In: M. L. Arpaia and R. Hofshi (eds.), Proceedings of Avocado Brainstorming. Session 3. Canopy Management. Pages 45-48. October 27-28, 1999. Riverside, CA. Hofshi Foundation. http://www.avocadosource.com.

SOME ECONOMIC REASONS TO CONSIDER CANOPY MANAGEMENT

Reuben Hofshi
Del Rey Avocado, Fallbrook, CA

There are many good reasons to "open up" a crowded orchard; the key reason is to optimize light penetration and interception. Light is critical for flowering and fruit production. In the shaded orchard, the surface area, which intercepts light, is reduced to only the treetops and the exterior margins of the block. Trees with canopies, which extend to the ground, have a much greater surface area; this equates to a higher photosynthetic capacity. Sugars, which are the end product of photosynthesis are the only source of energy for the tree and are critical for all processes from root growth to fruit production. There are other economic reasons to consider a canopy management program, which will be discussed below.

In crowded orchards the trees are usually tall and the fruit, which tend to be smaller, are found mostly at the treetop. This makes it difficult to size pick, which is both an economically sound practice and also an important cultural management tool.

Early season size picking is important for several reasons:

1. Prices are usually much higher in the early part of the season as compared to the remainder of the season;
2. Once some of the fruit is removed the remaining fruit have a tendency to size sooner;
3. Research conducted in Australia and South Africa show that removing at least 30% of the fruit as early as possible and prior to bloom may reduce alternate bearing.

Size picking is a costly proposition and it is getting costlier every year. The per pound rate is determined by the amount of sized fruit per tree, the size of the trees, the terrain on which they are grown, and the availability of experienced pickers. The harvesting workforce is substantially reduced during the months of December and January, the time of year when fruit prices are high, as workers take time off to travel home for the holidays. When harvesting tall trees, which require ladders and picking poles, fruit from below appear to be larger, and hence there is a greater potential for picking the wrong size. A good picker in mid December can harvest from tall trees from 250 to 700 pounds of fruit per day, depending on the amount of large fruit available, and how accurate a size pick is required. Four hundred pounds per day is a very reasonable average. At $100 to $120 per 10 hour day the cost of harvesting 400 pounds is $0.25 - $0.30 per pound. When the returns are high for the grower, as it has been during the last season (approximately $1.50 per pound), this is a somewhat acceptable cost. Since there are insufficient pickers to meet early harvesting needs there is an acute competition for the limited pickers. In small trees (15 feet tall or less, either young trees or rejuvenated trees) the picker's daily production increases dramatically to a range of 800 to 1,600 pounds for an average of 1,200 pounds. Under these conditions the harvest cost for the $100 - $120 per day worker is $0.083 - $0.10 per pound. This equates to one-third the cost of harvesting the tall trees. More importantly, in the absence of an adequate workforce, one worker is producing per day the same as three workers in the tall trees. This increases the likelihood that the grove with the smaller trees will be harvested in preference to the tall, overgrown orchard. The consequence is multi faceted:

1. The availability of workers for orchards with smaller trees is increased;

2. The harvesting cost per pound for a small tree is a fraction of the cost to harvest a tall tree;
3. There is an overall increase in the average return for the year since fruit was picked early with high prices relative to the rest of the season;
4. The remaining fruit size faster than those on trees, which have not been size picked;
5. The early harvested trees have a greater probability to produce a reasonable crop the following year.

How does this translate in real money? Table 1 illustrates the costs of harvesting and the net revenue for 3 scenarios. The calculations assume that the orchards will produce 6,500 pounds per acre. One grove is a pruned or young grove maintained at or below 15 feet. The other two orchards are tall and crowded. In the grove where the trees are small there are 4 harvests. The first harvest is a 20% size pick in mid December followed by a 25% size pick at the end of January, and 25% size pick at the end of March. The remaining fruit (30%) are harvested in June. There are two options with the tall trees, size picking versus no early size pick (December). In the second scenario, the first harvest is in mid December (10%), followed by removal of 30% of the crop at mid March and the remaining 60% in June. In the final scenario the tall trees would have 20% of the fruit harvested at the end of February, and a final harvest at the end of July. In this case, the fruit is held longer due to slower fruit sizing since more fruit are stored on the tree longer. Note that in Scenario 1 that 70% of the fruit is picked pre-bloom while in the other two scenarios that 40% and 20% are harvested pre-bloom, respectively.

Table 2 illustrates that the grower with the smaller trees can earn as much as $1,229 more than the farmer with the tall trees with a early size pick and $1,450 more than the farmer with the tall trees with no early size pick. As discussed above, there is a shortage of experienced pickers and they are likely to be in short supply until later in the harvesting season. Additionally, there may be a preference to harvest the smaller trees over the tall trees. Due to these factors the size pick option in the tall trees may not even occur. The efficient utilization of the workforce, as measured in terms of work-days to harvest the crop is much greater in the shorter trees when compared especially to the tall trees that are also size picked (Scenario 2). Another aspect of the high cost of harvest is that with current high returns, as shown in Table 1, the cost of harvest is just over 10% of gross returns. If prices decline to an average of $0.75 per pound, $0.12 per pound is 16% of the gross return.

A second economic consideration for maintaining “smaller” trees is pest management. Pests, such as mites, thrips, fruit flies to name a few, are becoming a way of life for avocado growers. In the absence of effective biological control growers need to apply certain pesticides to their trees. In the hilly terrain of southern California with trees that are 25 to 35 feet tall, helicopter application may be the only means to spray and only with marginal efficiency. Helicopter service is expensive and is in limited supply if timely and repetitive applications are required. Since many groves are located on the urban interface, helicopter application may not be always possible and ground rigs may be the only option. Trees which are 15 feet or shorter could be effectively sprayed by ground rigs by either a grower or by a contracted crew whereas it is difficult to obtain good coverage in taller trees. The difference could be between no application at all if helicopters are not an option and a reasonably priced ground application.

Growers may argue that the cost of canopy management is high, particularly if semi-annual pruning is contemplated. A grower may apply some or all the savings as discussed above towards canopy manipulation and within a year or two the crowded tall orchard will once again become a commercially viable enterprise with increased production and increased income.

Table 1. Differences between total harvest costs, net revenue and work-days for avocados harvested under 3 scenarios. All scenarios assume a total yield of 6,500 lb. per acre.

Harvest month	Percent of total crop harvested	Pounds per harvest	Fruit return per pound	Gross return per acre ($)	Typical harvest charge per pound[z]	Total harvest charge per harvest	Estimated production capacity per picker (lb. per day)	Work-days to harvest crop[y]
Scenario 1. Grove maintained at 15 feet with multiple harvests.								
December	20	1,300	1.80	2340	0.12	156.00	1200	1.08
January	25	1,625	1.30	2113	0.08	130.00	1600	1.02
March	25	1,625	1.20	1950	0.08	130.00	1600	1.02
June	30	1950	1.00	1950	0.08	156.00	1600	1.22
Total crop	**100**	**6,500**	**1.23**	**8353**	**0.086**	**572.00**		**4.33**
Total Expenses						*572.00*		
Net Revenue						*7,781.00*		
Scenario 2. Tall trees with an early size pick.								
December	10	650	1.80	1170	0.30	195.00	400	1.63
March	30	1,950	1.25	2437	0.15	292.50	800	2.44
June	60	3,900	1.00	3900	0.12	468.00	1200	3.25
Total crop	**100**	**6,500**	**1.16**	**7507**	**0.147**	**955.50**		**7.31**
Total Expenses						*955.50*		
Net Revenue						*6,552.00*		
Scenario 3. Tall trees with NO early size pick.								
February	20	1,300	1.30	1690	0.15	195.00	800	1.63
July	80	5,200	1.05	5460	0.12	624.00	1200	4.33
Total crop	**100**	**6,500**	**1.10**	**7150**	**0.126**	**819.00**		**5.96**
Total Expenses						*819.00*		
Net Revenue						*6,331.00*		

[z] This is the typical charge per pound by commercial harvesting crews.
[y] Work-days to harvest the crop = pounds per harvest/production capacity per picker per day.

Table 2. Comparison between net revenue and total work-days required to harvest between different strategies for harvesting avocado fruit between small and large trees.

	Net Revenue	Difference between Scenario 1	Total work days to harvest crop
Scenario 1. Grove maintained at 15 feet with multiple harvests	$7,781		4.27
Scenario 2. Tall trees with an early size pick	$6,552	$1,229	7.31
Scenario 3. Tall trees with NO early size pick	$6,331	$1,450	5.96