EFFECTS OF POST-DROUGHT YEAR PRUNING ON THE RECOVERY OF WALNUT

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ABSTRACT

Trees (cv. Chico) subjected to severe water stress in 1990 that significantly reduced shoot growth were returned to full irrigation and heavily pruned early in 1991. This pruning treatment was compared with similarily 1990 stressed trees that were also fully irrigated in 1991 but were left unpruned. The heavy pruning stimulated more trunk growth (about a 24% greater increase in cross-sectional area) than the unpruned trees. Fruit loads and yields in the season following the pruning regimes were not significantly different. This suggests that 'Chico' responds with vigorous vegetative growth to the resumption of adequate irrigation precluding the need for severe pruning.

OBJECTIVES

To evaluate two pruning regimes following a year when mature 'Chico' walnuts received less than half (16 acre-inches/acre) of the normal orchard water use requirement (42 acre-inches/acre). The hypothesis was that heavy pruning would be required to stimulate vegatative growth that had slowed considerably in the drought year due to water stress.

PROCEDURES

A block of cv. Chico trees (22 x 22 ft spacing) planted in early 1982 at the Kearney Ag. Center and grown under full irrigation was irrigated with 16 acre-inches/acre (hereafter referred to as inches) in 1989 to simulate a drought year. A controlled deficit irrigation (CDI) regime was used to apply the water. After the simulated drought of 1989, the trees were returned to full irrigation in 1990 and 1991 (48 and 42 inches per year, respectively). An explanation of CDI and the regime used, a description of the experimental orchard and irrigation system is included in the paper "Walnut Orchard Recovery Following a Single Drought Year" contained herein.

To compare trees with different characteristics, 11 pairs of trees (22 total) were selected based primarily on tree size and to a lesser extent 1989 nut yield. One tree of each pair was left unpruned in early 1990. The other tree received heavy heading cuts on every major fruiting limb; cuts were made on two year old wood leaving only the basal two to three buds.

To assess trunk growth in the year of the pruning, trunk circumference measurements were made on March 21 and November 7, 1990 about one inch above the graft union.

The orchard was harvested in mid September with a commercial shaker and individual tree weights were determined. Composite nut samples for each plot were taken, dried, and analyzed by Diamond Walnut Growers, Inc. for nut component weights (shell and kernel), size (commercial classifications), and quality.

RESULTS AND DISCUSSION

Tree Growth

The unpruned trees had a cross-sectional trunk increase averaging 45.1 sq. cm. The heavy pruned trees had an average 55.9 sq. cm. increase in cross sectional area. Since trunk growth is usually related to shoot growth, this suggests that the heavy pruning increased canopy growth.

Nut Yield and Fruit Load

Yields of dry, in-shell nuts (at 8% water content) averaged 1465 and 855 lbs/acre for the unpruned and heavy pruned trees in 1990 (Table 1). Nut load was reduced by a similar percentage (about 42%). While these reductions are substantial, they were not significantly different than the unpruned trees at the 5% confidence level using Duncan's Multiple Range Test. However, heavy pruning clearly can be expected to remove some crop. The hypothesis of using heavy pruning is that the following year's yield will more than balance the crop that is pruned off.

In 1991, all trees were left unpruned early in the season to allow for more precise evaluation of the previous season's pruning treatments. Surprizingly, the 1990 heavy pruned trees had slightly lower 1991 yields than the 1990 unpruned trees (Table 1). The difference was not statistically significant. While fruit load was also somewhat lower, the difference was not statistically significant. Individual nut weights and kernel percentages were also not significantly different. Failure of the 1990 heavy pruning to set more fruit following the drought-induced reduction in vegetative growth suggests that a return to full irrigation (alleviation of the tree water stress) was enough to trigger adequate shoot growth. The additional shoot growth that occurred with the heavily pruned trees (as suggested by the previously mentioned trunk growth data) did not support any additional crop in 1991.

Commercial nut size characterization for both 1990 and 1991 shows almost identical values for the different 1990 pruning treatments (Table 2). Nut quality for both years was also similar with the exception of offgrade in 1990 (Table 3). Higher offgrade in the

heavy pruned trees presumably resulted from less shading of the nuts and subsequently more sunburn and shrivel.

CONCLUSIONS

Heavy pruning following a season where cv. Chico trees suffered a severe water-stress related reduction in shoot growth did not increase fruit load the following year as compared with trees that underwent the same stress but were unpruned. This suggests that 'Chico' responds with vigorous vegetative growth to a return to adequate irrigation precluding the need for severe pruning.

Table 1. Harvest and fruit load data.

Early 1990 pruning treatment		Yield dry in-shell[1/] (lbs/acre)	Fruit load (nuts/tree)	Individual nut weight (gm/nut)	% Kernel
1990	None	1465	587	12.5	44.5
	Heavy	855	346	12.6	45.3
		NSD	NSD	NSD	NSD
1991	None	6327	3794	8.4	48.6
	Heavy	6044	3511	8.8	47.8
		NSD	NSD	NSD	NSD

NSD indicates no significant differences in the column.

Table 2. Commercial nut size categories.

Early 1990 pruning treatment		Jumbo	Large	Medium	Baby	PeeWee
				% by #		
1990	None	93.6	4.2	2.1	0.9	0.1
	Heavy	93.3	3.9	1.0	1.7	0.1
		NSD	NSD	NSD	NSD	NSD
1991	None	9.8	16.1	23.7	35.6	14.9
	Heavy	10.8	13.4	23.8	35.1	17.0
		NSD	NSD	NSD	NSD	NSD

NSD indicates no significant differences in the column.

Table 3. Commercial harvest quality parameters.

Early 1990 pruning treatment		Edible yield[1/]	Large sound[1/]	Off-grade[2/]	Internal damage[3/]	Insect damage[1/] (% by #)	RLI #1[4/]
		---------- % by weight ----------					
1990	None	44.0	96.7	0.8 a	1.6	0.2	24.1
	Heavy	44.3	96.5	1.9 b	2.3	0.3	23.4
		NSD	NSD	*	NSD	NSD	NSD
1991	None	47.8	18.9	1.1	2.5	0.6	39.0
	Heavy	46.8	25.3	1.2	1.4	0.3	39.2
		NSD	NSD	NSD	NSD	NSD	NSD

1/ of tree nut load.
2/ of kernels.
3/ of large externally sound nuts.
4/ Reflective Light Index. The higher the RLI, the lighter the kernel color.

* Asterisk beneath colums indicates significant differences at the 5% confidence level between numbers followed by different letters. NSD indicates no significant differences in the column.