Nickels Soil Lab Projects

Project No.: **12-HORT6-Niederholzer**

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Minimum Pruning Systems for Almonds

Objectives:

The objective of this trial is to evaluate tree training/pruning methods for maximum early production while maintaining long-term yields in tightly spaced (16' x 22') almonds.

Treatments:

1) **Standard** - Three primary limbs selected at 1st dormant, tipped but long pruned, secondary's selected 2nd dormant, centers kept open, limb tying/staking as necessary. Yearly traditional, light pruning continued.
2) **"Unpruned"** - Three primary limbs selected, tipped and left long at the 1st dormant pruning then no additional pruning unless needed to facilitate orchard operations or to remove broken limbs. Minimal staking as necessary was used.
3) **Mechanically Topped** - Same as unpruned, but with machine flat-topping to remove half of prior season's top shoot growth during the 2nd dormant season and again in spring of the 4th leaf. No additional pruning.
4) **Temporary Scaffolds** - Train limbs at 1st dormant to favor 3 permanent upright primary scaffolds, temporarily retain lower less dominant branches, removing only ones competing strongly with permanent scaffolds. Retain as much wood as possible. Temporary limbs gradually removed during years 5-8 after producing some crop and adding to tree size. From then on standard pruning.

Interpretive Summary:

The **yield results from this field trial continue to question the need for regular pruning** to maintain almond production once the primary scaffolds have been selected. Yield results for Nonpareil and Monterey show no difference in production between Pruned and Unpruned trees. Nonpareil out-produced all other varieties in this 16th leaf orchard (**Table 1**). **Although the Unpruned and Mechanically Topped trees appear to be losing more lower fruitwood each year, the total yields remain the same as the Standard pruned trees.** (Standard pruned trees have open centers with significant light penetration into the lower canopy.) Possibly the upper canopy of unpruned trees has compensated for the loss of lower fruitwood. It is noteworthy to mention that this same phenomenon was observed in the original unpruned trial conducted at Nickels in the 1980-1990s. However, continuation of this compensatory fruiting habit is uncertain and remains our primary concern.

Again, we did not see any difference between treatments for hull rot, stick-tights, or any other disease, but shaker damage appears to be more prevalent in both the Unpruned and Mechanically Topped (also unpruned) trees. Despite ample water the only summer leaf disease found has been leaf rust seen sporadically throughout the plot since 2006. There was little rust in 2012 following an aggressive foliar disease control program. This site is on rolling terrain and does not experience stagnant humid air conditions during the summer and thus far, no alternaria or scab has been found. Drying conditions in the windrows at harvest adequately dry the crop for hulling. The soil at this site is a Class II gravelly, sandy loam underlain with clay at 30-50 inch depth. Deep slip plowing and land leveling operations have improved the profile, but this orchard exhibits moderate vigor when compared to the strongest young almond orchards found today. This might be limiting the negative effects of shading on fruitwood longevity and ultimately yield. July leaf samples show adequate to optimal levels of leaf nutrients (data not presented).

So far, this test has produced yields comparable to the best in the Arbuckle area. The relevance of these trial results to other growing regions is unknown, but similar in the Central and Southern San Joaquin Valley have supported these findings. The validation of the minimum pruning concept will require a few more years to determine the total production over the life of the orchard and to track the possible accelerated yield decline over the 20-22 year expected life span of this orchard.

Past results:

- Minimally pruned trees and temporary scaffold trees out yield standard trees in the early years.
- Temporary limb training is expensive and probably uneconomical.
- Production between all treatments leveled out in the 6th year.
- Accumulated cost savings of $800 - $1,100 per acre to the 16th year are possible with minimum pruning methods.
- Aldrich growth habit is incompatible with the temporary limb method.
- Some minimal amount of secondary and inside branch removal may be beneficial under minimum pruning.
- No increase in disease or sticktights was found for minimum pruning.

- Tree height appears shorter with minimum pruning.
- There have been no problems drying crop on orchard floor.
- Lack of pruning resulted in a higher % of leaning trees.

The central questions concerning minimum pruning are:

- Number of primary limbs to select?
- Necessity of heading primaries?
- Feasibility of retaining multiple scaffolds?
- Need for limb tying?
- Shading of fruitwood and eventual yield decline?
- Range of varieties, growing conditions/vigor and tree spacings compatible to minimum pruning without resulting in undesirable consequences?

Table 1. Pruning Test Yields – 2012.

PRUNING TEST YIELDS
2012
Kernel lbs/acre

	Aldrich	Carmel	Monterey*	Nonpareil*
Standard	**3,156**	**2,249**	**2,446**	**3,010**
Temp Scaffold	**---**	**2,064**	**2,844**	**2,940**
Mech hedged	**3,029**	**2,587**	**2,562**	**3,025**
Minimum/unpruned	**3,217**	**2,639**	**2,769**	**3,094**

*No statistical difference between pruning treatments

Organic Production Systems for Almonds – 2012

Objectives:

Evaluate the economics and productivity of USDA and CCOF compliant organic almond production methods suitable for the Sacramento Valley region in comparison to conventional production methods.

Interpretive Summary:

For the past 7 years we have been evaluating a 7-acre almond planting of Nonpareil/Fritz (75/25; see **Figure 1** for tree layout) by comparing three production systems; Conventional (Conv), Transitional (Trans) and Organic (Org). The Conv trees are produced using practices typical for almond production in the area. The Trans trees were grown conventionally for 3 seasons and then converted in September 2008 to organic practices. The Org trees are grown using practices approved for organic production by the USDA and CCOF. A list of contrasting cultural practices and the associated product costs are shown in **Table 2**. Other costs common to both systems (i.e. irrigation, harvest, overhead, etc.) are not included. This trial is not replicated due to the limited space available. However, this side-by-side comparison is intended to be a valid case study of differing almond management systems.

The yield differences between Conv and Org/Trans Nonpareil production remained in 2012. Nonpareil yields show 1699 lb/acre and 1592 lb/acre advantage to the Conv over the Org and Trans productions systems, respectively (**Table 3**). Kernel size (24-25/oz) was similar between the treatments and quality was excellent for all three systems, virtually no worm or ant damage was found.

During the seven seasons of this trial, organic production levels, disease management, weed control, and nitrogen fertility have been the most challenging issues.

- **Weed Control:** While propane flaming in the tree row has been mostly effective, it is slow and expensive. Sections of the Org trees received a weed cloth barrier at planting which has prevented most weed growth in the 6 ft. wide tree line but at the considerable expense of $1500/acre plus yearly repair expenses. Weeds were hard to control along the edges of the cloth were mowers couldn't operate. The weed cloth was removed at the end of the 2011 after annual maintenance became too expensive and time consuming to continue. The surface drip system was replaced in October 2007 with a dual line subsurface drip system (SDI), primarily to reduce weed growth, seed emergence and associated weed control costs. This has reduced propane flaming expenses significantly compared to previous seasons. However, flaming is not effective during wet conditions and only marginally at cold temperatures. Given the 18 inches of rainfall in the Arbuckle area, weed growth gets ahead of the flamer in the winter requiring hand hoeing. This should also be reduced as canopies shade the soil surface. One immediate advantage of the switch to SDI irrigation was a reduction in harvest time tree water stress by running SDI hoses during harvest without wetting the crop significantly.
- **Fertility:** In 2011 the nitrogen fertility program in the Org/Trans trees was changed to include more organic fertilizer. Yard waste compost was discontinued in 2011. Instead, 50 lbs N/acre as sodium nitrate and an additional 25 lb N/acre as 4-0-2 liquid fertilizer was applied through the irrigation system. This was done in an effort to improve leaf N and canopy size. Leaf N levels remain good in both blocks (Conv and Org/Trans).
- **Disease control:** For the four consecutive seasons, significant amount of precipitation fell at bloom and into the summer; 0.49 inches in the last half of February, 4.72 inches during March, 0.88 inches in April, no rain in May, and 0.05 inches in June. Despite this rainfall and our past history of rust infections in the organic block, we are beginning to gain ground

on disease control in that block. No significant blossom disease was observed, and limited rust symptoms developed during mid to late summer. Our aggressive program of one sulfur spray per month following petal fall probably contributed to this positive outcome. We are hoping that by keeping leaves on the trees into and through harvest, we will see better organic crop yield in 2013.

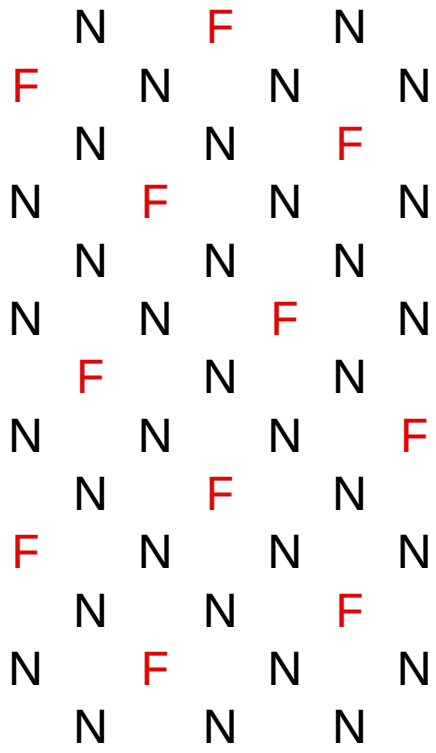

Figure 1. Trial Planting Design **-** 75% Nonpareil (N)/25% Fritz (F).

Organic Block – December, 2012

Conventional Block -- December, 2012

Table 2. Production Costs per Acre- 7th leaf. Application costs are not included.

----------Conventional----------			----------Organic----------		
Practice/Material	Applied	Cost/acre ($)	Practice/Material	Applied	Cost/acre ($)
Nutrition			Nutrition		
50# N/acre as CAN-17	April 9	60.26	2.5 lb/acre Solubor	February	3.75
150# N/acre as UN-32 (2x at 75 lb/acre)	May 1, June 7	111.30	50# N/acre Sodium nitrate	April/May (20#/30#)	202.80
40#K_2O as 0-0-8 (K_2SO_4)	June 7	60.00	25# N/acre and 12.5# K (4-0-2 liquid)	June	328.12
40#K_20 as 0-0-12 (KCl)	July 17	30.00			
2.5#/acre zinc sulfate 35.5%	November	2.00			
Solubor (5.5#/acre)	July (3#);Nov (2.5#)	8.25			
Weed Control			Weed Control		
Rely (4 pints/acre)	January	21.93	Propane	8 flamings	240.00
Alion (5 oz/acre)	February	35.34	Labor for flaming		100.00
Treevix (1 oz/acre)	July	9.67	Hoeing (weed eating)	5 times	60.00
Glyphosate (3 pints/acre)	July	4.48	Mowing	5 times	30.00
MSMO (32oz/100 gal)	July	1.44			
Mowing	5 times	30.00			
Insects/Mites			Insects/Mites		
Dimilin (12.8 oz/acre)	Pink bud	28.25			
Envidor (18 oz/acre)	July	40.11	Horticultural oil (2 gal/acre)	July	10.00
Disease			Disease		
Vanguard (5 oz/acre)	Pink bud	20.70	2 pints Sporatec, 4 oz/100 gallons Ecospreader	Pink bud	40.70
R-11 (8 oz/100 gallons)	Pink bud	1.87	Regalia (2 qt/acre), Actinovate (12 oz/acre), and 4 oz/100 gallons Ecospreader	Petal fall	32.89 + 56.41
Rovral (1 pt/acre)	Full bloom	21.33	Trilogy (1 gallon/acre)	2 WAPF	41.90
1% 440 oil	Full bloom	5.00	Kumulus DF (25#/acre)	4-5 WAPF	24.75
Pristine (12 oz/acre) + R-11 (8 oz/100 gallons)	Petal fall	41.77	Sulfur DF (25#/acre)	Late April	24.75
Bravo (4 pts/acre)	2 WAPF	83.20	Sulfur DF (25#/acre)	Late May	24.75
Ziram (8 lb/acre) + Tilt (4 oz/acre)	4-5 WAPF	41.56	Sulfur DF (25#/acre)	Aug 1	24.75
Quash (3.5 oz/acre)	Late April	29.75			
Tilt (4 oz/acre)	Early June	6.24			
Total costs	Not including application	686.22		Not including application	1156.27

Table 3. 2012 Yield / Kernel Size / Leaf %N

System	2012 Nonpareil yield lbs/ac	Kernels/oz	Trunk circ.cm (2011)	July leaf %N
Conventional	2,709	24	55.7	2.68
Transitional	1,117	25		2.43
Organic	1,010	25	52.2	2.35