Project Report: **92-BG1** BARK STRENGTH EVALUATION

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SUMMARY With this research we are trying to determine whether or not the bark "tightens" after irrigation cutoff, as many growers believe, making the tree less susceptible to shaker damage during harvest. For this study we developed a method to measure how much force it takes to remove the bark from a section of branch in the laboratory, or from a small area of trunk in the field. This is a measure of Cambial Strength (also called Bark Strength). In all studies thus far, we have found no evidence that irrigation cutoff is related to shaker damage (Table 1), nor have we measured any increase in cambial strength after irrigation cutoff (Figure 1). We have found however, that trees in different locations (Table 2) show large differences in cambial strength, and that trunk strength is typically much less than branch strength (Figure 2). Daily drunk growth was measured with accurate transducers (Figure 3), but trees having large differences in growth rate did not show any difference in strength (Figure 4). Ethephon substantially increased cambial strength at UC Davis (Figure 5) and also caused increased strength in a trial conducted at the West Side Field Station (Table 3). However, we were unable to cause shaker damage at the West Side on any trees, despite operating the shaker at the highest pressures possible. From these experiments it is clear that ethephon increases cambial strength, but it is not clear whether ethephon would significantly reduce shaker damage. To determine this, it will be necessary to test for the effect of ethephon on trees that are more susceptible to shaker damage.

Table 1. Number of trees which were damaged or undamaged after shaker harvest, for a series of irrigation cutoff dates (irrigation treatments). Treatment #1 was the earliest cutoff (about 2 months prior to harvest) with each successive treatment cutoff at weekly intervals. There were slightly more damaged Carmel than Nonpareil, but because of the overall small percentage of trees showing damage, no statistically significant effect of variety or irrigation treatment was found.

Damage Rating, 1990 Almond Harvest
Kings Co.

	IRRIGATION TREATMENT #							
	1	2	3	4	5	6	7	8
Undamaged	95	92	93	96	91	91	92	89
Damaged-CARMEL	1	4	2	0	4	3	2	4
Damaged-NONPARIEL	0	0	1	0	1	2	2	3

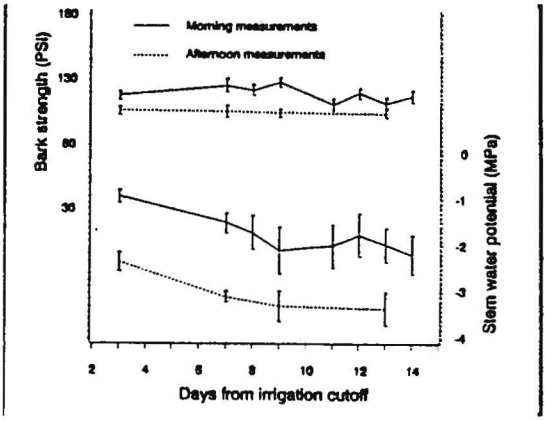
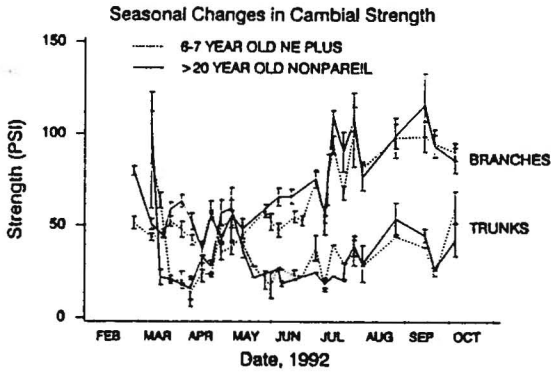


Figure 1. During the first two weeks (14 days) after irrigation cutoff, both morning and afternoon tree water potentials (lower two lines) decreased, indicating progressively more water stress. No changes were apparent in branch cambial strength (upper two lines). Error bars indicate a 95% confidence interval.

Location	Treatment	Bark Strength (PSI)	Water Potential (MPa)
DURAM	Early (July)	51	-0.91
	Late (Sept.)	73	-1.37
BAKERSFIELD	Early (July)	112	-2.21
	Late (August)	118	-3.03
UCD (June)	CONTROL	54	
	ETHOPHON	89	

Table 2. Branch cambial strength (bark strength) and midday water potential for trees grown in a deep soil northern location (Duram) and a dryer south location (Bakersfield) early and late in the 1991 growing season. Trees in Duram were under less water stress and had less cambial strength than trees in Bakersfield; at both locations water stress increased during the season, but only in Duram was this associated with an increase in cambial strength. The effect of ethephon in Davis is also shown.

Figure 2. Fluctuations in branch and trunk cambial strength during the 1992 season for trees at UC Davis. Error bars indicate a 95% confidence interval.



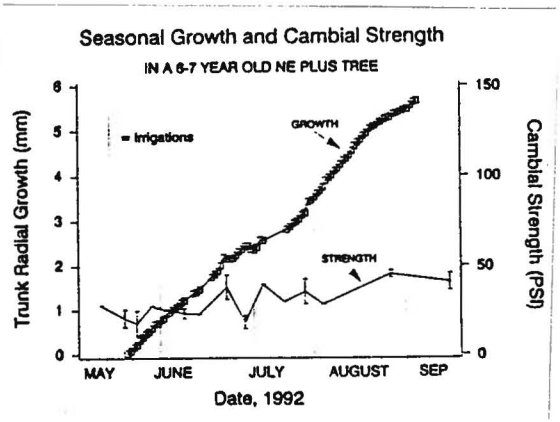


Figure 3.
Example data from a single neplus tree in the field at UC Davis, showing automated daily measurements of trunk size (gaps indicate lost data) and periodic measurements of cambial strength. The rate of trunk growth in millimeters per day, can be calculated as the difference in trunk size between two consecutive dates. Error bars indicate a 95% confidence interval.

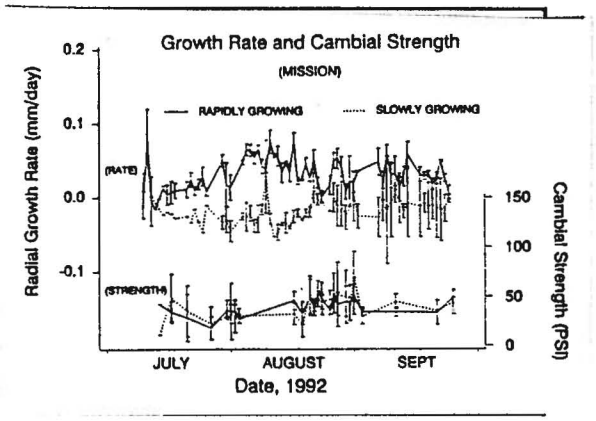


Figure 4. Average growth rate and cambial strength for three rapidly growing and two slowly growing mission trees in the field at UC Davis. Differences in the rate of trunk growth are clear, but the trees with the faster growth (ie., more active cambium) do not have lower values of Cambial strength. Error bars indicate a 95% confidence interval.

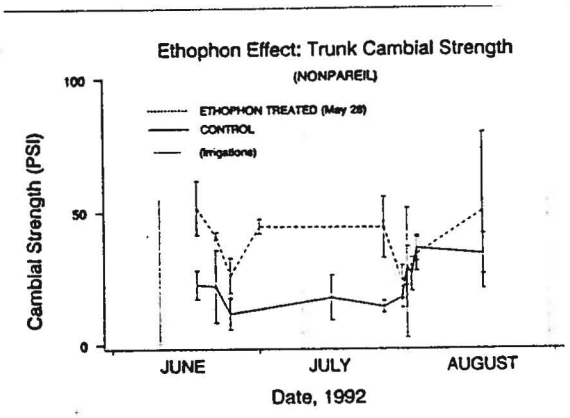


Figure 5. Long lasting effect of ethephon, sprayed directly on the trunk, in increasing cambial strength of nonpareil under field conditions at UC Davis. Error bars indicate a 95% confidence interval.

Table 3. Ethephon and antitranspirant effects on cambial strength and tree water potential at the West Side Field Station in 1992. There was no statistical difference between carmel and nonpareil varieties, and so the values were pooled. Lines indicate a 95% significance (Duncans test). None of the trees in any of the treatments experienced barking injury.

Irrigation and Treatment Effects: WSFS
Carmel & Nonpareil, 1992

		WET (1 WEEK IRRIGATION CUTOFF)	DRY (3 WEEKS IRRIGATION CUTOFF)
CAMBIAL STRENGTH (PSI)	ETHOPHON	36.80	43.20
	CONTROL	32.80	29.00
	ANTITRAN.	25.40	22.80
WATER POTENTIAL (MPa)	ANTITRAN.	-1.70	-1.87
	CONTROL	-2.02	-2.44
	ETHOPHON	-2.12	-2.45