

Midwinter irrigation can reduce deep bark canker of walnuts

Beth L. Teviotdale □ G. Steven Sibbett

Deep bark canker (DBC), a bacterial disease of walnut, occurs in all walnut-growing regions of the state. The disease causes deep longitudinal cracks in the bark of trunk, scaffolds, and larger branches. A dark reddish brown exudate flows copiously from these cracks during late spring through fall. Internally, streaks of black necrotic tissue develop in inner bark near the cambium and small black pits in outer wood. Infected limbs usually have less foliage, have yellow leaves, and are weaker than other unaffected sections of the tree.

The pathogen, *Erwinia rubrifaciens*, attacks English walnut, *Juglans regia* L., but not black walnut, *J. hindsii* Jepson, or Para-

dox hybrid, *J. regia* × *J. hindsii*. Although all commercial cultivars are susceptible, Hartley is most seriously affected.

The bacteria enter through bark injuries. Mechanical harvesters can spread deep bark canker when shaker pads infested with bacteria injure healthy trees. Trees not mechanically shaken also contract the disease, implicating other tree-injuring agents, such as sapsuckers, which may directly transmit the bacteria or create entry points.

Surgical techniques to remove existing cankers and sterilization of harvest equipment to prevent spread have not provided control or adequate protection. Topical applications of protectant chemicals or injec-

tions of antibiotics are not effective.

Orchard mapping has associated walnut tree vigor with incidence and severity of DBC. Trees weakened or stressed by marginal soils, poor water management, nutrition, or pest and disease problems more commonly are infected than those growing vigorously. Remission of DBC symptoms has occurred where stress conditions are alleviated.

Poor tree vigor in walnut often results from inadequate, or excessive, moisture in the root zone. In much of the San Joaquin Valley, normal winter rainfall does not replenish deep soil moisture, and orchards irrigated only during the growing season become water-deficient by mid-August. The study reported here compared the effects of two irrigation regimes on incidence and remission of DBC: standard practice (growing-season irrigation only) and standard practice supplemented with winter irrigation sufficient to wet the soil profile to 8 feet.

The experiment began in 1977 in an 11-year-old Tulare County Hartley walnut orchard with initially 51.6 percent of its trees showing DBC symptoms. The orchard was divided into 5- by 5-tree treatment blocks, treatments paired and replicated 10 times. There was no significant difference in disease incidence between areas destined to be winter-irrigated and those to receive the standard practice. The peripheral 16 trees in each block served as guard rows; data were collected from the central 9 trees.

Soil moisture content was monitored with tensiometers placed at depths of 18, 36, 60, and 96 inches. Tensiometer stations were in two blocks of each treatment. The orchard was irrigated with hosepull sprinklers, and winter irrigations were begun in January and repeated until soil moisture reached 96 inches. Spring irrigations in both treatments began in March, the final irrigation taking place in mid-October after harvest.

Incidence of deep bark canker was determined by presence or absence of exudate from bark cracks in November and December of each year. Trees having no DBC cracks were scored healthy, those having one or



Bark canker disease causes deep cracks in trunk, scaffolds, and larger branches of walnut trees. Weakened trees are the most likely to be infected.



Dark, reddish brown exudate oozes from cracks from late spring through fall and is a sign of active disease.

more cracks with exudate were scored actively diseased, and those with cracks but no ooze scored diseased but inactive. The inactive designation was not included until 1978.

Three years of added winter irrigation significantly decreased the percentage of trees with active disease symptoms and correspondingly increased the percentage of trees with inactive cankers (see table). Tensiometer readings showed more frequent periods of dry soil and lack of available water, particularly from January through July, in the

standard-practice areas than where winter irrigation was included.

Results of this study support the observation that cultural practices can have a dramatic effect on incidence of deep bark canker disease. In this case, sufficient soil moisture was maintained by supplementing low rainfall with midwinter irrigations. Inadequate supply of water is a common problem in walnut culture, but programs aimed at improving tree vigor to combat deep bark canker need to include all aspects of tree

culture. Procedures required to enhance recovery will vary with each orchard. Where increased soil moisture is indicated, the very serious problem of *Phytophthora* root and crown rot must be considered when designing an irrigation schedule.

Beth L. Teviotdale is Plant Pathologist, Cooperative Extension, San Joaquin Valley Agricultural Research and Extension Center, Parlier; and G. Steven Sibbett is Farm Advisor, Tulare County. The authors thank Marion S. Bailey for his assistance in this work.

Effect of supplemental winter irrigation on severity of deep bark canker of walnut, Tulare County, cultivar Hartley

Year	Irrigation regime	Percent trees†		
		Healthy	Disease active	Disease inactive
1977	Winter plus standard	51.7	48.3	—
	Standard	48.2	51.3	—
		n.s.	n.s.	
1978	Winter plus standard	48.8	36.7	14.3
	Standard	36.3	45.3	18.1
		n.s.	n.s.	n.s.
1979	Winter plus standard	44.3	34.1	21.6
	Standard	34.8	52.3	11.6
		n.s.	*	n.s.
1980	Winter plus standard	43.2	28.4	28.4
	Standard	33.0	56.8	8.0
		n.s.	**	**

†Data collected from central nine trees in each treatment block. Figures are mean percent; arcsine transformation. Data analyzed using t-test; n.s. is not significant; * is significant, $P = 0.05$, ** $P = 0.01$.

Cabbage aphid control on Brussels sprouts and broccoli

Norman F. McCalley



Cabbage aphids feeding in growing point of broccoli.

Cabbage aphids in Brussels sprouts and broccoli heads at harvest are cause for rejection of the crop by processors and fresh market buyers. To achieve acceptable control, growers apply systemic insecticide sprays at the onset of head formation and additionally as needed to protect the heads from infestation. Meta Systox-R and Phosdrin are the standard insecticides used in California's Salinas Valley.

The purpose of this investigation was to evaluate candidate insecticides against the cabbage aphid, *Brevicoryne brassicae* (L.), on Brussels sprouts and broccoli. Brussels sprouts 'Jade E' were transplanted June 16, 1976, in the first experiment at a test site at Hartnell Community College, Salinas. Plots 25 feet long by one bed (3 feet wide) were replicated four times in a randomized complete block design. Insecticides were applied