DESCRIPTION:	**Effects of Pruning Method on Fruit Size, Yield and Limb Rub**
PROJECT LEADER:	**Chuck Ingles, UCCE Sacramento County**
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EFFECTS OF PRUNING METHOD ON FRUIT SIZE, YIELD, AND LIMB RUB

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Abstract

Four pruning methods are being used on six trees each in this experiment, and pruning treatments were started in Dec. 1999. The pruning methods used are: 1) short pruning, 2) intermediate pruning, 3) long pruning, and 4) short pruning with upright "poles." The long pruning trees have apparently not been pruned heavily enough, so in 2001 there were far more buds left, which resulted in smaller fruit. However, the number of fruit per tree was the same in all treatments. Short pruning resulted in the largest fruit. Long pruning resulted in the greatest amount of limb rub and short pruning had the least. There were no differences in total yield among treatments. Long pruning was quickest to perform, especially in the first year, and in the first year there were no significant differences in fruit size or yield among the treatments.

Problem and its significance

Several distinct pruning methods are used in the Sacramento River district, and there are probably many hybrid or intermediate styles. Probably no one method is ideal every year.

One method is **short pruning**, in which a large proportion of fruit are produced short spurs originating on main branches. In this method, more of the upright and lateral shoots are removed and spurs are promoted along the branch. This method can allow more sunlight to reach spurs and allow excellent ladder access with few crossing limbs. Limb rub may also be lower, since a greater proportion of the spurs are anchored to main limbs rather than lateral branches. On excessively vigorous trees, however, shading of spurs may occur by fast-growing top shoots. Also, it can be difficult to produce many spurs if most of the new growth occurs on vigorous, upright shoots and little spur growth occurs.

In another method, often promoted by Dan Strydom, **long pruning** is used to produce a relatively large proportion of the fruit spurs on hangers or small branches. This style has the advantage of producing more buds, which can theoretically increase fruit number, although potentially at the expense of fruit size. However, some growers find that fruit set has remained constant regardless of the number of buds left after pruning. Another potential advantage with this method is that a larger proportion of the fire blight strikes occur away from the main limbs, and cutters may be able to remove the hangers rather than cut into the main limbs. A drawback to this style is that ladder access and spray coverage may be reduced by crossing limbs. There is also concern about increased limb rub damage because more of the spurs are borne on longer branches.

There are many **intermediate** methods. With the intermediate method used in this trial, strong upright one-year-old shoots are removed, whereas those of intermediate vigor are often headed to "four fingers" to create spurs for next year, and lower vigor shoots are thinned if necessary but allowed to remain. Main lateral branches are kept well spaced and maintained in an outward orientation,

Another method is one in which fruit spurs originate mainly from limbs allowed to grow upright on main branches; these are sometimes called "**poles**." With this method, several

upright shoots along these branches are initially headed around 6 to 10 in. long. Each year, one shoot is allowed to continue the upright growth and is headed, creating a sturdy upright limb. An advantage to this method is that spurs originate off of strong, but fairly short, upright limbs, which reduces limb rub. Also, excellent ladder access is possible when few lateral branches are allowed to grow, which also allows sunlight to reach the lower part of these upright limbs. Fire blight strikes can be removed from these upright limbs without sacrificing main branches. One problem with this method is that, by making heading cuts on these upright limbs each year, spur production on the poles may be minimal. Also, the weight of these limbs and their fruit could bend the main branch downward excessively.

Objectives

The objective of this year's trial was to determine the effects of four pruning methods on flowering and fruiting characteristics: Number of buds, fruit yield, percent fruit set, fruit size, and limb rub damage.

Methods

This study is being conducted in an Elliot & Sons, Inc. Bartlett orchard, planted in 1962, on Randall Island. The orchard spacing is 16 x 16 ft. and the rootstock is Winter Nelis. The experiment is set up in a randomized, complete block design with four treatments and six single-tree replications per treatment. Because it takes time to redevelop the branches and spur locations, the pruning methods will take about five years to become fully established. The treatments used, which were implemented beginning in the winter of 1999-2000 as described above, are as follows:

1. Short pruning, with the majority of spurs produced on main lateral branches
   Dec. 1999: Pruned very heavily; all strong uprights and most smaller lateral branches removed
   Dec. 2000: Pruning not as heavy
2. Intermediate pruning, with spurs produced on a balance of hangers and lateral branches
   Pruned as noted above
3. Long pruning, with a majority of the fruiting spurs produced on hangers
   Dec. 1999: The only pruning was the removal of about 4 large overhanging branches
   Dec. 2000: Main pruning was to remove all strong, 1-year-old, upright shoots, as well as three to four older strong upright poles
4. Short/upright pole pruning, with the majority of spurs originating on upright limbs (poles)
   Pruned as noted above

In March 2001, we flagged all flower buds on a representative branch from each of the 24 trees used in the experiment. We used a different flag color for buds on spurs or short shoots vs. buds at the tips of shoots. Harvest (one pick) occurred July 25, at which time we counted and weighed all fruit from each marked branch and the fruit from the remainder of each tree. Limb rub damage was evaluated by randomly selecting 20 fruit per tree and rating the percent scarring on each fruit.

In order to provide a rough estimate of the number of buds per tree, simple algebra was used. It was assumed that the proportion of buds to fruit harvested on the flagged branch is similar to the proportion of buds to fruit harvested on the whole tree. Therefore, the number of buds per tree is arrived at by dividing the number of buds on the branch by the number of fruit on the branch and multiplying by the number of fruit on the whole tree.

Results

In 2000, the long pruned treatment had slightly more buds than other treatments, but in 2001, this treatment had significantly more buds (Fig. 1). However, there were no significant differences in the number of fruit per tree (Fig. 2). This relationship between number of buds and number of fruits in 2001 is shown in Fig. 3. Not surprisingly, the percent fruit set in the long pruned treatment was significantly lowest (Fig. 4). The weight of individual fruits in this treatment was significantly lowest, whereas that of the short treatment was highest (Fig. 5). There were no differences in total yield among treatments (Fig. 6).

There were no significant differences among the treatments in the proportion of fruit that had more than 1% limb rub damage (Fig. 7). However, the long pruned had the greatest proportion of fruit with more than 5% limb rub damage.

Discussion

This research showed one phenomenon that most growers know: If too many buds are allowed to remain by light pruning, the fruit may be small. However, the long-pruned trees produced no more fruit than the other treatments. Therefore, the trees compensated by reducing the percentage of fruit set, but apparently not before fruit size was impacted. Based on previous research (Ingels, unpublished data), the mean weight of individual fruits with long pruning (0.32 lb.) corresponds to about 2 1/4-in. fruit, and that for short pruning (0.42 lb.) corresponds to about 2 1/2 in. fruit. Previous research also showed that buds at the tips of long shoots produce the smallest fruit (Ingels, 2001), and long pruning presumably leaves a large amount of these shoots.

It will take more years to determine which pruning method is best overall (if one is actually better) but it is clear that fruit set in pear trees is somewhat self-regulating. That is, very light pruning for two years results in more buds, but not necessarily more fruit. However, fruit size can be reduced even though the number of fruit produced is the same. Similarly, heavy pruning reduces the number of buds but not necessarily the number of fruit that set. But these fruit will be larger.

It is important to note that the labor required to prune in the long treatment was far less than in the other treatments. This was particularly true in the first year (Dec. 1999), and there were no differences in yield or fruit size in 2000. Therefore, long pruning could result in considerable savings in the cost of pruning if performed one year only. A few large cuts can remove a substantial amount of buds and may have little effect on fruit size. This method may be useful during lean financial times when pruning may not otherwise be done. However, a second year of light pruning will result in smaller fruit. In Dec. 2001, the long pruning treatment was pruned more heavily than in the previous two years, although there were still virtually no heading cuts made. Other treatments were pruned similar to previous years.

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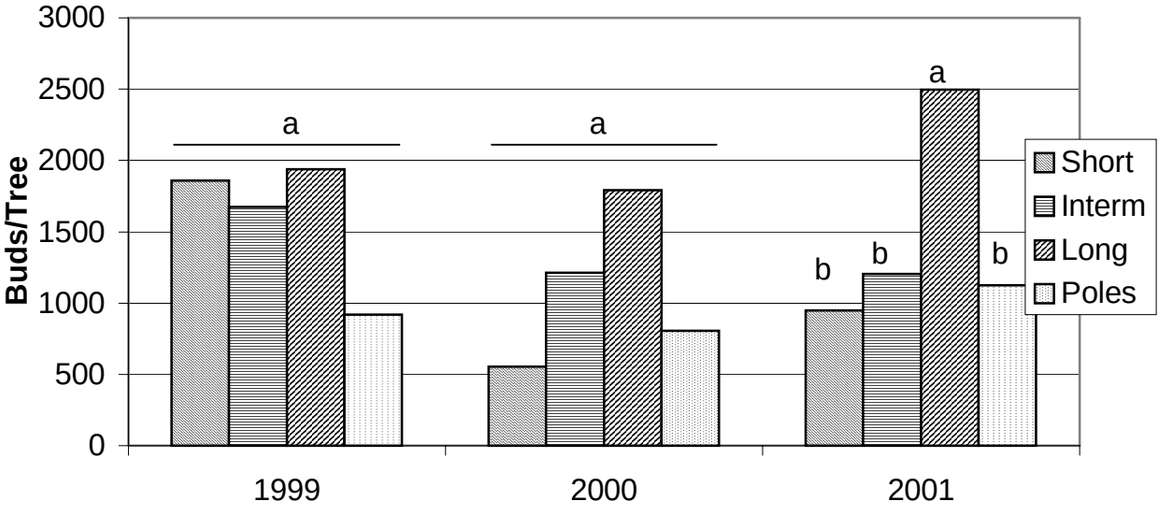
References

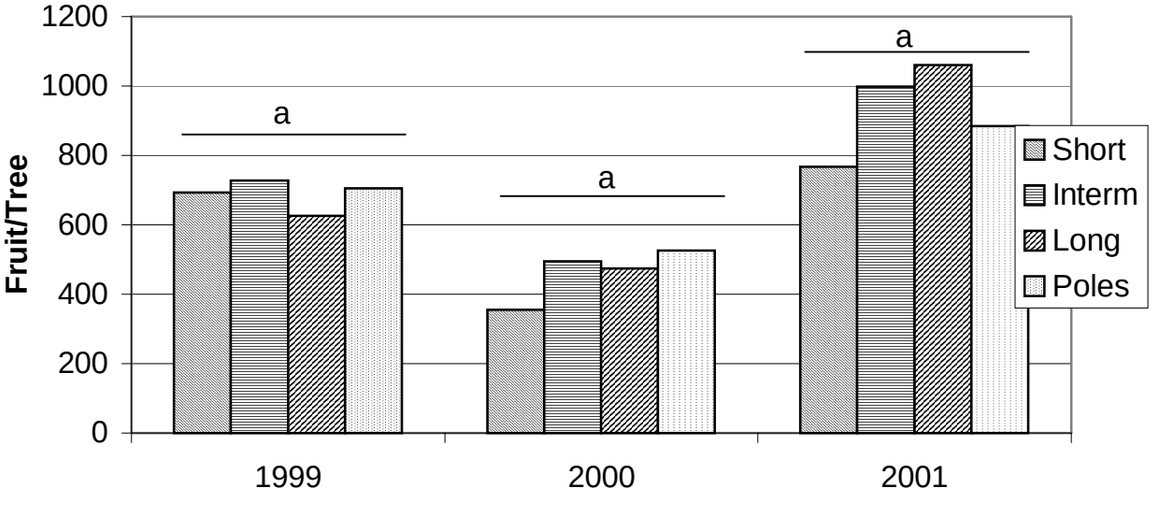
1. Ingels, C. 2000. Effects of pruning method on fruit size and yield. 1999 Calif. Pear Research Reports: 289-296.

Figure 1. Effects on Number of Buds.



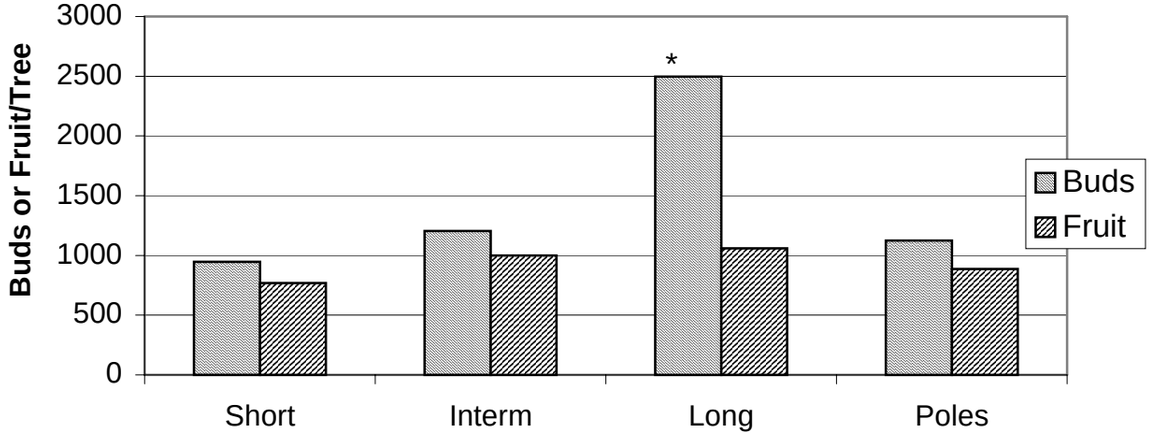
Means with the same letter in each year are not significantly different (Fisher's LSD, P<0.05).

Figure 2. Effects on Number of Fruit.



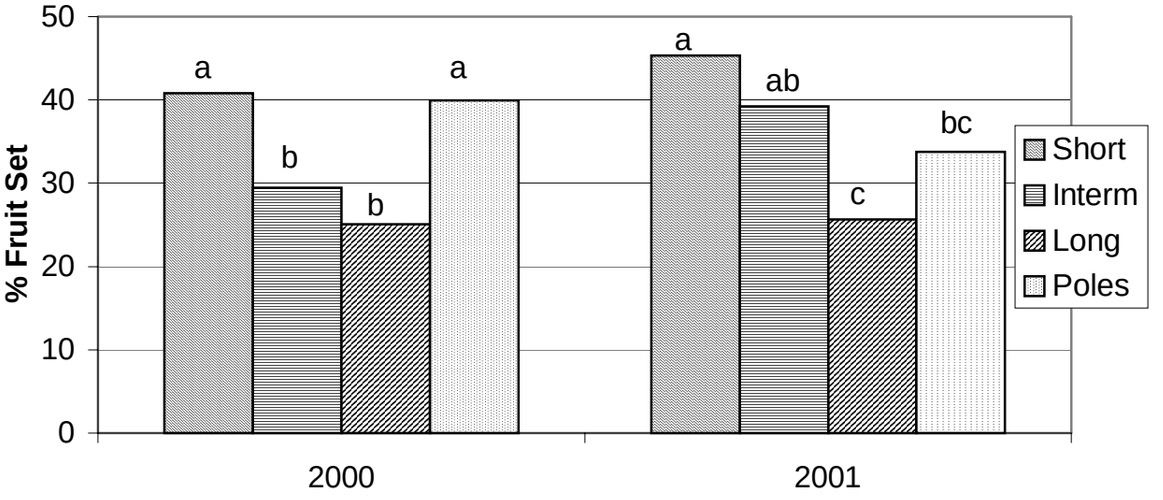
Means with the same letter in each year are not significantly different (Fisher's LSD, P<0.05).

Figure 3. Effects on Buds and Fruit (2001)



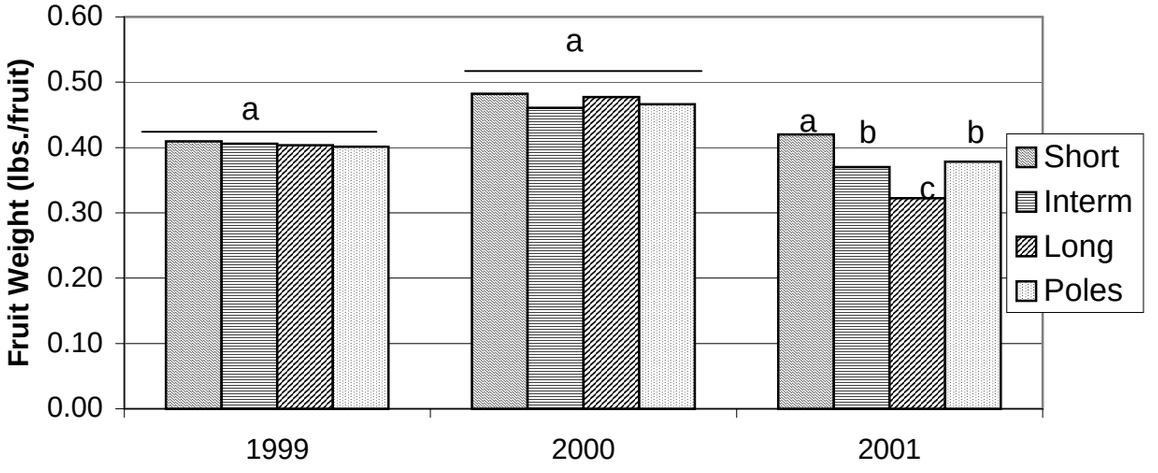
This treatment had significantly more buds than the other treatments (Fisher's LSD, P<0.05).***

Figure 4. Effects on Fruit Set.



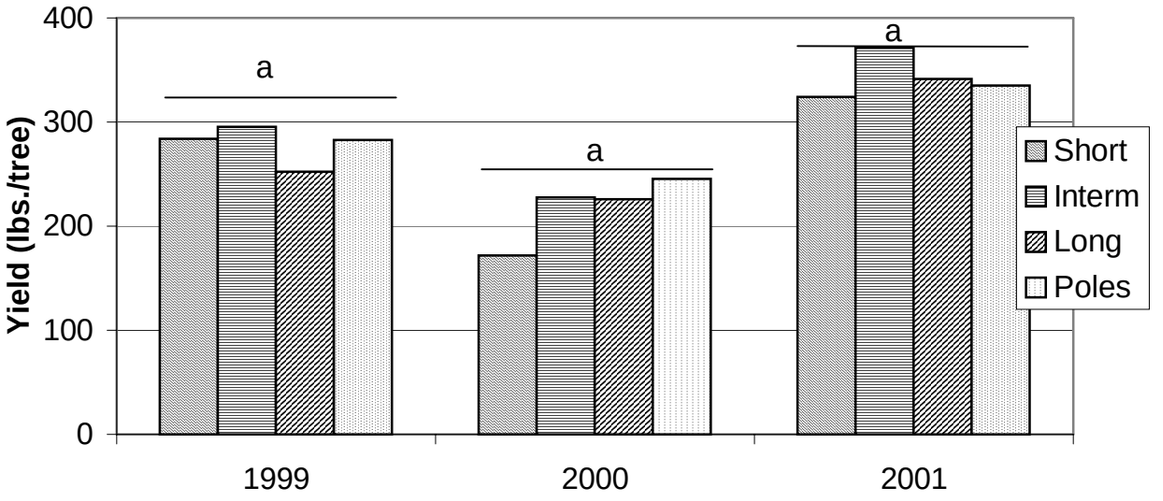
Means with the same letter in each year are not significantly different (Fisher's LSD, P<0.05).

Figure 5. Effects on Fruit Weight.



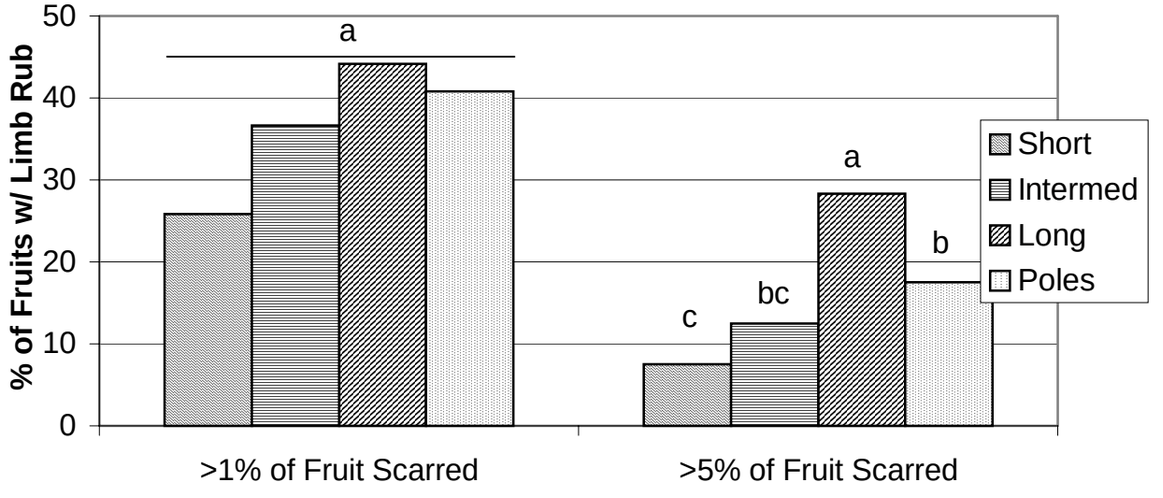
Means with the same letter in each year are not significantly different (Fisher's LSD, P<0.05).

Figure 6. Effects on Yield.



Means with the same letter in each year are not significantly different (Fisher's LSD, P<0.05).

Figure 7. Effects on Limb Rub.



Means with the same letter in each year are not significantly different (Fisher's LSD, P<0.05).