
Long Term Evaluation of the Effects of Almond Leaf Scorch Disease on Orchard Productivity

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Objectives:

1. Compare yields of ALS-affected and unaffected trees.
2. Re-survey orchards to determine extent of *X. fastidiosa* spread since initial surveys in 2003/2004 and assess the fate of trees identified as infected in the initial survey.

Interpretive Summary:

Almond Leaf Scorch (ALS) disease has been present in California for more than 60 years (ABC 2004). This disease is caused by the bacterium *Xylella fastidiosa* (Xf), which causes several other important plant diseases, most notably Pierce's disease of grapes. The disease is present in orchards throughout the state, but typically affects only a small proportion of trees, although in rare cases orchards have been severely affected (Kirkpatrick 2007). With the exception of planting resistant cultivars (e.g., Kirkpatrick 2007), there are no effective management strategies that prevent trees from becoming infected. Consequently, growers must often decide to keep or remove infected trees.

The decision to keep or remove infected trees is a function of two components: risk of infected trees serving as sources for in-field, secondary pathogen spread and yield losses due to infection. This project will provide the long term data required to assess both of these risks. Based on current data, risk of tree-to-tree spread of ALS appears to be low (Groves et al. 2005). However, this assessment was based on data collected over a relatively short time period, 2 or 3 years. We resurveyed the orchards used in this study to extend this assessment to 5-6 years (depending on the year of the 1st survey). Screening of samples from these surveys is not yet complete. On completion, the spatial distribution of trees identified as infected in the first year of the study (2003 or 2004) will be compared to the spatial distribution of trees identified as infected in the current year (2008).

Provided that infected trees do not serve as an important source of inoculum, the decision to keep or remove infected trees should be based off potential long term yield loss. To assess this, we compared the yields of ALS-affected and healthy trees for the past 5 years. Results for 2008 are consistent with previous findings (i.e., Sisterson et al. 2008). Specifically, ALS-affected trees produced approximately 40% and 20% fewer kg of kernel than unaffected trees for the cultivars Sonora and Nonpareil, respectively (Fig. 1).

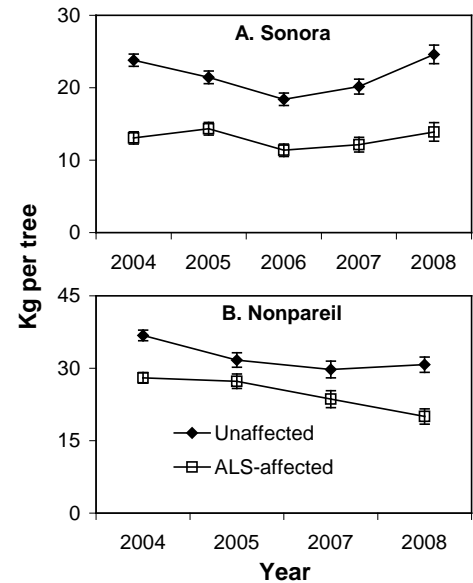


Fig. 1. Yields of ALS-affected and unaffected trees. A) Results for the cultivar Sonora averaged over 3 orchards (2004 to 2007) or 2 orchards (2008). B) Results for the cultivar Nonpareil from one orchard.

The final factor to consider is the probability of tree death. Some reports suggest that ALS-affected trees should die within 3-8 years of symptom onset (ABC 2004). To assess this risk we determined the fate of trees first identified as infected in 2003 or 2004 (Table 1). Tree death was observed at only one site, with 6% (6 out of 105) of trees identified as infected in 2004 dying by 2008. However, at this site, 4% (10 out of 283) of trees identified as unaffected in 2004 also died or were nearly dead in 2008. Thus, it is likely that factors other than ALS contributed to tree death. Together, the results suggest that death of ALS-affected trees over a 5-6 year period was rare.

Table 1. Results of orchard survey. Orchards were surveyed in 2003 or 2004. Then in 2008, the status of trees identified as being infected in the first survey was re-assessed.

Orchard	Cultivar	Total num. of trees	1 st Survey			Status of infected trees in 2008			
			Num. Infected	Mean rating ^a	Year of survey	Num. alive	Num. dead	Num. Removed	Mean rating ^a
A	Sonora	388	105	3.6	2004	90	6	9	3.6
B	Sonora	896	53	3.4	2003	13	0	40	3.0
B	Nonpareil	1,728	23	2.6	2003	23	0	0	3.7

^a Trees were rated on a scale of 1 (healthy) to 4 (all scaffolds symptomatic for ALS).

References:

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