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EPIDEMIOLOGY AND MANAGEMENT OF WALNUT BLIGHT

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Introduction

The disease walnut blight, caused by the bacterium *Xanthomonas arboricola* pv. *juglandis (Xaj)*, continues to be a threat to the industry on an annual basis. This yellow bacterium lives between scales of male and female flower buds, as well as in dead buds and cankers. The pathogen can also cause leaf and bud infections. Cankers form from fruit infections that progress into the peduncle and stem. Rain and temperature are driving environmental conditions. The XanthoCast (https://www.agtelemetry.com/) program is a walnut blight risk assessment tool that tracks hours of leaf wetness accumulated per day from rainfall, dew, or irrigation water for three temperature regimes (6-12°C, 12-17°C, and 17-27°C) and calculates the risk or potential for disease in a given location. Early-blooming cultivars (e.g., Vina, Ashley) are prone to disease because favorable environments generally occur in early spring in California, whereas late-blooming ones (e.g., Chandler) generally flower when less rainfall and higher temperatures occur. In inoculation studies, however, early- and late-blooming cultivars are similar in their susceptibility.

Objectives

1. Screening for Blight Resistance in Walnut.
2. Epidemiological Studies.
3. Management Studies.

Screening for Blight Resistance in Walnut

In 2020, we continued our collaboration with the UC Davis walnut breeding program to identify new walnut blight-resistant genotypes early in the breeding selection process. Consistent results over three years were obtained for many walnut selections, whereas others were more variable. Highly susceptible cultivars such as Vina, Ashley, Payne, Sinensis, Serr, Chandler, Ivanhoe, and PI159568 generally developed high disease levels after inoculation and supported high bud populations. A trend for lower disease susceptibility and lower bud populations was found on cvs. Idaho and Gillet. Disease and bud populations have been consistently low for cv. Cheinovo, but horticultural and nut characteristics of this genotype do not meet industry standards.

To date, walnut progeny of numerous crosses show a wide range of susceptibility. Recovery of *Xaj* from inoculated female buds was consistent in two years for many genotypes in the breeding program. Some of these consistently had low or no recovery of *Xaj* indicating that they do not support pathogen survival, and

they also developed a low incidence of fruit blight. Genotypes with high *Xaj* survival in buds developed high or low levels of disease, suggesting the presence of other genetic determinants for disease susceptibility or that certain environmental conditions possibly have a strong effect on infection and disease development. Our studies indicate that low *Xaj* survival in buds and low fruit infections may be used as indicators of walnut blight susceptibility in the UC Davis breeding program.

Epidemiological Studies

Xaj strains highly resistant to copper (≥100 ppm MCE) continued to be detected in several locations, but there was no resistance to mancozeb or copper-mancozeb mixtures.

Management Studies

In blight management studies, copper-mancozeb continued to perform well; however, mancozeb is facing potential registration withdrawals in some countries.

Triphenyltin hydroxide (SuperTin) and dodine (Syllit) were identified as possible effective mancozeb alternatives (Fig. 1). SuperTin, however, was rejected by EPA after it was submitted to the IR-4 Specialty Crop Pesticide Registration program. In lab assays, dodine was also very toxic in mixtures with copper (Cu) at low concentrations against Cu-sensitive and Cu-resistant *Xaj* strains. Dodine was registered in California in Feb. 2021, and additional large-scale testing is planned before general guidelines can be provided to the industry.

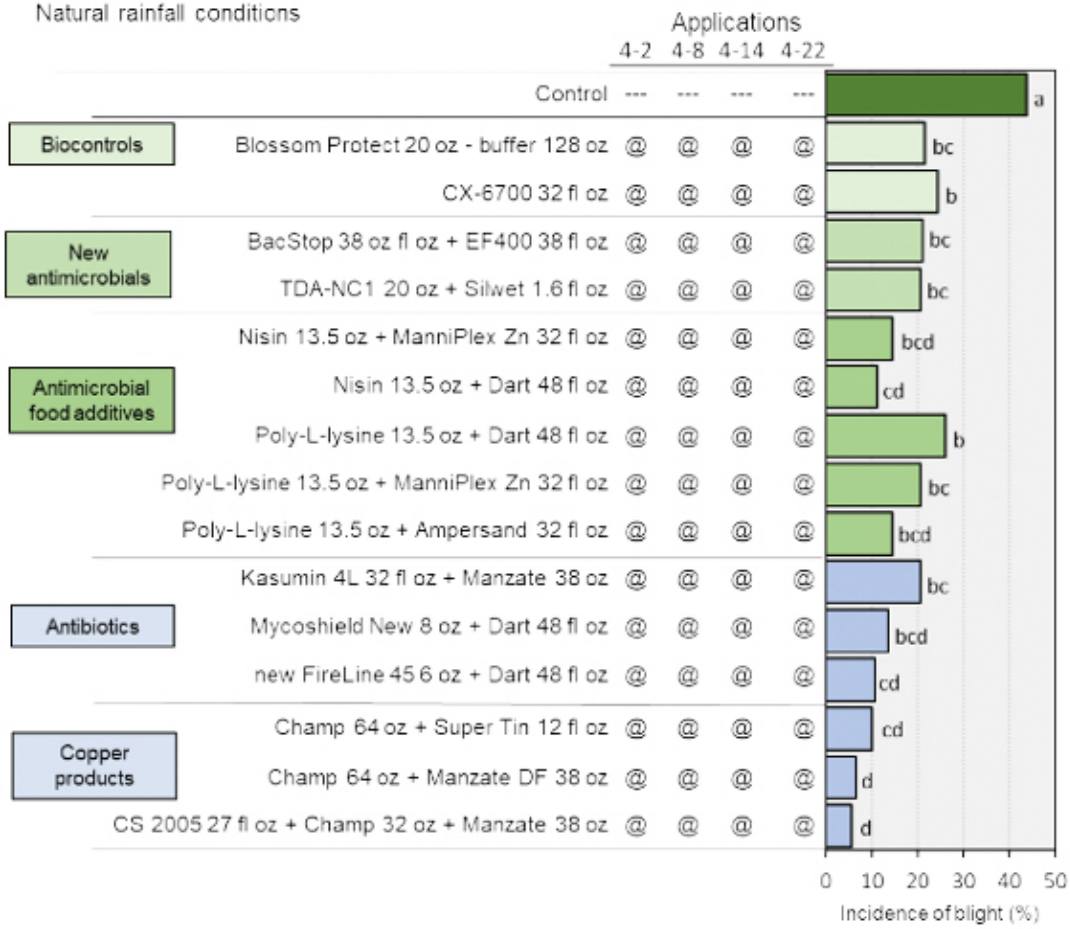
A mixture of mancozeb (Manzate) with a low rate of water-soluble copper sulfate (e.g., CS 2005-27 fl oz or MasterCop-32 fl oz/A) and a half rate of a fixed Cu (e.g., Champ-32 oz/A) was as effective as a mixture of fixed copper (Champ-64 or 80 oz/A) with mancozeb (Manzate-38 fl oz). This treatment provides a readily available copper and a persistent fixed-copper that slowly ionizes to provide residual activity of the treatment when applied as four, 7-10 day applications. This treatment could reduce total Cu use per season and complies with EPA goals.

Kasumin continued to perform well in mixtures with mancozeb or Cu. A new 2022 label will allow up to four applications per season with rotation to a different mode of action after two applications.

Dart (capric/caprylic acids) was identified as a promising mixture partner for oxytetracycline (FireLine, Mycoshield), and this mixture provided efficacy similar to copper-mancozeb. Oxytetracycline has a proposed federal registration date of October 2021, but CA registration is not expected until 2022.

The biocontrols Blossom Protect, bacteriophage product CX-6700, essential oil plant extract ET91, and natural product TDA-NC1 all provided moderate to high efficacy in several studies. These new treatments potentially can become viable alternatives to Cu for organic and conventional walnut production. The potential biopesticides (i.e., exempt-from-tolerance) food preservatives nisin and ε-poly-L-lysine (EPL) were effective in mixtures with Dart, Ampersand, and ManniPlex Zn. An agrochemical company is currently helping us to formulate these food grade active ingredients as agricultural formulations.

Fig. 1. Efficacy of new bactericide treatments for managing blight on cv. Tulare walnut Yuba Co. 2020
- Populations of *X. arboricola* pv. *juglandis* highly resistant to copper -



Applications were done using an air-blast sprayer at 100 gal/A. Disease was evaluated on May 13, 2020