Project No. 92-84 - Almond Pruning

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Objectives: To develop research-based information to answer pruning questions for three different situations: 1) What is the impact of alternate year pruning compared to annual pruning? (Krueger) 2) What is the best method of training and pruning a high density hedgerow orchard when maintaining it indefinitely? (Edstrom) 3) What is the best method for removal of temporary trees in double planted orchards when they crowd? (Connell)

Results:

1) *Alternate Year Pruning of Almonds*

(Bill Krueger, Warren Micke, and Jim Yeager)

Annual pruning is a recommended procedure for mature almonds. Growers who prune every other year or even once every three years have observed no apparent deleterious effects to tree vigor or production. Alternate year pruning has been shown to be an acceptable practice with lateral bearing walnuts.

This study was undertaken to compare the impact of alternate year pruning to that of annual pruning on mature almond production and kernel quality.

A mature uniform 20 acre block of almonds located in Hamilton City was selected for the trial. The 1978 1:1 planting has 50% Nonpareil, 25% Price and 25% Peerless at 70 trees per acre. Only Nonpareil was used for the pruning treatments. The ten acres of Nonpareil were divided into a randomized complete block with four treatments and five replications. Yield data was collected one year prior to assigning the treatment to make sure that there were no significant differences due to block location. The treatments were initiated during the winter of 1987-88 and were: 1) Annual pruning; 2) pruning prior to odd numbered years; 3) pruning prior to even numbered years; and 4) unpruned starting prior to the 1988 crop. Pruning was the same for all treatments and consisted of four, approximately 1.5 inch or larger cuts per tree or the equivalent. Pruning weights following each pruning averaged between 37 and 53 pounds per tree.

After five years of pruning treatments there have been no significant differences in yield or accumulated yield between any of the treatments. In 1991, kernel weight was significantly greater for annually pruned compared to non-pruned and alternate year prunéd not pruned prior to the 1991 crop. Again in 1992, there was a trend towards larger kernel size for the annually pruned and alternate year pruned prior to the crop year compared to the non-pruned and the alternate year pruned not prior to the crop year. This difference was significant between alternate year pruned prior to the 1992 crop and non-pruned.

EFFECT OF ANNUAL VS. ALTERNATE YEAR AND NO PRUNING

TREATMENTS	1992 Wt. g/kernel	1992 Yield lbs/tree	Accum. Yield 1988–92 lbs/Tree
Alt. yr. prior to even yr.	1.15 A	31.65 A	158.52 A
Annual Pruning	1.13 AB	31.42 A	152.14 A
Alt. yr. prior to odd yr.	1.11 AB	32.49 A	156.57 A
Non-pruned	1.08 B	29.20 A	151.88 A

Numbers followed by the same letter are not significantly different at the 5% level.

Pruning treatments had a significant effect on quality (kernel size) in 1991 and 1992. Since kernel size has little effect on crop value and there was no effect on total yield, there has been no effect on overall crop value to this point.

We expect that yield in the non-pruned trees will eventually decline due to lack of renewal of fruit wood. We would like to continue the trial until this occurs.

2) *Sustaining Yields in Hedgerow Systems*

(Edstrom, Micke)

The objective of this trial is to develop methods to train Nonpareil almonds into a hedgerow configuration and develop pruning systems capable of sustaining high yields in hedgerows.

Production economics have pressed growers to increase the bearing in newly developed orchards. High density plantings can proportionately increase early yields given the increased trees planted per acre. Hedgerow systems, where tree spacing is less within the row than between rows has allowed heavy early production with use of existing equipment.

Concern over the viability of almond hedgerow systems arises as the trees crowd. Limited sunlight entry into the canopy can affect fruit bud formation and may confine production to the top of the canopy. Yields may then begin to decline resulting in a hedgerow orchard with less productive capacity or one with higher cultural costs than that of a standard planting.

Hedgerow research in other tree crops has shown the value of various tree training and pruning practices on maximizing early production without sacrificing mature yields.

In 1979, a Nonpareil - Price almond block, at a 1:1 ratio, was planted 7' x 22' (270 trees/acre) at the Nickels Soil Laboratory in Arbuckle, California. The following four pruning treatments were begun at the end of the first growing season.

1) Temporary Hedge: standard pruned on permanent trees, gradually whisked back temporary trees then removed at 8th year, 1986, leaving a 14' x 22' spacing.
2) Permanent Hedge: standard pruned hedge maintained at 7' x 22'.
3) Two Scaffold Hedge: two primary limbs trained out into row middles - 7' x 22' hedge.
4) Unpruned Hedge: trained to three scaffold on 7' x 22' then no further pruning.

Yields in 1992 were lower than expected, given what appeared to be a good early set. This can partially be attributed to small kernel sizes in the 1992 crop. Kernel sizes this year were 0.94 grams/kernel or 30 kernels/oz., compared to 1.18 grams/kernel or 24 kernels/oz. last year. This represents a 20% reduction in size, which helps account for the lower yields.

Again in '92, no statistically valid differences were found between the 4 treatments, but, numerical differences show the temporary hedge to again be lowest in yield.

1992 NONPAREIL YIELDS

	LBS./AC
Unpruned Hedge	2471 A
Permanent Hedge	2268 A
Two Scaffold Hedge	2079 A
Temporary Hedge	1739 A

Included in this report are the historical yields for this test plot. Keep in mind that this planting is growing on Class II and Class III soils of limited depth, irrigated by a drip system, using a single pollinizer - Price.

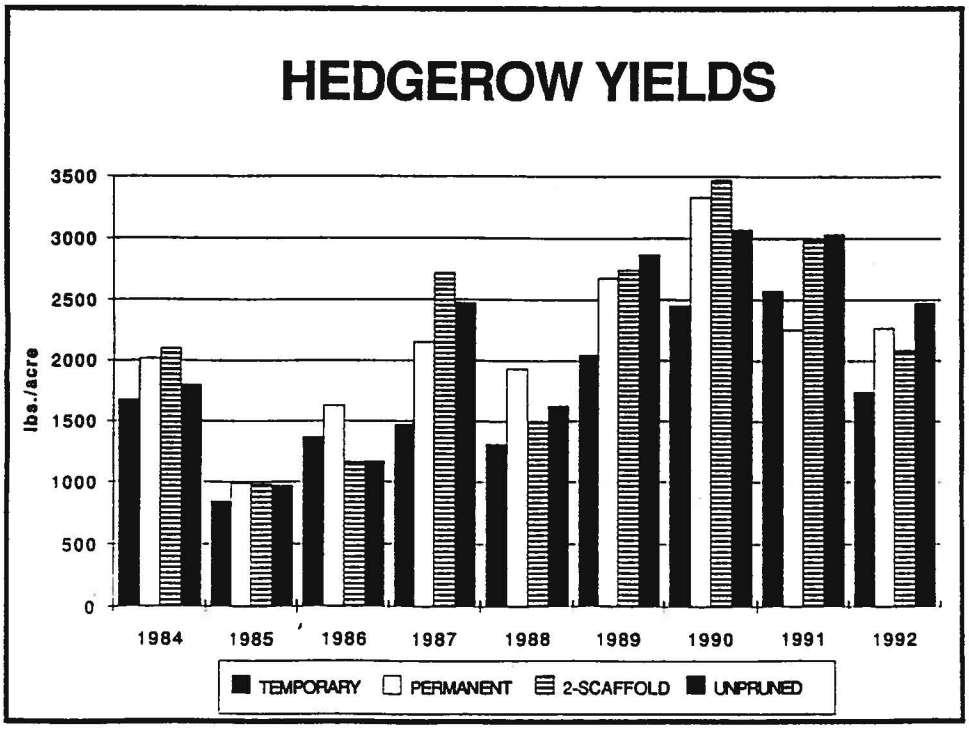
HEDGEROW YIELDS - 1984-1992

(lbs./acre)

YEAR	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*ACCUM*
LEAF	5th	6th	7th	8th	9th	10th	11th	12th	13th	
Two Scaffold	2096	982	1161	2720	1498	2746	3470	2992	2079	19744
Unpruned	1800	969	1168	2474	1626	2870	3072	3036	2471	19486
Permanent	2016	990	1628	2149	1932	2680	3333	2254	2268	19250
Temporary	1674	845	1368	1472	1308	2046	2450	2576	1739	15478

Most notable in these figures is the yield disparity between the *Temporary Hedge* plots and the *other* treatments. Alternate trees in this treatment were wisked back in 1984 and 1985, and then removed in 1986. Although these trees now have substantially refilled the space, they continue to lag behind in yield.

Accumulative yield totals, up to the 13th leaf, show a 4000 lbs. crop loss resulting from this extreme pruning and tree removal scheme. Future yields may rebound, but such an accumulative loss may never be recovered. However, fruiting on all long-term hedges (treatments 2,3, and 4) continue to decline in the lower canopy, presumably due to shading. Future yields in these plots may decrease more sharply over time than the yields of Temporary Hedge trees, and thus, equal out subsequent yields and reduce accumulative yield differences.



3) *Removing Temporary Trees in Double Planted Orchards*

(Connell, Micke, Yeager, Krueger)

The objective of this trial is to evaluate temporary tree removal by comparing three pruning treatments:

1. Keeping temporary trees
2. Gradual thinning out of temporary trees
3. Heavy whisking of temporaries with chain saw cuts

Pruning in treatment 1 has been confined to removing crowded or crossing limbs by thinning out. Pruning temporary trees in treatment 2 involved thinning out upper limbs or centers wherever they crowded the permanent trees. Temporary trees in treatment 3 had large chainsaw cuts made from the ground to remove the tree center or whisk back the sides whenever permanent trees were crowded.

Treatments 2 and 3 have been imposed over the past four years to manage sunlight so that the temporary trees don't inhibit the growth of the permanent trees. Wood in the lower canopy of temporary trees that doesn't affect the permanent trees has been kept. The upper canopy of temporary trees has been thinned out to allow the permanent trees to spread and over grow the temporaries.

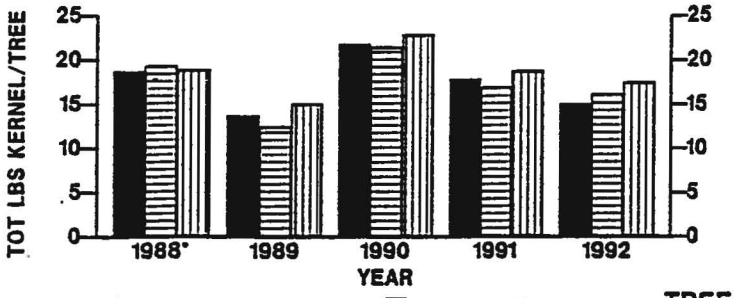
In 1988, pre-treatment yield measurements were collected. Following the imposition of pruning treatments in 1988-89, cumulative yields for 1989 through 1992 show no statistically significant differences between the three treatments in either the 'Butte' or 'Mission' varieties. This suggests that the tree removal program is progressing at the appropriate rate. Permanent trees are expanding to fill the orchard space as temporary trees are gradually thinned.

AVERAGE KERNEL POUNDS PER TREE (140 TREES PER ACRE)

Year	1988*	1989	1990	1991	1992	4 Year Accum.
LEAF	7th	8th	9th	10th	11th	Yield
'BUTTE' VARIETY						
Keeping temporaries	19.0	15.1	23.0	18.8	17.5	74.3 A
Gradual thinning	18.8	13.8	21.9	18.0	15.1	68.8 A
Chain saw whisking	19.4	12.5	21.6	17.0	16.2	67.3 A
'MISSION' VARIETY						
Keeping temporaries	17.8	5.1	16.0	16.6	15.2	52.9 A
Gradual thinning	17.1	6.1	15.4	15.0	14.0	50.4 A
Chain saw whisking	17.8	5.0	15.2	14.3	11.3	45.7 A

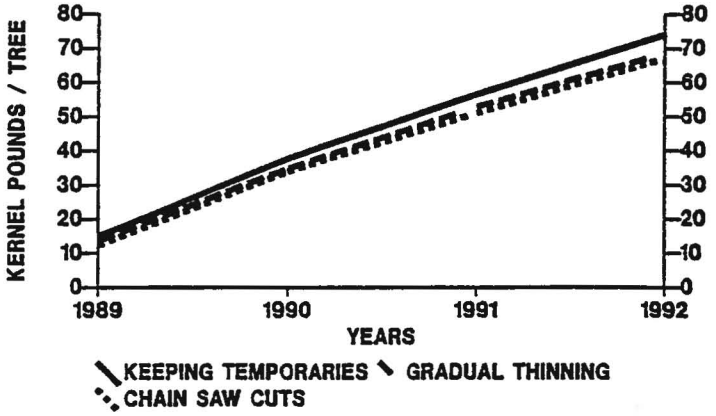
* 1988 shows pre-treatment yields.

TREE REMOVAL TRIAL --- BUTTE VARIETY
YIELD SUMMARY 1988 THROUGH 1992

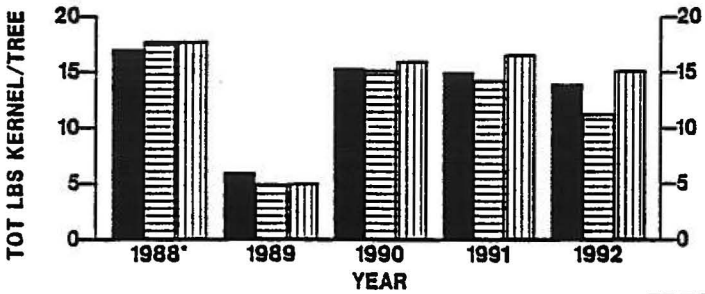


*1988 SHOWS PRE-TREATMENT YIELDS

TREE REMOVAL TRIAL --- 'BUTTE' VARIETY
CUMULATIVE YIELD 1989 THROUGH 1992

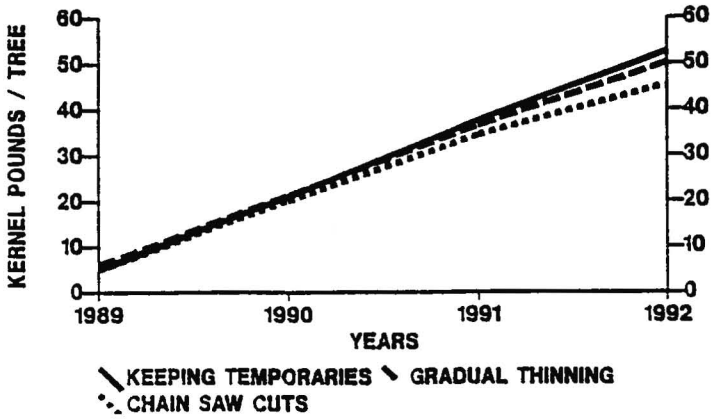


TREE REMOVAL TRIAL --- MISSION VARIETY
YIELD SUMMARY 1988 THROUGH 1992



*1988 SHOWS PRE-TREATMENT YIELDS

TREE REMOVAL TRIAL --- 'MISSION' VARIETY
CUMULATIVE YIELD 1989 THROUGH 1992



Although yield differences between treatments are not statistically significant at the 5% level, numerically, cumulative yields are lower as the severity of pruning increases. Chain saw pruning from the ground, although easier, resulted in the numerically lowest yield. So far, yields are numerically highest when temporary trees are kept.

Temporary tree removal may begin later this winter depending on additional evaluation of data and discussions with our grower cooperator. Trunk circumference measurements will be taken this winter to measure effects of pruning on tree growth and a determination of pruning/removal needs will be made. Ultimately, we should be able to determine if tree removal is the best approach to deal with crowding in double planted orchards.