Almond Board of California
Annual Report
March 1996

Project No.: 95-BF4- Almond Culture and Orchard Management

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Objectives:

1. To compare the benefits of various covercrops, and to determine the adaptability of each to almond orchards. Comparisons of soil fertility, organic matter content, and biological activity will be made.

2. To compare two types of drip irrigation systems (above ground and buried) in a 6-year-old almond orchard and to determine the effects of irrigation strategies on hull rot which has become a problem in this orchard. An additional objective is to study the effect of high boron levels on nut removal at harvest. Preliminary data suggests excess boron may cause increased mummies at harvest.

3. To determine the influence of shaker damage to tree trunks on productivity and its impact on hull split and insect damage in young trees. The information from this project will not only help evaluate the productive life of damaged orchards but will also help in the management of insect pests.

4. To evaluate training methods and to develop pruning systems to maintain the productivity of almonds in tightly spaced hedgerows.

5. To evaluate temporary tree removal in double planted orchards by comparing three treatments: 1) maintaining hedgerow indefinitely; 2) gradual removal of temporary trees with thinning cuts; and 3) heavy whisking of temporary trees with chain saws.

6. To compare six late blooming almond varieties (Butte, Padre, Carrion, Livingston and selections 2-19E and 2-43W) in a replicated test plot. To evaluate three training/pruning treatments on these six varieties: 1) minimal pruning, 2) intermediate pruning and 3) long pruning.

7. To determine if *Monilinia laxa* is developing fungicide resistance in Madera County or if disease outbreaks are due to inadequate fungicide coverage.

Procedures, Results and Discussion: See Attached

ALMOND BOARD OF CALIFORNIA 1995 ANNUAL REPORT AND FINAL REPORT

DATE: MARCH 18, 1996

?ROJECT TITLE: **SOIL-BUILDING WITH COVER CROPS IN CALIFORNIA ALMOND ORCHARDS**

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METHODS AND ACTIVITIES:

A cover crop trial comparing ten cover crop mixes was planted November 9, 1992 at Arnold Farms on Cressey Way, Atwater. Each plot is 2 middles wide by 14 trees long, replicated twice, with the Nonpareil row in the center. Comparisons were also being made in 5 orchards with established cover crops in 1993 and 1994.

The following cover crops were compared at Arnold's:

> Annual grasses: Blando brome, Zorro fesque
>
> Annual legumes: Cahaba white vetch, sub clover mix, Rose clover, non-til clover, bur medic, annual clover mix
>
> Mixed species: resident vegetation, Beneficial Blend, Insectary Mix

Measurements have been made for organic matter (OM) in April and July in 1995. The April samples are listed in Table 1. The cover crop and trees were surveyed periodically for insect, mite and spider activity. Both PTB and NOW traps were maintained to monitor these pests. Cover crop height was measured periodically, and mowings were recorded for each cover.

Tours were held April 21, 27, and May 5, 1993, on April 15, 1994 and April 10, 1995 for growers, researchers, and farm advisors.

RESULTS AND DISCUSSION:

Samples show moderate OM levels for all cover crop species in the planted cover crop trial. See Table 1. The resident vegetation had a higher OM level than the Beneficial Blend and the Insectary Mix in 1995. Both the two mixes and the resident vegetation have a wide variety of plant species which grow over a long time period. The resident vegetation which has been established many years, has consistently had the highest OM level in the Arnold orchard. The Blando brome and Zorro fesque continued to have low OM levels. There is not a distinct difference in OM levels between the covers, and it takes years of intensive cover cropping to raise the OM levels appreciably.

The cover crop and trees were surveyed periodically for insect, mite and spider activity. The numbers of ladybird beetles were moderate to high during April and May. The numbers of beneficial, parasitic wasps are highly variable, but appear to be in lower numbers in the resident vegetation and higher in the planted covers, especially those with a good mixture of species. These plots are too small to isolate the beneficial insects to one plot.

Table 2 lists the numbers of earthworms per counting ring in 1993-1995. High earthworm numbers indicate good soil health and viability. In past years the highest numbers of earthworms were the Glenn and Ron Anderson orchards and in the Eck orchard. Moderate numbers were found in the Lashbrook orchard and they increased later in the summer. Few earthworms have been found in the Takhar orchard even though he has used a BIOS mix for several years. No earthworms have been found in the Arnold Farms. This orchard was "seeded" with earthworms from the Ray Eck orchard in mid-April 1994, but this was not successful.

CONCLUSIONS:

The highest soil organic matter averages over several years have been in the long-established vetch covers in the Ray Eck and Glenn Anderson orchards and in the resident vegetation in the Ron Anderson orchard. These orchards also have the top earthworm counts. In the Arnold Farms block, the highest OM levels are in the established resident vegetation, the Beneficial Blend and the Insectary mix. The lowest OM levels are in the annual grass plots; Blando brome and Zorro fesque. In the five established orchards, the OM levels are very high for sandy soils in the Central Valley. There is not a distinct difference in OM levels between the covers, and it takes years of intensive cover cropping to raise the OM levels appreciably.

Ladybird beetle numbers are highest in dense, diverse covers such as the Beneficial Blend, the Insectary mix, vetches and clovers. These are covers in which plentiful supplies of prey insects flourish. Numbers were low in the resident vegetation, Blando brome, Zorro fesque, and in the poor stand of bur medic which support fewer prey insects. The numbers of beneficial, parasitic wasps are highly variable, but appear to be in lower numbers in the resident vegetation and higher in the planted covers. These plots are too small to isolate the beneficial insects to one plot.

High earthworm numbers indicate good soil health and viability. The highest numbers of earthworms in past years were the Glenn and Ron Anderson orchards and in the Eck orchard where soil organic matter levels are high. It appears to take many years with high levels of OM inputs to establish a good population of earthworms.

A planted cover is a good tool to establish diverse plant populations to attract and promote beneficials, and the legume covers can provide abundant organic matter which will rapidly decompose before harvest. Even a diverse, luxuriant resident cover can be very satisfactory.

Table 1. Average seasonal organic matter in surface six inches.

ORGANIC MATTER MEASUREMENTS-INNOVATIVE GROWERS

GROWER, LOCATION, CULTURE	ORGANIC MATTER CONTENT 1993	1994
GA, HILMAR, VETCH, ORGANIC	1.46	1.44
RA, HILMAR, RES VEG, STANDARD	1.53	1.61
RE, HILMAR, VETCH+CLOVER, ORGANIC	1.46	1.18
PC, ATWATER, VETCH+CLOV, ORGANIC	0.96	0.89
TT, HILMAR, VETCH+CLOV, STANDARD	0.96	0.93

ARNOLD FARMS, TEST BLOCK	1993	1994	1995
RESIDENT VEGETATION	1.10	0.88	0.92
BENEFICIAL BLEND	0.80	0.65	0.75
INSECTARY MIX	0.86	0.71	0.95
CAHABA WHITE VETCH	0.71	0.61	0.67
ZORRO FESQUE	0.62	0.53	0.68
NONTILLAGE CLOVER MIX	0.67	0.62	0.75
BLANDO BROME	0.65	0.53	0.57
BUR MEDIC (POOR STAND 1993)	0.68	0.59	0.66
SUBCLOVER MIX	0.55	0.61	0.76
ANNUAL CLOVER MIX	0.61	0.53	0.67
ROSE CLOVER	0.54	0.63	0.69
CLEAN TREE STRIPS	0.54	0.32	--

Table 2. Earthworm counts per ring.

GROWER	1993 DATE 5/15	6/7	7/12	1994 DATE 4/25	5/9	1995 5/2
GA HILMAR VETCH	9	15	8	6	12	-
RA HILMAR RESIDENT VEGETATION	2	8	9	20	14	-
RE HILMAR VETCH + CLOVER	6	IRRIG	14	23	12	-
PC ATWATER VETCH+CLOVER	0	6	0	2	4	1.4
TT HILMAR RESIDENT+ CLOVER	0	0	0	0.7	0.3	-
COVER CROP TEST ATWATER SAND	0	0	0	0	0	0

COMPARISON OF ALMOND TREE GROWTH, PRODUCTION AND HULL ROT UNDER VARIOUS DRIP IRRIGATION MANAGEMENT

Wilbur Reil, Yolo/Solano Farm Advisor

Objectives

Farmers continue to strive to improve irrigation efficiency because of both the increasing cost of water and power and the availability of only limited amounts of water. Drip irrigation is increasingly becoming popular. Most drip systems use single hoses with 4 to 6 point sources for water emission. Also, buried drip irrigation systems are now being suggested and limitedly used with perhaps even higher efficiency. This trial is designed to compare two types of drip irrigation systems (above ground and buried) in a uniform almond orchard. Hull rot has also become a problem in this same orchard so water management will also be evaluated during July-August. In Yolo County, boron is present in excess quantities in the irrigation water. Observations show that nuts are hard to knock with many nuts remaining after shaking.

Plans and Procedures

Three irrigation systems were installed in a 6 year-old almond orchard on the Nonpareil rows (every other row)in 1992. The systems are (1) above ground drip of a single hose designed to apply 100% ET until first hull split then be reduced to 50% ET for one to four weeks; (2) buried drip with a hose buried on each side of the tree 5 feet from the tree row and 12 inches deep to apply the same amount of water as treatment 1; and (3) an above ground drip to apply the same water as 1 and 2 until early hull split, then apply twice the water or 100% ET of the other two systems. Additionally, extra boron was added in 1993 to three trees of four different varieties to determine its effect on number of mummies left after harvest. A total of 1.9 pounds solubor was applied per tree under the emitters. Counts were made at harvest on the number of nuts remaining on trees after harvest and the number of dead shoots per tree killed by hull rot.

Results

Data for 1992 was primarily to get the system up and running and to obtain preliminary hull rot data. While treatment 1 and 2 are applying the same amount of water the buried drip system has no surface moisture and no evaporation, therefore, more of the water is available to the tree than in treatment 1 and it is estimated at approximately 60 to 65% ET rather than 50%.

Table 1 shows the results of reduced water applications in July on nuts remaining of the tree after shaking and the number of nuts killed by hull rot.

Table 1. Evaluation of Nonpareil nuts remaining on tree after shaking under three irrigation management systems. The same quantity of water was applied to trees until 1% hull split when different rates were then applied.

Type System: Irrig. Rate: Year	Surface 100% ET	Surface 50%* ET	Buried 50%* ET
1995	280	99	91
1994	312	63	44
1993	118	28	16
1992	683	282	205

*For at least 2 weeks at early hull split.

Table 2. Nonpareil Shoots killed by hull rot under three drip irrigation management systems at early hull split. The same quantity of water was applied to trees until 1% hull split when different rates were then applied.

Type System:	Surface	Surface	Buried
Irrig. Rate:	100% ET	50% ET	50% ET
Year			
1995	12.7	5.2	2.3
1994	8.2	1.7	0.9
1993	3.6	0.5	0.5
1992	12.2	0	1.8

Table 3 shows the number of nuts remaining after shaking in the trial where additional boron was added (+ Boron) compared to no additional boron (- Boron). The irrigation water does contain over 1 ppm boron. While higher than desirable this was not considered to be a problem on almonds. The almond trees are planted on Nemaguard rootstock.

Table 3. Almond nuts left on tree after shaking in 1993, 1994 and 1995. Added boron (+B) was only applied in 1993 compared to no additional boron (-B).

	1993		1994		1995	
	+B	-B	+B	-B	+B	-B
Nonpareil	604	29	575	42	179	83
Price	226	84	244	37	83	42
Butte	295	180	540	198	-	-
Padre	465	110	518	85	-	-
Average	498	101	469	91	-	-

The results show that adding boron caused a major increase in nuts left on the trees after shaking in all four varieties tested. No excess gum was visible on the attachment on hull and nut to the peduncle. The average of all four varieties was 498 with the high boron compared to 101 with no added boron or a 4.9 fold or 490% increase in 1993. The same trees without adding any additional boron averaged 469 with high boron compared to 91 with no added boron or a 5.2 fold or 515% increase in 1994. In 1995 only the Nonpareil and Price trees were counted. An approximate 2 fold difference in nut of nut retention due to the earlier higher boron was observed.

Conclusions:

These data suggest reduced moisture in the tree during the hull split period may reduce the incidence of hull rot and improve nut removal at harvest. Both the above ground drip that had the water reduced to 50% ET at early hull split and the buried drip that also had the amount of water reduced in half had less nuts remaining on the tree after shaking than the trees maintained at 100% ET. Trees under adequate or luxurious moisture status such as the 100% ET during hull split had a higher amount of hull rot in all years. While the soil surface was wet around individual drippers in this system it was run only the same length of time as the other two systems with twice the number of emitters. The surface was wet approximately the same length of time as the 50% ET treatment. The humidity in the tree canopy was low in all systems suggesting that humidity may not affect hull rot whereas the moisture status within the tree itself may be the cause.

The higher number of nuts left on the tree after shaking in the system receiving 100% ET throughout hull split also suggests that nut abscission may be enhanced by some stress during the maturation process. Some moisture is needed to stimulate hull split but perhaps intermediate or approximately 50% ET may provide sufficient moisture for proper hull split while enhancing nut removal.

Adding boron to an excess level caused a major increase in the nuts left on the trees after shaking in the four varieties. There was approximately a 500% increase in nuts left on trees with added boron when compared to trees not receiving additional boron. Excess boron appears to increase the number of nuts remaining on trees after shaking. The effect of the added Boron applied in 1993 was still present after two years although the difference was not as severe as previously shown.

These data suggest that perhaps tree water status at early hull split and excess boron may both cause nuts to be harder to shake from the tree.

TRUNK DAMAGE ON YOUNG ALMOND TREES

March 26, 1996

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PROBLEMS AND OBJECTIVES: Trunk damage is a common problem in Kern County Almond Orchards. Most orchards will have some trees that have been damage at the time of harvest. The age is not a factor. Trunk damage exist in young and old orchards. Trunk damage on young trees take place at the time of the first harvest by a mechanical shaker. This is done when the tree is four years old.

To study the effect of bark damage on young trees, a five year old orchard was selected in 1994 who's trees have been bark damaged in the 1993 harvest season. The trees were treated immediately after the injury with tree seal. This treatment was repeated in late fall and early spring.

The objectives were the following: 1) to determine the amount of bark damage, 2) to determine the effect of damage on hullsplit, 3) to determine the amount of healing of the damage area in subsequent years, 4) to determine Ceratocystis canker infection, 5) and to determine true mortality.

Results:

Amount of Trunk Damage. **Table 1**. Shows trunk circumference, percent of damage bark and the percent of undamaged bark. The amount of damaged bark varies from 19 to 56 percent. This means that not every tree gets damaged the same amount.

Hullsplit Development. To evaluate hullsplit development, weekly nut samples were taken from damaged and undamaged trees. The average amount of tree trunk damage was 81% which healed with new back later on. By the spring of 1994, 21% of the damage area had new bark and by the spring of 1995, 38% of the area was healed over. In other words, the 81% bark damage in 1993 was reduced to 43% in 1995.

The effect of trunk damage on hullsplit can be seen on *Figure 1* and *3*. *Figure 1* shows hullsplit development in 1994. The onset of hullsplit on damage trees was two weeks earlier than the undamaged trees. Also, the amount of hullsplit from the damaged trees was greater than from the undamaged trees. However, there were bigger hullsplit differences in *Figure 1* than on *Figure 3*. The reason being that the trees have healed more on *Figure 3* than on *Figure 1*.

There were bigger differences on kernel weight between damaged and undamaged trees. The kernel weight (*Figure 2*) of the undamaged trees was bigger than the kernel weight of the damaged tree. However, these differences are not present in *Figure 4*. This again indicates that the trees have heal some of the damage area.

Healing of Damaged Area: One of the surprises of this study was the amount of healing on the damage area. **Table 1** shows the amount of healing on the damaged areas. The healing varies from 22% to 89%. The greater the damage, the greater the amount of healing.

Other Objectives: We also determine tree mortality due to bark damage. Even though the amount of bark damage varied from 19% to 56%, only 4% of the trees died as consequences of bark damage.

We also wanted to determine if trunk damage will lead to Ceratocystis infection. At this time, we don't see any evidence of infection.

DISCUSSION: The amount of bark damage due to shakers is variable on young almond trees. It varies from 19% to 56% and in some cases, it can be 81%. However, the worst effect of bark damage was tree death. In this study, we lost 4% of the trees. This is significant because it represents yield losses and replacement costs.

Bark damage influences hullsplit development. The onset of hullsplit is two weeks earlier on damaged trees than on undamaged trees. This has an impact on hullsplit sprays. If a hullsplit spray is timed at the onset of hullsplit of a normal tree, the nuts from a damaged tree would have been exposed to NOW for two weeks.

The most pleasant surprise was the evidence of new bark on the damaged area. We called it healing because of the new callous on the damage area. This callous tissue may have been the result of tree seal applications. The effect of tree seal on callous formation on damaged bark needs to be studied in replicated experiments.

Table 1. Tree size (trunk circumference) and the percent of bark damaged and undamaged by the trunk shaker. Also the amount of healing taking place in the damaged area.

CIRCUMFERENCE		**TRUNK CONDITION**		
Block	*(cm)*	*Damaged (%)*	*Undamaged (%)*	*Healing (%)*
A	59	56	44	89
B	60	46	54	60
C	62	31	69	63
D	55	19	81	22

Figure 1. Percent of hull split from damaged and undamaged trees (81% of the trunk circumference was damaged and no healing occured on 60% of the trunk circumference).

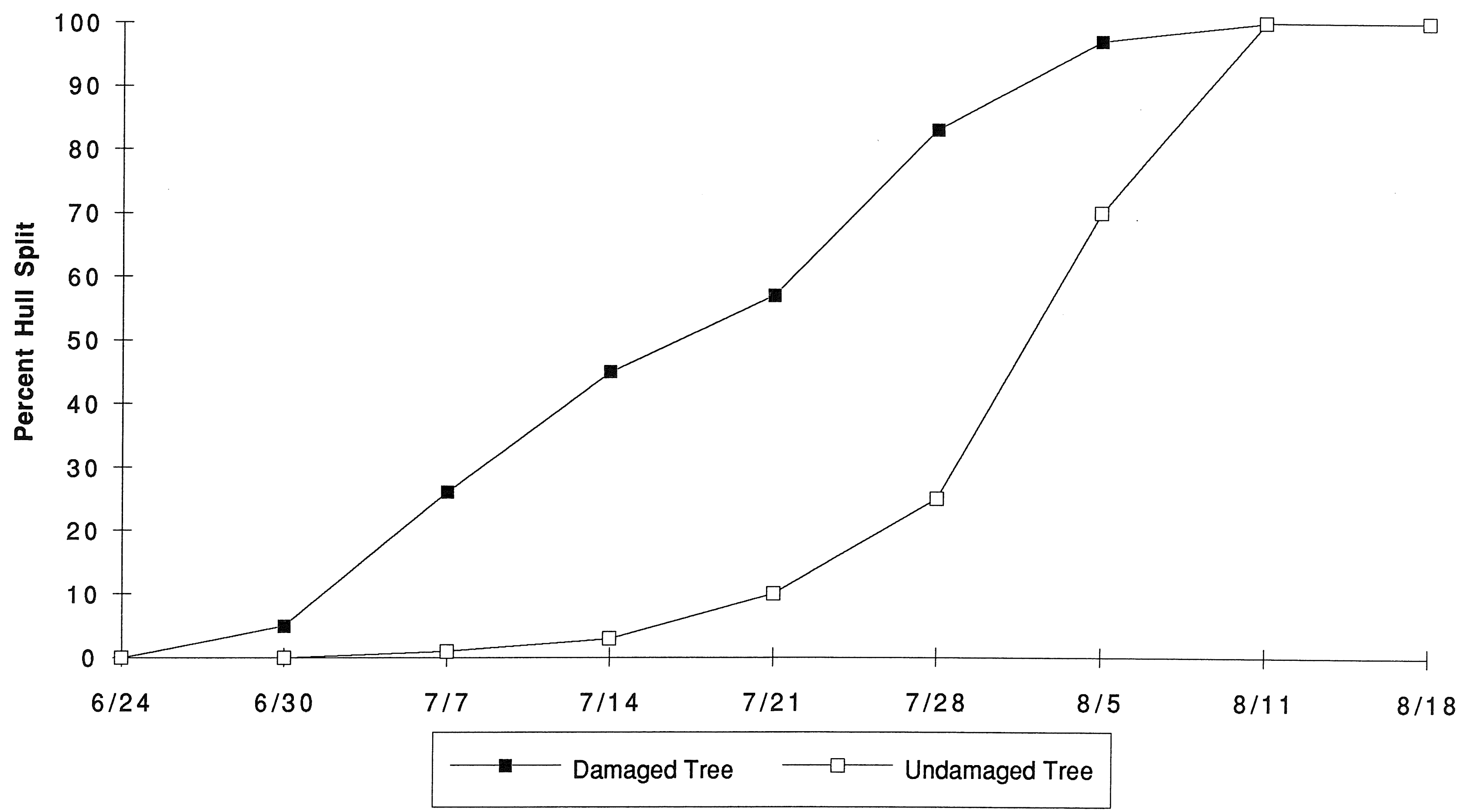


Figure 2. Kernel weight from damaged and undamaged trees (81% of the trunk circumference was damaged and no healing occured on 60% of the trunk circumference).

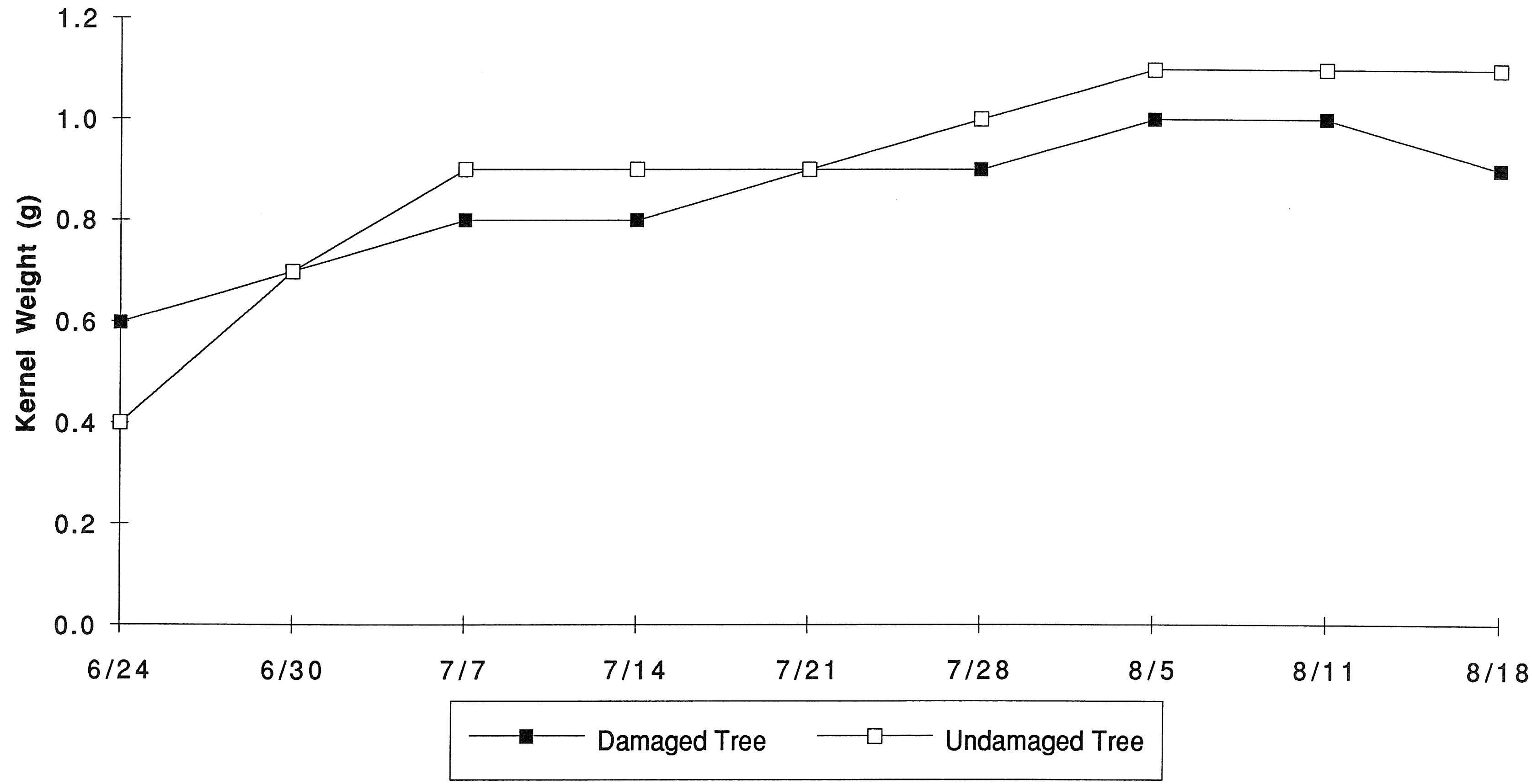


Figure 3. Percent of hull split from damaged and undamaged trees (43% of the trunk circumference was damaged and not healing).

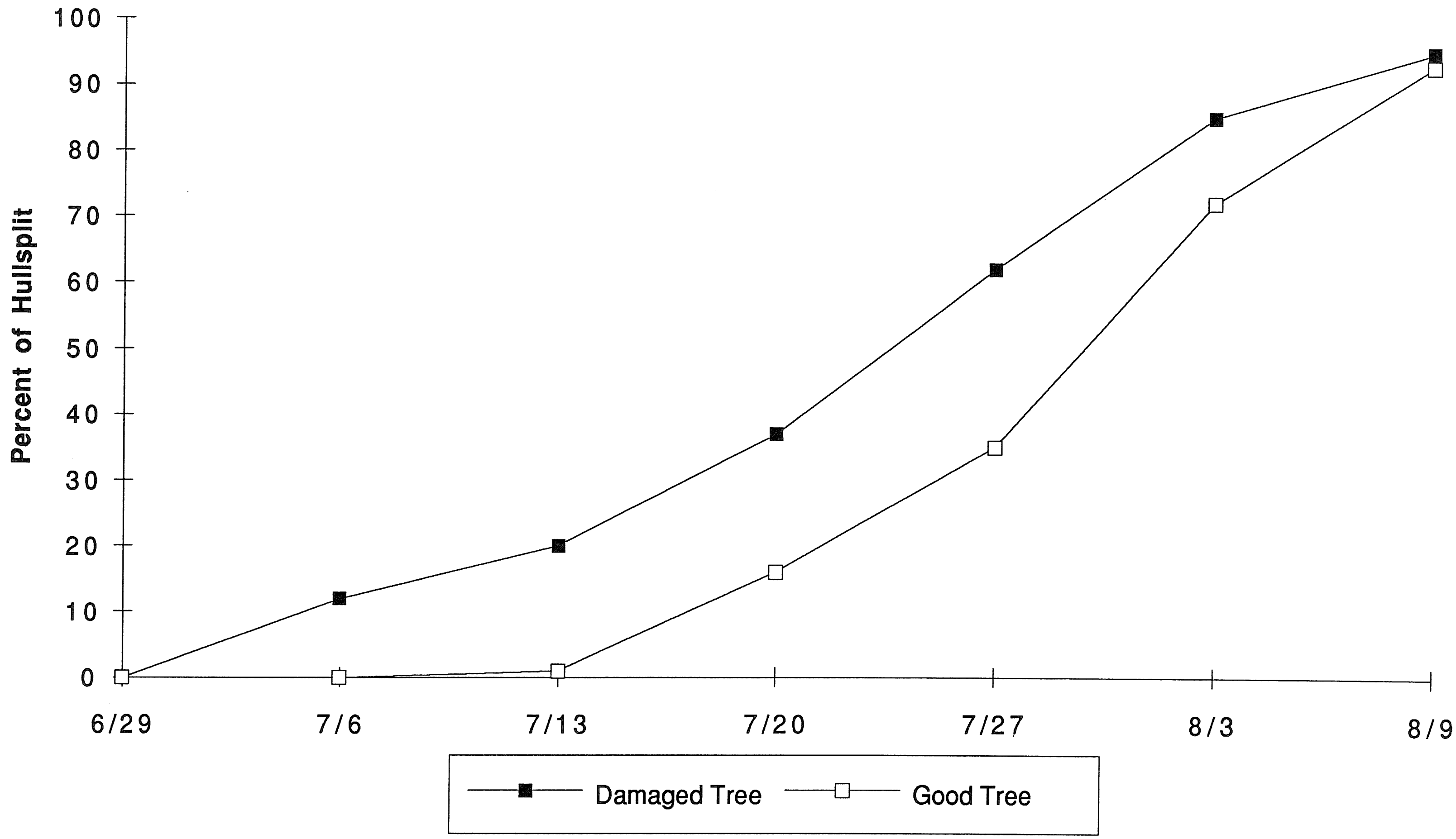
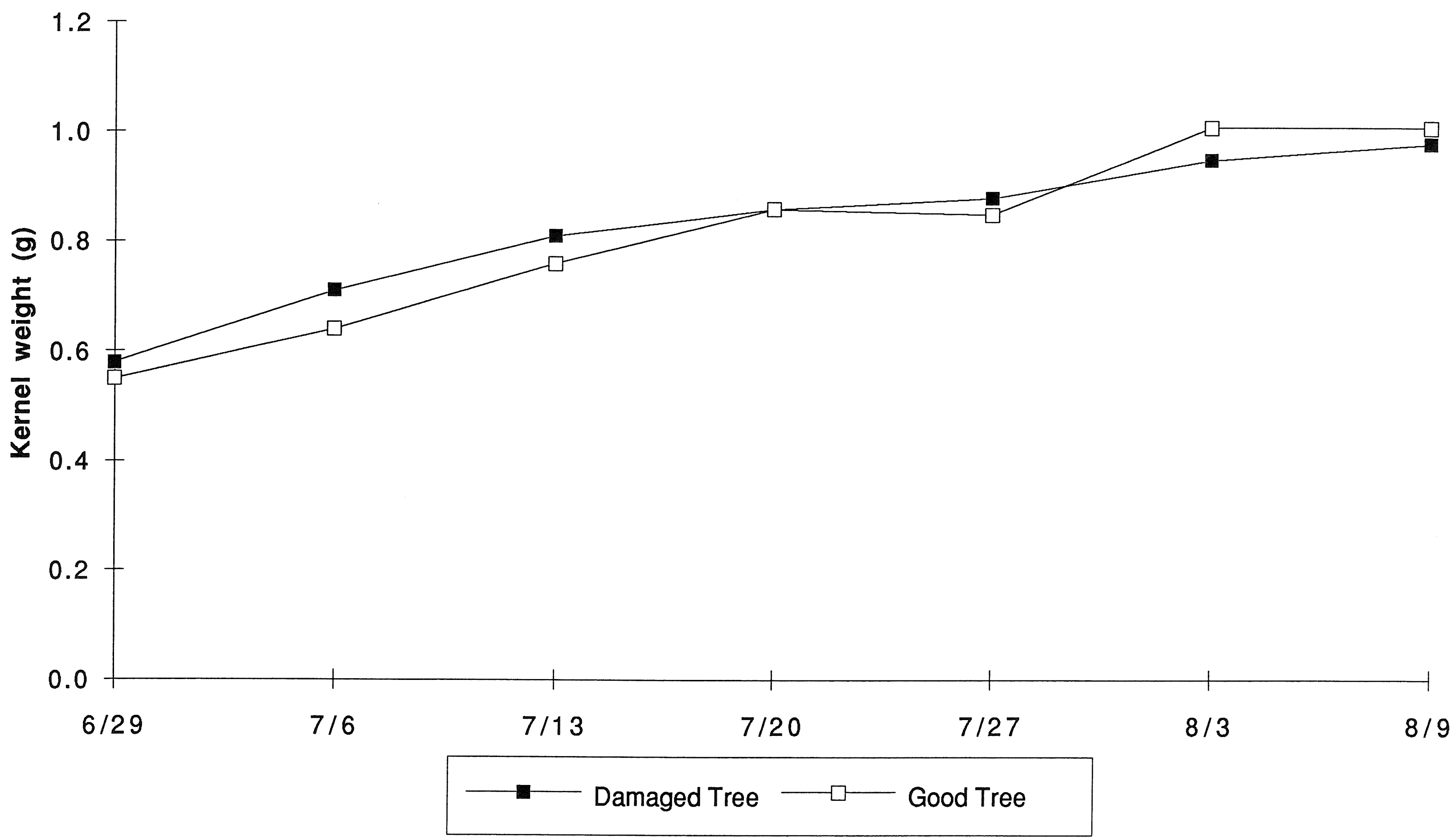


Figure 4. Kernel weight from damaged and undamaged trees (43% of the trunk circumference was damaged and not healing



SUSTAINING YIELDS IN HEDGEROW SYSTEMS

J. P. Edstrom, W. C. Micke, J. Yeager

In 1979, a Nonpareil - Price (at a 1:1 ratio) almond block was planted 7' x 22' (270 trees/acre) at the Nickels Soil Laboratory in Arbuckle, California. The following four training treatments were used for this plot:

1) <u>Temporary Hedge</u> - standard pruning for permanent trees, with temporary trees gradually whisked back and then removed after their 8th year (1986 - 87), leaving a 14' x 22' spacing.
2) <u>Permanent Hedge</u> - trained to three scaffolds, standard pruned and maintained at 7' x 22'.
3) <u>Two Scaffold Hedge</u> - a 7' x 22' hedge trained with two primary limbs growing out into the row middles and standard pruned.
4) <u>Unpruned Hedge</u> - a 7' x 22' hedge trained to three scaffolds and then essentially unpruned since.

In the past, we have reported on the yield reduction resulting from alternate tree removal in the temporary hedge. An accumulative loss of about 6,000 meat pounds/Ac have been lost since 1987 when alternate trees were pulled. However, accumulative yields are nearly equal for the three other treatments which have maintained the 7' x 22' hedgerow. Yields for the 1995 crop year were 1,297 lbs./Ac for Standard Hedge, 1,598 lbs./Ac for 2-Scaffold Hedge, 1,215 lbs./Ac for Unpruned Hedge, and 1,097 lbs./Ac for the Temporary Hedge treatment.

Again, the Unpruned Hedge continues to produce yields equal to trees receiving yearly pruning, despite the lack of fruitwood within 6' of the orchard floor. The dense shade resulting from lack of pruning has prevented flower bud formation and greatly reduced leaf development in the bottom of the trees. Surprisingly, shaker removal of Nonpareil crop from the tangled upper branches is acceptable. However, poling would be very difficult with such intertwined tertiary branches, especially for the Unpruned treatment.

Table 1. <u>Yields by Hedgerow System for 1987 - 95</u>

Kernel Pounds per Acre
Leaf/Year

Treatment	9th 1987	10th 1988	11th 1989	12th 1990	13th 1991	14th 1992	15th 1993	16th 1994	17th 1995	Accum.[1] 1984-95
2 Scaffold	2720	1498	2746	3470	2992	2079	1943	2835	1598	26,120
Unpruned	2474	1626	2870	3072	3036	2471	1804	2799	1215	25,304
Permanent	2149	1932	2680	3333	2254	2268	1189	2678	1297	24,414
Temporary	1472	1308	2046	2450	2576	1739	1280	2448	1079	20,285

1. Accumulative Yields Since Production began in 1984.

Removing Temporary Trees in Double Planted Orchards --Joseph Connell, Butte County (with Warren Micke and Jim Yeager)

Problem and Objectives:

When double planted trees crowd, extra trees are commonly thinned and then removed. Improving light penetration, renewing fruitwood, and maintaining the orchard's future productivity are reasons given for tree removal. The current objective in this trial is to evaluate temporary tree removal by comparing two treatments:

1. Maintaining a hedgerow indefinitely with standard pruning.
2. Removing temporary trees that had been whisked back by gradual thinning or by heavier chain saw cuts.

Methods:

Over the past seven years we have attempted to minimize crop loss following temporary tree removal by gradually phasing out the temporary trees. In 1995, the temporary trees were removed after harvest. We will determine the impact of the temporary tree removal on yield this coming season. In the future, we will determine if and when plots with trees removed will catch up to or exceed the yields of the crowded plots where the hedgerow is being maintained indefinitely. Ultimately, we expect to determine if "temporary" tree removal should be considered once an orchard has been double planted. The effect of tree removal on the size of remaining trees will also be assessed.

Results:

Results of the previous treatments are shown in the following table and figures. Cumulative yields for 7 years from 1989 through 1994 show no statistically significant differences between the three treatments on either variety (table 1).

Table 1.

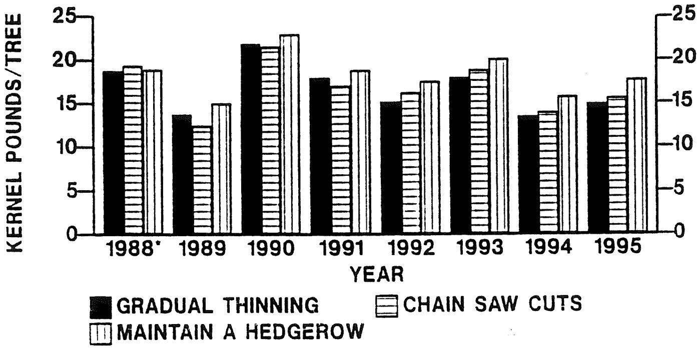
Treatment	7 years accum. yield lbs/tree	7 year average yield lbs/acre	% of #1	Tot lbs/acre lost to tree removal over 7 years
Butte				
1. Maintaining hedgerow	128.0a	2561	100	0
2. Gradual thinning	115.1a	2303	90	1805
3. Chain saw whisking	115.9a	2317	91	1702
Mission				
1. Maintaining hedgerow	92.5a	1850	100	0
2. Gradual thinning	87.4a	1749	95	707
3. Chain saw whisking	81.1a	1623	88	1590

kernel pounds/acre are calculated on the basis of 140 trees per acre.

Yield differences between treatments are not statistically significant at the 5% level, in Mission, cumulative yields are lower as the severity of pruning increases. For Butte, both methods of removing temporary trees resulted in similar numerical yield reductions. For both varieties, yields are numerically highest where we continue to maintain the double-planted hedgerow.

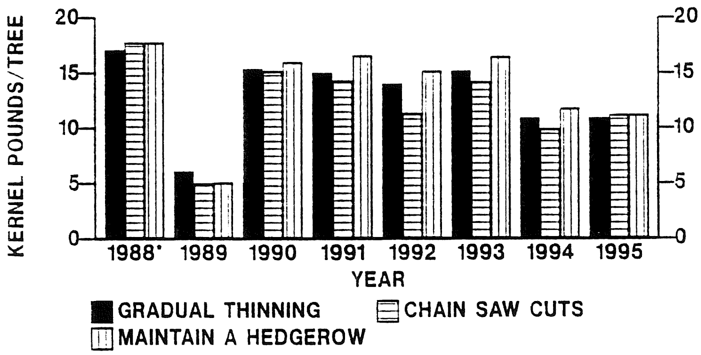
A yield summary of both the Butte and Mission varieties is shown in figures 1 and 2 respectively. Trend lines for cumulative yields are shown for Butte and Mission in figures 3 and 4 respectively.

FIGURE 1. YIELD SUMMARY, BUTTE ALMOND.
TREE REMOVAL TRIAL



*1988 shows pre-treatment yields.

FIGURE 2. YIELD SUMMARY, MISSION ALMOND.
TREE REMOVAL TRIAL



*1988 shows pre-treatment yields.

FIGURE 3. CUMULATIVE YIELD TREND, 'BUTTE'.
TREE REMOVAL TRIAL

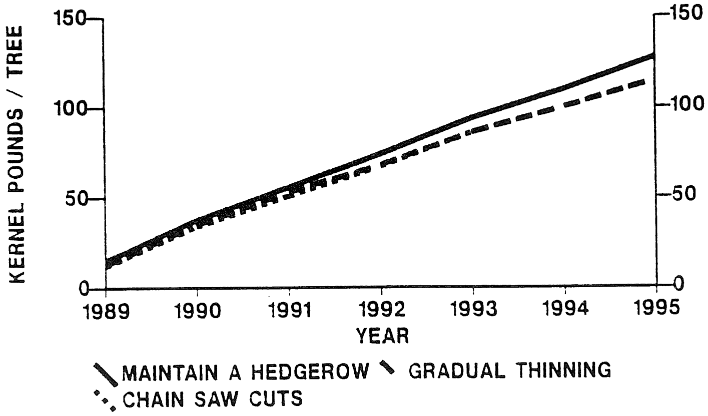
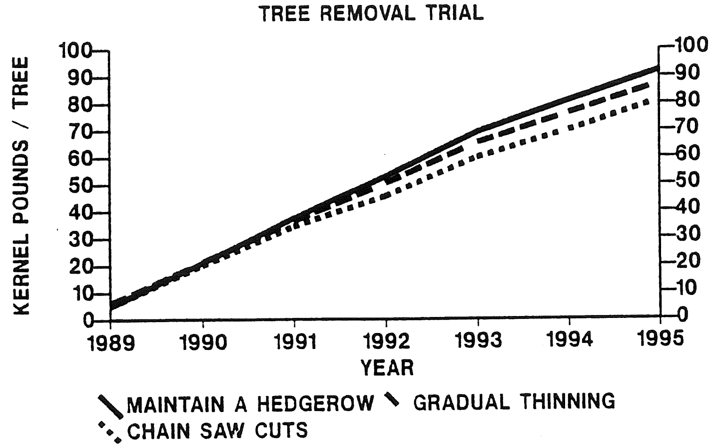


FIGURE 4. CUMULATIVE YIELD TREND, 'MISSION'.



Conclusions:

Thinning out of the temporary trees was done very gradually over the past seven years to try and minimize the yield reduction that comes with tree removal. Yield differences between treatments are not statistically significant, suggesting the rate of tree removal was appropriate.

We managed sunlight so that the temporary trees didn't inhibit the growth of the permanent trees. Wood in the lower canopy of the temporary trees that didn't affect the permanent trees was kept. The upper canopy of temporary trees was thinned out to allow the permanent trees to spread and over grow the temporaries. The permanent trees expanded to fill the orchard space as temporary trees were gradually thinned.

Although reductions are not significant statistically, meat pounds lost to gradual tree removal have really added up over this 7 year period (table 1). This raises the question of whether these losses can ever be made up over the remaining life of the orchard. If not, keeping double-planted trees permanently may be the best approach. The final outcome remains to be seen as this trial progresses.

ANNUAL REPORT OF ACTIVITIES IN 1995
FOR THE ALMOND BOARD OF CALIFORNIA

PROJECT: Evaluating Four Varieties as Pollenizers for Butte

PROJECT LEADER: Mark Freeman, Fresno County Farm Advisor

A 20-acre orchard was planted in 1992 with 50% Butte, 25% Padre, and 25% of four other varieties--Carrion, Livingston, 2-19E, and 2-43W. The objective is to evaluate the last four varieties as pollenizers for the Butte variety. Those four varieties were replicated four times within the orchard (as shown on the enclosed map). Measurements include trunk circumferences, bloom dates, and yields (both total amounts and quality).

In 1995, there was much bloom on all varieties but a very poor set and subsequent yield. In addition, birds (scrub jays) removed nuts from some of the treatments which also happened in 1994. Because of those two problems, bird losses and poor set, all replications of single varieties were harvested together.

Variety	1995 Yields
Butte	331 lbs/acre
Padre	397 lbs/acre
Carrion	386 lbs/acre
2-19E	240 lbs/acre
Livingston	195 lbs/acre
2-43W	142 lbs/acre

The bloom data and trunk circumference data has not been totaled and analyzed yet. That data along with the nut quality analysis done in 1994 by Blue Diamond Growers (on the two numbered varieties) will be forwarded to Warren Micke for use in future almond variety publications. Because of the severe bird pressure, we will use this plot as a demonstration plot and have not requested more funding from the Almond Board.

Evaluating 4 Almond Varieties as Pollinizers for Butte

BUTTE	BUTTE	ROW 36
PADRE	PADRE	ROW 35
BUTTE	BUTTE	ROW 34
PADRE	LIV	ROW 33
BUTTE	BUTTE	ROW 32
CAR	PADRE	ROW 31
BUTTE	BUTTE	ROW 30
PADRE	243W	ROW 29
BUTTE	BUTTE	ROW 28
219E	PADRE	ROW 27
BUTTE	BUTTE	ROW 26
PADRE	CAR	ROW 25
BUTTE	BUTTE	ROW 24
LIV	PADRE	ROW 23
BUTTE	BUTTE	ROW 22
PADRE	243W	ROW 21
BUTTE	BUTTE	ROW 20
219E	PADRE	ROW 19
BUTTE	BUTTE	ROW 18
PADRE	CAR	ROW 17
BUTTE	BUTTE	ROW 16
LIV	PADRE	ROW 15
BUTTE	BUTTE	ROW 14
PADRE	243W	ROW 13
BUTTE	BUTTE	ROW 12
219E	PADRE	ROW 11
BUTTE	BUTTE	ROW 10
PADRE	LIV	ROW 9
BUTTE	BUTTE	ROW 8
219E	PADRE	ROW 7
BUTTE	BUTTE	ROW 6
PADRE	243W	ROW 5
BUTTE	BUTTE	ROW 4
CAR	PADRE	ROW 3
BUTTE	BUTTE	ROW 2
PADRE	PADRE	ROW 1

ALMOND VARIETIES
50% BUTTE
25% PADRE
25% OF 4 NEW VARIETIES
- 2-19E
- 2-43W
- CARRION
- LIVINGSTON

36 TOTAL ROWS
ROWS SPLIT IN HALF (A,B)
EACH ROW 54 TREES

TO INVESTIGATE:
RELATIVE VALUE OF NEW VARITIES
- BLOOM DATES
- MATURITY DATES
- YIELD
- TREE SIZE
- YIELD, NUT QUALITY

EVALUATION OF FUNGICIDE RESISTANCE AND SPRAY COVERAGE
Brent A. Holtz and Themis J. Michailides

Problem and Objective:
Several large almond growers in Madera County believe that *Monilinia laxa*, the fungus which causes blossom blight in almonds, has become resistant to fungicides commonly used. Isolates of *Monilinia laxa* have been found in California that are resistant to benlate, but inadequate fungicide coverage, rather than the development of fungicide resistance, can be a more likely cause of blossom blight outbreaks. The objective of this study is to determine if fungicide resistance is developing in Madera County, or if disease outbreaks are due to inadequate fungicide coverage.

Plan:
Isolates of *Monilinia laxa* were collected and grown on fungicide amended agar medium in Petrie dishes, where the isolates were evaluated for growth and resistance to fungicides. Fungicide plots were also established in problem orchards where both the coverage and fungicide were evaluated for their efficacy towards controlling brown rot blossom blight.

Results:
Twenty-eight isolates of *Monilinia laxa* were obtained from brown rot blighted almond blossoms in February from the S&J Ranch in Madera County. These isolates were tested for resistance to benomyl by comparing radial growth on fungicide-amended and nonamended potato-dextrose agar (PDA). Twenty-five (89%) of the isolates grew on PDA amended with 1 μg benomyl, though their growth was significantly less (Student's ***t*** test at the 5% level). Mean colony growth on PDA was 49.75 ± 7.6 mm while mean colony growth on PDA + benomyl was 34.0 ± 14.7 mm. Only three isolates were completely inhibited by the 1 μg benomyl.

Brown rot blossom blight was also evaluated at the S&J Ranch. The percent blighted blossoms per 200 counted was recorded in February from three spray treatments. These treatments included a non-bloom sprayed plot under a power line, a ground sprayed plot, and an air sprayed plot. In the non-sprayed plot 7.8% of the blossoms were blighted compared to 3.2% in the ground sprayed and 2.1% in the air sprayed. There was significantly more blossom blight in the non-sprayed plot when compared to the ground and air sprayed plots. There was no significant difference between the ground and air sprayed plots.