COMPARISON OF GROWTH AND PRODUCTIVITY OF PRUNED AND UNPRUNED YOUNG 'HOWARD' WALNUT TREES AS IMPACTED BY CROP LOAD

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ABSTRACT

In 2004, terminal shoot growth in 'Howard' walnut trees was significantly greater in pruned than in unpruned trees. However, because the pruned trees need to regrow the amount of shoot that was pruned off during the dormant season, overall tree height was not significantly different in the pruned versus unpruned trees. Unpruned trees had significantly more shoots that broke below the terminal than pruned trees. Fruit load was significantly higher on unpruned trees.

In 2005, there were significantly more shoots growing in the pruned treatment trees compared to the unpruned. Unpruned trees tended to be shorter at the end of the growing season, except for the unpruned with fruit removal treatment. However, this relationship will change after pruned treatment trees are pruned in the winter of 2006. The greatest number of nuts were on the treatment that was pruned in 2004 but not pruned in 2005.

Trees formed by pruning have a very different structure than unpruned trees. In pruned trees, less shoots break below the terminal but those that do grow more aggressively than the shoots that break below the terminal in unpruned trees. This tends to give a more dense canopy in the pruned trees over time.

Midday stem water potential was similar in all treatments early and late in season when trees were fully watered. However, during midseason when all treatments became somewhat stressed, the level of stress tended to be greater in pruned trees compared to unpruned trees.

INTRODUCTION

A study was set up on two year old Howard walnut trees at the Nickels Soil Lab in Colusa County to look at the impact of the following pruning and fruit removal treatments

Treatment 1- unpruned, no fruit removal
Treatment 2- unpruned, with fruit removal
Treatment 3-pruned (1/3 of previous years growth removed each year until tree fills allotted space, no fruit removal)
Treatment 4- pruned as in treatment 3 with fruit removal.
Treatment 5- pruned as treatment 3 in winter 2003-4, unpruned in winter 2004-5

MATERIALS AND METHODS

In the spring of 2004 and 2005, fruit were removed from Treatments 2 and 4 when they were approximately ¼" in diameter. Terminal shoot growth was measured approximately every 2-3 weeks during the growing season in 2004 and at the end of the growing season in 2005. The number (2004 and 2005) and timing (2004) of in-season branching points formed (sylleptic shoots) were assessed as well. The number of shoots that broke below each terminal were counted late in the season in 2004 and will be counted in 2005. The number and the percentage of minor and major sunburned nuts on each tree were counted in early September in both 2004 and 2005. Midday stem water potential was measured approximately every other week on 10 trees per treatment. Leaves were bagged at least 15 minutes before measurements were taken with a plant pressure chamber. In 2004, nuts were counted on the tree. In 2005, trees were harvested by hand shaking and all nuts were collected, counted and weighed. Sub-samples were taken for drying from each tree. Samples for leaf nitrogen analysis were collected in mid-July.

RESULTS AND DISCUSSION

2004

Terminal shoot growth was significantly greater in the pruned treatments in 2004 (Table 1). However, on the pruned treatment trees, the amount that was cut off has to be regrown before a net positive growth for the season occurs. When this is factored in, there were no significant treatment effects on tree height (Table 1). Average tree width was similar in all treatments (Table 1). T3 (pruned) had significantly less fruit than T1 (unpruned; Table 2). There were significantly more in season branching points (sylleptic shoots) in both of the pruned treatments compared to the unpruned treatments (Table 1). There were significantly more nuts on unpruned compared to pruned treatment trees (Table 2). There were no treatment impacts on number or severity of sunburned nuts (Table 2).

2005

There were significantly more shoots actively growing in the pruned treatment trees on June 1 and July 31, 2005 (Fig. 1). There was also a tendency towards increased numbers of growing shoots in the defruited treatment trees although the differences were not significant (Fig. 1). Shoot length and generation of sylleptic shoots (shoots that branch in-season) measurements had not been completed at the time of the report deadline so will be presented next year. There were no significant treatment differences in trunk circumference on any of the three measurement dates in 2005 (Fig. 2). Tree height was significantly greater in T2, T3 and T4 compared to T1 and T5 (Table 1). Fruit removal resulted in significantly taller trees in the unpruned trees but not in the pruned trees (Table 1). It is important to remember that pruned treatment trees will be pruned in the winter of 2006 so height at beginning of 2006 growing season will be significantly less than indicated in Table 1.

The greatest number of nuts was on T5 trees (pruned in 2004 but not in 2005; Table 2). Many of these trees had severe (undesireable) bending over from crop load. Crop load was not significantly greater on T1 (unpruned) than on T3 (pruned) in 2005. There were significantly more nuts with minor sunburn in T1 compared to T5 (Table 2). In addition, there were significantly more nuts with major sunburn in T3 compared to T1 in 2005 (Table 2).

Midday stem water potential was similar in all treatments early in the season when trees were fully watered. (Fig. 4). However, as the season progressed and trees became somewhat stressed, the treatments began to separate out with the trees from the unpruned treatments tending to have less negative midday stem water potentials (less stressed) after mid-July (Fig. 4). Finally, by late September when the trees were recovering in water potential, the treatments again became more similar (Fig. 4).

PRELIMINARY CONCLUSIONS

Two years after initiating pruned and unpruned treatments, it appears that in terms of tree height, (Table 1), trunk circumference (Fig. 2), light interception (Fig. 3) and crop load (Table 2), the unpruned trees are doing as well or better than the pruned trees. Fruit removal had little effect in the first year of the trial when numbers of fruit per tree were few (Table 2). However in the second year of the study when crop load was higher (about 250-300 nuts per tree), fruit removal led to significantly larger trees in the unpruned but not in the pruned treatment trees (Table 2). There is also some indication that unpruned trees may maintain a better (less negative) water potential although the mechanism for this is unclear.

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Table 1. Effects of treatments on average terminal shoot growth, number of in-season branching points formed per terminal shoot, average tree height, average tree width and number of shoots that broke below terminal in 2004 and 2005.

Treatment	*Average terminal shoot growth (cm)*	*Number of in-season branching points (sylleptic shoots)*	*Ave.tree height (cm)*	*Tree width (meters)*	*# shoots that broke below terminal*
2004					
1 (unpruned)	40.5 b	0 b	332.3 a	3.05 a	11.1 a
2 (unpruned w/fruit removed)	46.1 b	0.4 b	351.6 a	3.22 a	9.9 a
3 (pruned)	95.4 a	0.9 a	340.5* a	2.62 a	5.1 b
4 (pruned w/fruit removed)	96.7 a	0.9 a	325.7* a	2.81 a	6.7 b
2005					
1 (unpruned)			424.0 b		
2 (unpruned w/fruit removed)			497.6 a		
3 (pruned)			465.7** a		
4 (pruned w/fruit removed)			475.5** a		
5 (pruned 2004, unpruned 2005)			400.1** b		

Data collection on missing items not completed at time of report deadline.

*measurements done after dormant pruning

**measurements done before dormant pruning

Table 2. Effects of treatments on number of fruit per tree and sunburn in 2004 and 2005.

Treatment	***#nuts per tree***	***Percent minor sunburn***	***Percent major sunburn***
2004			
1 (unpruned)	78 a	4.6 a	2.1 a
2 (unpruned w/fruit removed)	.		
3 (pruned)	48 b	2.9 a	3.1 a
4 (pruned w/fruit removed)	,		
5 (pruned 2004, unpruned 2005)	44 b	1.0 a	0.1 a
2005			
1 (unpruned)	266 b	6.5 b	1.9 bc
2 (unpruned w/fruit removed)	18 c	0 c	0 c
3 (pruned)	237 b	2.9 a	3.1 a
4 (pruned w/fruit removed)	9 c	0 c	0 c
5 (pruned 2004, unpruned 2005)	350 a	15.7 a	4.7 a

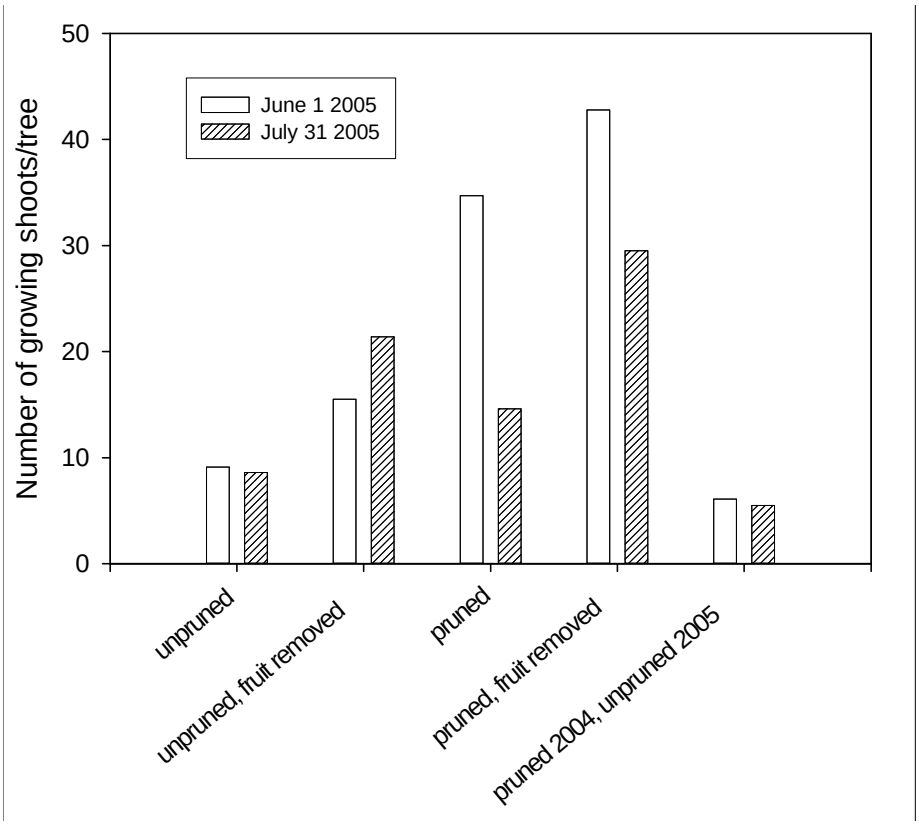

Fig. 1. Number of growing shoots per tree on June 1 and July 31, 2005 by treatment.

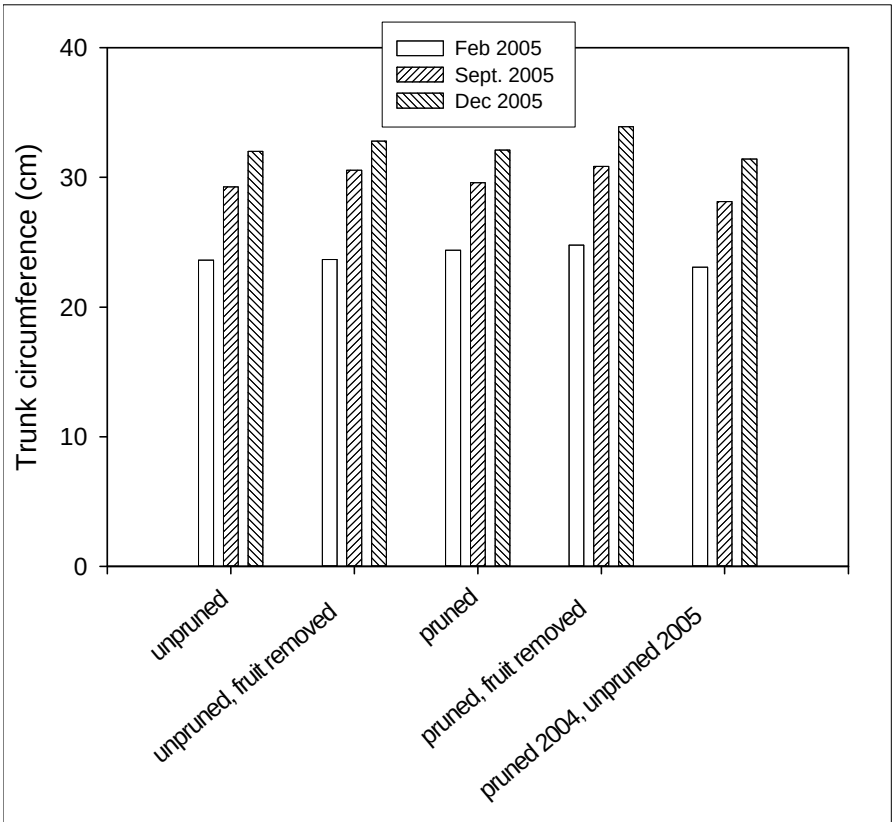

Fig. 2. Trunk circumference by treatment in February, September and December 2005.

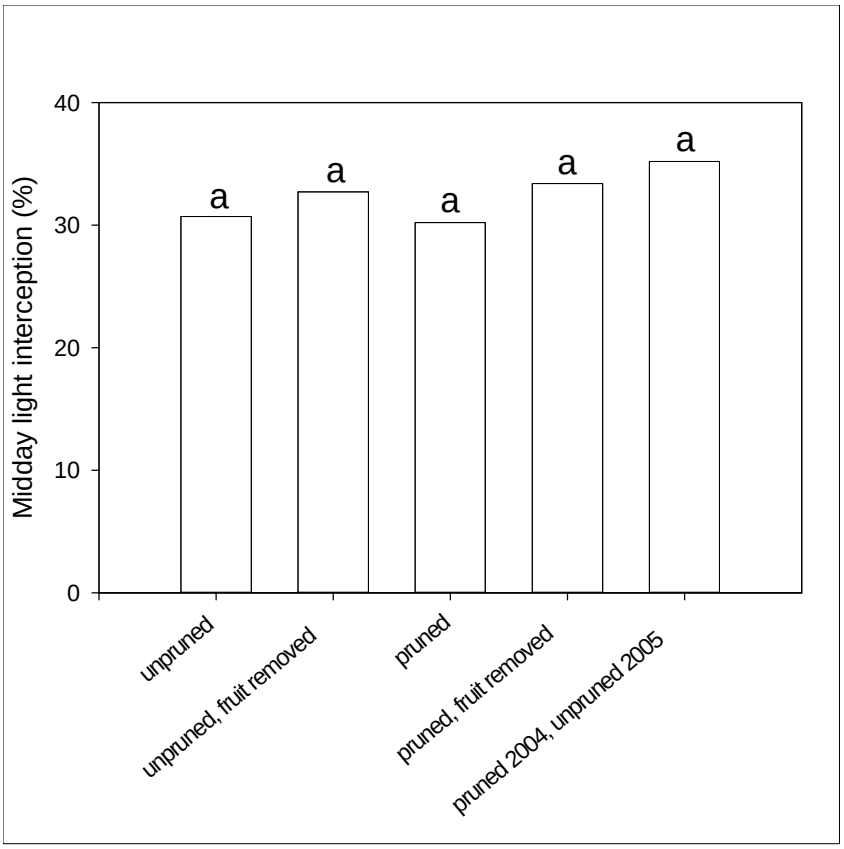

Fig. 3. Midday light interception measured on June 22, 2005.

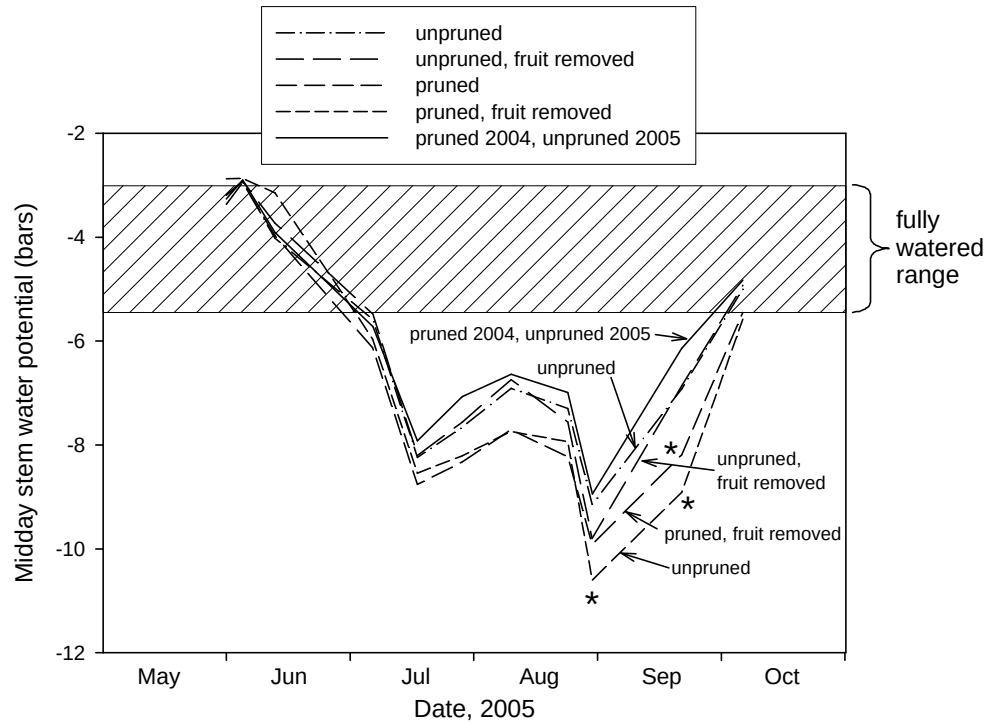

Fig. 4. Midday stem water potential by treatment for 2005 season. Cross-hatched area marks range for fully watered tree.