MECHANICAL PRUNING OF TULARE COUNTY DRIED PLUMS

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ABSTRACT

Prune trees are typically pruned by hand; however, a recent study conducted in the northern Sacramento Valley suggested that mechanical pruning techniques may be implemented without adversely affecting yield or fruit size. In 2010, a similar study was conducted in Tulare County to determine the impact of mechanical pruning on tree height, light absorption, yield and fruit size. Four pruning techniques (standard hand prune, mechanical topping, mechanical V-Cut, and use of pruning towers) were established in a randomized complete block design. Pruning treatment affected tree height, with flat topped rows exhibiting significantly shorter height than other treatments. Pruning treatment did not affect adsorption of photosynthetically active radiation (PAR). Neither fresh nor dry yield was affected by pruning treatment; however, one block yielded significantly higher than the other two blocks. The high yielding block also exhibited significantly higher percent absorption of PAR. Implementation of pruning towers plus a cursory follow-up with hand pruning resulted in significant increase in fruit size as estimated by fruit weight. The results suggest that mechanized pruning techniques may be employed without adverse affect on yield or fruit size; however, implementation of these treatments over successive years is necessary to evaluate the long-term implication of pruning treatments on the economics of yield.

INTRODUCTION

In Tulare County, dried plum trees are typically pruned by hand with loppers and ladders; however, growers have expressed interest in the potential to employ mechanical pruning treatments as an alternative to hand pruning. A study conducted in Glenn County by B. Krueger, et al suggests that mechanical pruning may be used in combination with less detailed pruning from the ground without detrimental effect on yield or fruit size. In the Glenn County study, mechanical pruning to create a “V” in the top of prune trees, followed by dormant pole pruning from the ground, resulted in increased yields over standard hand-pruned trees. Additionally, the “V” cut plus dormant pole prune treatment cost over 50% less per acre than the standard hand-pruned plots. The incorporation of mechanical pruning costs approximately $40/acre; however, the mechanical pruning expense is in addition to some ground work. Consequently, the economic savings of adding a mechanical pruning component is still determined largely by the cost of the subsequent hand labor.

The effects of mechanical pruning on dried plum production in the southern San Joaquin Valley (SSJV) is yet unknown. Because of the climatic dissimilarity between Glenn County and Tulare County, a regional trial based in the SSJV is necessary to evaluate the potential impacts of mechanical pruning techniques on yield, fruit size, and long-term tree health. Additionally, a comparative assessment of the economic benefits of mechanical pruning between orchards in the northern Sacramento Valley the SSJV is necessitated by the disparity in labor costs between the two regions.

OBJECTIVES

The objective of this study is to compare the impacts pruning treatments on fresh yield, dry yield, and fruit size of dried plums. The study will include four pruning treatments: i). standard/hand prune, ii) mechanical "V" top, iii) mechanical flat top, and iv) pruning towers. Additionally, to assess the impact of pruning treatments on tree size, post-pruning tree height and percent adsorption of photosynthetically active radiation (PAR) was assessed across pruning treatments.

METHODS

A 22 acre block of French prunes on Mariana rootstock was utilized for the study. The block was planted in 2001 with 20 ft x 16 ft spacing and rows running east/west. Four pruning treatments were employed in a randomized complete block design (RCBD), with entire rows serving as replicates. Within each of three blocks, each pruning treatment was exacted over three consecutive rows, thereby minimizing interplot interference by enabling data collection from the middle of three identically-treated rows. Each row contained 75 trees and represents approximately 0.53 acres. Upon plot establishment, an orchard map was created to illustrate locations of both weak and missing trees.

Trees were pruned in the first week of February 2010 with four different treatments: i). standard/hand prune, ii) mechanical "V" top, iii) mechanical flat top, and iv) pruning towers. All mechanized treatments were followed with hand crews to make select cuts.

Assessment of tree size. Two techniques were employed to determine the effect of pruning treatments on overall tree size. Tree height was assessed in March 2010 and percent absorption of PAR was measured in July 2010. To measure tree height, five trees were selected at random from each test row and two measurements were taken from each selected tree, one on the north side and the other on the south. Using a telescoping measuring stick, the total height from the top of the burm to the visibly-tallest branch was recorded. The average height per tree was calculated, resulting in 5 subsamples of tree height within each test row. In late July 2010, percent PAR was determined by running light sensors under the orchard canopy within approximately 40 minutes of solar noon (1 pm due to daylight savings time).

An analysis of variance (ANOVA) was utilized to assess influence of block and pruning treatment on tree height and percent PAR and differences between means were determined with a Waller-Duncan K ratio test (K=100). Additionally, influence of percent PAR on yield was assessed with regression analysis. All statistical analyses were conducted using SAS (Cary, NC).

Determination of yield. The day prior to harvest of test plots, all weak trees occupying test rows were harvested by hand. Consequently, all yield data was adjusted to reflect numbers associated with a full compliment of 75 trees per row. Test rows were harvested independently, and two 5 lb subsamples of fresh prunes were collected from each row. Subsamples were weighed in the field and then independently run through the dehydrator. Total fresh yield was determined by weighing each bin prior to dehydration. Total dry yield from each row was determined by multiplication by a conversion factor based on fresh:dry weight of subsamples.

An ANOVA was utilized to assess influence of block and pruning treatment on fresh and dry yield and differences between means were determined with a Waller-Duncan K ratio test (K=100).

Assessment of fruit size. After dehydration, subsamples were utilized for determination of size distribution. For assessment of size as a continuous variable, individual dried fruit weights were recorded for the first 50 pieces of fruit randomly selected from subsample bags. The average fruit weight per subsample was calculated. For assessment of size as a categorical variable, subsamples were run through a series of nested screens (38,36,34,30,28,26,25). The number of fruit and weight of fruit caught in each screen was recorded and the proportion of fruit in each category was calculated by weight.

The influence of block and pruning treatment on individual fruit weight was determined by ANOVA and differences between means were determined with a Waller-Duncan K ratio test (K=100). Categorical data was analyzed by ANOVA comparing proportions of fruit in size categories with respect to block and treatment.

RESULTS

Assessment of tree size. Pruning treatment significantly affected tree height ($P \leq 0.0001$) (Fig 1A). Flat topped trees were significantly shorter than all other pruning treatments. Percent PAR varied significantly between blocks ($P \leq 0.03$), with block 3 (north side of orchard) exhibiting higher light absorption than either block 1 or 2 (Fig 1B). Pruning treatment had no statistical affect on light absorption.

Figure 1A

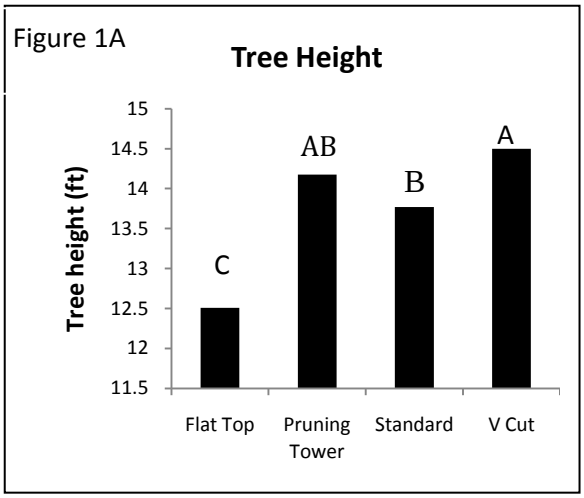
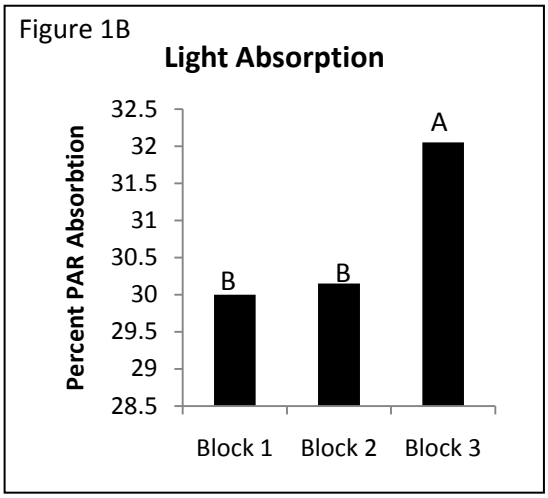


Figure 1B



Yield. Pruning treatment had no significant effect on either fresh or dry yield; however, yield varied significantly by block ($P \leq 0.01$) (Fig 2 A and B), with block 3 (northern block) exhibiting higher fresh and dry yield than either block 1 or 2.

Figure 2A

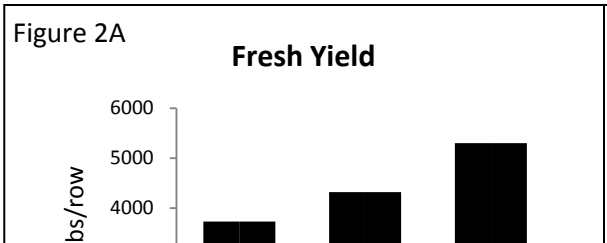
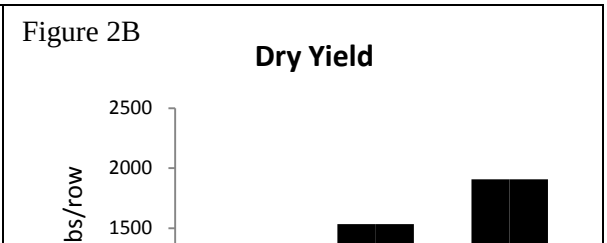
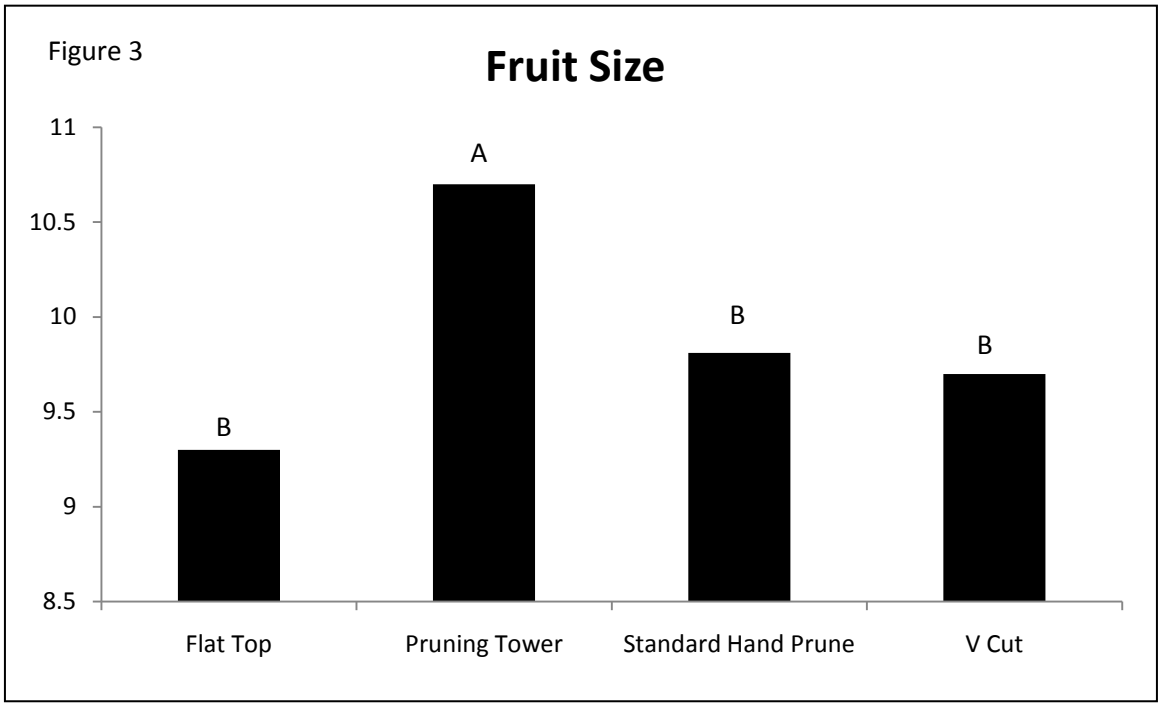


Figure 2B



A
B
B
B
B
A

Fruit size. When measured as a continuous variable, fruit size was affected by pruning treatment (P≤0.0001) (Figure 3). The use of pruning-towers followed by hand crews resulted in significantly larger fruit than the three other treatments, and fruit weight was 9% higher in pruning-tower plots than in the standard hand-pruned plots. Fruit size did not vary by block. When fruit sized was assessed as a categorical variable, no statistical differences were observed in proportions of fruit captured in each size category.



DISCUSSION

The results after one year suggest the potential for implementation of mechanical pruning techniques without consequence to yield or fruit size. The main factor affecting yield was block, or geographic region of the orchard. Interestingly, the block exhibiting the highest yield also

demonstrated a significantly higher adsorption of PAR. These results suggest that further studies should be developed to investigate the association of light absorption with yield in dried plums.

Though fruit size was affected by pruning treatment, successive years of pruning are needed to determine whether pruning will affect the fractional distribution of fruit into size classes. A shift in the categorical sizing of fruit into higher size classes will result in significantly higher economic returns to the grower. It is important to note that mechanical pruning treatments did not adversely affect fruit size; all three mechanical treatments were either statistically similar or larger than the standard hand pruned trees.

The implementation of mechanical pruning techniques on dried plums will likely vary based on labor costs. The cost of standard-hand pruning in the Glenn County trial was approximately $600/acre, whereas the standard-hand pruning in the Tulare County trial was approximately $350/acre. This difference in hand-pruning costs may reflect differing labor costs in northern Sacramento Valley and the SSJV, and perhaps also a reflection of the economic times during the implementation of pruning trials at either location.