Avocado Pruning Trials

Continuing Project; Year 3 of 5

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Benefit to the Industry

This project directly addresses "Canopy Management", an area identified by the California avocado industry as a research area of "primary interest".

Most avocado groves in Southern California are crowded resulting in little light penetration into the lower canopy. This condition is believed to have led to poor fruit set in the lower canopy and a general reduction in fruit production overall. Thinning has traditionally been the method to overcome the crowding problem, but growers often balk at removing mature trees, and the remaining trees continue to grow upward making harvesting very difficult. The researchers will evaluate various pruning methods compared to thinning, and compared to a treatment in which no pruning or thinning is done.

At the end of this project we should be able to tell growers which canopy management method (if any) is most beneficial in terms of yield, fruit size and costs for harvesting. An economic study will be completed which will determine if an increase in yield is off-set by increased costs for pruning, weed control etc.

Objectives

The primary objectives of this project are:
1. Compare several styles of pruning and other forms of canopy management in order to determine the best style to maintain maximum fruit production and maximum fruit size.
2. Keep track of labor costs involved in the various styles of pruning in order to develop a cost study on each pruning style.
3. Keep track of picking costs from each block of pruned trees and the block of control trees.
4. Teach growers proper means of pruning avocados.

A secondary goal has developed during the course of this project:
1. Utilizing one of the pruning styles (the Cal Poly style), try to enhance fruit set with a bloom spray.

Experimental Plan and Design

1. Pruning Trial. There are two research plots located in commercial avocado groves in this project. One is located at the Nick Stehly Ranch in Valley Center, CA, and the other is located at the Lamb Ranch in Camarillo, CA. Both groves are approximately 20–25 years old; the scion/rootstock is Hass/Topa Topa.

Both research plots were pruned initially in the spring of 1998. Each plot contains eight blocks of at least 16 trees. Each block is pruned or maintained in a certain style. In addition, each block contains a block of 16 trees that were left canopied to serve as the control block.
Our pruning styles are:

- **Stumped, pruned to Cal Poly style (vase shape).** These trees were initially stumped to three feet in height and grown back with light pruning on the upper shoulders of the canopy and some inside pruning to open up the center to allow light penetration. Light pruning was done to maintain the trees in June and November of each year. Trees are topped at 14 feet in height
- **Stumped, pruned to a single leader.** These trees were initially pruned to three feet in height, then all re-growth was removed except for a strong central leader. Each year (June and November) trees were lightly pruned to maintain a modified Christmas-tree like shape. Trees are topped at 14 feet in height. The bottom canopy is allowed to spread, but pruned before inter-mingling with the canopy of the neighbor tree.
- **Stumped, no follow up pruning.** These trees were initially stumped at three feet in height, but no follow-up pruning was done. This serves as a control comparison for the previous two methods.
- **High stumped, pruned to Cal Poly style.** These trees were initially stumped at eight feet in height. The purpose was to determine if stumping height has an effect on yield.
- **Two cut pruning.** Each year one of the worst encroaching branches (into a neighbor tree) is removed and one branch high in the tree (above 15 feet) is removed. The purpose is to gradually bring the height of the tree down to a manageable level while gradually bringing the canopy width in closer to the trunk. By not stumping initially, these trees are never out of production.
- **Israeli method, one main branch removal per year.** Starting on the southwest side of the tree, one main branch was removed the first year. Each year a branch is removed such that, after five years, all of the main branches will have been removed. By the fifth year, a new canopy will have developed that will provide continuous production without having the tree taken out of production.
- **Thinning.** Every other tree (on a diagonal pattern) was removed in the first year. Remaining trees are allowed to grow into the space of the removed trees without pruning.
- **Non-pruned control block.** These trees remain in a canopied condition to serve as a control block.

Since November 1, 2000 we have lightly pruned the single leader trees and the Cal Poly style trees twice to maintain their shape. About 10 minutes was spent on each of these trees during each pruning session; this pruning was done in November and in June. It appears that it is necessary to prune the new growth in June, but the new shoots were only pruned about half-way back to keep the fruit from being sun-burned.

The stumped trees with no follow-up pruning have begun to grow back together such that shading and leaf drop will be expected in the next year. We expect this to be the beginning of a canopied condition.

Pruning in the two cut method and the Israeli method (one major branch removal method) was done in August/September. About 20 minutes was spent on each tree to remove the branches, cut up the wood and chop the trash.

2. Yield Enhancement in a Pruned Block. Although this was not a part of the original proposal, we had a good chance to work with a large block of trees that were pruned to the Cal Poly style (topped at 12 feet) on the other side of the Stehly Ranch. The idea was to see if we cold enhance the fruit set in pruned trees with a bloom spray or a boron application to the soil or a phosphorus acid trunk injection. All of the materials were applied in April of 2000. The bloom sprays consisted of Crop Set (two rates), phosphorus acid (buffered) bloom spray, phosphorous acid (buffered) trunk injection, fish emulsion, Gro-Getter, Sunburst, boron, copper and a water spray control. We also had a non-sprayed control. The flowers were sprayed using a battery-powered back pack sprayer. The pruned trees averaged 12 feet in height and the flowers were easily sprayed with the backpack sprayer. The treatments were replicated six times. Flowers were sprayed the first week in April, 2000, about 50% bloom opening.

Summary

1. Pruning Trial. The harvest at the Stehly Ranch in Valley Center was completed in April, 2001. Yield data for the 4 inside trees in each block are summarized in Table 1 and yield for all of the trees in each block are reported in Table 2. (Please note that in the semi-annual report in April 2001 we reported data on all 16 trees in each block. This was technically incorrect since the outside trees are considered to be "border trees").

Table 1. Yield data from various pruning styles without border trees (Stehly Ranch, Valley Center).

	Lbs/tree	Lbs/acre	Lbs/fruit	Oz/fruit	Picking cost/lb	N (number data trees)
Control	233.8	24,401	0.40	6.4	$0.23	4
Cal Poly	36.7	3,998	0.55	8.7	$0.07	4
Single Leader	49.5	5,391	0.58	9.3	$0.07	4
Stumped, no follow up	111.3	12,134	0.52	8.3	$0.07	4
Thinned	447.6	24,616	0.40	6.5	$0.06	2
2 cut	130.6	14,234	0.45	7.3	$0.15	4
Israeli	188.5	20,542	0.40	6.4	$0.07	4
High stumped, Cal Poly	5.2	570	0.50	8.2	$0.03	4

Table 2. Yield data from various pruning styles with border trees (some plots had more trees than others due to configuration of the plots on the hillside).

	Lbs/tree	Lbs/acre	Lbs/fruit	Oz/fruit	Picking cost/lb	N (number data trees)
Control	252.0	27,420	0.37	6.0	$0.23	16
Cal Poly	45.9	5,004	0.53	8.6	$0.07	22
Single Leader	42.7	4,657	0.56	9.0	$0.07	18
Stumped, no follow up	81.3	8,857	0.53	8.5	$0.07	25
Thinned	321.8	17,537	0.42	6.7	$0.06	10
2 cut	149.6	16,265	0.40	6.4	$0.15	24
Israeli	236.7	25,082	0.50	7.9	$0.07	16
High stumped, Cal Poly	23.6	2572	0.43	6.9	$0.03	16

This is the third year of harvest in the pruning trial. The control block has continued to bear fruit at an unusually high rate. We believe this is due to the placement of the beehives that were located just across the road. Of interest is the high yield in the thinned block and the Israeli block, both located at some distance from the beehives.

While the control block is bearing at a high rate, the fruit size is much smaller than the pruned blocks. We have data from the packouts for each plot, and the price of fruit according to size at the time of harvest, but at this time these data have not yet been tabulated.

Picking costs were very low in the pruned blocks. Essentially, the pickers had to pick at the top of their ladders in the control block and the harvest was very slow. No ladders were used in the stumped blocks; all fruit was picked from the ground and it went very fast. To complicate the picking cost data, we had some new pickers and some older experienced pickers and each day there was a different mix of skill levels. In the future it would be better to use the same pickers each day during the harvest.

One of the problems we have noted while pruning the single leader and the Cal Poly style trees is that quite a few side shoots are pruned off that will flower and bear fruit the next year. This pruning has to be done, however, in order to maintain the shape of the canopy and for light to reach to lower canopy. The benefit is that a lot of fruit are setting in the lower canopy that are picked by pickers standing on the ground. The pruning of these shoots seems to be an unavoidable negative factor in avocado pruning. The overall yield per acre would improve if the pruned trees were on a closer spacing than the current 20' x 20' spacing.

Since November 1 there have been several tours of the plot for individual growers and a tour for approximately 100 growers and 120 Master Gardeners. Dr. Partida has also conducted tours for his students and for growers from one of the pacing houses.

2. Yield Enhancement in a Pruned Block.

The first harvest from this trial was completed in January 2001. Initial results looked positive for Crop Set sprayed at 8 oz/acre; these trees averaged 157 lbs fruit/tree, compared to 69 lbs/tree for the water sprayed control and 96 lbs/tree for the non-sprayed control. The only other treatment that may be positive was the phosphorous acid (buffered) trunk injection producing an average of 123 lbs/tree. None of the other treatments appeared to be beneficial. These data will be analyzed for statistical significance.

The bloom sprays were repeated on the same trees in April-May, 2001.

The bloom spray trial fits in well with the pruning trial since our goal is to develop a new system for producing high-yielding avocado trees.