Nickels Soil Lab Projects

Project No.: 06-HORT4-Edstrom

Project Leader: John Edstrom
P.O. Box 180
Colusa, Ca. 95932
(530) 458-0570
jpedstrom@ucdavis.edu

Project Cooperators: Bill Krueger, Stan Cutter, Nickels Trust

1) Pruning Systems for High Density Orchards

Interpretive Summary:

Now into the 10th season of evaluating minimum pruning (i.e. "Unpruned" treatment) we are still optimistic about the viability of a minimum pruning system for almonds, particularly under conditions of moderate to good vigor. The primary concern involves the shading out of lower/middle fruitwood and potential yield reduction from the teen years onward. So far, Nonpareil seems quite well suited to the system, while Aldrich is questionable and Carmel and Monterey are reasonably well suited. Accumulative yields have been equal between minimum and standard pruned trees for all varieties except Carmel, which was lower for "unpruned" trees. The "temporary limb" concept, as practiced here, is not worth the extra labor and is of questionable value. Mechanical topping appears to have value but was not adequately evaluated in this test.

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 almonds.

Materials and Methods:

Trees on Lovell peach rootstock were planted in 1997 at a 16' x 22' spacing, north and south. The soil was slipped plowed prior to planting and the trees are irrigated 2X per week with micro sprinklers to meet Etc. The soil series is Arbuckle, a sandy loam with a clay layer at 25 to 60 inches. Ample amounts of nitrogen, potassium and zinc are applied monthly to maintain high leaf mineral levels. The orchard design is 1:1 with Nonpareil rows alternating with pollinator rows of Monterey, Carmel and Aldrich. Four different training systems as described below began in the first dormant season. There

are four replicates of Nonpareil, three of Monterey, two of Aldrich, and two of Carmel. Beginning in the fourth leaf, yield data has been collected.

Treatments

1) **Standard** - Three primary limbs selected at 1st dormant, tipped but long pruned, secondaries 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.

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.

Results and Discussion:

Past results have shown that 1) minimally pruned trees and temporary scaffold trees out yield standard trees in the early years, 2) Temporary limb training is expensive and probably uneconomical, 3) Production between all treatments leveled out at the 6th year and have been equal ever since, 4) Cost savings of $ 500-700 per acre to the 10th year are possible with minimum pruning methods, 5) Aldrich growth habit is incompatible with the temporary limb method 6) Some minimal amount of secondary and inside branch removal may be necessary under minimum pruning, 7) Nonpareil is most compatible with minimum pruning followed to Monterey, Aldrich and Carmel in decreasing order of compatibility, 8) No increase in sticktights was found for minimum pruning, and 9) Tree height appears shorter with minimum pruning.

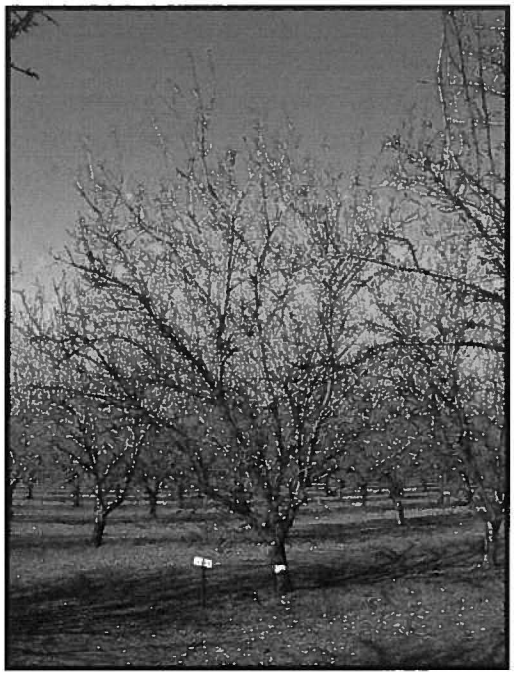
A common misunderstanding concerning the "Unpruned" treatment in this test needs clarification. The "unpruned" trees did receive some limb training. Three primary limbs were selected and all other competing limbs were removed the first dormant pruning. This method should actually be called minimum pruning.

We suspect one key to our success with minimum pruning in this test involved training the primary scaffolds in the 1st dormant season. The three primary limbs selected received only light tipping, and so, we reduced the proliferation of 2nd limbs. We then avoided the need to prune out extra secondary limbs at the 2nd dormant pruning. Tree canopies remained more open and manageable. As trees grew, the canopies opened with the weight of the crop. Conversely, when primaries are headed during the 1st

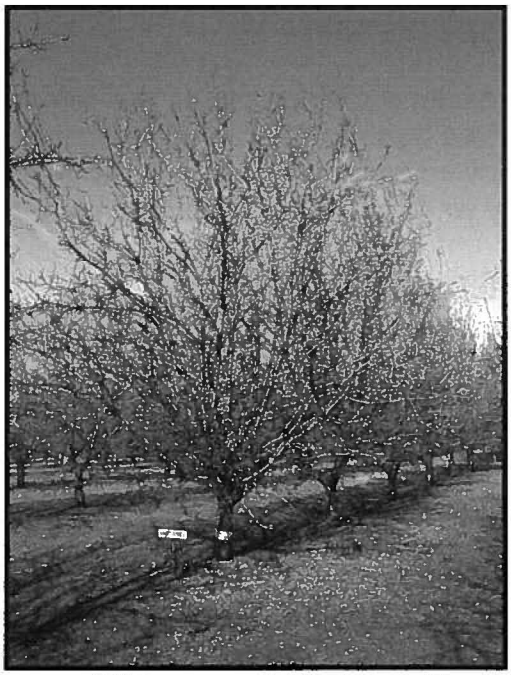
dormant pruning, many secondaries develop, requiring heavy pruning during the 2nd dormant season. Attempts at using minimum pruning concepts on this type of tree may result in overly dense/tangled canopies and later, excessive shading. If growers are forced to remove extra secondaries then a minimum pruning style is essentially unattainable and key advantages are lost.

Another current method of training 1st leaf almonds involves retaining 5-8 limbs as primary scaffolds. These extra primaries limit the vigor of each other and may prevent/limit excessive bud burst/limb growth and the consequent need for much pruning.

The central questions today concerning minimum pruning strategies are; 1) the number of primary limbs to select, 2) the necessity of heading primaries, 3) the feasibility of retaining multiple scaffolds, 4) the shading of fruitwood and early yield decline, and 5) the range of varieties and growing conditions/vigor amenable to minimum pruning



Nonpareil Standard Pruning



Nonpareil "Unpruned" Minimum Pruning

PRUNING TEST ALMOND YIELDS

	Aldrich		Carmel		Monterey		Nonpareil	
	accum	*2006*	*accum*	*2006*	*accum*	*2006*	*accum*	*2006*
Standard	14110	2483	12833	1705	13187	1667	13114	2703
Temp Scaffold	---	---	13441	1777	13583	1747	13414	2610
Mech hedged	13791	2308	13854	1686	13092	1661	13320	2586
Minimum/ Unpruned	13662	2127	11215	1492	15857	1757	13970	2660

2) Deep Tillage Slip Plow Effects on Almonds

Interpretive Summary:

Test results show no yield or tree size advantage to trees on slip plowed ground verses unplowed through the 10th year. Soil pits revealed only limited deeper root growth into slip plowed zones compared to root growth in unmodified soil. No differences in kernel quality were found nor in percentage tree survival.

Objectives:

The objective of this test is to evaluate the effects of slip plow soil modification on three varieties of almonds, Nonpareil, Carmel and Aldrich planted on Lovell or Brights Hybrid rootstock.

Materials and Methods:

Three varieties of almonds, Nonpareil, Carmel and Aldrich were planted in 1997 on Lovell or Brights Hybrid rootstock. Prior to planting, replicated areas of this 20 acre block received a commercial slip plow operation on a 10 foot grid to a depth of 6 feet in a north/south direction with a diagonal pass (SE-NW), the locally recommended practice. Soil conditions at this site consist of a sandy loam topsoil underlain by a dense clay layer at a variable depth of 30 to 60 inches (Arbuckle series, Class II). The planting receives weekly or bi-weekly irrigations via micro sprinklers applying 36-40 inches per season. Nitrogen and potassium fertilizers are injected monthly to maintain high leaf mineral levels. Soil banded potassium sulfate @ 1500 lbs per acre was applied November, 2005. Foliar sprays of zinc and boron are also applied annually.

Results and Discussion:

Yield data for 2006 continues to show no yield advantage to slip plow soil modification. Nonpareil yields were actually numerically higher in non-plowed soil than where the soil

was slip plowed, 2910lbs/ac for slip plow verses 2862 lbs/ac non-slip. Kernel sizes were nearly equivalent at 1.12 gms/kernel or 25 kernels/oz. The applicability of these findings to other soil types is unknown. We would expect that the clay layered nature of this Class II Arbuckle soil would be amenable to mixing by slip plow and lead to higher production. This has not been the case. Even in years of good production, 2002, 2003 and 2006 kernel yields were equal between treatments. One must question the net present value of spending $400-500 per acre on slip plowing and then waiting four years onward for a return on investment. Depending on soil and drainage limitations we must carefully consider such high expenditures upfront verses the benefits of slip plow soil modification in micro-irrigated orchards. The possible benefits of soil modification at this site might appear as the trees age. Tree survivability advantages to slip plowing may result after an exceptionally wet spring as found in 2006.

3) Evaluation of Almond Production on Raised Beds

Interpretive Summary:

Major areas on the west side of the Central Valley consist of layered hardpan or shallow soil, limiting the vigor and productivity of almonds. Shallow soils plus the widespread use of drip irrigation systems that apply water to a narrow area laterally greatly confine root extension and possibly tree vigor and yield capacity. Orchard middles, often consisting of wider areas than those wetted by micro-irrigation, allow minimal root development and thus in affect are underutilized or "wasted" for root growth/function. A novel orchard planting system was developed at the Tatura Research Station in Victoria, Australia to compensate for local soils subjected to high water tables. The Tatura Raised Bed System moves soil from the "middles" onto large beds down the tree row to increase soil volume and raise roots above saturated soil. Soil structure and biological activity are aided by a pre-plant fertilizer/amendment program and by growing a rye cover crop one season before tree planting. Although soils are older and less fertile in Australia, a similar system may prove advantageous for some California soils. This is the first year of the trial.

Objectives:

Evaluate for almonds the affect on productivity, kernel quality and farming practicality of raised beds for shallow Class II soils.

Materials and Methods:

Three tree rows will serve as replicates to evaluate Raised beds, verses Standard berm planted rows. Raised beds were formed during the summer of 2005, 20 inches high x 11 feet wide, amended with 3 tons sugar beet lime and 5 tons compost per acre (equal to 6 and 10 tons per bed acre respectively). Standard berms were formed at 8 inches in height x 5 feet in width. Plots were irrigated the previous summer/fall to stimulate weed growth/microbial activity in the beds. All berms/beds will be instrumented with soil moisture reading devices and irrigated to maintain uniform berm moisture levels via

micros. Tree growth and yield data will be collected. A single wire trellis to protect trees from added wind exposure will be installed on all plots.

Results and Discussion:

Raised bed soil was amended with 6 tons per treated acre of sugar beet lime and 10 tons per acre of compost concentrated in a 10 foot band centered on each bed row. Amendments were thoroughly disc incorporated into the soil. Beds were then constructed using multiple passes of a road grader to gradually add layers of soil from row middles to form raised beds 20 inches tall and 11 feet wide. Water was sprinkled onto beds as needed to settle added soil. Nonpareil trees on Lovell rootstock were planted April 20th by shovel into the top center of beds and berms at a16' X 22' spacing for 124 trees per acre in an offset design. Trees were immediately sub-surface probe irrigated and then 3 weeks later, sprinkler irrigated before the low volume irrigation hoses were installed. Two- 4 liter per hour drip emitters were installed per tree. Two ounces of actual nitrogen per tree as UAN was injected during 3 irrigation sets throughout the season.

No tree loss was found in any plot, however tree growth was only moderate given the late spring planting. No tree size differences were found between the Raised bed and Standard berm planted trees.

20" x 11' Raised Bed

Recent Publications:

Annual Report of the Nickels Soil Lab, Nickels Trust May 2007