Almond Board Report October 2002

Project Title: **Nickels Soil Lab Projects**
Project Leader: **John Edstrom**
University of California Cooperative Extension
P. O. Box 180, Colusa, CA 95932

Project Cooperators: **Bill Krueger, Dr. Bruce Lampinen, Dr. Larry Schwankl, Stan Cutter, Nickels Trust**

1) Pruning Trials for High Density Orchards

John Edstrom, Bill Krueger & Dr. Bruce Lampinen

The objective of this field trial is to evaluate 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 of Nonpareil, Carmel, Monterey and Aldrich. Orchard soil was slip plowed, microsprinkler irrigated and planted at 16'x22', 124 trees/acre.

Pruning Treatments

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. Minimal staking as necessary.

3) **Mechanically Topped** - Same as unpruned, but with machine flat-topping to remove half of prior seasons top shoot growth beginning at 2nd dormant and again in spring 3rd leaf.

4) **Temporary Scaffolds** - Train limbs at 1st dormant to favor 3 permanent primary scaffolds, retain many other temporary branches below on the trunk, removing only ones competing 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 is quite good in this planting allowing a realistic evaluation of the unpruned method under strong growing conditions. Tree canopies are now closing in forming a dense orchard canopy. These 6th leaf trees produced 2600-2800 lbs/acre this season but statistical analysis showed no significant difference in yields between the four pruning treatments. (Table 1) Yield trends from 4th & 5th leaf favored the Unpruned and Temporary trees, especially for Monterey and Carmel varieties.

Table 1.

Treatment	Aldrich	Carmel	Monterey	Nonpareil	Average
Standard	3,141	2,437	2,240	2,718 a	2,613
Temporary Scaffold		2,921	2,337	2,812 a	2,677
Mechanically Hedged	3,074	2,657	2,349	2,689 a	2,660
Unpruned	3,182	2,426	2,725	2,854 a	2,801
Mean	3,132	2,610	2,413	2,768	
	P = 0.05		LSD = 502 lbs.		

Discussion

Temporary limb concept

This method is probably not worth the extra effort. The only yield advantage (300 lbs/acre) came during the 4th leaf. During the 5 & 6th harvests, production was equal to the standard pruned trees. The pruning work required is difficult to prevent temporary lower limbs from competing too strongly with the upper permanent ones. Many permanent scaffolds are 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. Some "temporary" limbs will now be maintained permanently with Monterey as many limbs on this variety show even development between all main scaffolds. Careful training of competitive branches is complicated and properly training work crews is difficult. The Aldrich variety proved too troublesome with the lower scaffold idea from the start and this variety was eliminated from this treatment. On the positive side, strong north wind damage during the second leaf was far less in this treatment and in the "unpruned" compared to heavily damaged trees in "standard" pruned plots.

Unpruned Method

This method appears to have commercial potential. Nearly all unpruned trees look acceptable or very good. Nonpareil and Aldrich did appear too dense in the upper canopy with more shading below, but the heavy crop produced this year opened the centers naturally. Some Monterey trees are misshapen and have "mushroomed" open but the Sonoras and Carmels look fine. Removal of twisted, crossing and rubbing limbs may be more practical and 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. The long-term production of these trees is our only remaining concern.

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 1998. Too much was removed during that operation resulting in very vigorous growth the following spring. This dense upright growth of 3 to 8 feet was cut 1/2 during the May 2000 topping. However, this resulted in cutting into some prior year's wood, de-invigorating the trees and reducing tree height. As expected, 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. No hand pruning was done in 2002 either. Monterey and Nonpareil tree structure appears most affected by topping with heavily shaded interior. Aldrich trees appear more normal but are very dense.

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 some 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.

Summary

The pruning trials at Nickel Soils Lab have generated controversy on the effect of "nonpruning" under highly vigorous conditions where loss of fruitwood from shading is feared. However, as expected, we have observed a deinvigorating effect from the lack of pruning cuts. Trees settle down more naturally, so far, without shading lower fruitwood. Consistent, heavy cropping has also moderated growth. Now, after 6 seasons, many Nonpareil and Sonora trees look dense, but very good, as good as well-trained trees and most all are acceptable. Cost savings have been significant. Other varieties like, Monterey, Carmel and Aldrich may require different methods. But the "Unpruned" method continues to perform remarkably well, both in terms of production and tree framework. After selecting three primary scaffolds, trees left unpruned are as productive, or more, than pruned trees through the 6th leaf. This minimum system which was successful for 20 years in the old test at Nickels on weak soil is performing well here under much more vigorous conditions.

The "Temporary" system looks questionable. Yields don't appear to justify the extra pruning efforts. In hindsight, we should have tied the permanent scaffolds to help maintain their dominance and avoided so much extra training of temporary limbs. The productivity of this method over the next few years may change this negative assessment. Also, long-term yields could find mature yield gains to this idea when compared to the possible declining yields of the "unpruned" trees.

As an alternative, a multiple scaffold technique could use large caliper high headed trees to allow

enough room to select and sustain 6-8 well spaced scaffolds. Past attempts using 34 inch heading at planting keeping 6-8 primary limbs have been troublesome in the long run.

2. Comparison of Microirrigation Systems for Almonds

John Edstrom, Dr. Larry Schwankl & Stan Cutter

A 22-acre field demonstration began in 1990 to evaluate the three major types of microirrigation: Drip, Subsurface Drip (SDI) and Microsprinklers. This trial uses 36 one-half acre plots to simulate commercial conditions on four almond varieties, Nonpareil, Butte, Carmel and Monterey. The systems under study are:

1. Surface Drip - single hose	4 - 1 gph Netafim PC emitters/tree
2. Surface Drip - double hose	8 - 0.5 gph Bowsmith emitters/tree 4 ft. from rows
3. Microsprinkler	1 - 10 gph Bowsmith Fanjet between trees
4. Microsprinkler double	2 - 5 gph Bowsmith Fanjets around trees
5. Microsprinkler double1.2 ET	2 - 7.5 gph Bowsmith Fanjets around trees
6. Subsurface Drip - double hose	8 - 0.5 gph Geoflow emitters/tree, 4 ft. from rows
7. Surface Drip double hose150% Et	8 - 1 gph Netafim PC emitters at 4 ft.
8. Subsurface Drip double New	8 - 0.5 gph PC Geoflow emitters at 4 ft

Subsurface drip treatments were established the first year with surface hoses and early in the 2nd year converted to SDI with the tubing installed at a depth of 15 inches. Previously, Netafim Ram tubing was evaluated as SDI but became extensively plugged by almond root intrusion. All of these lines were replaced, spring of 2000, with pressure compensating Geoflow trifluralin impregnated SDI placed at a depth of 8-10 inches directly above the abandoned Netafim hoses. This treatment is # 8 - New Geoflow double.

Results

Nonpareil production 2002 was the highest to date in this test, which put more pressure on each system to perform. But, again, yield results show no difference between the three types of microirrigation when standard water rates were applied. Yields this season (Table 1) were also very good for Butte and Monterey, while Carmel had an off year resulting in some kernel gumming. This season, we adjusted the water application rate upwards for the microjet systems to compensate for their lower water efficiency to provide more equal moisture to the tree roots than in the past when equal water was applied to all three systems. Still, given 15% more water, with a heavy crop, the micros did not out produce the drip systems.

But, when micros received 25% more water than drip, (Micros Double 150%) yields increased significantly. Efforts to raise yields in the single hose drip by using two hoses and extra water have not resulted in higher yields as found when micros received 25% more water. Additional plots in this test orchard that have received excessive irrigation (200%, Etc) since planting via micros are now showing tree decline due to phytophthora crown rot, crown gall and heart rot. Early extraordinary production in these Monterey trees is now (after 12 years) being negated by early tree loss.

The standard Drip Double hose plots have not performed well. Efforts to expand the wetted soil area with dual hoses have not resulted in better yields. Unfortunately, flow meters in these plots measured reduced water flow depriving trees of adequate water. Shallower soil wetting from these lower output emitters combined with clogging of smaller emitter orifices may be responsible.

No yield enhancement has been found for Micros Double verses Micros (single). Previously, soil moisture uptake measurements indicated that an advantage might be obtained from surrounding the tree canopy with wetted soil (Micro Double) verses a circular wetted area midway between trees (Micros). No advantages have been measured, however, more efficient frost protection can be obtained by applying water directly beneath canopies.

Evaluation of sub surface drip systems (SDI) suggests that the original deep placement of hoses at 15 inches maybe inferior to the newly installed SDI at 8 inches (Shallow verses Deep Geoflow). However, the new SDI emitters are pressure compensating, the old ones are not, so a fair comparison isn't possible. Root intrusion has not been a problem with the triflurilin herbicide product (Geoflow) as was found in the standard SDI emitters (Netafim). Overall, the yields and performance from SDI in almonds continues to be promising.

YIELDS - Lbs/Acre

	Variety				
System	**Nonpareil**	**Butte**	**Carmel**	**Monterey**	**Average**
Drip	3,070 bcd	2,814 b	1,710	2,811	2,601
Drip Double	2,800 cd	2,514 b	1,558	2,424	2,324
Micros	3,238 bc	2,891 b	1,878	2,543	2,637
Micros Double	3,395 ab	2,927 b	1,954	2,538	2,703
Micros Double 120%	3,847 a	3,621 a	2,494	2,851	3,203
Drip Double 150%	2,913 bcd	2,839 b	1,703	2,564	2,505
SDI Double:					
Shallow New Geoflow	2,855 cd	2,622 b	1,624	2,626	2,432
Deep Original Geoflow	2,699 d	2,726 b	1,193	2,454	2,268

P=0.05

3. Almond/Marianna 2624 Performance

John Edstrom and Stan Cutter

Marianna plum 2624 rootstock is the most useful rootstock for Oak Root Fungus sites and has become increasingly important in the expansion of almonds onto the heavier soils. Mission, Ruby and Padre cultivars have shown excellent compatibility with M2624, but field performance of Butte has been troublesome. Evaluating the commercial potential of M2624 plantings however, requires closer spacings than typically used in almonds, resulting in more trees and higher investment expenses.

A test planting was established to check the productivity of four cultivars in a close-planted hedgerow on M2624 rootstock. All trees were obtained as certified virus free (scion and root) to remove the virus affects. Commercially harvestable replications were designed into the test for yield data collection. Butte, Mission, Ruby and Padre almonds were planted March, 1989, under drip irrigation, as single N/S rows at 10' x 20' spacings for 218 trees/acre.

Results

The drip irrigated test orchard was severely affected by the frost that hit the western Sacramento Valley on March 8.

Yields were very low for Mission, Padre and Butte, at 500-800 lbs/acre but, better for Ruby, which produced 1600 lbs/acre.

The hedging program started 4 years ago cutting alternate sides of alternate rows each winter will be complete this coming winter. Hedging greatly invigorated shoot growth and expanded the canopy. The effects on production of the four varieties will be measured.

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