Investigation of Pruning Strategies for Prunes Including Hand, Mechanical and Combinations

Bill Krueger, Franz Niederholzer, Erick Nielsen and Brian Mori

Introduction:

Prune trees are pruned to thin fruitwood, improve fruit size, reduce alternate bearing and control tree size and shape. Hand pruning with ladders and loppers has long been thought to be the best alternative for pruning because of the selective nature of the pruning which cannot be matched by mechanical pruning. Previous studies of mechanical pruning have shown the limitations of mechanical pruning. In a study conducted in Glenn County during the 1990's, pruning severely enough mechanically to achieve equal fruit size and value per ton as hand pruned treatments resulted in reduced yield. New developments in mechanical pruning equipment have made different types of mechanical pruning possible. Because of the cost and availability of labor, growers have continued to look for strategies to reduce pruning costs while maintaining yield and quality. These have included pruning from the ground without ladders using pneumatic pruners, pole chainsaws and long handled loppers and different types and timings of mechanical pruning and combinations of different pruning strategies.

Objectives:

The objectives of this study are to compare different pruning strategies including hand and mechanical at different times and in various combinations to see if these strategies can be incorporated into prune production without reducing returns to a greater extent than the potential cost savings. We realize that the results will be affected by growing conditions during the season and that what is the best treatment one year may not be the best in a different year. Our plan was to initially select a pruning strategy and then use the available tools such as mechanical thinning to optimize that treatment.

Methods:

During the winter of 2005-2006 a mature highly productive block of French Prunes was selected. The block was a north-south planting with a spacing of 14 X 17 ft. or 183 trees per acre. In the winter, 2006, prior to the beginning of the trial, the trees were 17-18 ft. tall. A total of 9 different pruning strategies were selected and applied in a randomized complete block design with 3 replicates. Each replicate consisted of an entire row of 33 trees.

The hand pruned treatment with ladders and loppers (Std) has remained constant during the three years of the trial and is intended to represent a typical dormant hand pruning. The other treatments have been hand pruned from the ground without the use of ladders using a combination of pneumatic pole pruners, pole chainsaws and loppers and long handled loppers. This pruning has generally, been a less detailed type of pruning that

removes fewer larger branches to allow for light penetration into the canopy. The differential mechanical pruning treatments have included; flat topped (T) at approximately 15 feet, "roof topped" (RT) at 12 feet on the outside of the tree and 15 feet in the row center, "V" by making a slanted cut on the east and west side of the tree row to form a V in the center of the tree 12-14 feet at the bottom center and 17 feet at the top on the outside and a "Mohawk"(MH) where slots were cut in the shoulder of the canopy on both sides of the row, leaving the center uncut. Mechanical pruning timings included, dormant (D), summer (S) in June and post harvest (PH) in September. After the first year, because of an excessively vigorous response to the dormant mechanical pruning and research by others which indicated a less vigorous response when the mechanical pruning was done immediately post harvest, we shifted from the dormant timing to post harvest. Table 2 summarizes the mechanical pruning treatments and timings.

Each year, the plots were harvested and green weights were determined using a load cell attached to the forks of the receiver. Two samples (approximately 100 fruit each) were collected from each plot. Sample weights were obtained before and after commercial drying (courtesy of Sunsweet Dryers, Hamilton City). Screen sizes were determined by running the samples through a sample shaking table at UC Davis. Drying ratio, dry count pound and dry yield per acre were determined. Current PBA prices were used to calculate value per ton and value per acre based on the sample screen sizes.

Results:

In 2008 the dry yield varied from 3.3 dry tons per acre for treatment one, which had not been differentially mechanically pruned since the dormant season of 2006, to 6.07 for treatment 4 (DV in 2006and SV in 2007) (Table 1). The average was 4.38 tons per acre. Dry count per pound and value per ton were better for the lowest yielding treatment (1) and poorer for the highest yielding treatment (4). However, the higher yield more than compensated for the slightly lower value per ton, resulting in the highest value per acre for treatment 4.

Discussion:

During the three years of the trial there have been two years of moderate crop, 2006 and 2008 and one year of heavy crop 2007. In the first year of the study, all of the treatments had a higher yield and value per acre than the standard pruning treatment (Table 2). This was due to a moderate fruit set overall which resulted in good fruit sizes with no differences in value per ton between treatments.. The standard pruning treatment reduced the total yield and, therefore, the value per acre. In 2007, fruit set was heavy and all of the treatments required intervention in addition to mechanical pruning treatments to size the fruit and prevent tree damage. These steps included, mechanical thinning, skirt pruning, cluster thinning with poles, mechanically cutting a narrow alley way (1 to 2 feet) in the row middle and propping as needed.

Through the three years of the trial, combined yield for all of the treatments has been greater than for the standard pruned treatments (Table 2). Yields for treatment 1, which

only received differential mechanical pruning (dormant topping) in 2006 has been declining compared to the standard treatment for the last two years. The reason for this is unclear. The trees are taller than most of the other trees and show more limited new growth. Treatment 7, which was post harvest roof topped prior to the 2008 season, had the lowest yield per acre in 2008. It is believed that this was the result of the trees being cut too severely. The height of the topping was set on one replication and was set to provide a moderate topping. Unfortunately, the area where the cutting bar height was determined was some of the smaller trees. By the time this error was discovered, half of trees had been pruned, so we left it set to complete the treatment. This resulted in over-pruning which, we believe, is reflected in the reduced yield. We expect that this treatment will rebound in 2009.

In 2006 and 2007, the estimated cost for the hand pruning was $3.25/tree or $594/acre with overhead included. The dormant polesaw pruning was estimated to cost about $200/ acre. The mechanical pruning was estimated to cost about $40/acre. So, the mechanical plus dormant pole saw pruning would cost about $240/acre. In 2008 the ground hand pruning consisted of 10-20 cuts per tree with pole loppers and 12-24 cuts per tree with long handled loppers. The cost was approximately $2.00 per tree or $370 per acre with overhead.

Conclusions:

Mechanical pruning can be used in combination with less detailed pruning from the ground using pole pruners, loppers or saws and other cultural practices such as mechanical thinning without reducing yield and crop value while offering significant savings compared to standard ladder and lopper hand pruning.

We would like to continue this trial for at least one more year to confirm the results and to follow any trends that may be developing.

Table 1. Pruning Trial Results 2008

Trt	Drying Ratio	Dry tons/ac	Count/lb	$/Ton	$/ac
1	**2.96a**	**3.30c**	**44.9a**	**1,725a**	**5,683bc**
2	3.02a	4.63b	51.9bcd	1,652bc	7,641abc
3	**3.12a**	**4.12bc**	**54.5cd**	**1,643cd**	**6,772bc**
4	**3.06a**	**6.07a**	**55.2d**	**1,589d**	**9,655a**
5	2.98a	3.34c	50.5bcd	1,680abc	5,578c
6	2.98a	4.10bc	491ab	1,710ab	6,999bc
7	3.02ab	4.49bc	50.1bc	1,658bc	7,436bc
8	2.99ab	4.65b	51.8bcd	1,671abc	7758ab
9	3.22b	4.72b	54.8cd	1,643cd	7,739abc

Numbers followed by different letters are significantly different at the 5% level using Fischer's test

Table 2. Treatment and Yield Summary 2006-2998

	Mechanical Pruning Treatments			Dry Yield/ac as % of Standard			
Treatment	**2006**	**2007**	**2008**	**2006**	**2007**	**2008**	**Cum 06-08**
1	DT			166a	97cd	80c	107
2	DT	S RT		145ab	110abcd	112b	118
3	**Std**	**Std**	**Std**	**100c**	**100bcd**	**100bc**	**100**
4	DV	SV		36abc	114abc	147a	129
5	DV(eastside)		PH RT	160ab	117a	81c	116
6	SV		PH T	166a	114abc	100bc	121
7			PH V	169a	116a	109bc	125
8	D RT	SV		158ab	100cd	113b	116
9	D MH	S MH		125bc	114ab	115b	117

Letters followed by different letters are significant at the 5% level using Fischer's test