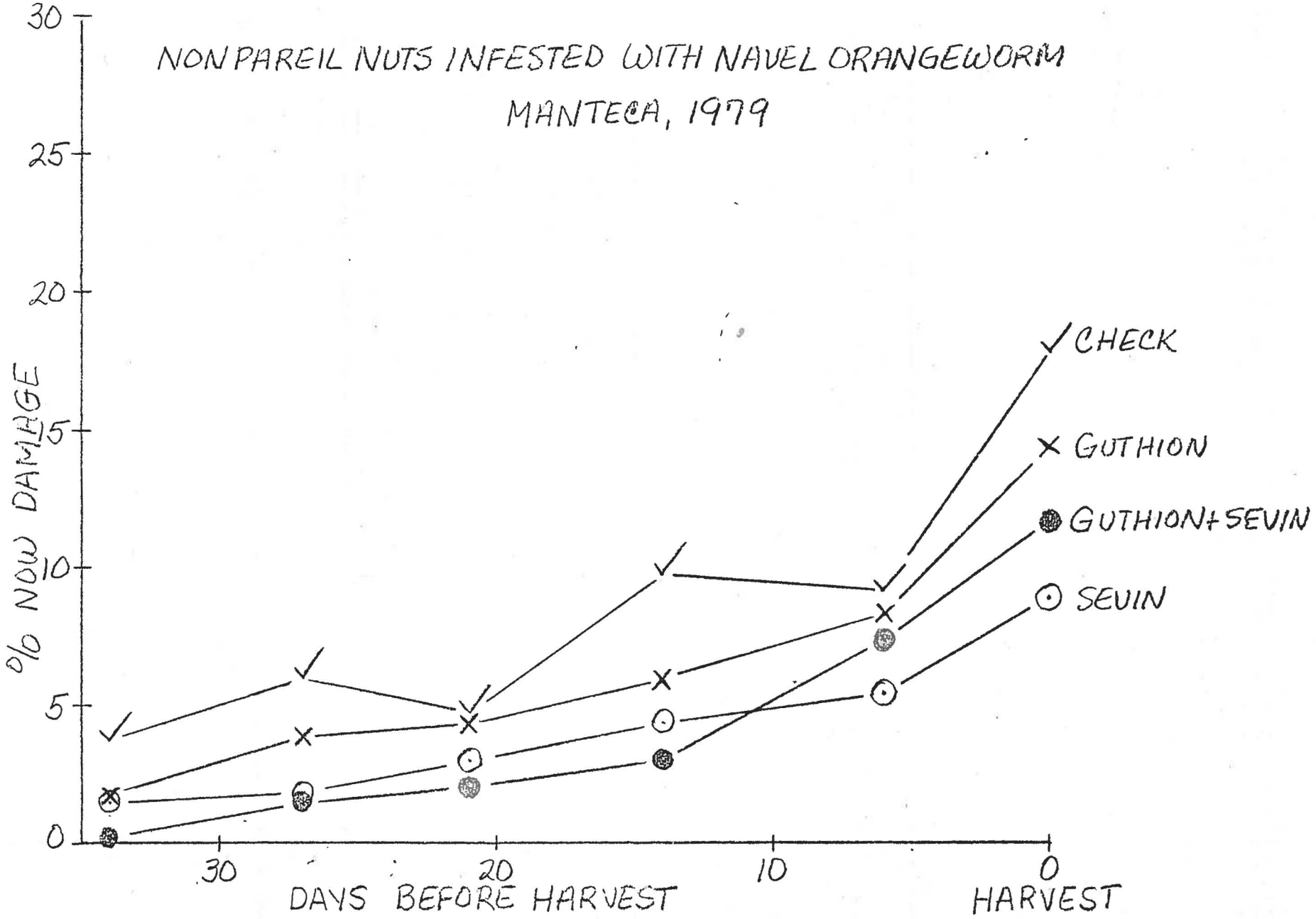
GRAF 2

MANTECA
1979
PEACH TWIG BORER




GRAF 3
MANTECA
1979
ORIENTAL FRUIT MOTH
GUTHION
SEVIN
GUTHION + SEVIN
CHECK
AVE. NO. MALE OFM / TRAP / DAY
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBE

GRAPH 4


NONPAREIL NUTS INFESTED WITH NAVEL ORANGEWORM
MANTECA, 1979
% NOW DAMAGE
30
25
20
15
10
5
0
CHECK
GUTHION
GUTHION+SEVIN
SEVIN
30
20
10
0
DAYS BEFORE HARVEST
HARVEST

MANTECA 1979

TABLE 1A

MITES AND PREDATORS IN AN ALMOND ORCHARD*

Treatments	April 27			May 18			June 1			June 18			July 2		
NOW Spray - Miticide	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀
Guthion - Hi Omite[a]															
European Red Mite	0	0	0	0.02	0	0	0.1	0	0	0.4	0.03	0	2.15	0	0.01
Pacific Mite & Two-spotted Mite	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0	0.5	0.1	0.01
Predator Mite (Metaseiulus occidentalis)	0	0	0	0	0	0	0	0	0	0.01	0	0.01	0.03	0.04	0
Guthion - Lo Omite[a]															
European Red Mite															
Pacific Mite & Two-spotted Mite															
Predator Mite															
Guthion - Check															
European Red Mite															
Pacific Mite & Two-spotted Mite															
Predator Mite															
Sevin - Hi Omite[g]															
European Red Mite	0	0	0	0.8	0	0.04	3.1	0.2	0.03	3.8	0.6	0.02	1.9	0.03	0.01
Pacific Mite & Two-spotted Mite	0	0	0.02	0.5	0.1	0.01	0.9	0.5	0.03	0.7	0	0	1.6	0.04	0.02
Predator Mite	0	0	0	0.03	0	0	0.02	0.04	0	0.01	0	0.02	0.01	0.02	0.01
Sevin - Lo Omite[g]															
European Red Mite															
Pacific Mite & Two-spotted Mite															
Predator Mite															
Guthion & Sevin - Hi Omite[g]															
European Red Mite	0	0	0	0.1	0	0.04	2.7	0.3	0	29.5	2.6	0.1	75.1	0.9	0.3
Pacific Mite & Two-spotted Mite	0	0	0.01	0.02	0.01	0	0.5	0.2	0.01	2.0	0.2	0.03	5.6	0.8	0
Predator Mite	0	0	0	0	0	0.01	0.01	0.01	0.01	0.01	0	0.02	0.1	0.1	0.03
Guthion & Sevin - Lo Omite[g]															
European Red Mite															
Pacific Mite & Two-spotted Mite															
Predator Mite															
Check - Hi Omite[a]															
European Red Mite	0	0	0	2.6	0.02	0.1	8.1	0.4	0.02	28.1	2.4	0.2	27.9	0.3	0.1
Pacific Mite & Two-spotted Mite	0	0	0	2.8	0.2	0.03	0.7	0.8	0.01	2.5	0	0.04	6.2	0.3	0.04
Predator Mite	0	0	0	0.03	0	0	0.02	0.02	0.1	0.01	0.01	0.01	0.01	0	0.02
Check - Lo Omite[a]															
European Red Mite															
Pacific Mite & Two-spotted Mite															
Predator Mite															

[1] Above figures indicate the mite population for the entire Guthion area (April 27-July 30). Omite was applied by air @ 20 GPA on August 10 at a high rate (5 lb. Omite 30W/Ac.) and at a low rate (2 lb. Omite 30W/Ac.).

[2] Above figures indicate the mite population for the entire Sevin area (April 27-July 16). Omite was applied by ground @ 200 GPA on July 19 at a high rate (5 lb. Omite 30W/Ac.) and at a low rate (2 lb. Omite 30W/Ac.).

[3] Above figures indicate the mite population for the entire Guthion & Sevin area (April 27-July 16). Omite was applied by ground @ 200 GPA only July 19 at a high rate (5 lb. Omite 30W/Ac.) and at a low rate (2 lb. Omite 30W/Ac.).

[4] Above figures indicate the mite population for the entire Check area (April 27-July 30). Omite was applied by air @ 20 GPA on August 10 at a high rate (5 lb. Omite 30W/Ac.) and at a low rate (2 lb. Omite 30W/Ac.).

*Average number per leaf of 200 leaves using a mite brushing machine.

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TABLE 1A
(cont'd)

Treatments	July 16			July 30			August 13			August 27			September 24		
NOW Spray - Miticide	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀
Guthion - Hi Omite$_a$															
European Red Mite	4.4	0.1	0.1	27.7	0.2	0.5	36.0	0.02	0.03	23.8	0	0.02	0.3	0.02	0
Pacific Mite & Two-spotted Mite	1.3	0.2	0.1	1.4	1.2	0.2	1.6	0.1	0.1	0.2	0	0	0	0	0
Predator Mite (Metaseiulus occidentalis)	0.04	0	0	0.1	0.04	0.02	0.1	0.1	0.02	0.04	0.7	0.1	0	0.4	0.1
Guthion - Lo Omite$_a$															
European Red Mite							32.6	0.1	0.04	21.7	0.02	0	0.2	0	0
Pacific Mite & Two-spotted Mite							0.8	0.03	0.1	0.3	0.04	0.1	0	0	0
Predator Mite							0.1	0.03	0.04	0.1	0.6	0.1	0	0.3	0.1
Guthion - Check															
European Red Mite							34.0	0.1	0.02	16.8	0	0	0.2	0	0.02
Pacific Mite & Two-spotted Mite							0.5	0.3	0	0.02	0	0	0	0	0
Predator Mite							0.2	0.02	0.02	0.1	0.7	0.3	0	0.1	0.1
Sevin - Hi Omite$_g$															
European Red Mite	2.6	0.01	0.01	1.6	0	0	0.7	0.02	0	2.7	0	0.02	0.4	0.01	0
Pacific Mite & Two-spotted Mite	1.2	0.1	0.02	0.1	0	0.02	0.2	0.1	0	2.6	0.1	0.1	0.02	0.01	0.1
Predator Mite	0.02	0.01	0	0	0	0	0	0	0	0.1	0	0	0.02	0.6	0.2
Sevin - Lo Omite$_g$															
European Red Mite				3.2	0	0	3.0	0	0.01	21.4	0.1	0.02	0.8	0.1	0.04
Pacific Mite & Two-spotted Mite				0.1	0.01	0	0.4	0.04	0	6.2	0.2	0.2	0.1	0.9	0.1
Predator Mite				0.01	0	0	0.02	0	0	0.1	0	0.02	0.1	1.1	0.1
Guthion & Sevin - Hi Omite$_g$															
European Red Mite	73.0	0.7	0.5	42.2	0	0	28.4	0	0	22.2	0	0	1.8	0.4	0.7
Pacific Mite & Two-spotted Mite	8.0	0.4	0	0.1	0.01	0	0.02	0	0.01	0.1	0	0	0.1	0.2	0.1
Predator Mite	0.03	0.1	0.03	0	0	0	0	0	0	0	0	0	0	0.2	0.04
Guthion & Sevin - Lo Omite$_g$															
European Red Mite				49.3	0.01	0	39.4	0.02	0	44.7	0.1	0	1.5	0.7	0.5
Pacific Mite & Two-spotted Mite				0.1	0.03	0	0	0.02	0	0	0	0	0.02	0.3	0.04
Predator Mite				0	0	0	0.02	0.01	0.01	0.04	0.02	0	0	0.2	0.2
Check - Hi Omite$_a$															
European Red Mite	31.4	0.1	0.2	44.7	0.2	0.3	22.0	0	0	5.2	0	0	0.3	0	0.02
Pacific Mite & Two-spotted Mite	2.9	0.04	0	0.7	0.6	0.02	0.1	0.04	0.02	0.02	0	0	0	0.02	0
Predator Mite	0.01	0.01	0.01	0.1	0.01	0.1	0.02	0.2	0.02	0	0.2	0.02	0	0.02	0
Check - Lo Omite$_a$															
European Red Mite							35.8	0.02	0.02	9.3	0	0	0.2	0.1	0
Pacific Mite & Two-spotted Mite							0.3	0.1	0.02	0.04	0	0	0.02	0	0.01
Predator Mite							0.1	0.1	0.04	0	0.2	0.1	0	0.02	0
Check - Check															
European Red Mite							33.6	0	0.02	16.3	0.02	0.02	0.2	0.1	0
Pacific Mite & Two-spotted Mite							0.2	0.2	0.04	0.02	0.04	0.02	0	0	0
Predator Mite							0.02	0.1	0	0.1	0.2	0.1	0	0.04	0

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TABLE 1B

MITE PREDATORS

	March	April	May	June	July	August	September	October	November
Total Lacewings[1] in 24 Pheromone Traps	1 5 2 1	0 1 0 6	5 2 1 21	23 75 54 27	25 22 17 13	3 4 2 5	3 2 0 2	3 2 3 1	4 6 11

Also observed in pheromone traps were lady beetle larvae and adults. These numbers have not been included here as they show no pattern.

Total Lacewings[2] in Leaf Brushing Sample	0	0	6	2	7	15	20	26	32	14

Also observed in leaf brushing samples were Stethorus spp, six-spotted thrips, minute pirate bugs and unidentified spiders. These numbers have not been included here as they show no pattern.

---

[1] Green and brown lacewing adults in PTB and OFM pheromone traps, entire orchard.

[2] Green and brown lacewing eggs and immatures in 800 leaf (mite brushing machine) sample, entire orchard.

TABLE 2

MANTECA - 1979

% NAVEL ORANGEWORM DAMAGE

Treatment	Nonpareil Preharvest					Nonpareil Harvest	Merced Harvest	Thompson Harvest
	Aug. 17	Aug. 24	Aug. 30	Sept. 6	Sept. 14	Sept. 20	Oct. 2	Oct. 2
Guthion a	0.8	2.3	3.0	5.5	6.3	14.8	4.5	7.5
Guthion b	2.8	5.5	5.8	6.3	10.5	14.1	12.3	9.3
Sevin a	1.3	1.5	2.0	4.0	4.3	6.8	6.5	8.5
Sevin b	1.8	2.3	4.0	4.8	6.8	11.1	7.3	7.3
G & S a	0.3	1.3	2.3	3.0	8.3	11.4	7.0	9.5
G & S b	0	1.5	1.8	3.0	6.5	11.8	10.5	9.8
Check a	3.5	6.0	4.0	9.8	8.8	17.3	6.8	7.3
Check b	4.0	6.0	5.5	9.8	9.5	18.4	9.3	9.3
Overall Avg.	1.8	3.3	3.5	5.8	7.6	13.2	8.0	8.5

% DAMAGE

	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant
Guthion a	0	0	0	0.5	0	0	0	0.3	0	0	0	0.2	0	0	0	0
Guthion b	0	0	0	0	0	0	0.3	0	0	0	0	0.3	0	0	0	0
Sevin a	0.5	0	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0
Sevin b	0	0	0	0	0	0	0	0	0.5	0	0	0.1	0	0	0	0
G & S a	0	0	0	0.3	0	0	0	0	0	0	0.1	0	0	0	0	0
G & S b	0.8	0	0	0	0	0	0	0	0	0	0.1	0.3	0	0	0	0
Check a	1.0	0	1.0	0.5	0.8	0	0	0	0	0	0.1	0	0	0	0	0.3
Check b	0.8	0	1.0	0	0.3	0	0.5	0	0	0	0.2	0.1	0	0	0	0
Overall Avg.	0.4	0	0.3	0.2	0.1	0	0.1	0.03	0.1	0	0.1	0.2	0	0	0	0.03

Chowchilla Almond IPM Plot

The Chowchilla Almond IPM plot is a 100 A. orchard of 12-year-old trees. The orchard is disced during the summer to control the weeds. There is a solid set sprinkler system present. The 2 varieties present are Nonpareil and Ne Plus.

Winter Mummy Sampling - Orchard Sanitation

The orchard was divided into 8, 12.5 A. plots, 50 acres of which were cleaned during the winter by shaking. There were approximately 11 mummies per tree on the Nonpareils after cleaning and 8 mummies per tree on the Ne Plus after cleaning. The uncleaned blocks had 96 and 63 mummies per tree, respectively. There was an average of 52 live NOW larvae per 100 nuts in the Nonpareil and 50 live NOW larvae in the Ne Plus per 100 nuts sampled in February. Treatments were applied to one 50 A. block that was cleaned and one 50 A. block that was not cleaned.

Monitoring Insects

NOW. The spring or May NOW egg deposition period started on April 23. The main period continued until the latter part of May with peak egg deposition occurring between May 7 and May 17. Consistent egg deposition occurred April 30, and Guthion was applied on May 10. This application was approximately 2 days before eggs hatched on the traps but worked into the farm program better. The Guthion treatment appeared to bracket the entire egg deposition period in May and gave excellent control. The second egg deposition period started on June 30 and continued until July 25, with the main peak occurring on July 9. The Sevin treatments timed to approximately 1% hull split were applied on July 16 to July 19. Plictran was included in all the Sevin applications. The final egg deposition period started with some eggs deposited on August 12, the main peak occurring on August 31.

PTB. PTB populations were much lower in 1979 than in 1978. Peak flight of the overwintering generation occurred on May 14. No peak occurred in July and a very small peak occurred on August 28 indicating little activity of PTB throughout the summer. A dormant application of Diazinon and oil had been applied during the winter. Very little PTB damage was observed.

Monitoring Mites and Predators

Mite populations were not nearly as severe in the orchard as in 1978. The trees throughout the summer were never under the serious water stress that occurred in 1978, although certain trees definitely had periods of stress. An application of Plictran to the border areas, especially those areas most subject to Pacific mite infestation was applied on July 16. Also, Plictran was applied with the Sevin treatments. The other areas did not have a mite buildup until late in the season.

Preharvest and Harvest Results

Preharvest samples were taken on August 20 and August 27. NOW damage increased from an overall average of 3.7% on August 20 to 8.7% on August 31 (harvest). This damage can be related back to the period of egg deposition that started on August 9 and continued throughout August. A correlation could be made comparing egg deposition occurring approximately 10 to 20 days before the increase in damage due to the NOW. Harvest samples showed the Guthion plot had 6.6%, Sevin plot had 7.8%, Guthion and Sevin plot had 6.3% compared to a check area of 14% damage. The 4 blocks that were cleaned showed a 7.0% infestation of NOW. The uncleaned areas showed 10.3% damage, a 32% reduction in NOW from orchard sanitation.

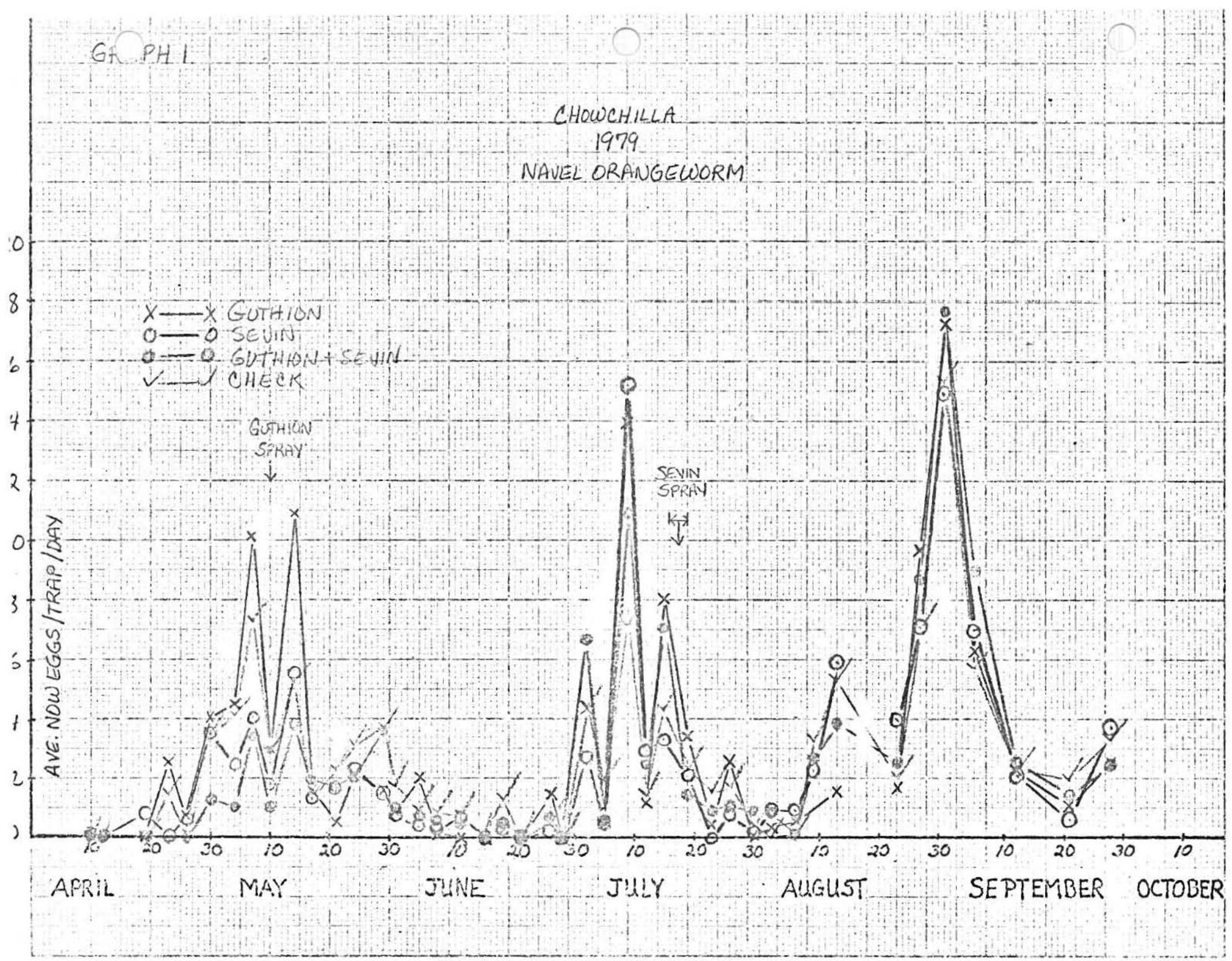
The 1979 harvest occurred on August 31. In 1978, harvest occurred on September 19, 3 weeks later than in 1979. Harvest damage was considerably higher in 1978 than 1979. Comparing August 31 sampling dates for both years, the check and Sevin treatments in 1978 showed a higher infestation than in 1979. The Guthion treatments were somewhat comparable. A reason for higher infestation in the 1978 Sevin treatment is that application timing in 1978 did not coincide with the peak egg deposition period, whereas in 1979, timing was much better.

Conclusions

1. Early harvest (approximately 3 weeks earlier) in 1979 appeared to reduce NOW damage appreciably. Overall average NOW damage on August 31, 1979, was 8.7% as compared to an overall average on August 29, 1978, of 10.9%. In 1978 the final harvest damage was 25%. This 2.3 fold increase in 3 weeks would have caused considerably more damage to the 1979 crop if harvest had been delayed.

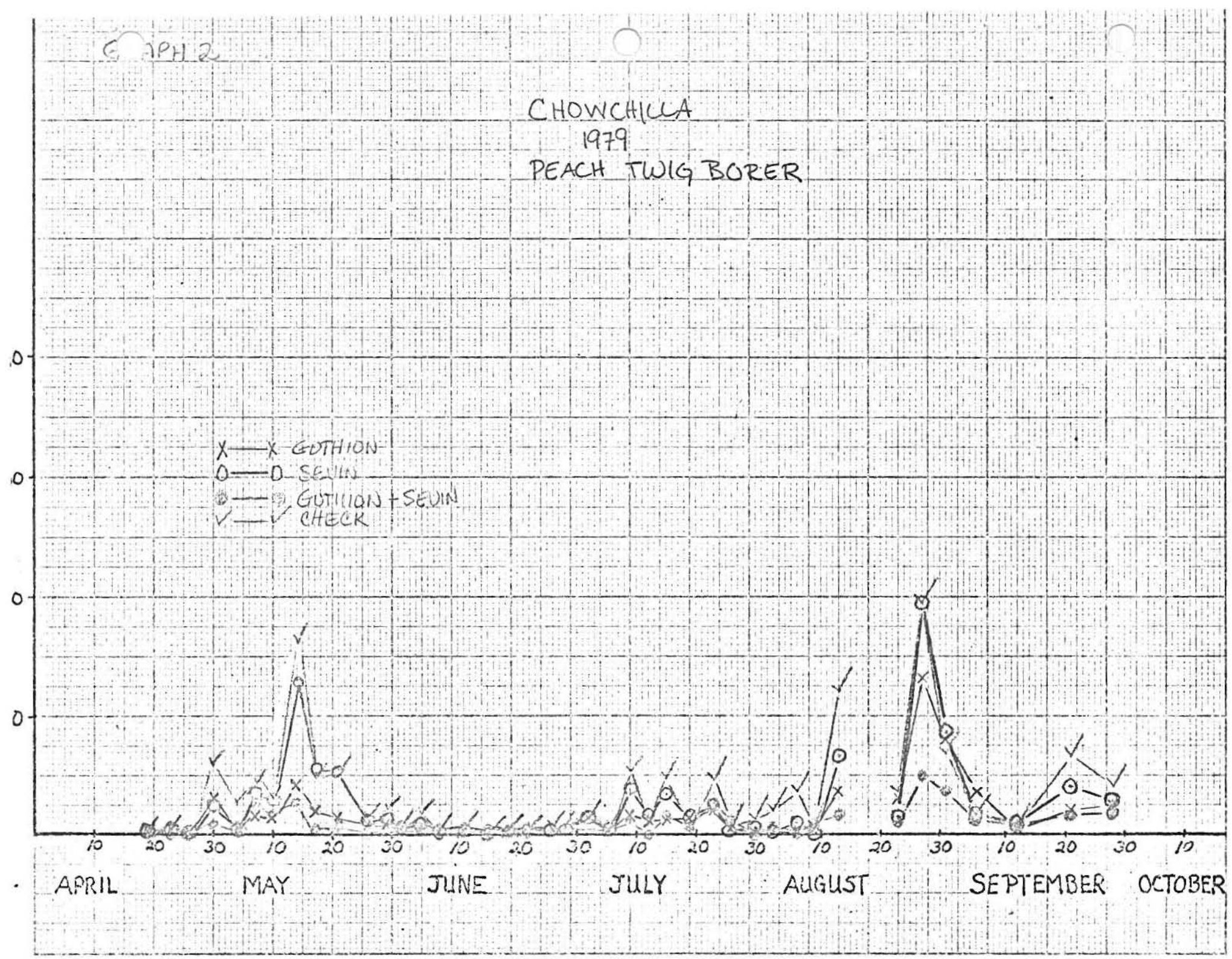
2. Cleaning plots as small as 12.5 A. will reduce NOW damage approximately 30% (90 mummies vs. 10 mummies per tree).

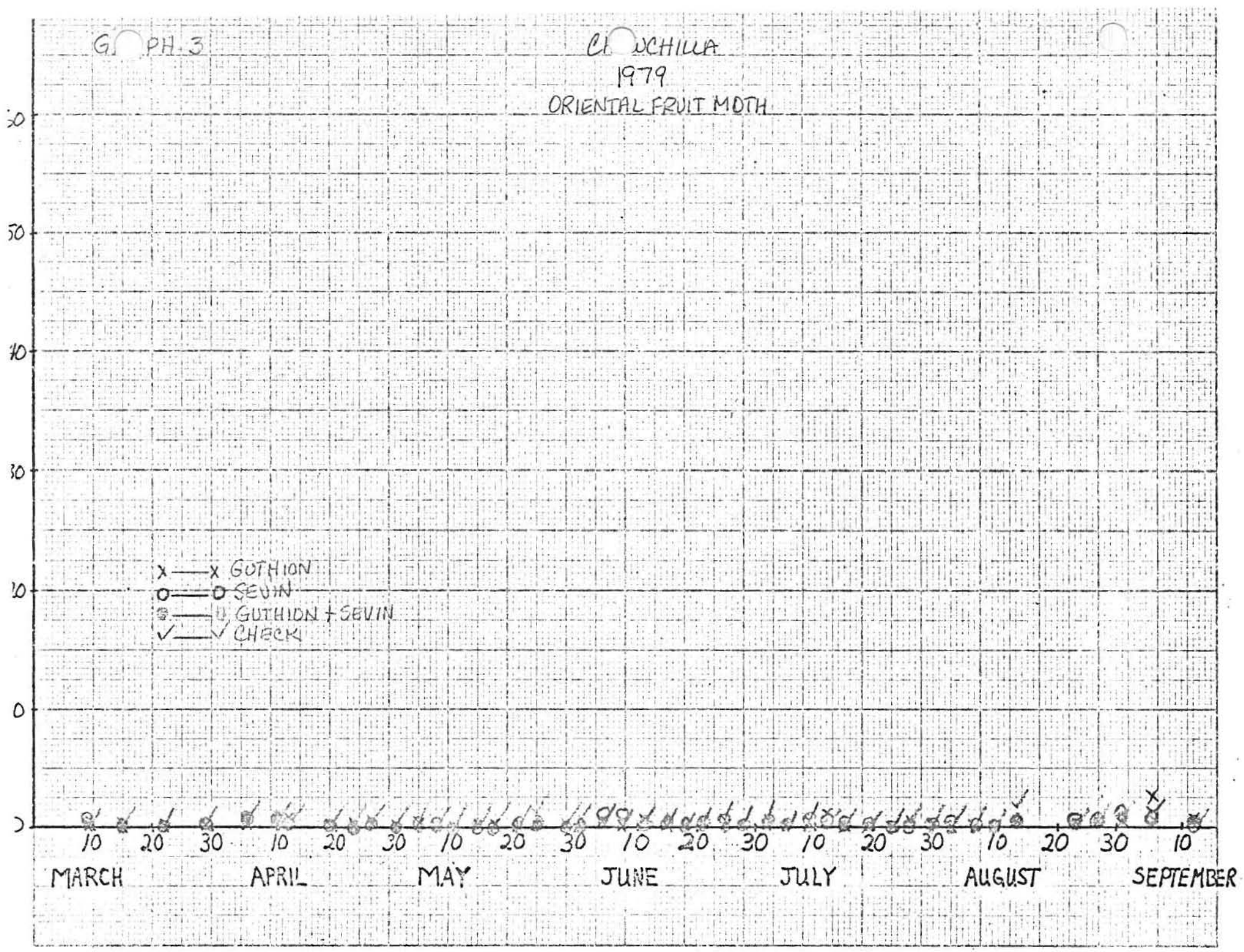
3. Water management to reduce water stress appeared to reduce Pacific mite buildup in the orchard.


GRAPH I
CHOWCHILLA
1979
NAVEL ORANGEWORM
X—X GUTHION
O—O SEVIN
O—O GUTHION + SEVIN
✓—✓ CHECK
GUTHION SPRAY
SEVIN SPRAY
AVE. NDW EGGS/TRAP/DAY
0
8
6
4
2
0
3
2
1
0
10
20
30
10
20
30
10
20
30
10
20
30
10
20
30
10
20
30
10
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER

GRAPH 2

CHOWCHILLA
1979
PEACH TWIG BORER




GRAPH 3
CLOCHILLA
1979
ORIENTAL FRUIT MOTH
50
40
30
20
10
0
X—X GUTHION
O—O SEVIN
□—□ GUTHION + SEVIN
✓—✓ CHECK
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER

GRAPH 4

NONPAREIL NUTS INFESTED WITH NAVEL ORANGEWORM

CHOWCHILLA, 1979

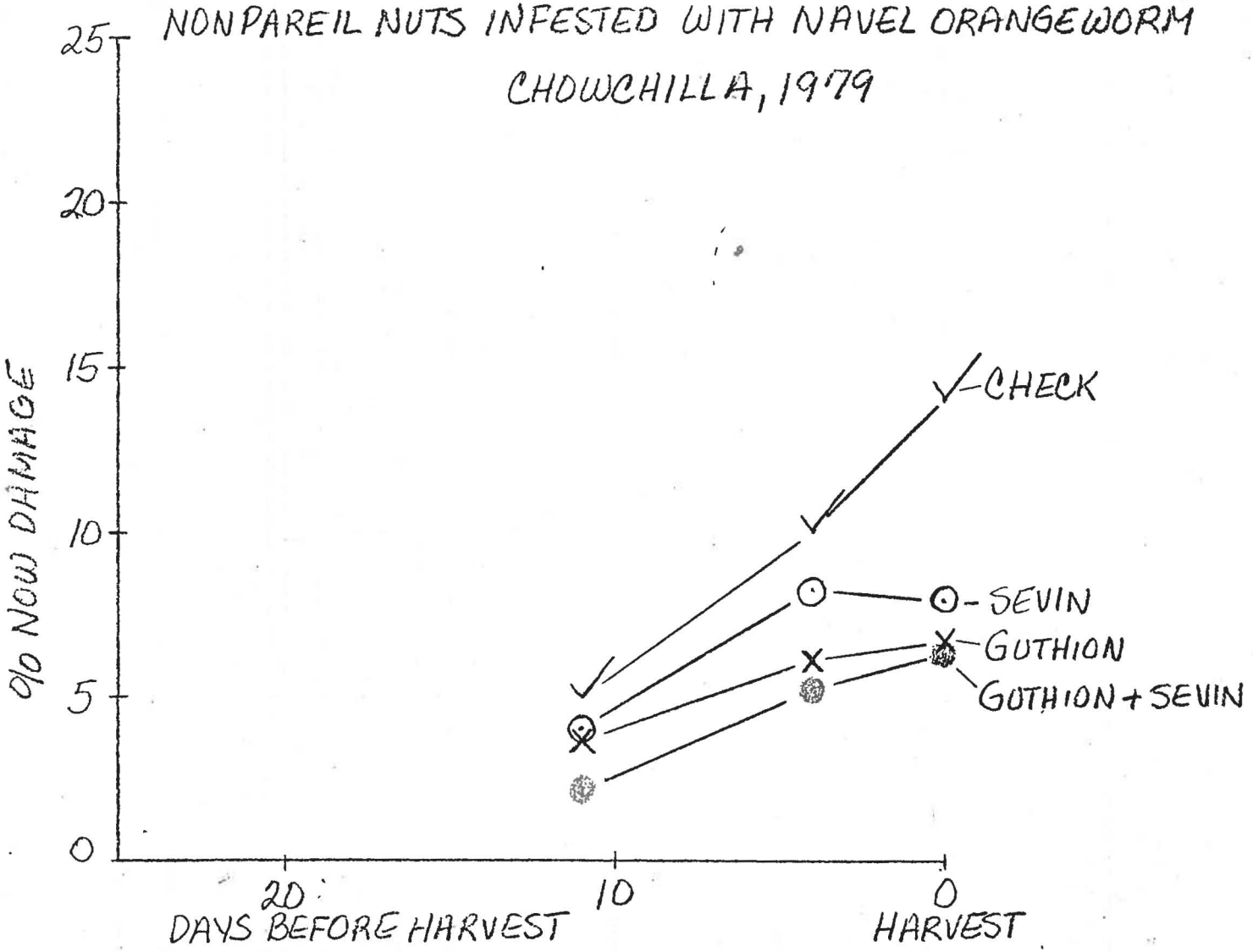


TABLE 2

CHOWCHILLA - 1979

% NAVEL ORANGEWORM DAMAGE

Treatment	Nonpareil Preharvest Aug. 20	Nonpareil Preharvest Aug. 27	Nonpareil Harvest Aug. 31	Ne Plus Harvest Sept. 17
Guthion c	2.3	4.8	5.9a	6.0
Guthion u	5.0	7.5	7.3ab	3.8
Sevin c	1.8	7.3	7.0ab	6.5
Sevin u	6.3	9.3	8.6ab	8.3
G & S c	1.8	4.5	4.9a	2.3
G & S u	2.5	5.8	7.6ab	6.8
Check c	6.0	7.3	10.3 b	8.3
Check u	4.0	12.8	17.7 c	8.5
Overall Avg.	3.7	7.4	8.7	6.3

% DAMAGE

	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant
Guthion c	0	0	0	0	0	0	0	0
Guthion u	0	0	0	0	0	0	0	0
Sevin c	0	0	0	0	0.1	0	0	0
Sevin u	0	0	0	0	0.2	0	0	0
G & S c	0	0	0	0	0	0	0	0
G & S u	0	0	0	0	0	0	0	0
Check c	0	0.3	0	0	0	0	0	0
Check u	0.3	0	0.3	0	0	0	0	0
Overall Avg.	0.04	0.04	0.04	0	0.04	0	0	0

Mc Farland Almond IPM Plot

The Mc Farland Almond IPM plot is comprised of 2, 40 A. square blocks. The trees are 7-years-old with Nonpareil, Mission, and Thompson varieties. Because of the low NOW problem that was present in the orchard in 1978, one 40 A. block was divided into 4, 10 A. plots where the standard control measures were applied. The other 40 A. was handled as an IPM block and only sprayed when necessary.

Winter Mummy Sampling - Orchard Sanitation

The 40 A. where chemical controls were used as a standard procedure averaged 0.4 mummies per tree on the Thompson variety and 1.5 mummies per tree on the Nonpareil variety. The 40 A. designated as the IPM plot had 0.6 mummies per tree on the Thompson variety and 3.6 mummies per tree on the Nonpareil variety. The block designated as IPM had no winter clean-up. The block designated for chemical treatments was cleaned during the winter because of an excessive amount of mummies left on the trees. No nut samples were taken from the block to determine the population of NOW present within the mummies.

Monitoring Insects

NOW. The egg traps for NOW showed light activity starting May 15 and then also on May 18. The Guthion treatment was applied on May 18. In comparing with the Mc Farland plot, flight periods from other orchards in Kern Co., the Guthion treatment on May 18 was considered late for a spring treatment. No egg deposition was noted on any of the traps except on June 27 until July 24. The Sevin treatment was applied on July 26. Beginning hull split occurred on July 10. The July 26 treatment was definitely applied too late in relation to beginning hull split. A third egg deposition period started on August 14 and continued until early September. The trees were knocked on August 13. Therefore, the Nonpareil variety should not have been affected by this final flight period.

PTB. The orchard received a dormant application of Parathion and oil in the winter preceding the 1979 season. The PTB showed very little activity in the May flight period, with trap counts so low that no peak could be defined. A slight peak was noted on July 12, a higher peak on August 28, with another peak occurring on October 22. These final 2 flights were fairly low in number. Very little damage occurred in any of the harvest samples from PTB.

Monitoring Mites and Predators

The Mc Farland orchard had a problem with citrus red mite in 1978. Very few citrus red mites were found throughout the season in 1979. Apparently, the Parathion and oil-dormant treatment did an excellent job of controlling the citrus red mite. A buildup of Pacific mite was noted in early July. The grower applied Omite to every 4th row middle. No major problem with Pacific mite occurred the rest of the season although Pacific mite was present. Omite was also included at 4 lbs./A. in the Sevin treatments applied to the 20 A. designated for Sevin. No buildup of Pacific mite occurred following the Sevin + Omite applications.

Preharvest and Harvest Results

Preharvest and harvest results are shown in Table 2. The overall average NOW damage occurring on August 2, 9, 16, and at harvest on August 20 showed no major differences between any of the samples throughout that period. The Guthion treatment showed 2.2% damage at harvest, the Sevin treatment 1.3%, the Guthion plus Sevin treatment 1.1% and the check area 0.6%. The IPM block showed no damage in the samples at harvest. It is unknown whether the lateness of both the Guthion and the Sevin applications actually caused disruption of some predator or parasite in the orchard causing a buildup of NOW or whether this is due to sampling errors. The Thompson harvest occurring on September 11 showed an average damage of 4.5%, 3.3%, 2.3%, and 3.5% for Guthion, Sevin, Guthion plus Sevin and the check, respectively. The increase of NOW in the Thompsons can be directly related to the NOW flight in late August as indicated by egg traps. With the removal of Nonpareils from the orchard, NOW may have concentrated more on the pollenizer rows.

Ants

Western Fireant was a major problem in the orchard in 1978 and caused damage again in 1979. Overall ant damage increased from 0.1% on August 2 to 3.5% on August 20. Most of the damage occurred after the nuts were knocked (August 13), therefore the damage increases rapidly with nuts on the ground although some damage occurred on the tree.

Foliear applied sprays of Guthion, Sevin or Guthion plus Sevin, had damage of 1.3, 1.4 and 1.1% respectively as compared to the unsprayed check of 9.8%. Therefore a good NOW control program will also provide ant control.

Conclusions

1. Parathion plus oil appeared to give excellent control of citrus red mite when applied as a dormant treatment.

2. Orchards with very low mummy counts during the winter (i.e., 1.1 mummies per tree) should not have a major NOW problem during the season, especially if an early harvest is carried out.

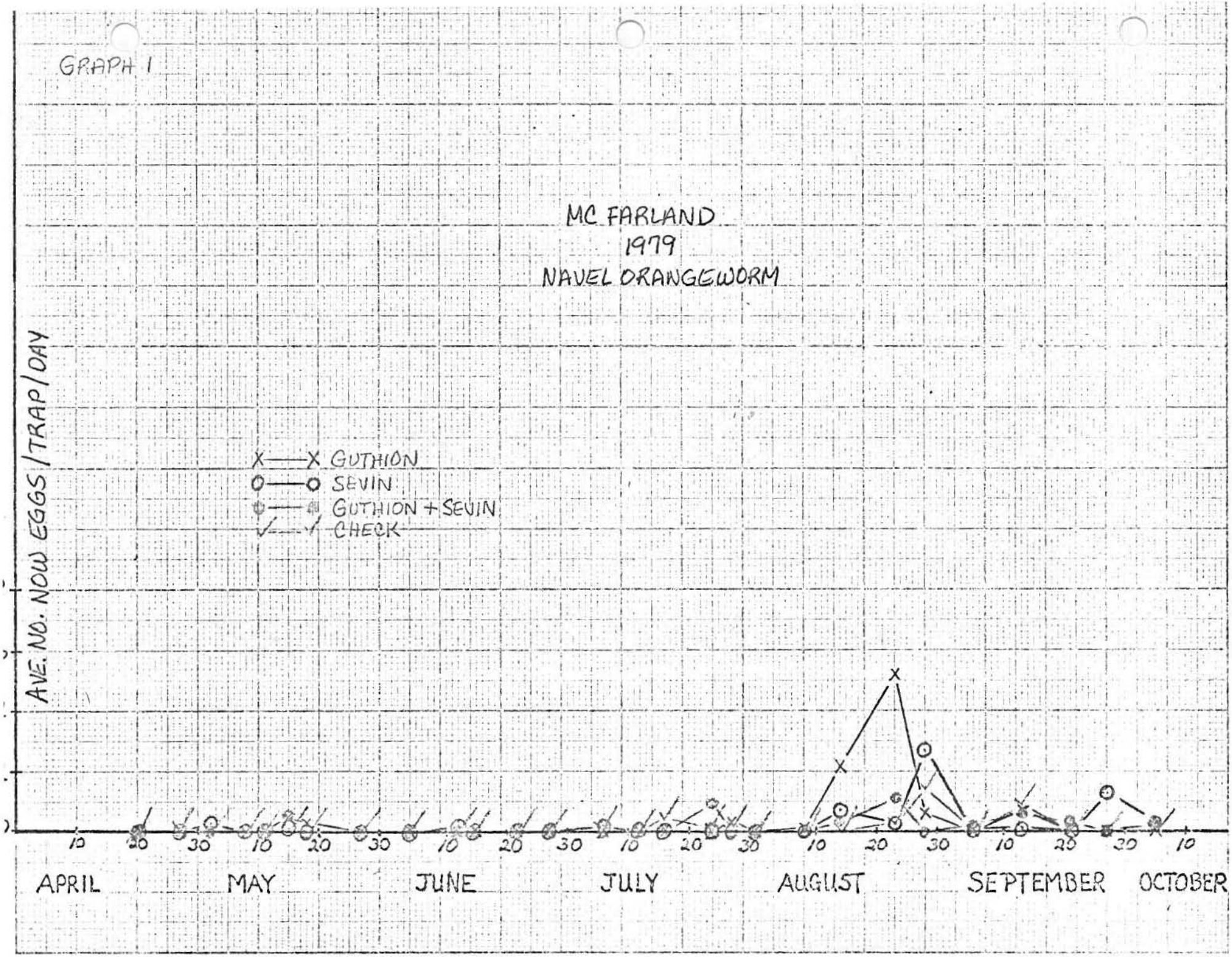
3. Late sprays of Guthion or Sevin appeared to be ineffective against NOW.

4. A combination of mummy counts (especially very low mummy counts) along with egg trap records possibly could be used to determine potential damage from NOW at harvest time.

5. Foliar sprays of Guthion or Sevin applied for NOW control provided control of ants.

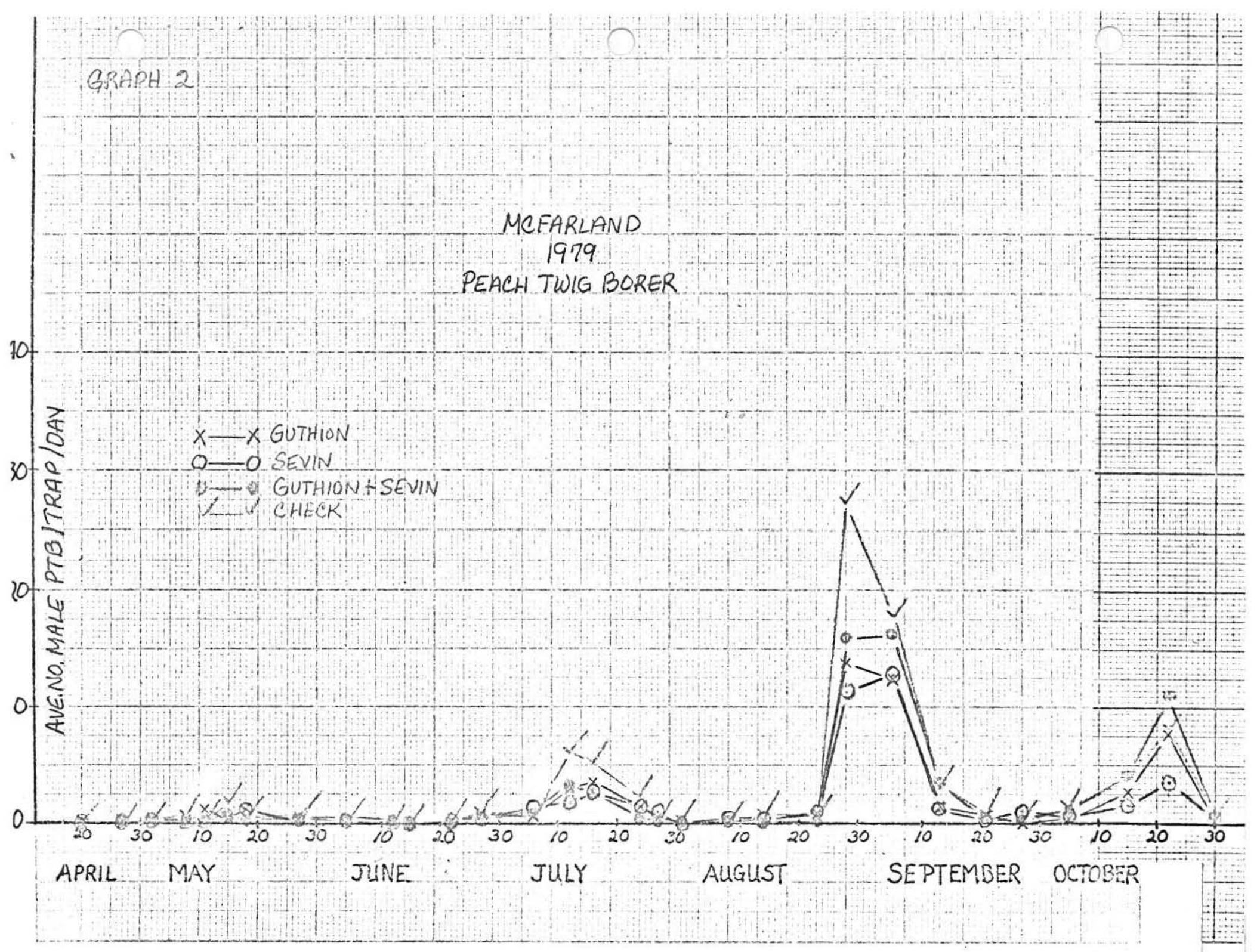
GRAPH 1

MC FARLAND
1979
NAVEL ORANGEWORM



GRAPH 2

MCFARLAND
1979
PEACH TWIG BORER



GRAPH 3

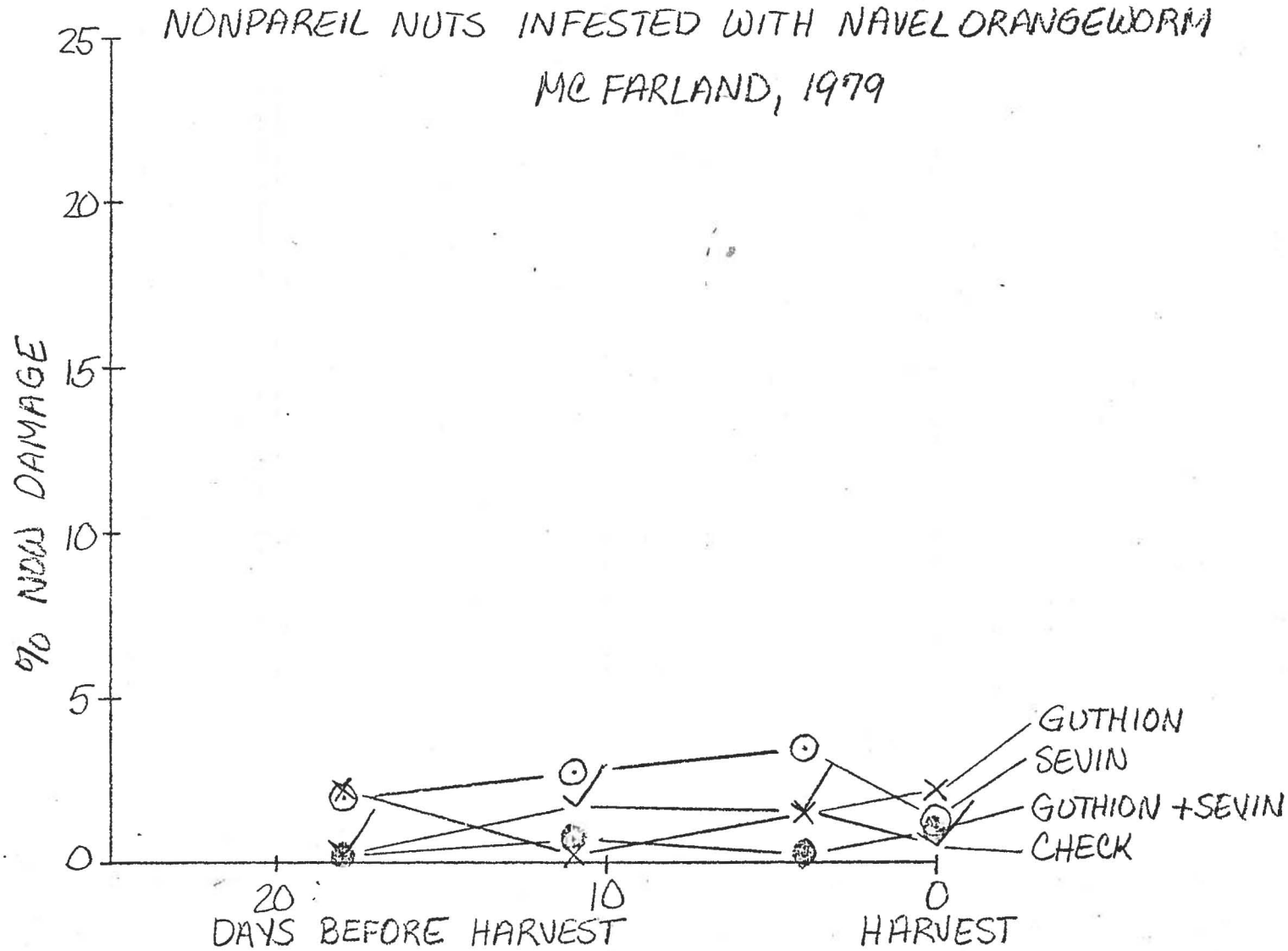

NONPAREIL NUTS INFESTED WITH NAVEL ORANGEWORM
MC FARLAND, 1979
% NOW DAMAGE
25
20
15
10
5
0
20
DAYS BEFORE HARVEST
10
0
HARVEST
GUTHION
SEVIN
GUTHION +SEVIN
CHECK

TABLE 2

McFARLAND - 1979

% NAVEL ORANGEWORM DAMAGE

	Nonpareil Preharvest			Nonpareil Harvest	Thompson Harvest
Treatment	Aug. 2	Aug. 9	Aug. 16	Aug. 20	Sept. 11
Guthion	2.3	0.3	1.5	2.2 b	4.5
Sevin	2.0	2.8	3.5	1.3ab	3.3
G & S	0.3	0.8	0.3	1.1a	2.3
Check	0.3	1.8	1.5	0.6a	3.5
IPM	0.5	0.3	0.3	0	-
Overall Avg.	1.1	1.2	1.4	1.0	3.4

% DAMAGE

	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant
Guthion	0	0	0.3	1.0	0	0.8	0	1.3a	0	0
Sevin	0	0.3	0	0.3	0.3	1.0	0	1.4a	0	0
G & S	0	0	0	0.3	0	1.0	0	1.1a	0	0
Check	0	0	0	0	0.3	2.5	0	9.8 b	0	0
IPM	0	0.3	0.8	0.5	0.3	0.3	0.2	3.8	-	-
Overall Avg.	0	0.1	0.2	0.4	0.2	1.1	0.04	3.5	0	0

Bakersfield Almond IPM Plot

The Bakersfield Almond IPM plot consists of 100 A. of 7-year-old trees of Nonpareil, Mission and Merced varieties with flood-type irrigation system. Trees are planted on berms and with a sod cover crop that is chopped regularly.

Winter Mummy Sampling - Orchard Sanitation

The orchard was cleaned during the winter of 1978-79. Approximately 19.7 Nonpareil and 48.7 Merced mummy nuts were left per tree giving an average mummy count of 21.3 mummies per tree throughout the orchard. These mummies were infested with an average of 180 NOW per 100 nuts at the beginning of the 1979 season. Although the average number of mummies per tree was considerably less than in 1978, the NOW/mummy were much higher in 1979 giving a population per acre of approximately the same for two years.

Monitoring Insects

NOW. Consistent egg deposition occurred on April 23. The eggs hatched on May 3. The Guthion treatment was applied on May 1, two days earlier than egg hatch because of a scheduled irrigation on May 3. A second egg laying period occurred June 26 until July 17. Hull split started on July 9 and the Sevin treatment was applied on July 18. Ideally, the Sevin should have been applied approximately 9 days earlier to coincide with the early hull split period. Egg deposition by both the overwintering and second generation was greater this year than in 1978. The second generation flight started on August 10 with considerable egg deposition lasting until September 15.

PTB. PTB were less this year than in 1978. The orchard received a dormant application of Parathion and oil. This dormant application appears to have given excellent control of PTB. The early May flight had such a low population that a peak didn't occur. A slight peak with a population of approximately 4 male moths per day occurred on June 24. Almost no PTB damage was observed, either in the hulls or in any of the nuts, at harvest time.

Monitoring Mites and Predators

Pacific mite was the principal mite present throughout the orchard in 1979. This mite was fairly low throughout the early growing season. The orchard is quite vigorous with no dry spots and the mites did not build up to any high populations in May or June. When the Sevin treatments were applied, Omite was included at 5 lbs./A. to insure mite control. The rest of the orchard received no miticide application. Part of both Guthion treatment areas had considerable mite damage occurring at harvest time. It occurred so late in the season no treatment was applied to these areas. The two check blocks, although having some mite buildup, showed very little defoliation in most of the areas. A small trial using Omite at 1, 2, and 5 lbs./A. was applied in the check area where considerable Pacific mite were present to see the effects of lower dosage Omite in these various areas. This work was in conjunction with Marjorie Hoy from Berkeley who will be making the final report on it. Basically, the 2 or 5 lb. rate showed no differences in the control or the buildup of Pacific mites in our plots.

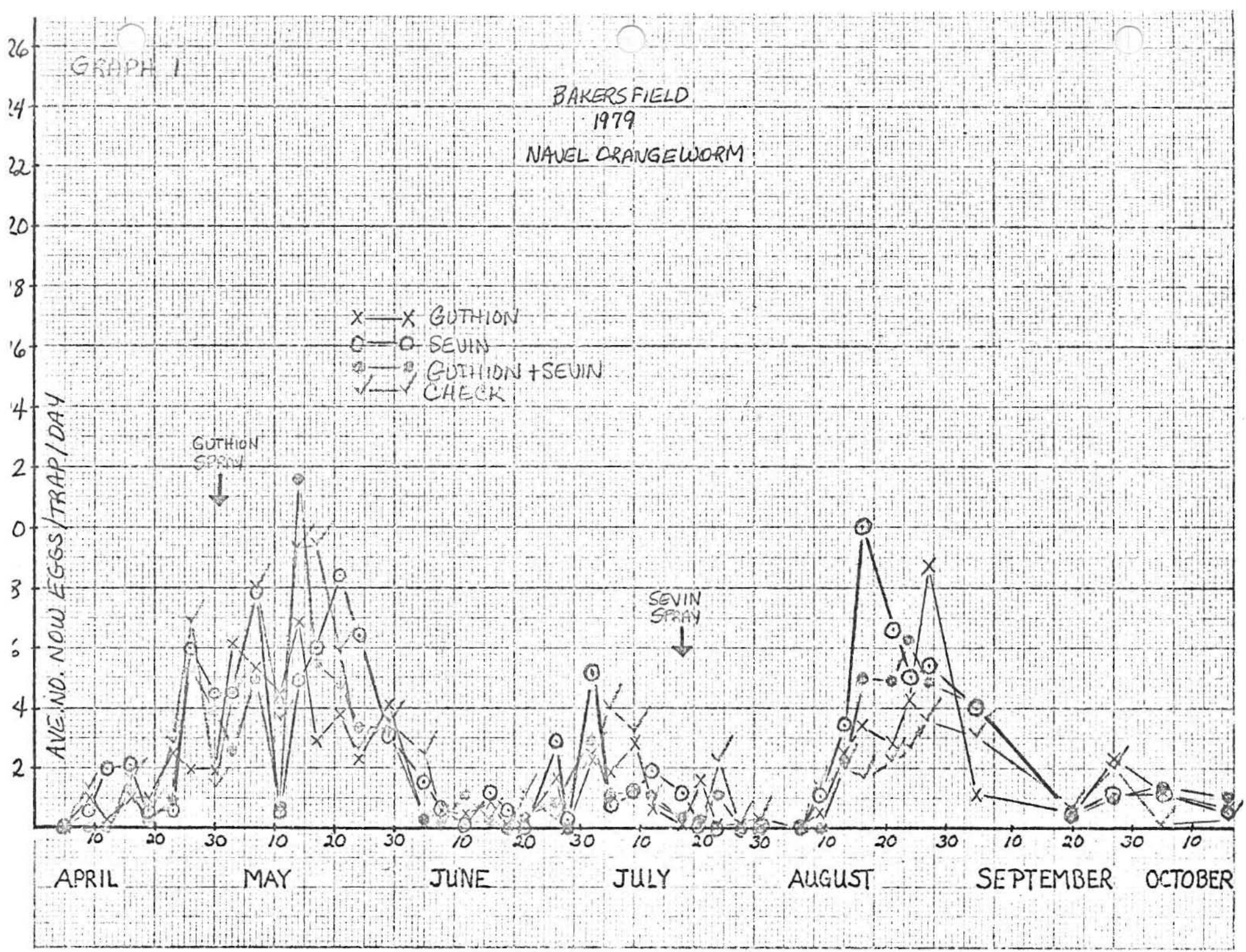
Preharvest and Harvest Results

Preharvest nut samples were taken at weekly intervals starting August 10 until the final harvest on August 30. The overall average increased from 1% NOW damage on August 10 to 7.6% damage on August 30. Harvest samples showed NOW damage of 6.4, 8.5, 6.5 and 9.0%in the Guthion, Sevin, Guthion and Sevin,and check blocks, respectively. The lack of control from Sevin also occurred in 1978 in this orchard. The July spray was applied approximately 9 days later than ideal, but this difference alone could not have accounted for the lack of control. The Merced variety was harvested on September 7 and had an overall average of 5.2% damage. The Merced variety was harvested on September 21, in 1978 and had an average of 44% NOW damage. This big reduction could be due partly to the earlier harvest of the Merceds and also perhaps to the heavier crop load that was present in the orchard.

Conclusions

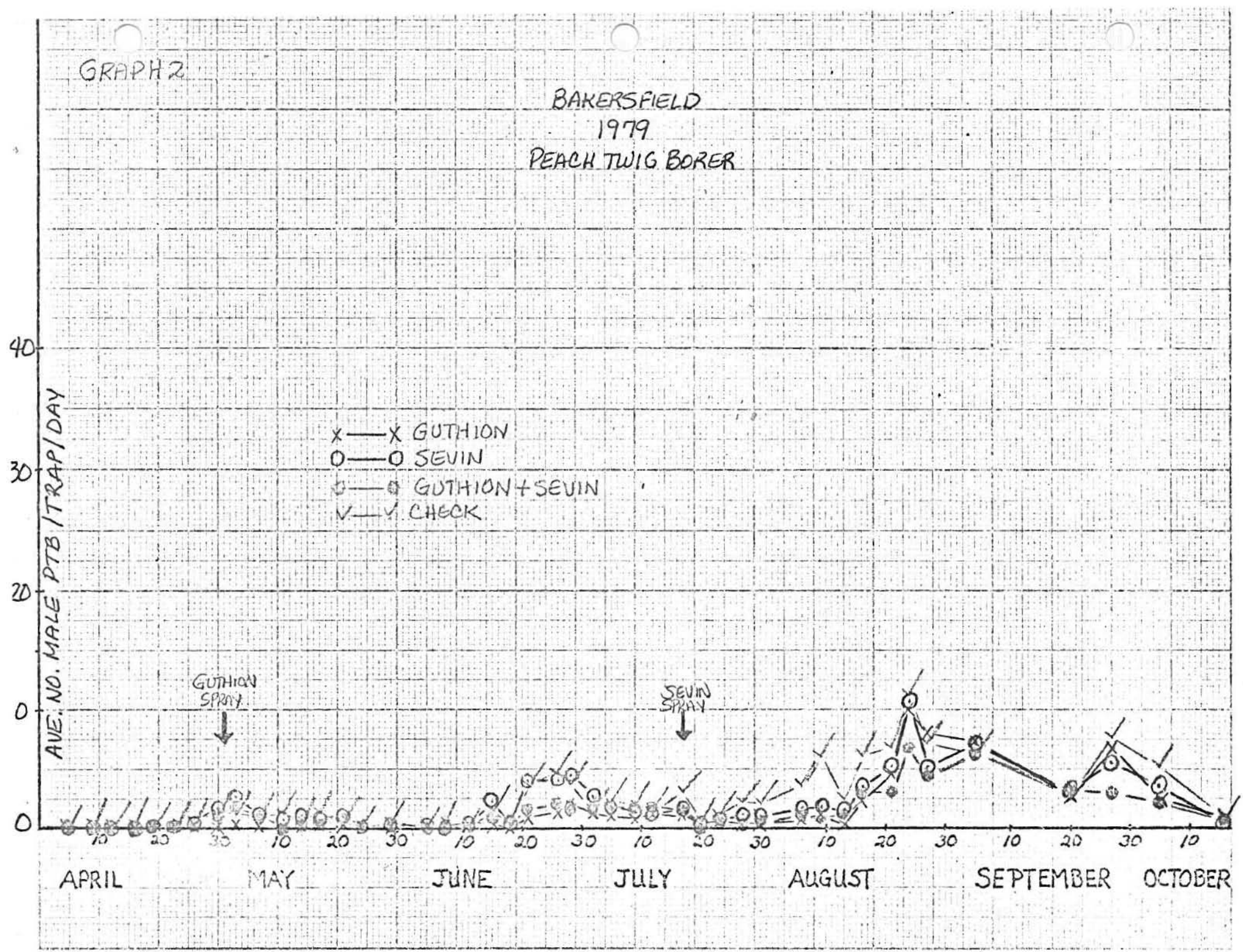
1. The Guthion treatment was applied on May 1, approximately 10 days earlier than the other Kern County plots. Although egg hatch occurred on May 3, perhaps the treatment was applied too early for maximum control. An application made May 5 would have provided better coverage for the overwintering generation egg laying period.

2. The Sevin treatment was applied late. Applications at very early hull split (1% or less) appear to give better control.


GRAPH 1
BAKERSFIELD
1979
NAVEL ORANGEWORM
X—X GUTHION
O—O SEVIN
⊕—⊕ GUTHION + SEVIN
√—√ CHECK
GUTHION SPRAY
SEVIN SPRAY
AVE. NO. NOW EGGS/TRAP/DAY
26
24
22
20
18
16
14
12
10
8
6
4
2
0
10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER

GRAPH 2

BAKERSFIELD
1979
PEACH TWIG BORER



GRAPH 3

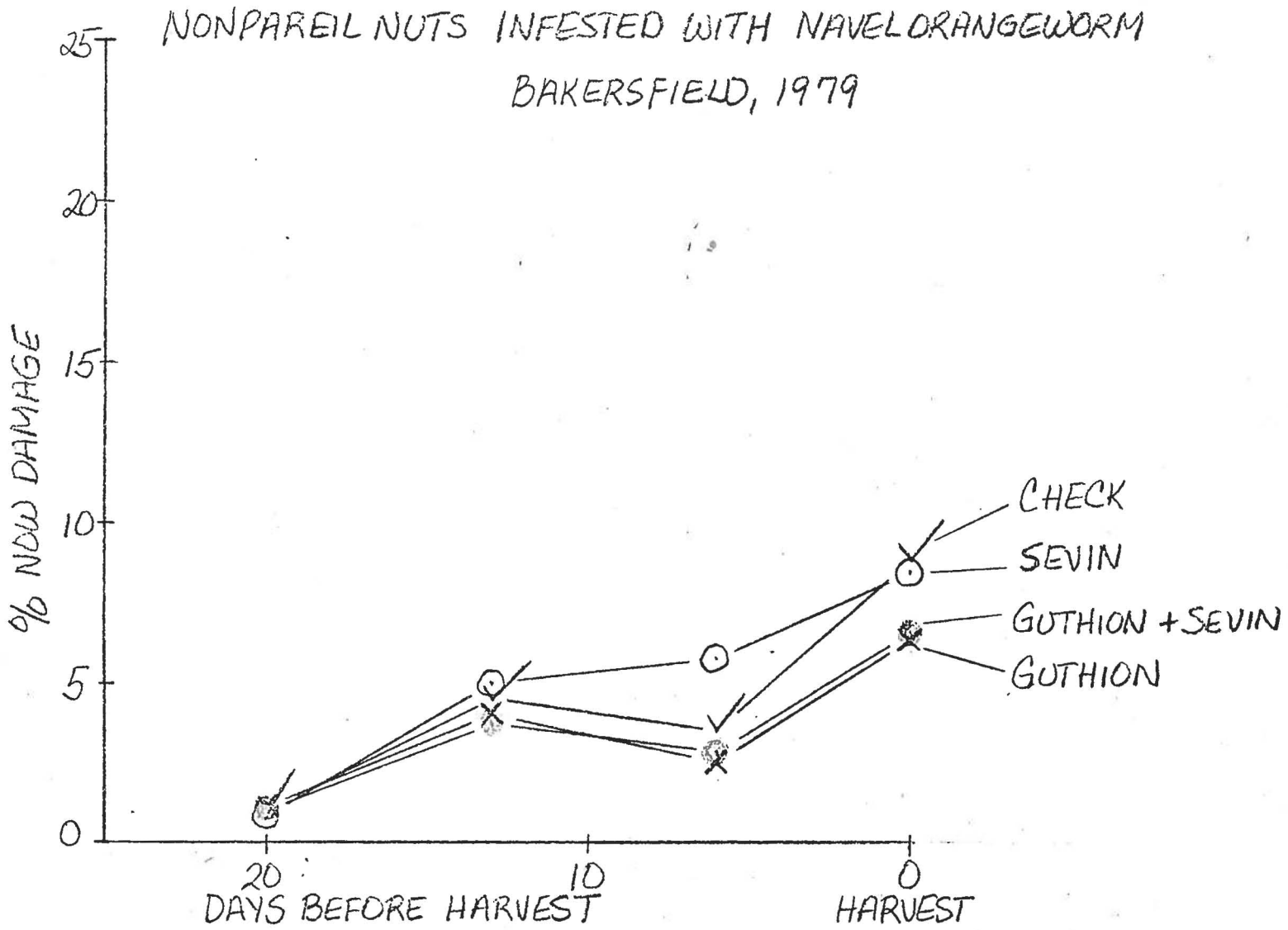

NONPAREIL NUTS INFESTED WITH NAVELORANGEWORM
BAKERSFIELD, 1979
% NOW DAMAGE
25
20
15
10
5
0
20
10
0
DAYS BEFORE HARVEST
HARVEST
CHECK
SEVIN
GUTHION + SEVIN
GUTHION

TABLE 2

BAKERSFIELD - 1979

% NAVEL ORANGEWORM DAMAGE

Treatment	Nonpareil Preharvest Aug. 10	Aug. 17	Aug. 24	Nonpareil Harvest Aug. 30	Avg.	Merced Harvest Sept. 7
Guthion	1.5	4.3	1.8	9.0	6.4	2.0
Guthion	0.8	3.8	3.3	3.8		1.8
Sevin	1.5	6.3	5.5	11.1	8.5	6.0
Sevin	0.3	3.8	6.0	5.9		10.5
G & S	1.8	3.3	3.3	7.3	6.5	2.0
G & S	0.3	4.3	2.5	5.6		8.8
Check	2.0	4.0	3.3	10.8	9.0	6.3
Check	1.0	5.0	3.8	7.2		4.0
Overall Avg.	1.0	4.3	3.7	7.6		5.2

% DAMAGE

	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant
Guthion	0	0	0.3	0.3	0	0	0.1	0.2	0	0
Guthion	0	0	0	0.3	0	0.5	0	0.1	0	0
Sevin	0	0.3	0	0.5	0	0.3	0	0	0	0
Sevin	0	0	0	0	0	0.3	0	0.3	0	0
G & S	0	0	0.3	0.3	0	0.3	0	0.5	0	0
G & S	0	0	0	0	0	0.3	0	0.1	0.3	0
Check	0	1.3	0	0	0.3	0.8	0.2	0.7	0	0.3
Check	0.3	0.3	0	1.8	0.3	0.8	0	1.5	0	0
Overall Avg.	0.04	0.2	0.1	0.4	0.1	0.4	0.04	0.4	0.04	0.04

Blackwell Almond IPM Plot

The Blackwell Almond IPM plot is an 80 A. block of 13-year-old trees composed of Nonpareil and Merced varieties. The trees are irrigated by a solid set sprinkler system. Because of the problems in 1978 with applications applied by ground spray rigs, these blocks were treated by helicopter applications at approximately 40 gal./A.

Winter Mummy Sampling - Orchard Sanitation

Four of the blocks, one of each treatment, was cleaned during the winter. The total mummy count of the block this year was considerably less than in 1978. Mummy counts averaged 11 per tree in the Nonpareils where they were cleaned and 78 mummies per tree where they were not cleaned. The Merced variety averaged 50 and 108 in the cleaned and uncleaned areas, respectively. The number of live NOW during the winter was approximately 25 per 100 nuts in the Nonpareil and 70 per 100 nuts in the Merced variety.

Monitoring Insects

NOW. The first major egg laying period started on April 27 and continued until May 22. The Guthion treatment was applied on May 10, timed to hatch of eggs laid on April 27 when consistent egg deposition occurred. The Guthion treatment appeared to be timed perfectly to egg deposition in May. The second egg laying period started in late June and continued until late July but very few eggs were deposited on any of the traps during this period. The Sevin treatment was applied at approximately 1% hull split which occurred on July 14. No assessment of correct timing could be determined by looking at the egg trap counts because of the low activity occurring in July. Very little egg deposition occurred in August or early September. But in late September and early October, egg deposition reached a maximum of 10.9 eggs per trap per day.

PTB. PTB flights occurred in May, again in July, and then late August and September. The May flight had 2 peaks, one peak occurring on May 4 and a second peak occurring on May 17. Although these 2 peaks occurred 13 days apart, the Guthion treatment on May 10 controlled most of this flight. The first generation PTB peak occurred on July 12 and the Sevin treatment applied on July 14 also did a good job in controlling PTB at this time.

Monitoring Mites and Predators

The principal mite occurring in the orchard in 1979 was Pacific mite. When the Sevin treatment was applied, Omite was combined with it which kept the mites in reasonably low numbers. No miticide was applied to either the Guthion or the check areas and certain areas in these particular blocks showed considerable damage. Most of the damage occurred in the Guthion-treated areas.

Preharvest and Harvest Results

Preharvest samples were taken on August 21, 28 and September 5 with harvest on September 10. The Guthion, Sevin and Guthion plus Sevin treatments showed very low infestation throughout the preharvest period. At harvest Guthion averaged 3.3% NOW damage, Sevin 4.5%, Guthion plus Sevin 2.7% and the checks 17%. The checks averaged 4.5% damage on August 7 increasing to 16% by August 21. Damage remained at approximately this level throughout the rest of the season showing very little increase in NOW activity or egg deposition from August 21 through September 10, results expected from monitoring egg traps. The average damage in all blocks that were cleaned for the Nonpareil harvest was 5.3%, whereas the uncleaned blocks averaged 8.5%, a difference of 37% benefit from cleaning the trees. This benefit occurred even though the blocks were only 10 A. in size and randomized with the uncleaned blocks throughout the plot. Also, the clean blocks still had considerable mummies left (approximately 24 mummies per tree).

The treatments that were applied by helicopter appeared to give outstanding control of NOW although the 2 sprays together did not improve control appreciably and probably were not advisable. The Guthion spray and the Sevin spray were applied at the ideal time and coincided with the egg deposition activity of NOW.

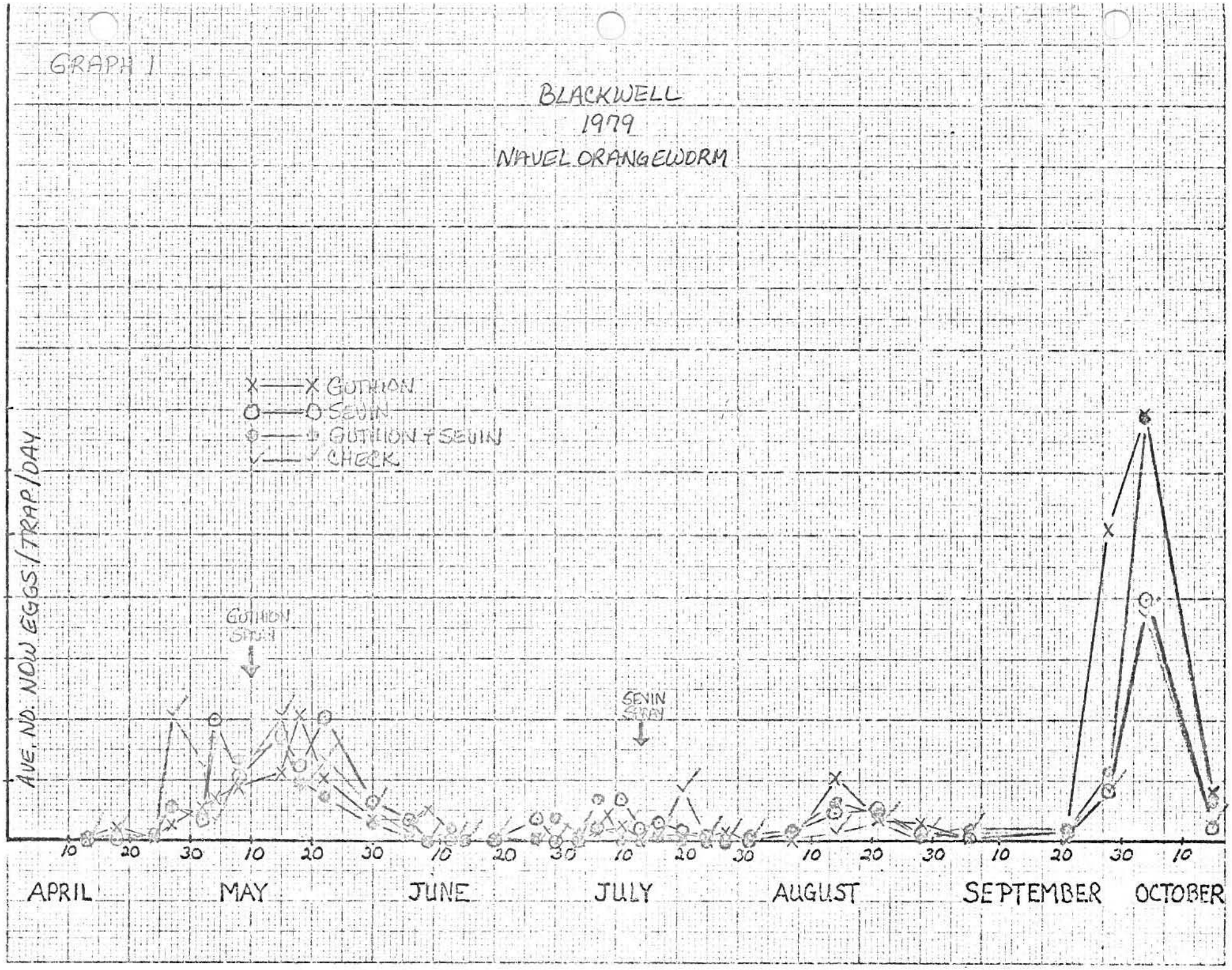
Conclusions

1. Cleaning plots as small as 10 A. can reduce NOW damage approximately 37% (88 mummies vs. 24 mummies per tree).

2. Helicopter applications of either Guthion or Sevin can give excellent control of NOW when applied at the correct time.

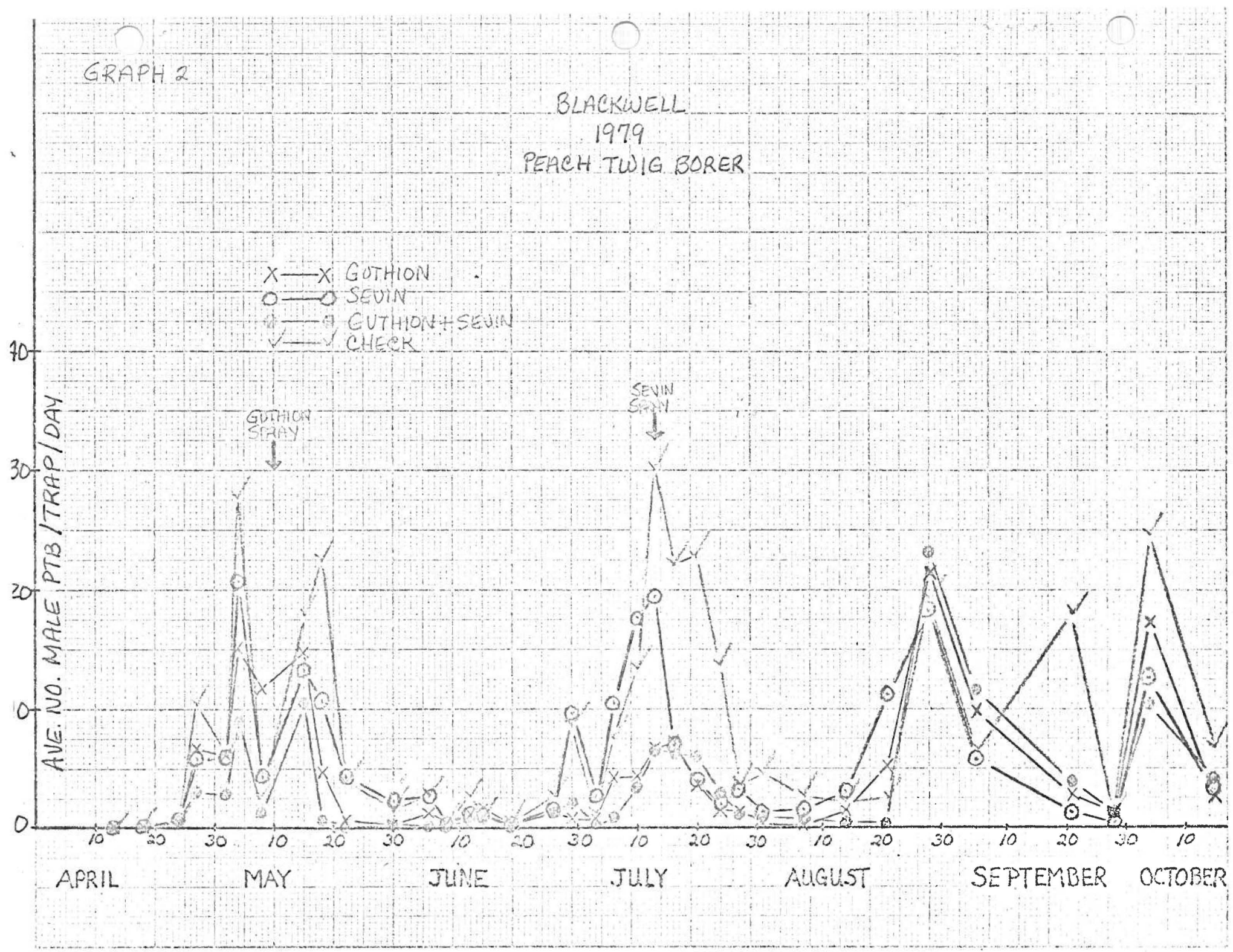
GRAPH 1

BLACKWELL
1979
NAVEL ORANGEWORM

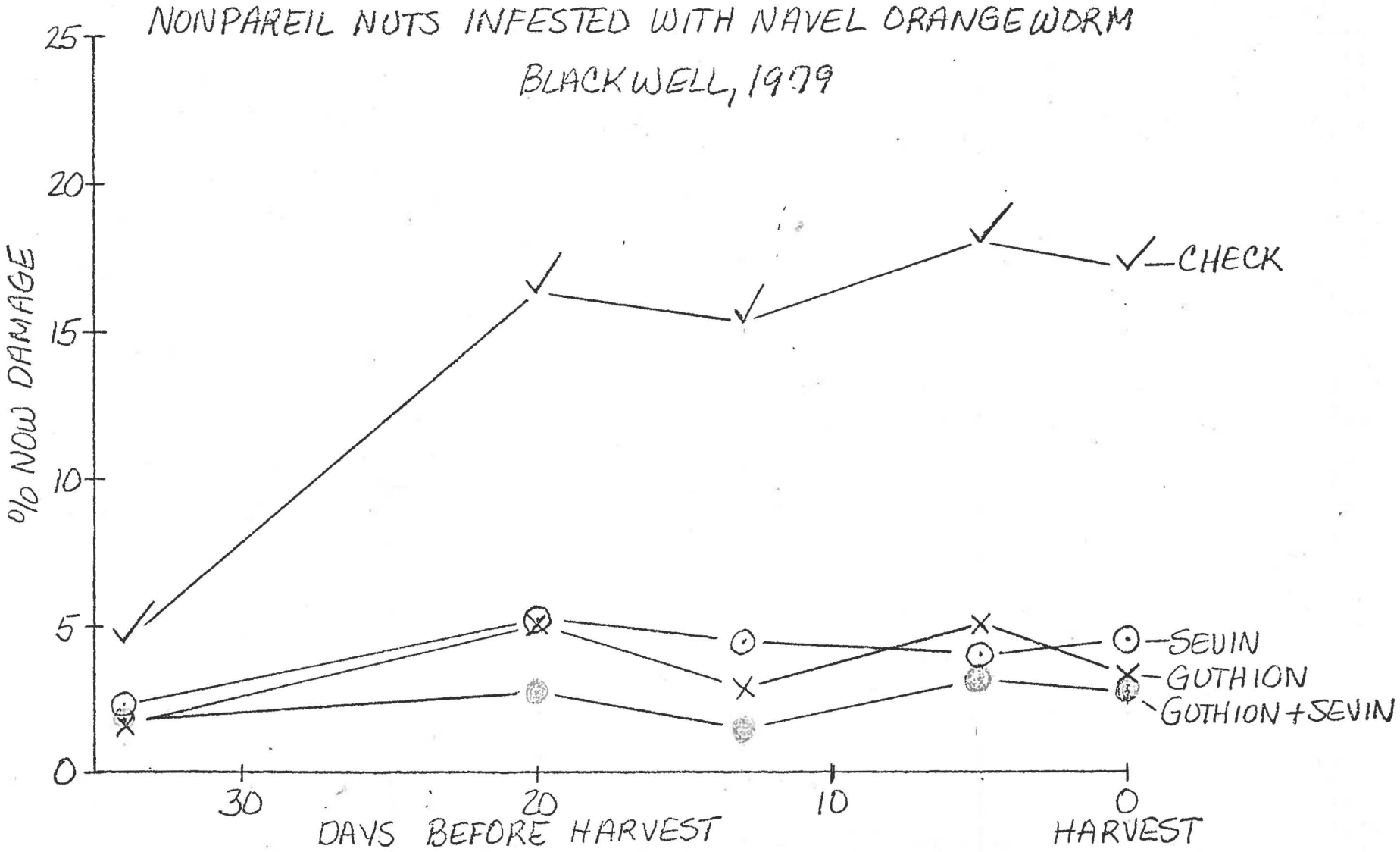


GRAPH 2

BLACKWELL
1979
PEACH TWIG BORER



GRAPH 3


NONPAREIL NUTS INFESTED WITH NAVEL ORANGEWORM
BLACKWELL, 1979
% NOW DAMAGE
25
20
15
10
5
0
CHECK
SEVIN
GUTHION
GUTHION + SEVIN
30
20
10
0
DAYS BEFORE HARVEST
HARVEST

BLACKWELL - 1979

TABLE 1

MITES AND PREDATORS IN AN ALMOND ORCHARD*

Treatments	May 22			June 14			June 29			July 10		
	E**	I	A♀	E	I	A♀	E	I	A♀	E	I	A♀
Guthion												
Citrus Red Mite	0.04	0	0	0	0	0	0.1	0	0	0.1	0	0.03
Pacific Mite + Two-Spotted Mite	1.6	1.2	0.1	2.2	0.3	1.5	3.2	1.0	0.3	2.7	3.9	0.3
Predators***	0	0	0.2t	0.1m	0.0	0.2m	0.2m	0.03m	0.1m	0.7m	0.2m	0.3m
Sevin												
Citrus Red Mite	0.02	0	0	0	0	0	0	0	0	0.2	0	0.1
Pacific Mite + Two-Spotted Mite	0.6	0.4	0.02	1.4	1.3	0.5	3.2	0.7	0.3	7.5	4.3	0.1
Predators***	0	0	0.02m	0.1m	0							
Guthion + Sevin												
Citrus Red Mite	0.01	0	0	0.1	0.1	0	0	0.02	0	0.2	0	0
Pacific Mite + Two-Spotted Mite	1.0	0.9	0.1	9.7	3.9	1.0	22.3	1.2	0.8	36.5	15.8	2.1
Predators***	0	0	0.01t	0.02m	0	0.01m	0.2m	0.1m	0.1m	1.1m	0.5m	0.4m
Check												
Citrus Red Mite	0.01	0	0	0.03	0	0	0.04	0.2	0.01	0.3	0	0.1
Pacific Mite + Two-Spotted Mite	0.1	0.3	0.1	0.6	0.04	0.01	4.2	0.7	0.2	22.0	5.6	0.1
Predators***	0	0	0	0	0	0	0.01m	0	0	0	0.1m	0
								0.01t				

*Average number per leaf of 200 leaves using a mite brushing machine

**E = eggs; I = immatures and adult males; A♀ = adult females

***m = predator mite (Metaseiulus occidentalis); lw - lacewing; t = six-spotted thrips

Guthion treatment - May 10; Sevin + Omite treatment - July 13

TABLE 2

BLACKWELL - 1979

% NAVEL ORANGEWORM DAMAGE

Treatment	Nonpareil Preharvest Aug. 7	Aug. 21	Aug. 28	Sept. 5	Nonpareil Harvest Sept. 10	Merced Harvest Sept. 21
Guthion c	1.0	7.3	3.5	4.5	3.1ab	6.5
Guthion u	2.3	2.8	2.3	5.5	3.5ab	4.0
Sevin c	1.5	5.3	3.8	3.3	3.8ab	3.8
Sevin u	3.3	5.0	5.3	4.8	5.2 b	2.0
G & S c	1.8	2.3	1.0	3.3	3.0ab	8.8
G & S u	2.0	3.3	1.8	3.0	2.5a	6.8
Check c	1.8	11.0	9.0	12.3	11.4 c	20.0
Check u	7.3	21.8	21.8	23.8	22.7 d	15.0
Overall Avg.	2.6	7.3	6.0	7.5	6.9	8.4

% DAMAGE

	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant	PTB	Ant
Guthion c	0.8	0.5	0	0.3	0	1.5	0	0.3	0	0.9	0	0
Guthion u	0	0.3	0	0	0.3	0.5	0	0.3	0	1.8	0	0
Sevin c	1.8	0	0	0	0.3	0.5	0.3	1.0	0.1	1.3	0	0
Sevin u	2.0	0	0	0.3	0.3	0.5	0	0	0.3	0.3	0	0
G & S c	0	0.5	0.3	0	0.3	1.5	0	0	0	1.1	0	0
G & S u	0	0.3	0	1.3	0.5	0.8	0	0	0	1.5	0	0
Check c	5.3	0	0	0.3	0.3	0.3	0.3	0	0.2	0.3	0	0
Check u	9.5	1.3	0	0	0.5	0	0	0.5	0.4	1.1	0	0
Overall Avg.	2.4	0.4	0.04	0.3	0.3	0.7	0.1	0.3	0.1	1.0	0	0