TITLE : Project 76-A3 Navel Orangeworm Research
Part 1 - Orchard Management
Part 2 - Ballico/Famoso Project

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Part 1 - Orchard Management

I. OBJECTIVES: (1) To determine the effects of timing of dormant tree shaking on subsequent almond production. (2) To determine if there is any benefit from orchard sanitation (removal of mummy nuts from trees) when practiced in a small area (40 acres) surrounded by noncleaned orchards.

II. INTERPRETIVE SUMMARY:

The effectiveness of orchard cleanup applied to small acreages susceptible to fly-in of navel orangeworm moths from adjacent uncleaned orchards has been a concern. However, tests on small acreages adjacent to uncleaned orchards indicate that cleanup is effective. For example, a 1975 cleanup in a 40-acre Chico orchard surrounded on three sides by uncleaned almonds reduced Nonpareil navel orangeworm rejects 53% in comparison to those in a partially cleaned check (i.e. 3.3% versus 7.0%).

In 1976, this same grower was able to clean only 20 acres of his orchard with his own trunk shaker. This was due to dry conditions unsuitable for winter cleanup during December 1975 and January 1976. Light trap catches for navel orangeworm moths were as high in May of 1976 as they had been at the start of harvest in 1975. With the threat of high rejects in the 1976-crop the grower sprayed with Sevin® after hull crack, and he harvested all Nonpareil by September 20. His rejects were 4.8% in the block that was cleaned and sprayed once with Sevin®, and they were 6.9% in his other blocks which were not cleaned but received two Sevin® sprays. An average reject level for 10 neighboring orchards was about 14%. The average production per Nonpareil acre was about 2300 pounds. The cost of orchard cleanup plus

dollar loss per Nonpareil acre at 65¢/lb of rejects plus service charges plus control costs was $129/acre for the cleanup plus one spray, $170/acre for the two sprays.

III. EXPERIMENTAL PROCEDURE:

A grower in the Chico area cleaned a 20-acre block (Block #4 in Fig. 1) in his orchard with his own trunk shaker. Nonpareil and Neplus varieties but not Mission variety were cleaned during foggy weather. This block was sprayed with Sevin® (5lb/acre) and Plictran® on July 28-30. Three 20-acre blocks (Blocks 1, 3, 5 in Fig. 1) were sprayed with Sevin® (5lb/acre) on July 21-26 and for a second time with Sevin® (5 lb/acre) and Plictran® on August 4-5. Irrigation and wind spread out the application of sprays on July 21-26. These three blocks were not cleaned. Block 6 located about one mile from those in Fig. 1 was used to represent an orchard operated by the same grower without cleaning or Sevin® sprays.

Blacklight traps were used to monitor NOW populations and pheromone traps were used to monitor PTB populations from April to November. A series of nut samples was taken 4 weeks prior to, 2 weeks prior to and at harvest to trace the rate of increase in infestation of the almonds. Six sample sites in each block were selected. A 100-nut sample was taken from each site on each of three dates (Aug. 8, Aug. 20, and Sept. 6). A retest of duplicate samples taken by the handler will be used to evaluate the effectiveness of the treatments. Results of handler test grading for total rejects are presented in this report.

One commercial scale huller with up-to-date shear-type hulling equipment was sampled to add to our information of how much NOW damage is removed during the hulling operation. Samples of Merced variety were taken after precleaning -

meats was obtained.

The amount of total rejects due to NOW has been obtained for several varieties in retests conducted for us by the California Almond Growers Exchange. A limited amount of this information is included in this report.

IV. RESULTS:

Table 1 shows the percent reduction in NOW damaged Nonpareil and Merced kernels due to hulling operations removing such kernels by breakage and screening or air leg operations. There was much variation from one huller to another. The average percent removal of NOW damaged kernels by the hulling operation was 16% for Nonpareil and 9% for Merced.

It was also determined that an average of 8.4% of the NOW damaged kernel's weight was actually consumed by the NOW larvae. The average for good kernels was 1.19 g compared to an average weight for NOW damaged kernels of 1.09 g.

Table 2 shows what percentage of total rejects is due to navel orangeworm in several varieties. These values vary somewhat depending on the area of the state. They also vary from year-to-year; not shown in Table 2. The data in this Table are only as example of the information being obtained in this area of work and are by no means complete.

A comparison of 1975 and 1976 mummy nut counts for Chico is shown in Table 3. The effectiveness of cleanup was about the same for both years. The check area had about the same mummy nut counts per tree for both years on Nonpareil. Many more Neplus mummys were present in 1976 than in 1975 as the Neplus trees were cleaned in the check area in 1975. The percent reduction in mummy nut counts for 1976 were 96% for Nonpareil and 99% for Neplus and Drake. The

magnified bird activity on the Mission mummys.

The Chico area orchard had much higher trap catches of NOW for both the cleaned and noncleaned blocks in the spring of 1976 than it did in the spring of 1975 (Fig. 4). However, the cleaned block did have a suppressed NOW population throughout most of the 1976 season (Fig. 3 and 4). Trap catches in May 1976 were almost as high as trap catches at the start of harvest in 1975. Because of this, the Chico grower decided to try Sevin® sprays in his orchard.

Table 4 shows the growers % total rejects from grade sheets and dollar loss per acre data for Nonpareil acreage and for total almond acreage. The grower had a net profit of $19 per Nonpareil acre or $29 per total almond acre when comparing the cleaned plus one spray block against the growers' untreated block. It cost the grower $22 per Nonpareil acre or $7 per total almond acre when comparing the blocks with two sprays with grower's untreated block. The grower very likely benefited more than these figures indicate when one considers that the untreated block had a history of being low in rejects but was the grower's highest reject block in 1976 (block #6 in Fig. 2). Also, an average reject level for 10 neighboring orchards was about 14% for the 1976-crop.

Fig. 2 may also be used to show that cleaning blocks 1 and 4 prior to the 1975-crop resulted in the lowest rejects (3.4% and 3.3%, respectively) the grower had had since before the 1971-crop. Also, the reject figures fall below those for block #6 which had been the grower's lowest reject block. Also, the cleaned plus one spray, block #4, continued to be the growers lowest reject block in 1976 with 4.8% rejects. Block #1, 3 and 5 had 6.1%,

#3 and 5 were partially cleaned in 1975, all Neplus plus some of the Nonpareil, and reject percentages for the 1975-crop did decline from those for 1974 while the reject level in the uncleaned Block #6 remained the same for 1974 and 1975.

V. DISCUSSION:

The data from this year's work in Chico and other data from individual 20 or 40-acre orchards continue to indicate that orchard sanitation is a profitable method of control for NOW. Having wet weather, either drizzle or wet fog during December and January, has proved to be the biggest problem in getting a through cleanup of mummy nuts and in getting over a growers entire acreage.

Tests are being conducted in cooperation with Dr. Kay Ryugo and Mr. Warren Micke in the Chico and Ballico areas to determine if dilute sprays of water, water plus surfactant, or water plus oil can loosen mummy nuts when applied the afternoon prior to dormant tree shaking. Bob Curtis has determined from his inquiries that either diazinon or Imidan® can be applied in such sprays so that a grower might accomplish his dormant spray in the same operation making this an economical operation for some growers.

Also, the influence of sprinkler irrigation and time of day of shaking on removal of mummys is being studied. Tests with fans used for fig harvest are being planned to determine if mummy almonds can be removed during rainy or foggy weather with such equipment. Much more acreage could be covered in a given amount of time than with a trunk shaker.

VI. PUBLICATIONS:

See Part 2.

I. OBJECTIVES: Investigate the effectiveness and practicability of an integrated pest management program for suppressing navel orangeworm populations in almond orchards by means of orchard sanitation, early and rapid harvest, and insecticidal control of the peach twig borer.

II. INTERPRETIVE SUMMARY:

The Ballico/Famoso Project involves a 12-mi^2 test area with 60 growers and 2600 acres of almonds plus a 9-mi^2 check area with 63 growers and 2200 acres of almonds in Merced County and a 380-acre test area plus a 440-acre check area, all one solid block of almonds owned by one grower, in Kern County. Residual fruits on hosts such as almonds, walnuts, peaches and various yard plants are removed from trees during December and January by mechanical and hand labor operations. Peach twig borer sprays are applied by most growers during the dormant season. Early and rapid harvest are encouraged where possible.

Mummy almonds and walnuts can be removed effectively and economically by trunk shaking trees over 20 feet tall and by hand poling trees less than 20 feet tall during foggy or rainy weather when trees are thoroughly wet. The moisture soaks into gums making them gelatinous and adds weight to the almonds making them come off the trees much more easily than is the case during dry weather. NOW populations have been suppressed enough by these operations to give 50 to 60% control in comparison to a check.

A dormant spray controlling peach twig borer has an important bearing on NOW control programs and is an essential part of good orchard management. Hull or nut meats damaged by peach twig borer or oriental fruit moth are preferred by NOW for egg laying, and the damage increases survival of the small orangeworms, helping NOW population build-up. Peach twig borer when uncontrolled can infest up to 40 percent of the Nonpareil meats in an orchard.

early and quickly as possible, also is essential to NOW control. ARS studies in 1973 have shown instances where orangeworm damage doubled in Nonpareils and quadrupled in Merceds in the harvest period. In 1976, weather conditions extended almond harvests and produced good illustrations of the orangeworm's ability to increase reject percentages in both cleaned and sprayed orchards.

Growers can expect to pay $15-30 per acre for orchard cleanup. Trunk shaking costs $13-25 per acre with an average of $21 per acre. Hand poling trees less than 12 feet tall averages $10 per acre (range $3-14), and hand poling trees over 12 feet tall averages $20 per acre (range $15-30). When closed-shell, thin-hull Mission are present in plantings, costs are in the low part of the ranges as this type of Mission does not harbor enough NOW to warrant cleaning. When trees are dry or have large numbers of nuts for hand poling or require scaffolding by trunk shakers, costs are in the upper part of the ranges.

Trunk shaking is recommended for most trees over five or six years old, as it is cheaper and the shaker damages trees less than does hand poling. Some fruit buds are removed by shaking, but there is no reduction in subsequent crop size. In contrast, hand poling can remove buds in an indiscriminate manner, slightly reducing the crop potential -- especially on Merced and Thompson varieties where many of the mummy fruits and buds are located along main limbs. Of course, hand poling may be appropriate along with pruning trees less than 20 feet tall and when these trees have less than 50 mummies per tree.

Adequate removal of mummy nuts or "how clean is clean," has not been pin-

Thompson trees, and no more than 20 to 30 mummies per tree should be left on Daveys and Drakes. Bird activity will remove remaining nuts in many areas of the State. This is particularly true in orchards near river bottoms, in flyways, or adjacent to other crops which support noticeable bird activity. Many of the most severe orangeworm problems are in areas of large, solid blocks of almond plantings. Here the bird activity may be inadequate relative to the number of mummies present.

Once the nuts are on the ground, it is important that they are destroyed before March 1 when moth emergence usually begins. ARS tests have established that normal operations, discing or flailing, combined with orchard floor management and environmental factors conducive to rotting, will destroy the nuts and navel orangeworms present. However, nuts on herbicide treated ground, especially those on berms or permanent irrigation checks should be blown or swept to the middle to be disced or flailed and exposed to rotting moisture.

Since fog and moisture during the winter months can be limited, making cleanup hard to complete, the following suggestions are offered:

Follow a cleanup priority so that the most susceptible and difficult varieties are knocked during optimum conditions. Here is such a priority listing:

Merced, Thompson and Drake generally have many mummy fruits and need to be cleaned under the wettest possible conditions, preferably after one or two days of wet fog or drizzle. These three varieties are considered to be prime overwintering sites for NOW.

Carmel and Price, for which the ARS has no experience, should be cleaned on very wet days until experience dictates differently.

varieties to obtain adequate cleaning. Some may be cleaned in the afternoon following a foggy night, or under other conditions when the trees are moist rather than dripping wet with water. However, Nonpareil trees in Kern County tend to have more mummies than any other varieties. Generally, very wet conditions are required to get adequate cleaning of Nonpareil trees having many mummies.

Davey should be cleaned under very wet conditions, but this variety is one of the least important as a source of NOW. The hulls generally come off leaving only the meat and shell on the tree and this makes it difficult for NOW survival.

Neplus and Peerless can be cleaned under moist conditions similar to those required for Nonpareil. These varieties may harbor many NOW. However, in most orchards the mummies fall off the trees of these varieties; it may be more economical to hand pole the few remaining nuts either along with pruning, or in January after many of the nuts have already fallen.

Mission with a closed shell and thin hull are of minor importance for overwintering NOW. This type of Mission does not need to be cleaned. However, a grower may want to consider cleaning Missions to further concentrate any bird activity on the few remaining mummies in the orchard.

Mission that have thick hulls and open suture in the shell are good overwintering sites for NOW. These should be removed under very wet conditions as for Merced.

Some growers conducting winter cleanup have "maximized" the number of hours of fog or heavy dew by shaking trees at night.

III. EXPERIMENTAL PROCEDURE:

The 380-acre block of almonds at Famoso was not cleaned prior to the 1976-

acre test block and the 440-acre check block.

Moth populations were monitored from early March to early November with blacklight traps for NOW and pheromone traps for PTB. A series of nut samples was taken 4 weeks prior to, 2 weeks prior to and at harvest to trace the rate of increase in infestation of Nonpareil and Merced meats and hulls. Twenty sample sites were selected in the test area and 20 in the check area from which 100 Nonpareil nuts per site were taken on each of 3 dates (July 27, Aug. 10, Aug. 24). Fifteen sample sites each were selected in the test and the check from which 100 Merced nuts per site were taken on each of 4 dates (Aug. 24, Sept. 7, Sept. 21, Oct. 5). The samples from Aug. 24 for Nonpareil and from Oct. 5 for Merced are used in this report to represent differences between test and check areas, as sample analyses of the more complete sampling of the areas have not yet been made.

The 2600 acres of almonds in the Ballico test were cleaned prior to the 1976-crop either by use of 9 trunk shakers or by a 35-man handcrew. Most growers put on a dormant spray for PTB control at their own expense.

Four orchards in the test and three orchards in the check having a history of high rejects were selected as trap sites for monitoring NOW and PTB populations. A series of nut samples was taken to chart the rate of increase of insect damage in hulls and meats up to harvest. Eighteen test area orchards with 5 sample sites in each one and 3 check area orchards with 5 sample sites in each one were selected from which 100 Nonpareil nuts per site were taken on each of 4 dates (Aug. 2, Aug. 17, Sept. 1, and Sept. 14). Some samples were taken from test area growers that had not harvested on

from a few orchards on 4 dates (Sept. 1, Sept. 14, Sept. 26, Oct. 12). The final evaluation of the effectiveness of the Ballico Project will be made on the CAGE retest of duplicate nut samples obtained from handlers to represent all growers in the test and check areas. Navel orangeworm and all other types of defects will be separated in these retests.

IV. RESULTS:

Comparisons of 1975 and 1976 mummy nut counts for the Ballico and Famoso areas are shown in Table 3. Even though the Famoso test area was not cleaned in 1976, it had much lower nut counts than did the check area for some unexplained reason. This should have benefited the Guthion® treatment made in the test area. In 1975, the percent reduction in mummy nut counts for Nonpareil, Merced and Davey were 89, 91 and 77% respectively. Missions were not cleaned. Comparable figures for 1976 showed test area counts were lower than those for the check area by 77, 57 and 35%.

Mummy nut counts for the Ballico test area were higher for all varieties in 1976 than in 1975 due to the dry weather during 1976 cleanup period. Check area counts were also somewhat higher in 1976 than in 1975.

Blacklight trap catches for entire years (Table 3) showed a test area: check area ratio of 1:2 in 1975 and 1:14 in 1976 for Famoso. Comparable ratios for Ballico were 1:5.9 in 1975 and 1:2 in 1976 showing that the 1976 cleanup in Ballico was not as effective as that in the foggy weather of 1975. Ratios for trap data up to July 31 of each year are even more striking. They were 1:4.7 in 1975 and 1:16 in 1976 for Famoso and 1:11.7 in 1975 and 1:4.6 in 1976 for Ballico.

Blacklight trap cathces (Fig. 5) for Famoso show that NOW populations were

Comparing 1975 with 1976 (Fig. 6), there was a similar level of moth catches in the test area for both years up to early September when the catches in the 1976 Guthion® treatment became much higher than those for the 1975 cleanup treatment. The check area catches arrive at about the same total catch both years with much higher catches occurring in the early season of 1975 than it early season 1976.

Blacklight trap catches show NOW populations were suppressed by orchard cleanup in the Ballico area (Fig. 7 and 8) throughout the season. Trap catches were much higher in 1976 than in 1975 for both the test and check areas (Fig. 8).

A cost analysis for the Guthion® treatment (Table 5) for Famoso was developed with preliminary data available for the 1976-crop. NOW rejects in Nonpareil were 72% lower and those in Merced were 22% lower in the treated than in the untreated blocks resulting in $166 per acre net profit due to the Guthion® treatment. The Nonpareil samples were harvested Sept. 5, 1975, and Aug. 24, 1976 with 4.0% NOW rejects for both years in the test area and 6.9% in 1975 and 14.3% in 1976 in the check area. The Merced samples were harvested Oct. 5, 1975, and Oct. 4, 1976, with 2.2% NOW in 1975 and 16.9% in 1976 for test area versus 11.7% in 1975 and 21.6% in 1976 for the check area. These data indicate that the 1975 cleanup may have benefited the Merced variety much more than did the 1976 - Guthion® treatment.

Table 6 and Fig. 9-11 show rejects for Nonpareil, Neplus and Merced varieties to be lower in the test area than in the check area after the 1975 cleanup of the test area. Fig. 9 shows that reject figures for

test area reject figure being lower than the check area figure. The check area and the extension of the test area (not cleaned in 1975) actually had an increase in rejects in 1975 over reject values for 1974. Table 6 shows that the average for Nonpareil rejects for the 1971-74 base years was 5.06% for the test area which is 20% higher than the 4.21% base figure for the check area. The 2.21% reject figure for the test area in 1975 is 30% lower than 3.16% figure for the check area. These two differences add to a 50% benefit for Nonpareil due to cleanup in the test area. Calculations made in this same manner result in a 7% benefit for Neplus, a 42% benefit for Merced and a 65% benefit for Thompson due to the 1975 cleanup.

V. DISCUSSION:

Previous observations showing that mummy almonds come off the trees much more easily in foggy or rainy weather in both hand and mechanical cleaning were confirmed during this year's work. The trees must be thoroughly wet for adequate removal of mummys from most varieties and for economical operation of a hand cleaning operation. Nonpareil trees may be cleaned in less than ideal weather. Trees with few mummys and no more than 20 feet tall may be cleaned by hand in dry weather, perhaps in combination with pruning operations.

The year 1977 will be the third and final year of the Ballico/Famoso Project. The results of the first year of orchard cleanup (1975-crop) look very good for most growers in the test area. Some growers with a history of rejects below the 4% level will find it uneconomical to try to control NOW unless they have very high almond production. With the dry winter and poor cleanup prior to the 1976-crop and more importantly the delayed harvest

Personal visits and questionaires will be used this spring to determine the operations of check area growers during the 1975, 1976, and 1977-crop production years. Some growers are known to have cleaned their orchards or altered their operations in other ways to reduce NOW damage.

Also growers in Merced county outside the test and primary check area for which we have complete records (1971-1977) will be used as a second check area. This should provide a better picture of our progress in the Ballico Project.

VI. PUBLICATIONS:

(1) Curtis, C. E. 1976. Economics of NOW control and implementing orchard cleanup. Almond Facts 41 (6):4-8.

(2) 1973. Scientists seek answers: where do they all come from? Almond Facts 38 (5):26-28.

(3) 1973. Scientists seek answers: early harvest and rapid delivery. Almond Facts 38 (4):28-31.

(4) 1973. Damage can be reduced from navel orangeworm. Almond Report 11 (2):21.

(5) Clark, J. D., and C. E. Curtis. 1973. A battery powered light trap giving two years' continuous operation. J. Econ. Entomol. 66 (2):393-396.

(6) Curtis, C. E., and R. L. Coviello. 1972. Navel orangeworms in almonds. Western Fruit Grower 26 (2):14-16.

(7) Curtis, C. E. 1972. Navel orangeworms and almonds. Proceedings Eleventh Annual Research Conference, Dried Fruit Industry Research Advisory Committee 11:15-24.

Table 1

Effect of almond hulling operation on amount of navel orangeworm damage left in inshell and meats after hulling.

Huller ID No.	Type of Huller	% NOW Damage (c/c) Before Hulling * Avg.	Before Hulling * Range	After Hulling Avg.	% reduction (-) or increase (+) in NOW damage due to hullin
		Nonpareil			
1	Old-grower	9.0	6-13	6.2	- 31.4
2	Old-commercial	3.4	0-5	3.2	- 7.7
3	Old-commercial	14.6	12-17	14.0	- 3.8
4	New-commercial	5.5	4-7	3.9	- 29.5
Avg.	---	8.1	---	6.8	- 16.0
		Merced			
2	Old-commercial	5.2	4-6	5.5	+ 4.5
3	Old-commercial	2.2	0-5	2.0	- 10.4
4	New-commercial	3.4	1-6	3.4	0
5	New-commercial	24.8	23-28	21.5	- 13.3
Avg.	---	8.9	---	8.1	- 9.0

* Before-hulling-samples taken after precleaning operation.

	Test Area			Check Area		
	Reject %		NOW as	Reject %		NOW as
	Total	NOW	% of Total	Total	NOW	% of Total
Nonpareil						
Ballico (B)	2.21	1.72	78	3.16	2.62	83
Famoso (F)	4.37	4.00	91	7.08	6.89	97
Chico (C)	3.34	3.00	90	7.01	6.48	92
Neplus						
B	2.03	1.42	70	2.34	1.48	63
C	3.54	2.95	83	3.73	2.84	76
Merced						
B	3.75	1.95	52	5.48	2.70	49
F	2.47	2.15	87	12.57	11.72	93
Thompson						
B	6.69	3.40	51	5.67	0.94	17
Davey						
B	1.58	1.55	98	1.64	1.30	79
F	2.61	2.57	98	5.03	5.03	100
Jordanolo						
B	2.99	1.19	40	4.34	3.37	78

12-square mile area).

	BALLICO				FAMOSO				CHICO			
	Test**		Check*		Test		Check*		Test**		Check	
	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976	1975	1976
Mummy Nuts Per Tree												
Neplus	< 1	4	16	21	—	—	—	—	10	<1	11**	80
Jordanolo	2	4	13	18	--	--	--	--	--	--	--	--
Nonpareil	2	8	22	25	30**	74*	268	317	9	4	116	101
Merced	3	13	34	48	11**	32*	116	74	--	--	--	--
Thompson	3	9	21	65	--	--	--	--	--	--	--	--
Drake	18	20	275	332	--	--	--	--	11	6	--	520
Davey	17	88	--	302	163**	643*	723	993	--	--	--	--
Mission	33*	27	49	79	248*	227*	245	291	--	85	--	260
Blacklight Trap Catches												
Cumulative Average	295	1280	1750	2525	3060	4240	6030	6030	2020	1700	1630	3230
Peak Week	80	295	450	630	800	1190	1100	1550	485	295	380	520
Total Rejects (% of Meat Weight)												
Nonpareil	2.2	3.3	3.2	3.8	4.4	4.0	7.1	19.2	3.3	4.8	7.0	6.9
Neplus	2.0	3.8	2.3	3.6	--	--	--	--	3.5	--	3.7	--
Merced	3.8	5.1	5.5	6.4	2.5	16.9	12.6	21.6	--	--	--	--
Davey	1.6	--	1.6	--	2.6	--	5.0	--	--	--	--	--

* Not cleaned.

**Cleaned.

Effects of dormant tree shaking and/or Sevin[R] sprays on rejects and dollar loss per acre for subsequent almond crop.

	Actual meat pounds Nonpareil per Nonpareil acre	% Total Rejects	Total $ Loss per acre[a]
Cleaned + Spray[b]	2322	4.76	129
Noncleaned + Spray[c]	2382	6.86	170
No cleaning or post bloom sprays[d]	2848	7.57	148

	Actual meat pounds All Varieties per Actual acre	% Total Rejects	Total $ Loss per acre[a]
Cleaned + Spray[b]	2125	4.21	122
Noncleaned + Spray[c]	2020	6.48	158
No cleaning or post bloom sprays[d]	2311	7.73	151

[a] Pounds rejects x 65¢/lb. + 20% of reject value for huller loss + handler's service charge + cost of NOW control measures and calculated for a production of 2000 meat pounds per acre.

[b] $15 for cleaning + $30 per acre for one spray (Sevin[R] and Plictran[R]) on July 29.

[c] $15 for spray (Guthion[R]) on July 24 plus $30 per acre for spray (Sevin[R] and Plictran[R]) on August 4.

[d] Another orchard owned by same grower, but 1.25 miles east of cleaned and sprayed orchard.

Guthion® Spray - Famoso - 1976

Effects of postbloom Guthion® spray on rejects and dollar loss per acre for subsequent almond crop.

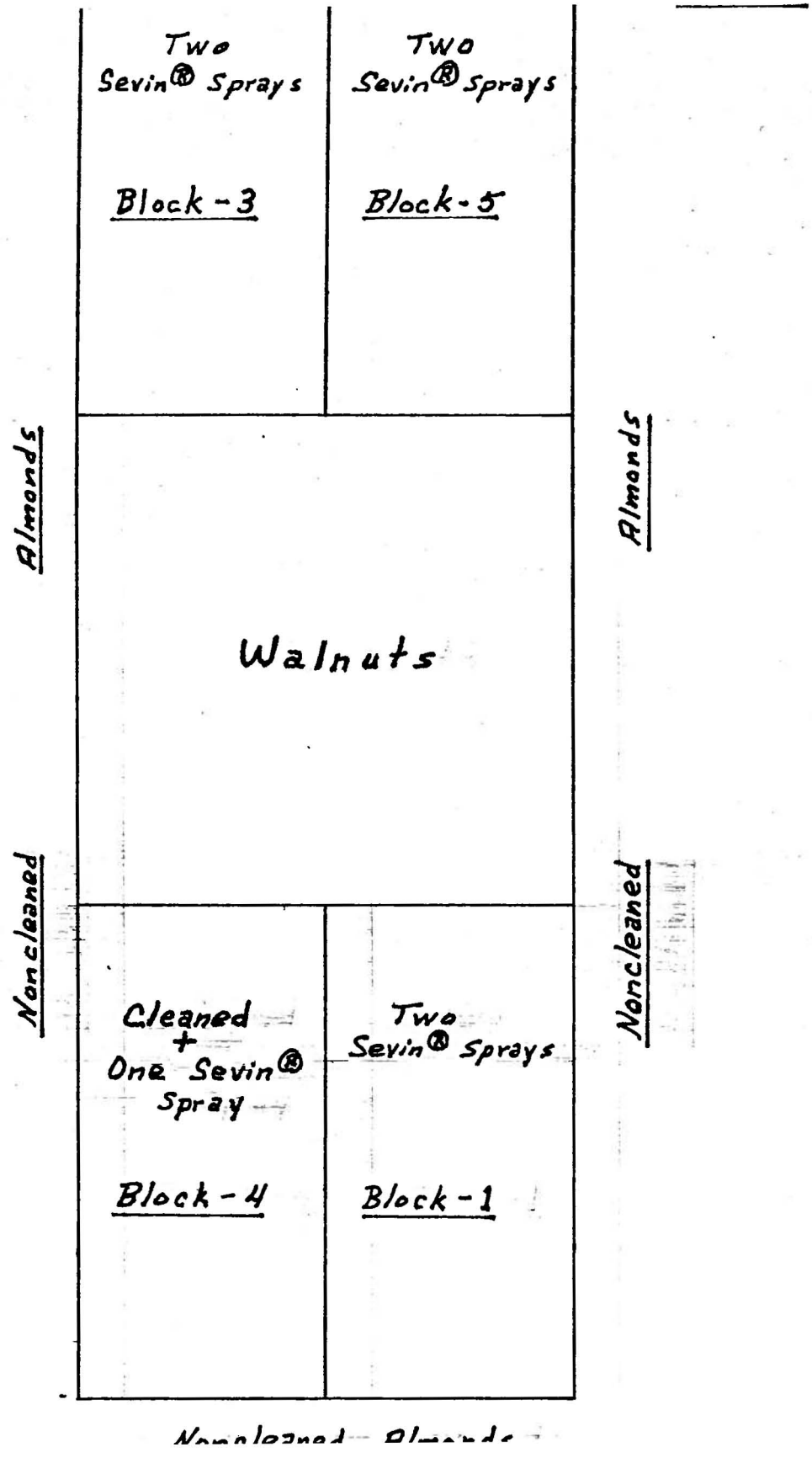
	Estimated Meat Pounds per Acre	% NOW Rejects	Total $ Loss per Acre*
Spray**			
Nonpareil	1450	4.0	52
Merced	375	16.9	64
Mission®	375	Nil	0
Guthion®	---	---	20
Total	2200	5.5	136
No Spray			
Nonpareil	1450	14.3	210
Merced	375	21.6	80
Mission	375	Nil	0
Total	2200	13.1	290

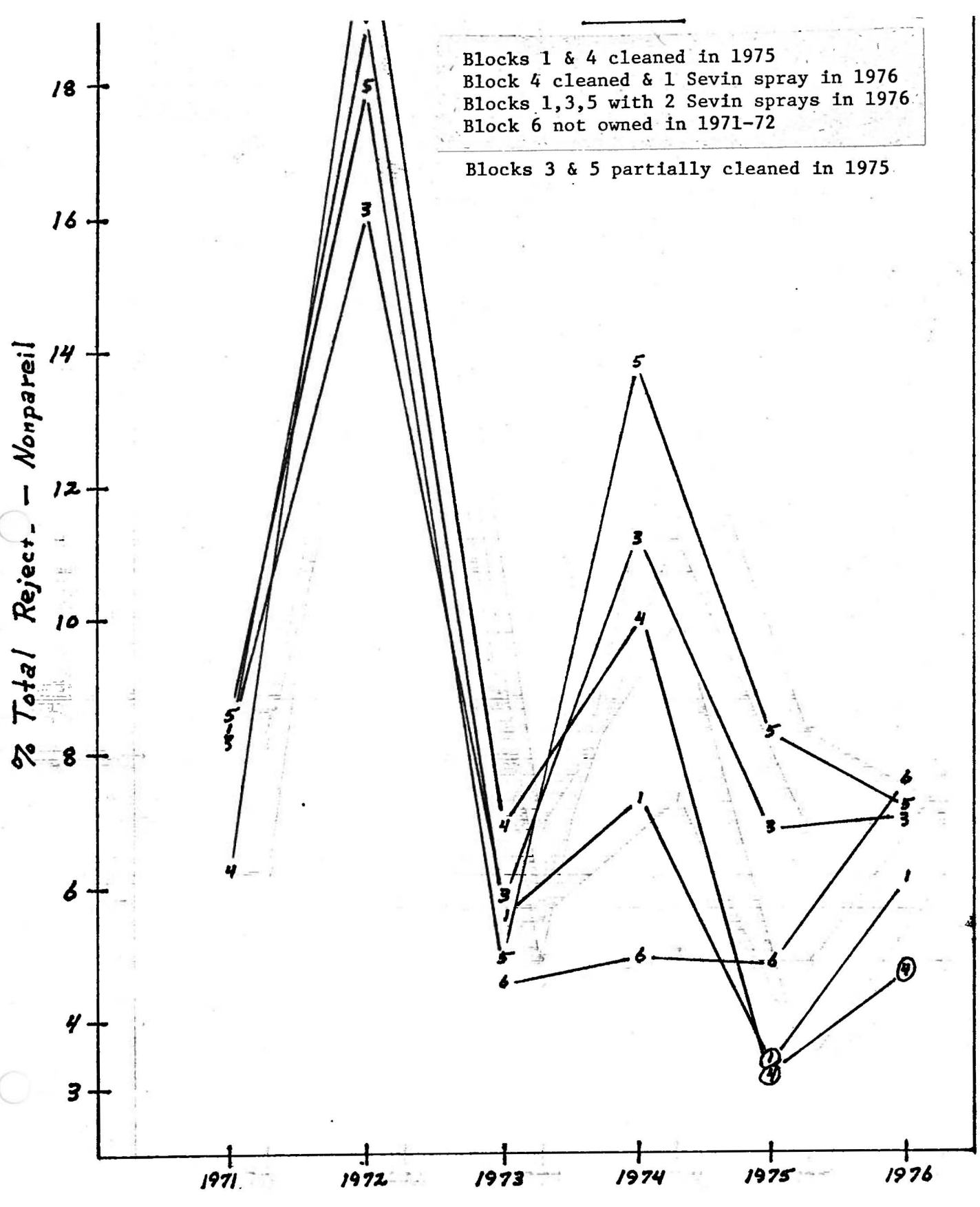
* Pounds rejects X 65¢/lb. + 20% of reject value for huller loss + handler's service charge + cost of NOW control measures.

** $20 per acre for one spray (Guthion®) on June 8.

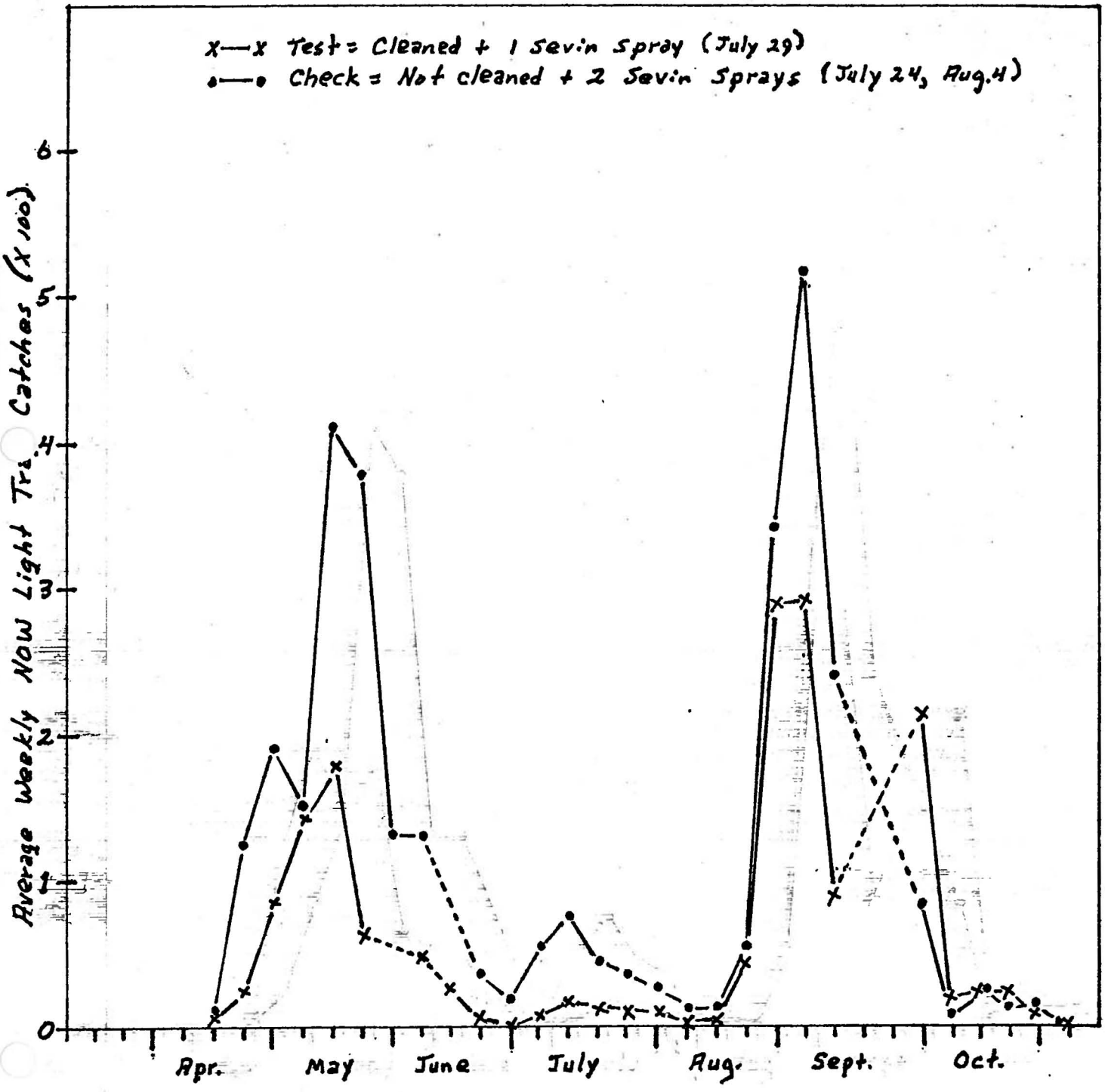
Effects of orchard sanitation - comparison of test area (1975 & 1976) with base years (1971-1974) and check area. Total reject data complete for 1975 but only a few orchards represented for 1976.

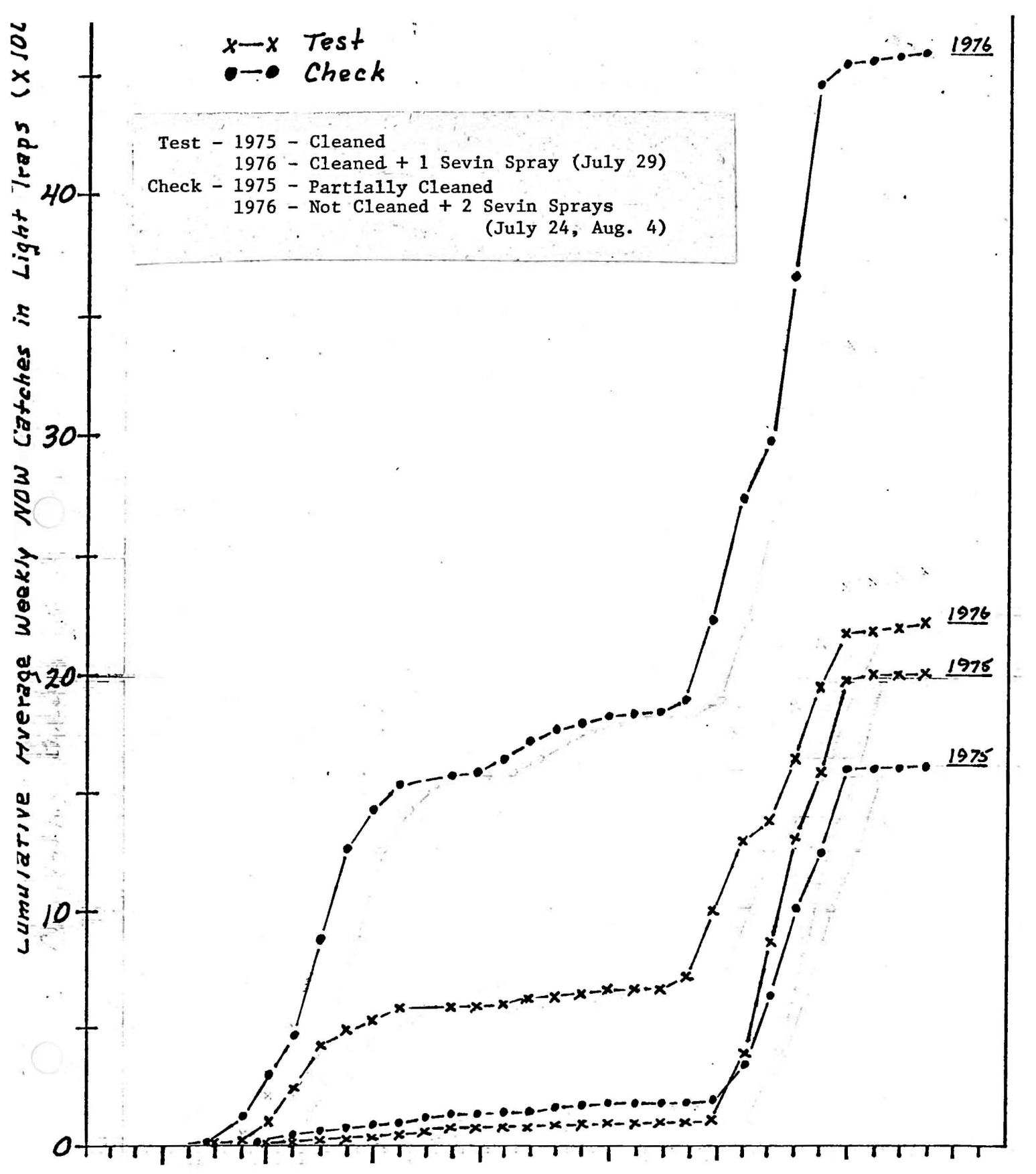
	Test Area			
	Avg. for Base Years 1971-1974	Test Year 1975	Test Year 1976	Increase or (Decrease) for 1975 over base years
Nonpareil	5.06	2.21	3.26	- 56%
Neplus	3.90	2.03	3.76	- 48%
Merced	7.05	3.75	5.12	- 47%
Thompson	7.26	6.69	---	- 8%
	Check Area			
Nonpareil	4.21	3.16	3.75	- 25%
Neplus	4.16	2.34	3.60	- 44%
Merced	6.40	5.48	6.40	- 14%
Thompson	3.95	5.67	---	+ 44%

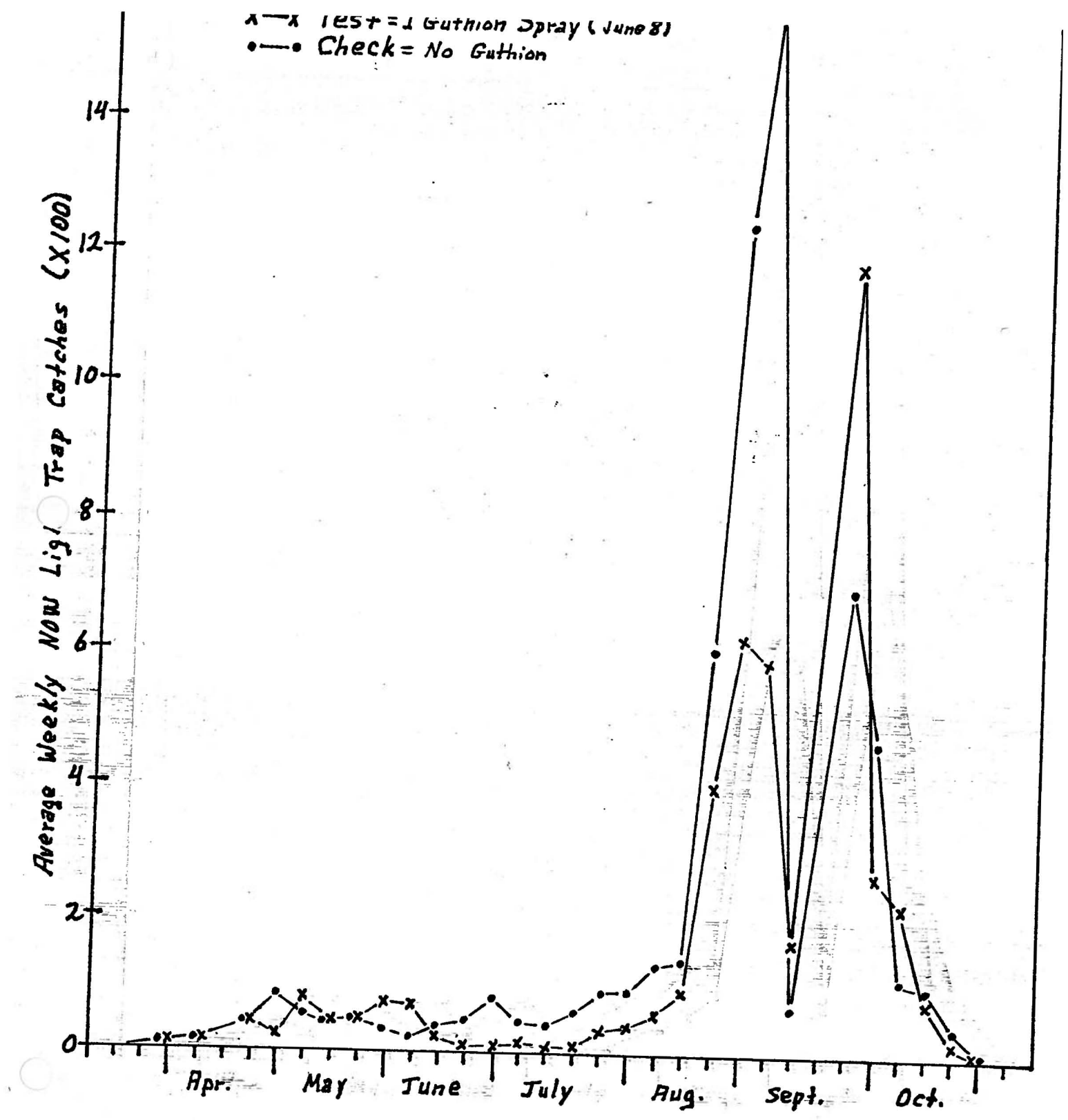

Two Sevin® Sprays
Block - 3
Two Sevin® Sprays
Block - 5
Almonds
Almonds
Walnuts
Noncleaned
Noncleaned
Cleaned + One Sevin® Spray
Block - 4
Two Sevin® Sprays
Block - 1
Noncleaned Almonds

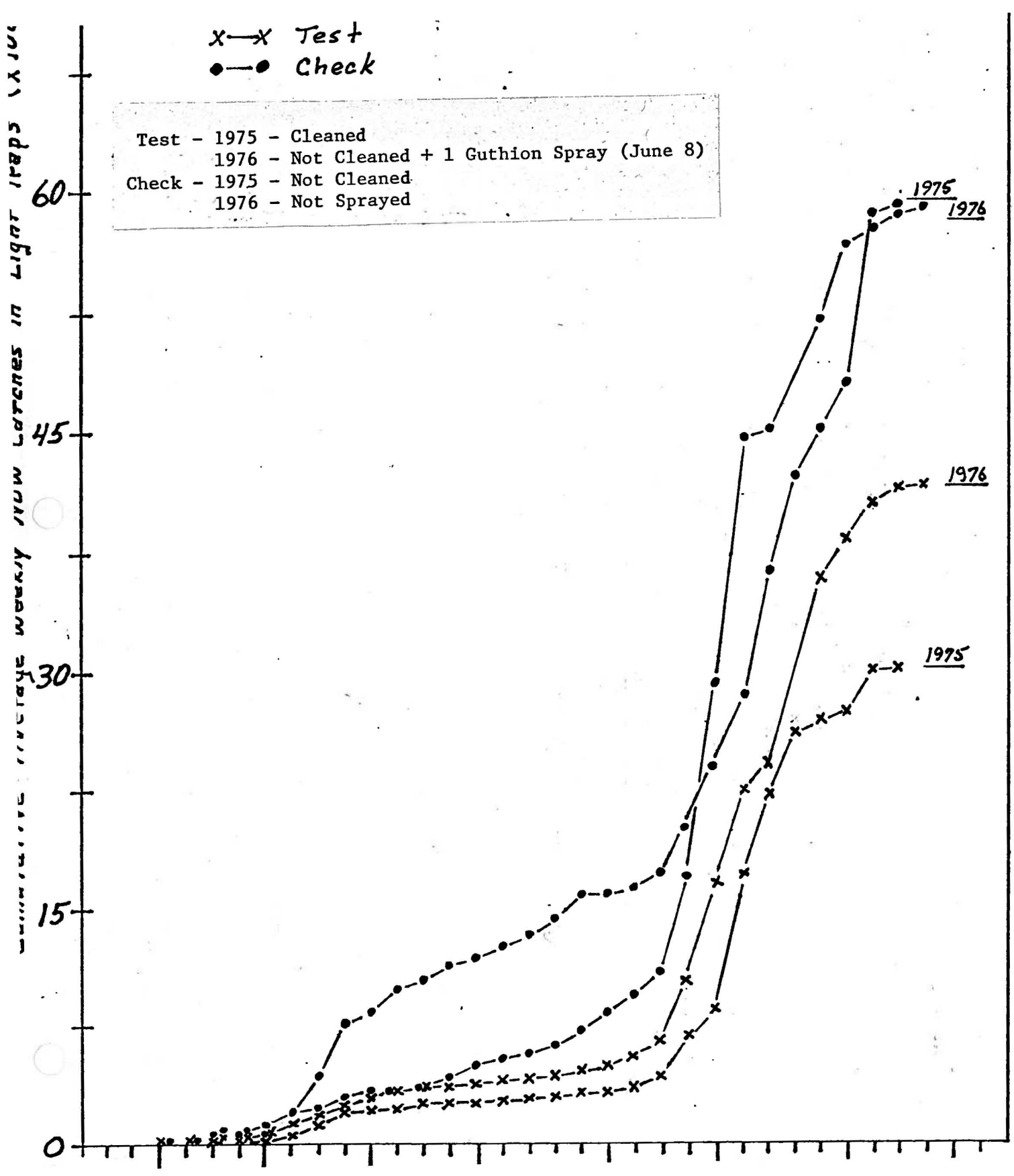

Blocks 1 & 4 cleaned in 1975
Block 4 cleaned & 1 Sevin spray in 1976
Blocks 1,3,5 with 2 Sevin sprays in 1976
Block 6 not owned in 1971-72
Blocks 3 & 5 partially cleaned in 1975
% Total Reject. — Nonpareil
18
16
14
12
10
8
6
4
3
1971
1972
1973
1974
1975
1976

CHICO - 1976

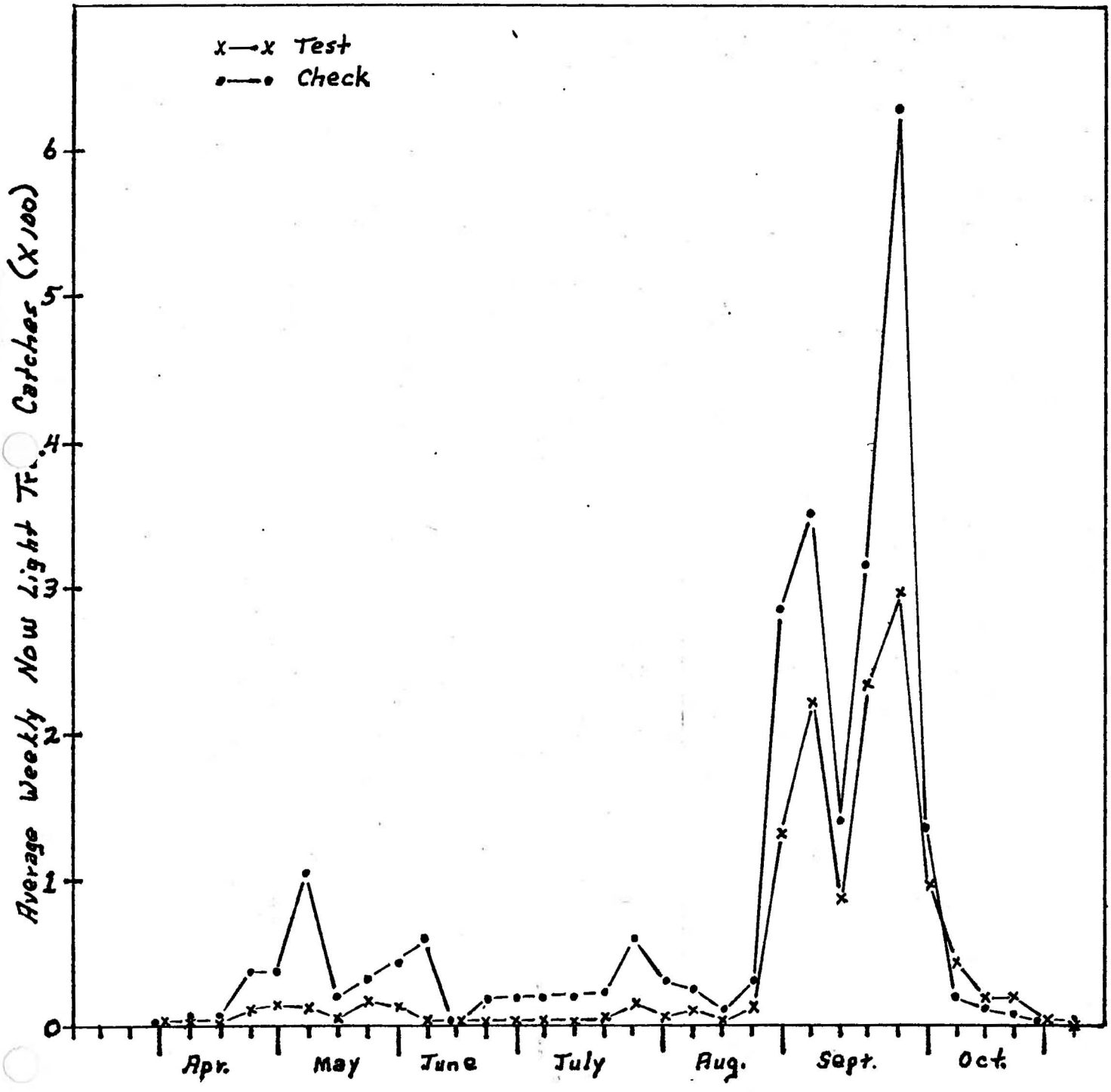

x—x Test = Cleaned + 1 Sevin Spray (July 29)
•—• Check = Not cleaned + 2 Sevin Sprays (July 24, Aug. 4)
Average Weekly NOW Light Trap Catches (X 100)
0
1
2
3
4
5
6
Apr.
May
June
July
Aug.
Sept.
Oct.

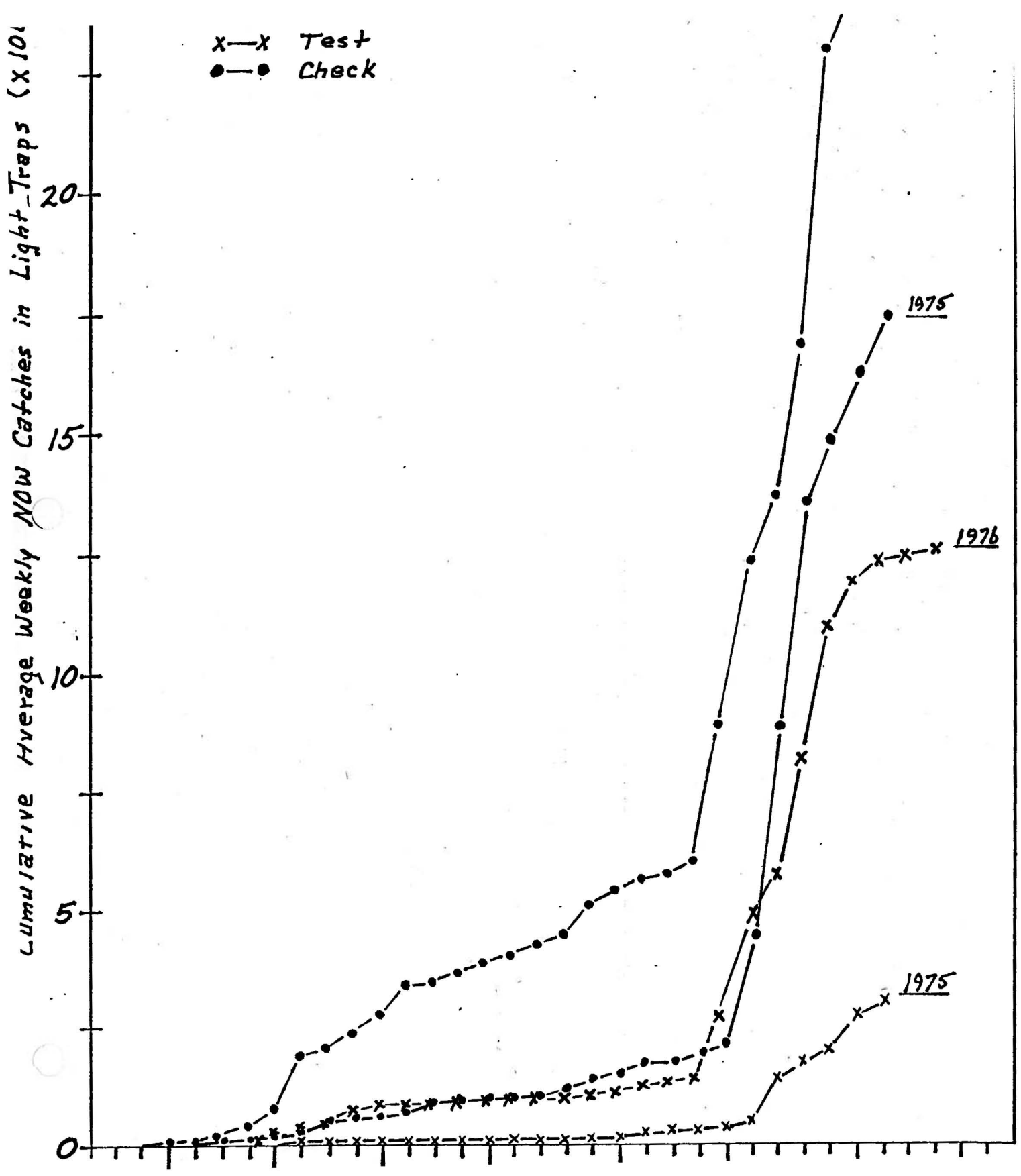

x—x Test
●—● Check
Test - 1975 - Cleaned
1976 - Cleaned + 1 Sevin Spray (July 29)
Check - 1975 - Partially Cleaned
1976 - Not Cleaned + 2 Sevin Sprays
(July 24, Aug. 4)
1976
1976
1976
1975
Cumulative Average Weekly NOW Catches in Light Traps (X 10
0
10
20
30
40

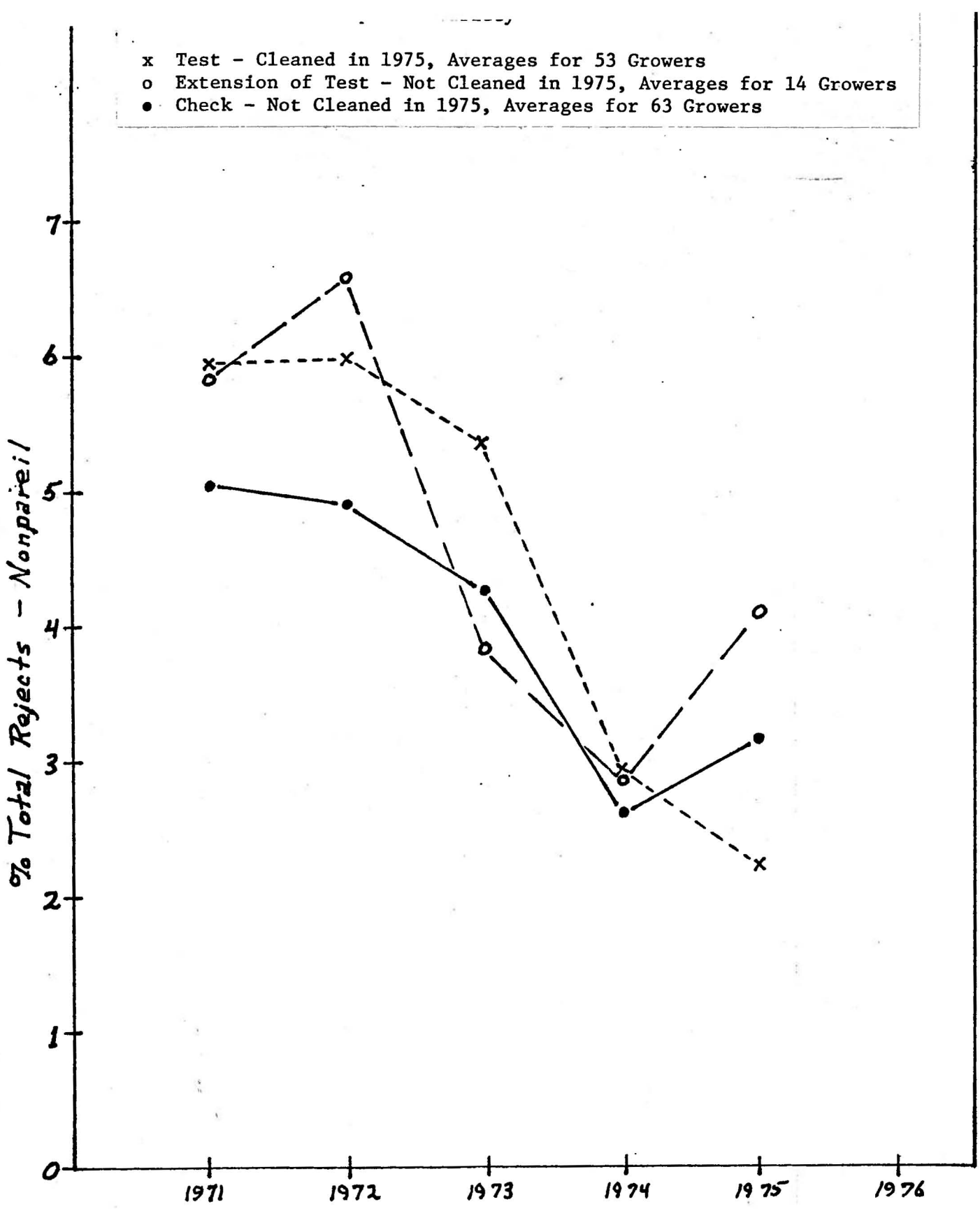

x—x Test = 1 Guthion Spray (June 8)
•—• Check = No Guthion
Average Weekly NOW Light Trap Catches (X100)
0
2
4
6
8
10
12
14
Apr.
May
June
July
Aug.
Sept.
Oct.

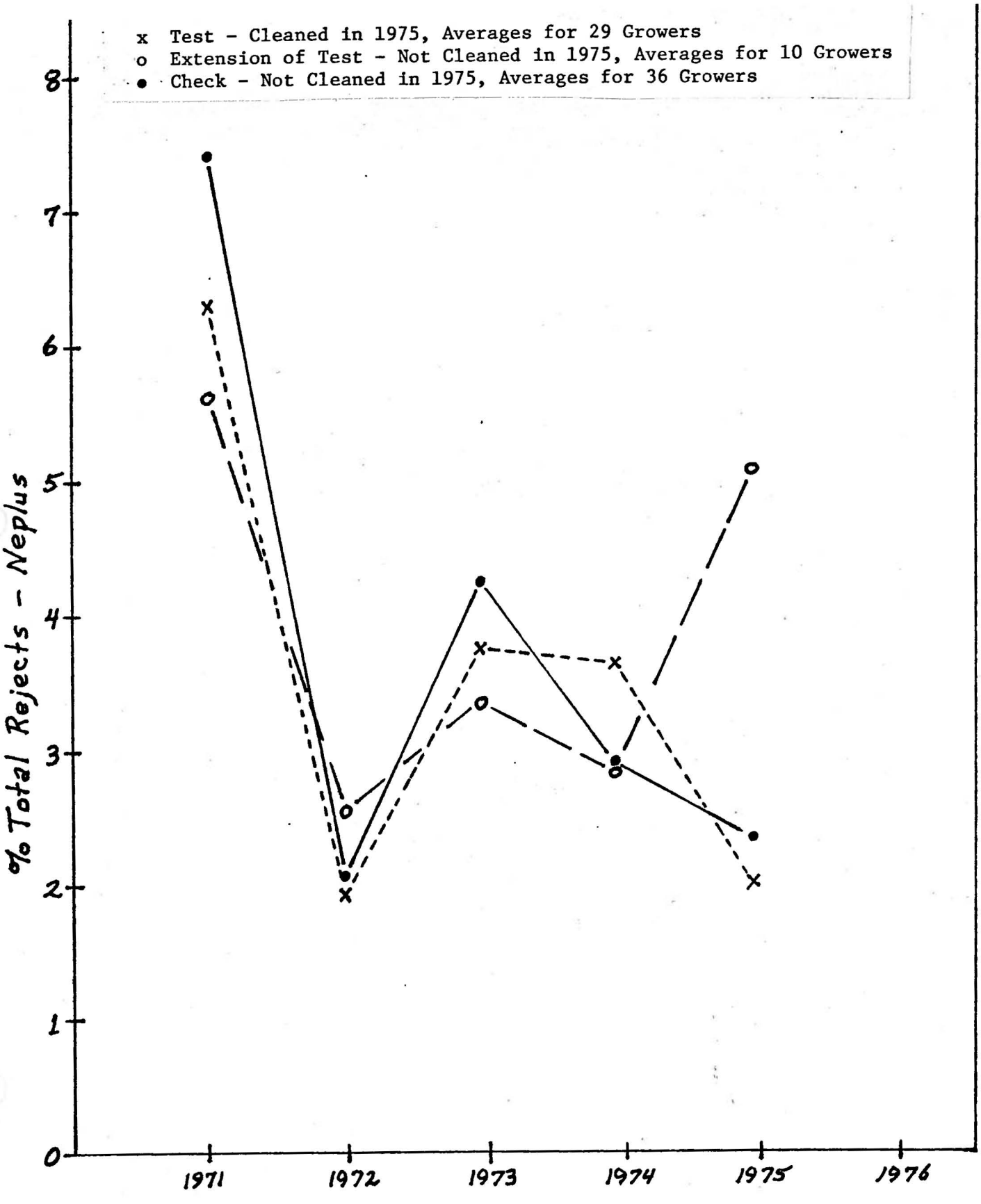

x—x Test
●—● Check
Test - 1975 - Cleaned
1976 - Not Cleaned + 1 Guthion Spray (June 8)
Check - 1975 - Not Cleaned
1976 - Not Sprayed
60
45
30
15
0
1975
1976
1976
1975

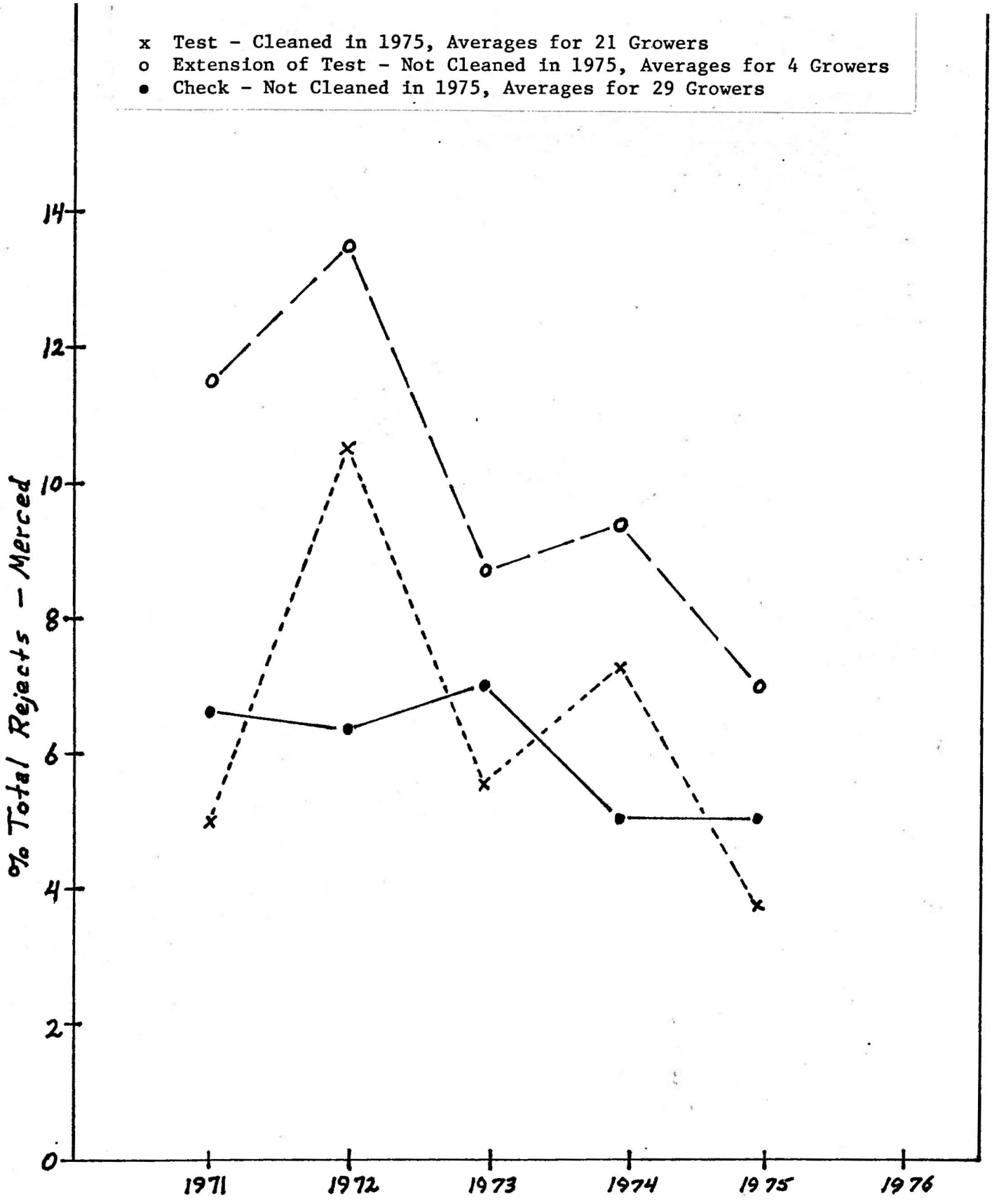
BALLICO - 1976




x—x Test
●—● Check
Cumulative Average Weekly NOW Catches in Light Traps (X 10
0
5
10
15
20
1975
1976
1975


x Test - Cleaned in 1975, Averages for 53 Growers
o Extension of Test - Not Cleaned in 1975, Averages for 14 Growers
• Check - Not Cleaned in 1975, Averages for 63 Growers
% Total Rejects - Nonpareil
0
1
2
3
4
5
6
7
1971
1972
1973
1974
1975
1976


x Test - Cleaned in 1975, Averages for 29 Growers
o Extension of Test - Not Cleaned in 1975, Averages for 10 Growers
• Check - Not Cleaned in 1975, Averages for 36 Growers
% Total Rejects - Neplus
0
1
2
3
4
5
6
7
8
1971
1972
1973
1974
1975
1976


x Test - Cleaned in 1975, Averages for 21 Growers
o Extension of Test - Not Cleaned in 1975, Averages for 4 Growers
• Check - Not Cleaned in 1975, Averages for 29 Growers
% Total Rejects - Merced
0
2
4
6
8
10
12
14
1971
1972
1973
1974
1975
1976