

**Pest Management Alliance Grant Progress Report
For Lake County
2000 Report**

Contract Title: *Areawide Implementation of Mating
Disruption in Pears Using Puffers*

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Date: September 30, 2000

Prepared for
California Department of Pesticide Regulation

Summary

Codling moth (*Cydia pomonella*) (CM) is the primary pest of pears in California. The economic threshold for cannery damage is 5% (including all other defects). FQPA and CalDPR use restrictions on azinphosmethyl and encapsulated methyl parathion have hastened the adoption of alternative CM control programs, mainly using mating disruption (MD). In 2000, 820 acres of pears in Kelseyville, Lake County, were treated with the new Paramount Aerosol Pheromone Dispenser®, a method which entails hanging relatively few (1-2 per acre) widely-spaced units around the orchard perimeter, each emitting a large amount of pheromone for a finite period each day, and above a certain ambient temperature threshold. To monitor CM activity, one set of four traps was hung per five acres: 1 mg. low, 1 mg. high, 10 mg. high and oblique-banded leafroller (OBLR) (the major secondary pest of CM MD programs). Egg-laying and larval infestation was evaluated for each CM and OBLR generation using tree, ground, and bin samples. Puffer-treated orchards were compared to a 20-acre standard treated block and two untreated sites. Harvest data showed a total of less than 0.2% damage in the puffer treated blocks, with the majority of damage in first-year upwind and border blocks adjacent to less-effective MD methods and large open spaced. Slight damage also occurred adjacent to a riparian corridor. Damage in the grower control was 0.0% and 48% in the untreated controls. OBLR damage was present in almost all blocks at harvest but least where chlorpyrifos (e.g. Lorsban®) was applied pre-bloom, followed by a BT treatment for the first summer generation hatch. Due to the success of the program, acreage under the puffer program will increase to 1360 acres in 2001.

Introduction

Codling moth (*Cydia pomonella*) is the key pest of pears in California. The economic threshold for damage in cannery loads is 5% (including all other defects). Damage in untreated controls ranges from 10 to 50%, signifying great need for effective control. State and federal actions in 1998 and 1999 have resulted in the restriction or loss of the two key organophosphate insecticides used to control codling moth, azinphosmethyl (e.g. Guthion®) and encapsulated methyl parathion (e.g. Penncap®). These restrictions have necessitated rapid transition of the pear industry into alternative pest management programs. The most proven and available current alternative is mating disruption, which has been researched in pears since 1987. Mating disruption has been demonstrated to be most effective when utilized on an areawide basis in orchards under low to moderate codling moth pressure. The most widely used strategy is hanging 150-400 pheromone dispensers per acre throughout a treated block. Each dispenser emits a small amount of pheromone over the life of the unit, about 60-120 days.

The demonstration project underway is utilizing an alternative, reasonably priced dispenser, the "puffer", developed by the late Dr. Harry Shorey of UC Riverside. The puffer has been further developed and registered by Paramount Farming Co. of Bakersfield, a large almond and pistachio operation. It is manufactured in Canada and sold directly by Paramount. The codling moth product is registered as the Paramount Aerosol Pheromone Dispenser®. Rather than hanging many dispensers which each emit

small amounts of pheromone, this method involves hanging two or fewer dispensers per acre, each emitting a large amount of pheromone at preset intervals and above a minimum ambient temperature threshold for 200 days. Prior to initiating this project, this dispenser was the focus of three years of pear industry-funded UC research on 160 acres in Lake County, which in 1999 expanded to 500 acres under a USDA Areawide Codling Moth Project (CAMP) grant). Based on the success of the Lake County project, in 1999 this project was expanded to 820 acres in 2000 under the CalDPR Demonstration Grant. This is 33% of the total acreage in the Kelseyville growing district and nearly 20% of the total Lake County acreage. One upwind 20-acre block of standard-treated Bartletts and two untreated sites were utilized as grower and untreated controls, respectively.

Materials and Methods

The recommended labeled commercial application rate using the Paramount puffer is two units per 40-acres, placed around the perimeter of the block. In this project, 1.1 units per acre were hung in late March every 65 feet around the perimeters of each orchard block. Each unit was programmed to emit 7.5 mg. of codlemone every 15 minutes from 3:00 p.m. to 3:00 a.m., for a total of 79.2 gms. of codlemone per acre over the season. Emission ceased when the ambient temperature dropped to 50° F. Units were hung in the upper one-third of trees using a hooked, telescoping swimming pool pole. If orchards shared borders, only one side was treated, thus reducing the rate. One set of four monitoring traps was hung per five acres; each set consisted of a 1 mg. low, 1 mg. high, and 10 mg. high codling moth (CM) and an oblique-banded leafroller (OBLR) trap. OBLR is the major secondary pest associated with reduced OP programs. Traps were monitored weekly (Figures 1 and 2).

CM and OBLR infestation was evaluated at specific intervals through the growing season. Egg searches were performed in the spring prior to first cover and again in late July prior to the stop-drop spray. This allowed for treatment decisions to be made in case significant numbers of eggs were found. First generation larval damage was evaluated via tree counts in late June and ground fruit counts in early July, again prior to a key treatment opportunity. 1B and second generation larval damage and worms were evaluated via late July tree and harvest bin counts. To evaluate overwintering potential, a post-harvest sample of fruit remaining on trees is currently being done. Each sample consisted of from 500 to 2,000 fruit per block, depending on block size and sample type.

For trapping and damage evaluations, puffer-treated blocks were compared to the one 20-acre standard-treated orchard, and two completely untreated sites upwind of the puffer project.

Results of field activity were reported to participating growers, PCA's and the CalDPR Project Manager via weekly fax (20 issues to date). In addition, mid-summer field days in both English and Spanish were held in July to present results to date. A cost study for the program was prepared for the 1999 season and will be updated after the entire season is completed, as well as a summary of comparative pesticide use for standard versus puffer mating disruption programs (Appendix II to IV).

Due to severe time and staff constraints, two secondary aspects of the project were unable to be accomplished during the 2000 season: cluster and shoot samples for pear psylla and mites, and the habitat and orchard floor surveys for true bugs. The effort involved in simply monitoring CM and OBLR on such a large scale, the time involved in data collection, preparation and distribution continues to be limited by finite funding, especially as acreage continues to increase. However, a summary of pesticide use report information will serve to indicate pest pressures that were treated.

Results

- a) **Objective 1:** *Demonstrate a cost-effective, labor saving, efficient, commercially-available method of delivering pheromone in a mating disruption program.* After one season, CM damage to puffer-treated blocks at harvest was less than 0.20% overall across 37 blocks versus 0.0% in the one standard control block and 48% in the untreated controls. Damage occurred only in first-year upwind blocks with large edge effects i.e. where the orchard bordered less effective mating disruption, or large open areas, or in proximity to apple trees. More telling, damage averaged 0.32% in first year blocks, located on the south and west upwind borders, but only 0.03% in second year blocks and 0.0% in the original project blocks treated since 1996. Like CM, OBLR damage was most severe in first year blocks, but present throughout all puffer-treated blocks, while the OP-treated grower control was free of damage. The puffer units lasted the entire season, showing only one hanging per season is required, although there was one (unexpected) battery change (Tables 1 to 5).
- b) **Objective 2:** *Verify the minimum level of monitoring needed to commercially use this method.* Very few moths were caught in 1 mg. low traps and catches were almost all in untreated controls and in one orchard that was the site of an untreated control in previous years. 1 mg. high traps caught more moths, but also caught moths in some blocks that had no 1 mg. low catches. 10 mg. high traps caught the most moths in the puffer blocks. The best correlation with damage in 2000 was with 1 mg. high traps, which correctly predicted damage in 71% of the blocks where it occurred, and likewise correctly predicted no damage would occur in 86% of damage-free blocks. 10xH traps correctly predicted damage 50% of the time it occurred but were 83% correct in predicting no damage. OBLR traps caught many moths, but numbers showed little correlation to severity of damage. The 5-acre trapping unit, though intensive, resulted in being able to pinpoint potential "hotspots" (Table 6).
- c) **Objective 3:** *Produce commercial yields of U.S. #1 Bartlett and Bosc pears using greatly reduced amounts of organophosphate insecticides.* No OP was applied to multiple year blocks during the 2000 season, versus the standard block that received at least two sprays. First year blocks received one to three OP treatments depending on trap catches and egg sampling. Exact amounts applied are currently being compiled from monthly use reports.

d) **Objective 4: Control secondary pests as needed.** No attempt was made to dictate secondary pest control. Leafrollers were controlled by one pre-bloom chlorpyrifos (e.g. Lorsban®) and perhaps one or two BT sprays for the first summer hatch. OBLR damage averaged 1.0% at harvest and ranged from 0.0-9.2%. Damage was worst where no pre-bloom Lorsban® was applied, and near riparian corridors. OBLR trap counts appear to be uncorrelated with damage but this is still being analyzed. One spray was applied for pear psylla and mite control in most puffer-treated orchards. Post-harvest treatments are still ongoing but are unnecessary in most puffer-treated blocks. (Data on secondary pest treatment will be compiled from monthly use reports). Very little stink bug damage was noted at harvest (0.013%) and no San Jose scale was found.

Discussion

Data at harvest indicated several points:

- 1) Mating disruption, specifically puffers, controls codling moth well even in a first year program *if* orchards start the season with relatively low pressure, and particularly when supplemented by at least one well-timed, effective cover spray.
- 2) Orchards that begin the season with high pressure will require greater supplementation by insecticides and more years to achieve adequate control. In 2000, the most problematic orchards were those on upwind edges bordered by less effective pheromone programs or large areas of open space or vineyard. Damage was also found close to backyard apple trees and in one orchard that had previously contained an untreated control in one corner.
- 3) Leafrollers, specifically oblique-banded leafroller (OBLR), will need to be controlled with chemicals under CM mating disruption because OBLR pheromone is still being researched. Orchards lacking pre-bloom Lorsban® had the most OBLR damage. BT applied for the first generation hatch was quite effective in reducing the severity of OBLR damage, and could be useful in mating disruption programs provided weather conditions are conducive to excellent timing and coverage. Other secondary pests, such as stink bugs and San Jose scale, may also eventually be problematic but only early-season damage from Western flower thrips was noticeable in 2000.

As a mating disruption tool, puffers are good dispensers in that distribution pattern, emission rates and timing are controllable and flexible, and they are only slightly affected by changes in ambient temperature (due to vapor pressure shifts). However, experience in 2000 brought out several economic and logistical issues:

- a. Units must be periodically taken down and checked to make sure they are emitting correctly. They are susceptible to being knocked down by heavy wind and human activity, such as spraying and harvesting. In 2000, batteries unexpectedly needed to be changed about two-thirds through

the season. Checking each unit takes about one minute per unit and can be done at the same time traps are checked. Another two or three minutes is required if reprogramming is required. Paramount continues to improve unit design.

- b. The accompanying programming unit currently costs \$350.00 and must be purchased separately by the user(s). It is very important that users are well trained in its function to avoid possible misprogramming.
- c. The current initial cost to enter the puffer program is theoretically an impediment to adoption, especially in poor market years such as 2000 (though growers have thus far been undeterred). For example, at the maximum two per acre for one 40-acre block, the cost would be \$40.00 per unit $\times 2 = \$80.00$ plus \$80.00 per filled cannister $\times 2 = \$160.00$, for a total cost of \$240.00 per acre. Cost to hang, check and remove adds about \$3.00 per acre. This is compared to \$220.00 for two hangings of 400 Pacific BioControl dispensers plus about \$25.00 per acre per hanging for application, or about \$270.00 per acre per season. Once the puffer and programming units are purchased, they are guaranteed for at least five years, so annual cost for a 40-acre or less block is reduced to \$160.00 per year plus hanging, checking and removing. As acreage increases, the number of units per acre decreases, making the system most cost effective for areawide programs where growers share up front and ongoing program expenses and benefit from reduced per acre costs. In 2000, the 820 acre project in Kelseyville used 1.13 units per acre. Also, as the total number of units purchased increases, the manufacturer will be able to purchase pheromone at a cheaper price, thus reducing the cost of a filled cannister.

Summary and Conclusions

The UC Shorey “puffer”, now sold as the Paramount Aerosol Pheromone Dispenser*, was utilized to control codling moth in an areawide demonstration project in Kelseyville, Lake County. The project was an expansion of an industry-funded one initiated by Dr. Harry Shorey and the current Principal Investigator in 1996. The original 163 acres are now in their fifth year. An additional 337 acres were added in 1999, which expanded to the current 820 acres in 2000.

Acreage added in 2000 was almost all on the upwind south and west edges, and along a bordering riparian corridor. It was expected these blocks would require supplemental OP treatments to reduce the incoming population and mitigate certain “edge effects”.

Puffers were hung at an average rate of 1.1 per acre (0.2 per acres fewer than in 1999), mainly around the perimeter of each block. Both codling moth and leafroller populations and damage were monitored throughout the growing season. Trap catch, egg laying, and damage data showed that:

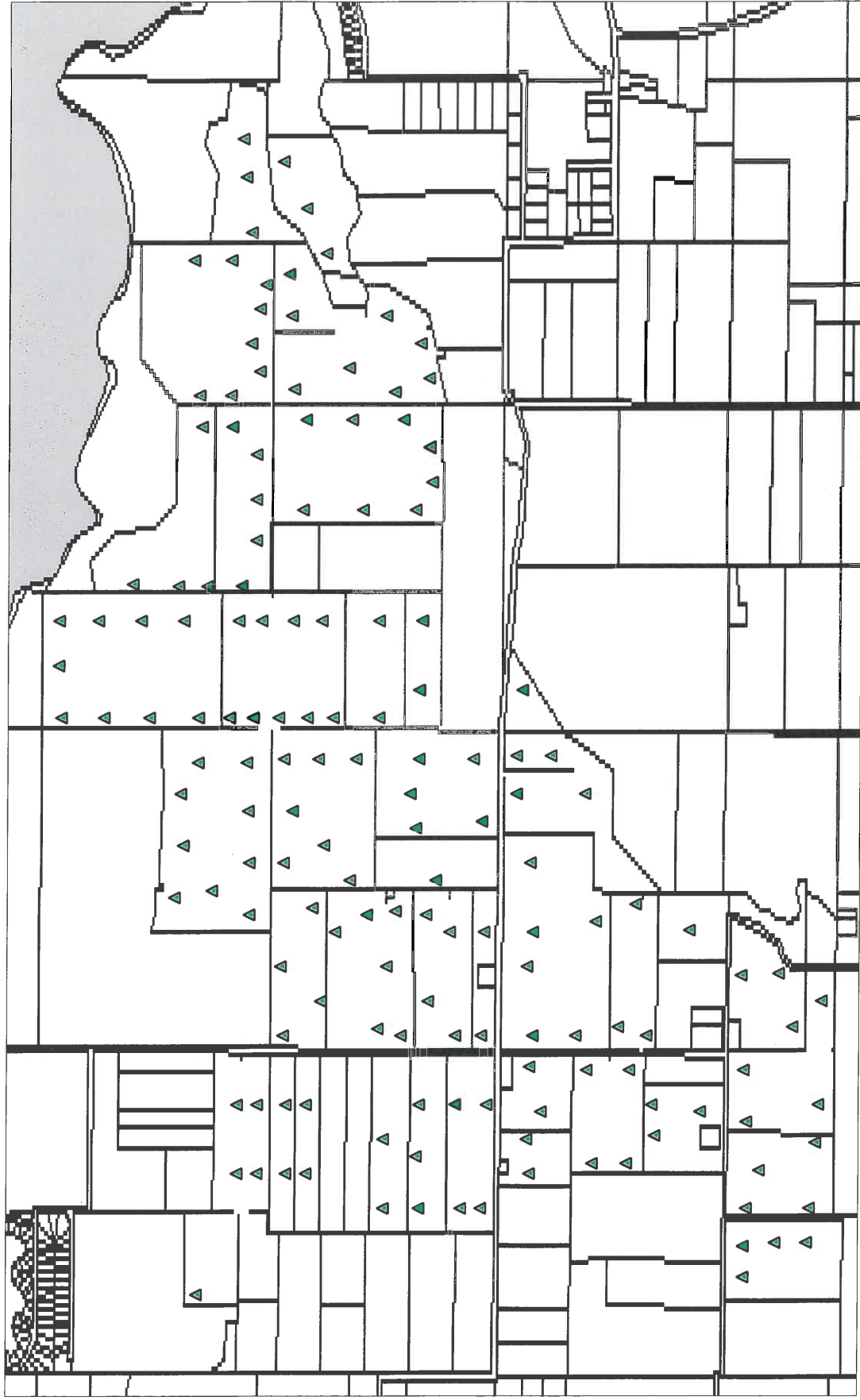
- 1) Codling moth pressure was much higher in 2000 than in 1998 or 1999, with higher overall trap catches and damage in all growing areas. Despite this, damage in the 37 puffer-treated project blocks was only 0.15%.

- 2) Virtually all damage occurred in first year, upwind blocks and mainly in rows bordered by either a) large open space or vineyard, b) less effective mating disruption programs, or c) in close proximity to backyard apple trees. Damage also occurred in proximity to a previously untreated control that had built up a high population, and along bordering riparian corridors.
- 3) Damage was reduced ten-fold in second year orchards and was zero in fifth year orchards, despite a complete lack of OP sprays for several years.
- 4) OBLR damage continues to be a noticeable secondary pest. Damage was worst, however, in first year orchards and those lacking a pre-bloom chlorpyrifos application. BT applied for the first summer generation hatch reduced final damage.
- 5) Other secondary pests such as stink bugs and San Jose scale were unproblematic and have failed to thus far increase appreciably. Early-season thrips damage was noticeable, though not economic. Pear psylla and spider mite damage was minimal in puffer-treated blocks despite the omission of the pre-harvest treatment required to control mites in standard-treated orchards.
- 6) Trap catch data indicated that 1XH catch gave the best correlation with the presence or absence of damage. 1XL catches were minimal except in the untreated controls and one high pressure puffer block. Presence of 10XH catches predicted damage in only half of the blocks where damage occurred, versus 70% for the 1XH traps. This contrasts with 1999 data in Potter Valley, Mendocino County, where damage was most closely correlated to 1XL catches.

Results after 2000 continue to be encouraging. As previous research and other demonstration projects have shown, however, mating disruption of any type is a multiple-year, multi-tactic strategy. In the Lake County project, one orchard required three years to reduce damage to zero and it is likely those with damage this year will need to receive at least one OP for the next one or two years. Growers must thus make a long-term commitment to the program, which often includes high initial costs required to reduce flight and subsequent damage. A plan to eliminate pressure from unfarmed apple and pear trees, especially upwind is becoming increasingly critical as mated females can fly 100 or more yards from an infested tree.

Figure II

Trap set locations



2000 LAKE COUNTY PUFFER PROJECT
1st Generation CM and OBLR Damage
Tree Fruit Samples - %/1000, Ground Fruit Samples - %/500

TREATMENT	Tree June 27-28, 2000			Ground July 18-25, 2000		
	CM 998 °D		OBLR 897 °D	CM 1314 - 1443 °D		OBLR 1335 - 1511 °D
	Eggs	Damage	Damage	Eggs	Damage	Damage
Average Puffer¹	0.06	0.04	0.26	0.1 ³	1.8 ³	1.6 ³
Grower Control²	0.0	0.0	0.0	0.0	0.0	0.0
Untreated Controls						
Quercus Seven Acres	3.3	3.8	1.0	8.4	50.4	0.8
Gold Dust (500 fruit)	0.6	27.8	1.6	**	**	**
Average Untreated Control	2.0	15.8	1.3	8.4	50.4	0.8

¹ 37 orchards

² 1 plot

³ 21 orchards

** no ground fruit

2000 LAKE COUNTY PUFFER PROJECT
Late 1st and 2nd Generation Codling Moth Damage

August 2 - 8, 2000, 1607 – 1722 °D

Table 2a:

Pre-harvest Tree Fruit Sample - %/2000

TREATMENT/BLOCK	TOP	BOTTOM	TOTAL
PUFFER			
North-west Area			
Hedgerow	0.0	0.0	0.0
Renfro	0.0	0.0	0.0
Pardee-Lake	0.0	0.0	0.0
Morrison	0.0	0.0	0.0
Akins	0.1	0.0	0.05
Pardee-home	0.2	0.1	0.15
South-west Area			
Colwell	1.9	1.2	1.55
Y/Stage	1.1	0.1	0.6
M/Twenty	1.9	3.5	2.7
E.A.T.	0.0	0.0	0.0
Rohner Home	0.0	0.0	0.0
Old Rickabaugh	0.0	0.0	0.0
Lone Pine	0.0	0.0	0.0
M/Brown	3.3	2.4	2.85
Murphy	3.6	2.9	3.25
Mid Area			
S/Stage	0.0	0.0	0.0
30 Acres	0.0	0.0	0.0
S/Timothy	0.0	0.0	0.0
M/Timothy	0.1	0.0	0.05
K-48	0.0	0.0	0.0
Cole	0.0	0.0	0.0
Sanderson	0.0	0.0	0.0
Cookson	0.0	0.0	0.0
Eutenier (%/1000)	0.0	0.0	0.0
R/Brown	0.0	0.0	0.0
East Area Downwind			
Young West	0.0	0.0	0.0
Sixty	0.0	0.0	0.0
Fourteen	0.0	0.0	0.0
Trailers	0.0	0.0	0.0
Triangle (%/1000)	0.0	0.0	0.0
Young East	**	**	**
Quercus 20	0.0	0.0	0.0
Wide	0.0	0.0	0.0
Neck	0.0	0.0	0.0
Gaddy	0.0	0.0	0.0
BP Gaddy	0.0	0.0	0.0
Manning	0.0	0.0	0.0
AVERAGE PUFFER	0.3	0.3	0.3
GROWER CONTROL			
Springer	0.0	0.0	0.0
UNTREATED CONTROL			
Quercus/Seven Acres (%/1000)	33.6	9.2	21.4
Gold Dust (%/1000)	-	-	63.2
AVERAGE UNTREATED	33.6	9.2	42.3

** no sample

2000 LAKE COUNTY PUFFER PROJECT
Oblique-banded Leafroller Damage
August 2-8, 2000, 1727 – 1881 °D
Pre-harvest Tree Fruit Sample - %/2000

Table 3b:

PROJECT YEAR/BLOCK	TOP	BOTTOM	TOTAL
FIRST YEAR ORCHARDS			
Colwell	0.2	0.0	0.1
Y/Stage	0.0	0.0	0.0
M/Twenty	0.7	1.0	0.85
E.A.T.	0.0	0.2	0.1
Rohner Home	0.0	0.0	0.0
Old Rickabaugh	0.0	0.0	0.0
Lone Pine	0.0	0.0	0.0
M/Brown	0.5	0.0	0.25
Murphy	0.3	0.6	0.5
Young East	**	**	**
Quercus 20	0.0	0.0	0.0
Wide	0.0	0.0	0.0
Neck	0.0	0.1	0.05
Gaddy	0.0	0.0	0.0
BP Gaddy	0.0	0.0	0.0
Manning	0.0	0.0	0.0
AVERAGE FIRST YEAR	0.11	0.13	0.12
SECOND YEAR ORCHARDS			
Hedgerow	0.0	0.2	0.1
Renfro	0.3	0.9	0.6
Pardee-Lake	0.0	0.0	0.0
Morrison	1.0	0.5	0.8
Akins	1.1	0.2	0.7
Pardee-home	0.6	0.0	0.3
S/Stage	0.2	0.1	0.15
30 Acres	0.2	0.0	0.1
K-48	0.0	0.0	0.0
Cole	0.0	0.0	0.0
R/Brown	0.2	0.6	0.4
Young West	0.2	0.6	0.4
Sixty	0.0	0.0	0.0
Fourteen	0.0	0.0	0.0
Trailers	0.0	0.0	0.0
Triangle (%/1000)	0.0	0.0	0.0
AVERAGE SECOND YEAR	0.24	0.19	0.22
FIFTH YEAR ORCHARDS			
S/Timothy	0.0	0.0	0.0
M/Timothy	0.3	0.4	0.35
Sanderson	0.0	0.0	0.0
Cookson	0.2	0.1	0.15
Eutenier (%/1000)	0.6	0.4	0.5
AVERAGE FIFTH YEAR	0.22	0.18	0.20

Table 6a: 2000 LAKE COUNTY PUFFER PROJECT - Weekly 1XL Trap Catch Summary

(Blank areas indicate zeros)

Date	Orchard Name	Hanson	K-7	Y/Stage	Grand Total
4/4/00	Gold Dust	1	0		1
4/6/00	0	0	0		0
4/11/00	1	0	0	0	1
4/18/00	1	0	1	0	2
4/25/00	0	0	0	0	0
5/2/00	3	0	0	0	3
5/9/00	4	0	0	1	5
5/16/00	0	0	0	0	0
5/23/00	12	0	0	0	12
5/30/00	0	0	0	0	0
6/6/00	1	0	0	0	1
6/13/00	0		0	0	0
6/20/00	4		0	0	4
6/27/00	0		0	0	0
7/4/00	1		0	0	1
7/11/00	2		0	0	2
7/18/00	0		0	0	0
7/25/00	0		0	0	0
8/1/00	1		0	0	1
8/8/00	3		0	0	3
8/15/00	0		0	0	0
8/22/00	7		1	0	8
8/29/00	1		0	0	1
9/5/00	1		0	0	1
9/12/00	0		0	0	0
Grand Total	42	1	2	1	46

Table 6b: LAKE COUNTY PUFFER PROJECT – Weekly 1XH Trap Catch Summary

Orchard Name	Date																										Grand Total
	4/11	4/18	4/25	5/2	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	8/15	8/22	8/29	9/5	9/12				
30 Acres	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Akins	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
BP Gaddy	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Cole	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1		
Colwell	0	0	2	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7		
Cookson	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
E.A.T. Rickabaugh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1		
Eutenier Home	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
Fourteen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Gaddy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Gold Dust	2	3	1	3	10	1	4	0	0	4	3	1	0	0	0	0	0	1	0	0	1	3	1	1	39		
Hanson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Hedgerow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
K48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
K-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	8	0	0	0	11		
Lone Pine	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
M/Brown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
M/Timothy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
M/Twenty	0	0	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6		
Manning	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Morrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Murphy	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0		
Neck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	11		
Old Rickabaugh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Pardee-Home	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1		
Pardee-Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2		
Q/Twenty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
R/Brown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Renfro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Rohner Home	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
S/Stage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2		
S/Timothy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Sanderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Sixty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Springer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Trailers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Triangle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Wide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Y/Stage	0	0	0	0	3	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Young East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	6		
Young West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Grand Total	2	4	4	3	24	1	4	1	0	8	3	1	0	0	8	1	1	1	0	0	19	4	1	1	90		

TABLE 6c: 2000 LAKE COUNTY PUFFER PROJECT - Weekly 10XH Trap Catch Summary

Weekly 10x10 Trap Catch Summary																									
Sum Of 10x Catches			Date																				Grand Total		
Orchard Name	4/11	4/18	4/25	5/2	5/9	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	8/15	8/22	8/29	9/5	9/12		
30 Acres	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	
Akins	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
BP Gaddy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cole	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Colwell	0	0	0	0	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	
Cookson	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	5	
EAT Rickabaugh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	
Eutenier Home	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	
Fourteen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gaddy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gold Dust	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hanson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hedgerow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	
K48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
K-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Lone Pine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
M/Brown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
M/Timothy	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
M/Twenty	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Manning	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	7	
Morrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
Murphy	0	0	0	0	0	0	0	0	0	1	3	0	0	0	3	0	0	0	0	0	5	0	0	12	
Neck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Old Rickabaugh	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	
Pardee-Home	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	4	0	0	6	
Pardee-Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	0	0	0	7	
Q/Twenty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	
R/Brown	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Renfro	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
Rohner Home	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	3	0	0	0	4	
S/Stage	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	
S/Timothy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sanderson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	
Sixty	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Springer	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trailers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Triangle	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Wide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Y/Stage	0	0	0	1	1	0	0	0	0	3	0	0	0	0	0	2	0	0	0	0	1	0	0	0	8
Young East	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Young West	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Grand Total	1	0	0	2	5	0	0	0	0	13	7	3	0	1	13	4	1	0	0	24	1	0	0	75	

Table 6d: 2000 LAKE COUNTY PUFFER PROJECT - Weekly OBLR Trap Catches

Orchard Name	5/16	5/23	5/30	6/6	6/13	6/20	6/27	7/4	7/11	7/18	7/25	8/1	8/8	8/15	8/22	8/29	9/5	9/12	Grand Total
30 Acres	0	3	21	5	4	2	1	0	1	0	0	3	1	0	1	0	2	3	47
Akins	0	11	20	16	13	12	6	0	0	0	0	0	2	3	8	0	0	0	91
BP Gaddy	0	7	24	12	18	60	51	8	1	4	7	22	10	3	6	4	0	0	237
Cole	0	2	24	4	13	3	3	2	0	0	1	1	2	1	5	1	2	0	64
Colwell	0	11	15	5	15	0	0	0	0	0	0	0	0	4	0	2	0	1	53
Cookson	0	4	29	22	8	19	25	10	0	1	3	1	5	11	16	1	2	2	159
E.A.T. Rickabaugh	0	0	8	7	7	6	3	1	0	0	0	1	1	0	3	2	1	0	40
Eutenier Home	0	2	19	6	0	6	2	3	0	0	0	0	0	0	0	1	0	0	39
Fourteen	0	0	2	4	0	0	3	0	0	0	0	3	1	0	4	2	0	0	19
Gaddy	0	24	35	43	45	100	79	17	7	9	5	11	16	1	43	11	1	7	454
Hedgerow	0	5	16	22	18	21	10	4	1	1	1	8	9	5	24	6	0	0	151
K48	0	0	5	8	7	0	0	0	0	2	0	4	9	12	12	4	5	1	69
K-7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lone Pine	0	8	22	4	13	13	2	4	1	1	0	3	1	7	3	1	0	0	83
M/Brown	0	3	8	0	0	0	6	2	1	0	0	0	0	2	1	0	0	0	23
M/Timothy	0	14	11	7	0	6	7	0	0	1	0	0	4	0	6	0	0	0	56
M/Twenty	0	20	31	2	20	11	1	4	2	0	1	6	3	2	14	6	4	7	134
Manning	0	7	17	15	18	42	23	21	1	1	2	1	11	2	13	6	0	8	188
Morrison	0	3	12	7	9	9	0	0	0	1	0	2	0	4	3	0	1	0	51
Murphy	0	12	58	48	36	62	58	23	4	2	3	3	7	2	1	1	5	1	326
Neck	0	36	91	25	87	76	41	6	4	3	2	13	23	8	10	5	2	2	434
Old Rickabaugh	0	5	6	4	7	5	3	2	0	1	1	1	3	5	2	6	0	3	54
Pardee-Home	0	19	24	38	18	5	4	2	0	1	0	1	0	2	1	0	2	2	119
Pardee-Lake	0	6	14	1	3	3	1	2	0	1	1	2	0	1	0	4	3	0	42
Q/Twenty	0	3	15	9	7	7	13	0	0	0	1	5	11	8	10	0	0	1	90
R/Brown	0	3	20	18	17	23	12	9	1	0	0	0	5	4	0	1	1	2	116
Renfro	0	4	6	6	5	5	2	0	0	1	0	1	4	2	2	0	0	0	38
Rohner Home	0	8	26	10	3	22	23	8	1	0	1	0	10	11	7	6	0	0	136
S/Stage	0	0	11	5	3	0	0	2	0	0	0	0	4	0	4	1	4	2	36
S/Timothy	0	0	4	0	0	2	0	0	0	0	0	0	0	0	3	2	0	0	11
Sanderson	0	0	2	2	4	4	5	0	3	0	0	1	3	0	3	0	0	0	27
Sixty	0	0	21	6	5	1	4	1	1	0	0	2	7	10	28	0	0	1	87
Springer	0	0	7	4	2	8	1	4	1	0	0	15	8	7	0	0	0	6	63
Trailers	0	0	8	4	1	1	1	0	0	2	1	2	8	5	9	2	0	0	44
Triangle	0	0	1	0	0	0	2	0	0	0	0	0	0	0	1	0	1	0	5
Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wide	0	9	22	31	24	35	17	11	3	5	6	12	13	9	23	8	3	3	234
Y/Stage	0	5	13	12	14	11	3	2	0	0	0	0	3	5	4	4	2	3	81
Young East	0	0	1	6	2	1	4	0	1	0	1	6	7	0	3	0	1	4	37
Young West	0	0	11	2	2	5	7	0	0	0	1	9	9	2	10	7	0	1	66
Grand Total	0	234	680	420	448	586	423	148	34	37	38	139	200	138	283	94	42	60	4004