

Pruning Systems for High Density Orchards

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Almond tree training and pruning practices haven't changed much for decades. Traditional concepts stressed careful selection of primary and secondary branches to develop a strong evenly spaced framework capable of supporting heavy crops. Large trees developed during the 30-40 year life span especially at wide spacings. Yearly pruning was needed on old trees to increase light into the tall canopies, stimulate growth and replace unproductive fruitwood. Considerable time, equipment and expense are required to complete this type of pruning operation.

Today, however, tree densities have increased to 100+ trees/ac, twice what they used to be and many new orchards are planted on weaker ground. Both trends result in smaller sized trees, which don't need to support such heavy weight (crop) per tree to be productive per acre. Scaffold number, position, orientation, or strength become less critical without large expansive canopies. Younger trees, typical of more tightly spaced orchards are inherently more vigorous so yearly pruning is not as critical to maintain vigor. Shorter statured trees naturally allow more light to penetrate deeper into the canopy promoting fruit bud formation without much pruning to "open up the centers". Big cuts may not be necessary. Improvements in water management using

microirrigation bring orchards into production fast (and impart vigor to older trees). Good yields are obtained in the 4th year compared to year 6 to 8 as in the past.

Many growers don't expect today's almond orchards to last longer than 20 years. Blocks will be replaced at a younger age simply to exploit new superior technology. These factors should all be considered when devising a profitable training/pruning strategy for today's high density orchards.

The **objective** of this field trial is to evaluate various tree training/pruning methods, which promote maximum early production while maintaining long-term orchard yield in tightly spaced almonds.

Four training systems were selected using 4 replicates of 33 trees using Nonpareil, Carmel, Monterey and Aldrich, microsprinkler irrigated and planted at 16'x22', 124 trees/acre:

- 1) **Standard Method** - Three primary limbs selected at 1st dormant, long pruned, secondaries selected 2nd dormant, centers kept open, limb tying/staking as necessary. Yearly traditional, moderate pruning continued.

- 2) **Unpruned** - Three Primary limbs selected at 1st dormant pruning then no additional pruning unless needed for equipment or wind damage, etc. Minimal staking as necessary.
- 3) **Mechanically Topped** - Same as unpruned, but, adding machine topping to remove half of prior seasons top shoot growth beginning at 2nd dormant with selective dormant thinning and topping in spring, if needed.
- 4) **Temporary Scaffolds** - Train limbs at 1st dormant to favor 3 permanent primary scaffolds, but also retain many other temporary branches below these on the trunk, removing only those which compete strongly with permanent scaffolds. Retain as much wood as possible. Temporary limbs scheduled for gradual removal during years 5-8 after producing some crop or sooner if they threaten primaries.

Results

Overall tree vigor has been quite good in this planting. This should allow a strong test for the unpruned and other methods under strong growing conditions. The north end of the planting is more vigorous than the south, providing two distinct conditions to evaluate these training methods. In the previous evaluation at Nickels of the unpruned method, weak growing conditions complicated drawing meaningful conclusions.

This years yields (Table 1) show large differences between varieties but no differences between pruning methods with fair production from all pruning methods in this 5th leaf block. Carmel and Monterey production was good while Nonpareil and Aldrich was mediocre. This years treatment affects differed from last years. For 2001, all pruning systems yielded statistically the same. This held for all varieties. Yield variability was high this year and prevented significant differences despite the apparent production advantage of the unpruned system in Monterey.

Table 1.

<u>2001 YIELDS - LBS./ACRE</u>						
<u>Trial</u>	<u>Aldrich</u>	<u>Carmel</u>	<u>Monterey</u>	<u>Nonpareil</u>	<u>Sonora</u>	<u>*Mean</u>
Standard	1,271	1,890	1,621	1,201	984	1,414
Temporary Scaffold	-	1,810	1,736	1,253	774	1,461
Mechanically Hedged	1,190	1,844	1,553	1,272	580	1,366
Unpruned	1,213	1,604	1,956	1,198	775	1,422
*Mean	1,225	1,787	1,717	1,231	778	N.S.

* = Weighted Mean (considers reduced number of pollenizer trees).

Observations

Temporary limb concept

This method still holds some promise but some temporary lower limbs are competing too severely with the upper permanent ones. Many permanent scaffolds appear smaller and weaker, compared to those on standard pruned trees. Secondary limbs have flattened with much water sprout growth in this treatment. Many trees are now too open in the center. Nonpareil and Monterey are affected the most, while Carmel and Sonora appear to be OK. Carmel rows have filled in well compensating for lower vigor of this variety. Some temporary limbs will be maintained permanently mainly with Monterey as many limbs on this variety appear of equal vigor and show even development between all primary scaffolds. However, those that are too low on the trunk are being gradually removed to facilitate shaking. Careful training of competitive branches is critical to this method but properly training work crews is difficult. Again this winter, extra effort was made to favor the permanent primary and secondary scaffolds. Removal of strongly competing lower limbs and the vertical shoots arising from them was continued. The Aldrich variety proved too troublesome with the lower scaffold idea and this variety was eliminated from this treatment.

Unpruned Method

This method appears to have commercial potential. Within the weaker soil area, nearly all unpruned trees look very good. Nonpareil and Aldrich in the vigorous

area appear a bit too dense in the upper canopy with more shading below, but a heavy crop has yet to be produced on these varieties, so they should open later. Some Monterey trees appear misshapen and have “mushroomed” open but the Sonoras and Carmels look fine. Removal of twisted, crossing and rubbing limbs may be desirable in all varieties. However, any cuts will likely cause sucker growth and set up the demand for even more pruning. Trees receiving no pruning cuts grow more evenly without overly vigorous limbs and appear to allow enough light penetration to promote cropping. These trees are also somewhat shorter which helps promote light penetration. There was no problem with crop removal at harvest despite the dense fruitwood, as the trees enlarge this may become a problem.

Mechanically Topped

All varieties in this treatment are shorter in height than in the other methods. Aldrich benefited some from topping with better branching forming a wider canopy, but still seems too dense in the center. In general, excessive shoot growth resulted from the dormant topping in 1999. This dense upright growth of 3 to 8 feet was cut 1/2 during the May 2000 topping. Cutting into the prior year's wood de-invigorated these trees and reduced tree height. Regrowth of top shoots after spring topping was only moderate. If any future spring topping is performed the hedger will be set to remove mainly current shoot growth. The decision was made during dormant pruning 2001 not to hand prune this treatment to thin out the very dense wood. Monterey and Nonpareil tree structure appears most

affected with heavily shaded interior. Aldrich trees appear more normal but are extremely dense. Again, a large crop could open the canopy and improve the density problem.

Standard Pruning

These trees are the tallest of all treatments and also exhibit a standard, open canopy. However, our pruning here is best described as "minimum", as not enough wood has been removed to qualify as standard pruning. Primary scaffold development is good while many secondary limbs are bending out of position exaggerating the open center, especially on Nons. There appears to be less lower "hanger" fruitwood in this treatment. Sonoras look quite good. Dormant pruning was increased somewhat this winter on standard trees to achieve more commercial level of pruning.

Summary

At this stage, the Unpruned Method seems to hold the most potential. Left unpruned or at most with a few cuts to remove badly angled, twisted, and interfering branches, this system seems to be workable. The Unpruned system which was successful in the old test at Nickels for 20 years on weak soil is working here so far under much more vigorous conditions. The Temporary system also shows some promise. In hindsight, we should have tied the permanent scaffolds to help maintain their dominance and avoided so much extra training of temporary limbs. Yields in the next few years should tell if this system is economical given the expensive training involved. Adding another system in this test, which maintained 6-8 scaffolds permanently, would have been instructive, although similar grower attempts have been troublesome in the long run.

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