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ETIOLOGY, EPIDEMIOLOGY, AND MANAGEMENT OF HULL ROT AND MOLD OF WALNUT IN CALIFORNIA

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Objectives

1. Identify all possible microorganisms causing mold in walnut samples collected from the major walnut-producing counties.
2. Determine when and how mold develops; are the molds attacking the hulls the same as those causing kernel mold?
3. Determine factors affecting mold and Brown Apical Necrosis (BAN).
4. Develop mold and BAN management methods.
5. Additional research funded by chemical companies: Manage Botryosphaeria canker and blight and anthracnose blight in walnut (fungicide efficacy trials).

Results & Discussion

Mold Microorganisms

Walnut samples were collected from 11 counties, and isolations showed 12 fungi plus the bacterium *Xanthomonas arboricola* pv. *juglandis* that causes walnut blight. Among the fungi isolated the most common were *Alternaria*, *Fusarium*, and *Aspergillus* species. In orchards where Botryosphaeria and Phomopsis canker and blight disease were severe, Botryosphaeria and Phomopsis species were also found causing mold.

In contrast to earlier reports, we found a strong correlation between the fungi causing kernel mold with those that decay the hulls of walnuts. Mold colonies seemed to initiate from the stylar end of the fruit. At least threefold more colonies of mold started from the stylar end than the stem end.

Mold Development

Serial inoculations in August, September, and October showed that the inoculations in October resulted in an increase in mold and there was a strong correlation between the fungi causing mold with those decaying the hulls of walnut fruit.

Factors Affecting Mold and BAN

For this objective, no definite conclusions have yet been reached. Because different cultivars generally show

differences in mold incidence, we periodically isolated fruit of Chandler, Vina, Tulare, Payne, and Hartley cultivars. In two years of isolations, *Aspergillus niger* was the most commonly isolated fungus.

▶ Mold Management

Three trials were established. In an Ivanhoe (early cultivar) walnut orchard, we showed that one Merivon + tebuconazole spray three weeks before hull split and one spray with flutriafol (Rhyme®) at 20-30% hull split reduced significantly walnut mold at harvest. Also, in a Livermore walnut orchard, two sprays with flutriafol, one in mid-August and the second in the first part of September, reduced mold by 30%.

In a Chandler walnut orchard, although the pre hull split and at 20-30% hull split sprays reduced mold, this reduction was not significant in the 2020 trial. However, in 2019 in the same orchard, similar sprays and timing using Rhyme® resulted in a 60-73% reduction in mold. Additionally, we repeated fungicide efficacy trials against Bot/Phomopsis canker and blight and the anthracnose of walnut. Blighted walnuts (with black hulls) were recorded on the ground at harvest (Oct. 6, 2020) immediately after shaking. The untreated control had 12.5% blighted fruit. Nine fungicide treatments significantly reduced (P=0.05) the incidence of blighted fruit in comparison to the untreated control trees; the best treatments were pyraziflumid with 4.7% and Luna® Experience + Serenade® with 5.0% blighted fruit. Regarding reduction in blighted spurs, the untreated control had 8.2% blighted spurs while all the fungicide treatments significantly reduced blighted spurs to a range of 0.8-2.7% (P=0.05). Spraying early in the spring against anthracnose (caused by *Marssonina juglandis*) significantly reduced the disease in a San Benito County Serr orchard.

In both early and late walnut cultivars, we may need at least two sprays (2-3 weeks pre hull split and in early hull split) to reduce mold.