

Temporary Three Pruning for Overcrowded Pecan Orchards

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Summary. Interfering limbs of alternating (temporary) 'Elliott' pecan trees were pruned annually to provide growth for limbs of permanent trees for a 6-year period. Yield, nut quality, and tree growth were similar for pruned and nonpruned plots, but there were year \times pruning interactions. Yields of the permanent trees were not affected by pruning the adjacent temporary tree.

Overcrowding of pecan [*Carya illinoensis* (Wangenh.) C. Koch] orchards is a serious problem throughout the pecan belt (Worley, 1991). Most orchards with spacings <80 ft (24 m) eventually will require thinning. Many attempts have been made to extend the production period of overcrowded orchards with pruning (Worley, 1991). Thinning by complete removal of alternate diagonal rows is often practiced, but this reduces yield until remaining permanent trees fill the open spaces. Some growers delay the complete removal of the diagonal rows by designating the trees in these rows "temporary." Over a period of several years, growers gradually remove the tree by removing competing limbs of trees adjacent to permanent trees (TP) to provide space for permanent tree growth. Eventually the entire tree is removed. Growers refer to this practice as "pancaking" or "wisping" (Paschal, 1992). Although growers use and recommend TP, there is little research to support or discredit the practice. If feasible, TP would provide increased profitability of an orchard through more-efficient use of orchard space and would be a belt-wide practice. This study evaluated the

feasibility of TP compared with no pruning from 1986 through 1991. Temporary trees were removed in 1992.

A previous study contained TP as one treatment, but significant limb removal was required only in the last year of the study and the resulting yield and nut quality were similar to the control (Worley, 1985).

This study, initiated in 1986, used five pairs of nine-tree plots in a large, crowded orchard near Marshallville, Ga. (lat. $\approx 32.4^\circ\text{N}$). The trees, in their 23rd leaf at the beginning of the study, were located in a well-managed grower orchard and received excellent care, including recommended fertilization, insect and disease control, herbicide strips with closely mowed sod floor, and drip irrigation. The test was on a block of eight rows of 'Elliott' between blocks of 'Desirable'. The trees were within a 700-acre orchard of many cultivars in an area of large orchards, many yard plantings, and woods seedlings; therefore, pollination was not a problem. Each plot consisted of a three-tree \times three-tree block with tree spacing of 40 \times 60 ft (12 \times 18 m). Trees adjacent to the center tree on four sides were designated as temporary trees, and those diagonally adjacent were designated as permanent trees. Plots were separated on all sides by guard trees (Fig. 1). The five pairs of plots (replications) had temporary trees in one plot of each pair pruned by the TP plan, and the designated temporary trees of the other plot had no pruning. Broken limbs and low limbs interfering with orchard equipment operation were removed from all trees.

Table 1. Yield per tree from 23-year-old 'Elliott' pecan trees with alternating (temporary) trees pruned or not pruned over 6 years.

Temporary trees	Year					Mean
	1986	1988	1989	1990	1991	
	<i>Yield^{a,b} (lb/tree)</i>					
Not pruned	77 a	50 a	49 a	51 a	77 b	59 a
Pruned ^x	84 a	68 a	22 a	62 a	57 a	59 a
	<i>Yield^{a,b} (lb/tree for center nonpruned permanent trees only)</i>					
Not pruned	82 a	49 a	60 a	48 a	87 a	65 a
Pruned	86 a	74 a	26 a	73 a	43 a	62 a

^aMean separation within columns by GLM ANOVA with PDIFF option at $P = 0.05$.

^b1988 and 1989 yields were estimated visually in August.

^xTemporary trees were pruned annually to provide room for permanent tree growth.

The pruning treatment for temporary trees included annual removal of limbs that intermeshed or would soon intermesh with the permanent tree. One to four limbs/year were removed flush with a noninterfering limb for trees within the row. Limbs pruned were seldom >4 inches (10 cm) in diameter. After pruning, there was a distance of at least 2 ft (0.6 m) between limbs of the temporary and permanent trees. Distance between rows was wider than tree spacing within the row; therefore, interfering limbs occurred on only two of the four sides of permanent trees.

Yield data (Table 1), unless otherwise specified, were per-tree averages for the center permanent tree plus the two adjacent temporary trees within the center row. Yield was measured from 1/25 of the area underneath each tree after the first shaking using the sector method (Worley and Smith, 1984) in 1986, 1989, and 1991. Yield in 1987 was lost when harvest occurred prior to collection of yield data. To ensure against complete yield data

loss, a visual estimate of yield per tree was made in August of subsequent years. Harvest yield data were not obtainable again in 1988 and 1989, and the visual estimates were used for these years in Table 1. The correlation for visual yield estimates and yields by the sector method in 1990 was $r = 0.81$, and mean treatment yields were the same for both methods. The visual estimates in 1988 and 1989 were considered good representations of the 1988 and 1989 actual yield.

A 50-nut subsample from each tree was used for quality analysis. Nut weight and size (corresponding to commercial size classifications of 13/16, 14/16, 15/16, and 16/16; a 16/16 nut will not pass through a 1-inch hole, a 15/16 nut will pass a 1-inch, but not a 15/16 inch, hole, etc.) were determined. Edible kernels were graded into fancy, standard, amber, and total edible (Worley, 1990).

Terminal shoot growth and number of nuts per shoot were measured on 50 terminal shoots/tree for the center permanent tree in Aug. 1989-91 at the height of maximum limb spread [≈ 30 ft (9 m)].

Data for yield demonstrated the inconsistent yields noted for 'Elliott' pecans between years (Table 1). Mean yield, nut size, and kernel quality across years were not different ($P = 0.05$) between plots with pruned and non-pruned temporary trees; however, pruning effects were not consistent over years, as revealed by year \times pruning interactions ($P = 0.05$). The yield interaction was apparent when trends favored pruning in 1986, 1988, and 1990 and no pruning in 1989 and 1991 ($P = 0.05$ in 1991) (Table 1). The data indicated the two treatments were out of phase with each treatment being favored in alternating years. An analysis of variance using only data

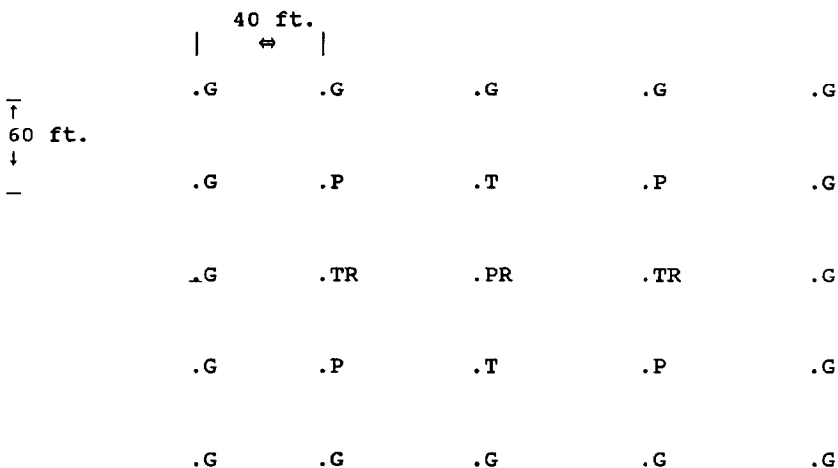


Fig. 1. Pruning plan for one plot of a temporary-permanent pruning system. G = guard tree, P = permanent tree, PR = permanent record tree, T = temporary tree, TR = temporary record tree.

Table 2. Nut quality parameters from 23-year-old 'Elliott' pecan trees with alternating (temporary) trees pruned or not pruned over 6 years.²

Trees	Year			Mean
	1986	1990	1991	
	<i>Nuts/lb^a</i>			
Not pruned	69 a	76 a	73 b	73 a
Pruned ^x	70 a	78 a	69 a	72 a
	<i>13/16-inch (20.6–22.1-mm) -size nuts (%)</i>			
Not pruned	1 a	28 a	10 a	13 a
Pruned	1 a	38 b	6 a	15 a
	<i>15/16-inch (23.8–25.3-mm) -size nuts (%)</i>			
Not pruned	53 a	10 a	31 a	31 a
Pruned	53 a	4 a	41 b	32 a
	<i>15/16-inch (23.8–25.3-mm) -size nuts— center permanent tree only (%)</i>			
Not pruned	54 a	12 a	24 a	30 a
Pruned	57 a	1 a	49 b	36 a
	<i>Percent kernel—using center permanent tree only</i>			
Not pruned	53 a	50 a	49 a	51 a
Pruned	53 a	50 a	52 b	52 a

²Treatments applied over 6 years but quality data was available for only 3 years.

³Mean separation within columns by GLM ANOVA with PDIFF option at $P = 0.05$.

^xTemporary trees were pruned annually to provide room for permanent tree growth.

from the center nonpruned permanent tree from each plot revealed no significant differences ($P = 0.05$) in any year, and data was similar to the data for the three tree plots (Table 1). An assumption that the yield reduction of pruned plots in 1991 was caused by limb loss due to pruning cannot be justified because the differences between treatments were numerically (though not at $P = 0.05$) as great for the unpruned permanent trees as for the plot means (Table 1).

Nut size and percent kernel means over years were not affected by treatment, but occasional treatment differences were noticed within years (Table 2). These size and quality differences were probably related to the total yield. Nut size is usually larger and kernel percentage higher with low tree yield.

Terminal shoot growth, number of nuts per terminal, kernel grades, and nut size in the 12/16, 14/16, and 16/16 class were not affected ($P = 0.05$) by pruning treatments. Means for these variables were: 0.1% for 12/16- (19.1-20.5 mm) size nuts, 41% for 14/16- (22.2-23.8 mm) size nuts,

12.7% for 16/16- (>25.3 mm) size nuts, 30.1% fancy-grade nuts, 19.0% standard-gradenuts, 1.6% amber-grade nuts, 3.9-inch (9.8-cm) annual terminal shoot growth, and 0.70 nut/terminal.

The optimum time for tree removal in overcrowded orchards has not been determined. Limbs of adjacent trees within the row in this study were beginning to intermesh at the beginning of the study, and the orchard manager indicated that orchard yields were declining.

To be economically feasible, pruning of the temporary trees would have to improve yield and/or nut quality of the permanent trees to offset pruning costs and losses from removed limbs. Pruning of temporary trees apparently did not improve light interception and reduce root competition enough to improve yield ($P = 0.05$) of the permanent trees. Yield losses for pruned temporary trees might have been greater if the trees had been planted in a square instead of a rectangle, thereby requiring pruning on four sides. Complete removal of the temporary trees at the

beginning of the study would have reduced yields by one-half, unless responses of the permanent tree to adjacent tree removal were much more than responses to adjacent tree pruning. Complete tree removal of similar temporary trees of 'Desirable' in the same orchard increased yields per permanent tree (significant at $P = 0.05$ in only one year), but not yield per acre (data not published). If the decision had been made in 1986 to thin in 1992, there would have been no advantage to pruning temporary trees in the interim.

Although growers are rapidly adopting the practice of wisping temporary pecan trees to give the permanent trees growing room, the practice as performed in this study was of no benefit.

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