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EFFECTIVENESS AND MECHANISMS OF DORMANCY BREAKING TREATMENTS FOR WALNUTS

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PROJECT OBJECTIVES:

1. Identify treatments to help walnuts maintain production after low chill winters.
2. Understand physiological responses to treatments to improve on calendar-based treatment timing recommendations

BACKGROUND

Walnuts are one of the highest chill requirement tree crops in California. Multiple recent winters have fallen short of the chill needed for a tight, economical walnut bloom. Scientists expect such winters to be more frequent in the future. Though lower chill varieties are in development, the industry needs tools to support currently planted varieties. Many products have been shown to compensate for inadequate chill in other crops and countries but need to be tested in California conditions. We applied potential dormancy breaking treatments to walnut trees and monitoring phenology (Is budbreak earlier? Did more buds break?), physiological (Did carbohydrate dynamics change?), and yield.

KEY FINDINGS

- Rather than wait for a low chill winter, we created warm winter conditions in large, open-top chambers built around mature Chandler trees at UC Davis, coupled with unheated trees for comparison. Approximately 30-40 days before budbreak, dormancy breaking treatments were applied to different scaffolds in each tree. We then monitored budbreak over many weeks.
- Over four years, we tested hydrogen cyanamide, specifically Dormex®, a blend of nitrogen compounds marketed as Erger®, and calcium ammonium nitrate (CAN-17), all compared with a water control. Dormex® is the only one of these products labeled for use as a dormancy breaker in walnuts (see label for use details). Erger and CAN-17 are labeled as fertilizers. In terms of budbreak timing, we found Dormex® at 2% and 4% and CAN-17 at 20% could prompt heated scaffolds to behave like they had received enough chill, whereas Erger at 6% and CAN-17 at

lower rates (5% and 10%) only partially compensates for lack of winter chill. Decreased budbreak is also a symptom of low chill. Our years of research in heated trees showed Dormex® at 2% often significantly increased the percentage of buds that opened on heated scaffolds, whereas Dormex® at 4% often increased budbreak numerically, but not to a statistically significant degree. CAN-17 often had numerically higher budbreak, but not significantly.

- Taken all together, our tented tree trials indicated that hydrogen cyanamide and CAN-17 were worth testing at a field scale. We've spent two years so far comparing Dormex® at both 2% and 4% and CAN-17 at 20%, monitoring budbreak timing, maturity timing, yield and quality in two Chandler orchards. One is a healthy 10th leaf orchard in Glenn County, and the other, planted in the hills above Arbuckle, is a few years past its prime, with some limb and spur dieback from tight space shading and Botryosphaeria.
- So far, budbreak timing is in keeping with what we saw in our tented tree trial. In the spring of 2023, after a high chill winter, budbreak was 2-3 days earlier across treatments. In the spring of 2024, after a moderate chill winter, budbreak was 5-6 days earlier at the Glenn County site and 8-11 days earlier at the Arbuckle site. We also looked to see if this earlier budbreak resulted in earlier maturity. At the Glenn County site 100% Packing Tissue Brown occurred 10-11 days earlier in the treated trees, with no difference between treatments. At the Arbuckle site, there was a numeric trend of PTB being a few days earlier, but it wasn't statistically significant. This points to a potential interesting side-benefit for these dormancy breaking tools – the ability to shift harvest timing for growers with too many acres of Chandler to harvest at once.
- Our yield results have been a bit surprising. As shown in the table below, last year, even when chill was more than adequate, we saw a significant 1,600 lb increase in yields at the Arbuckle site with Dormex® at 4%, and increased yields, though not statistically significant, in the other two treatments at Arbuckle (700-1,000 lb), and in all treatments, though not significant, at the Glenn County site (400 lb). This year, however, yields were the same or lower in treatments than the control. Yields were 400-700 lb lower than the control at Glenn County, statistically significant with CAN-17, and 200 lb less to 200 lb more than the control at Arbuckle, though none of these differences were statistically significant. This was surprising given that 2023-2024 was a milder winter than 2022-2023. Added up over two years, the cumulative yield was not different from the control at the Glenn County site, but was higher, significantly so with Dormex® at 4%, at the Arbuckle site.
- All this together points to the notion that these tools, applied at the timing and rates we used, may not be suited for every orchard every year. Applying dormancy breakers after optimal chill (like 2022-2023) to a thriving orchard, like the Glenn County site, may not to warrant the cost. However, these dormancy breaking treatments are likely to still be valuable tools following low and medium chill winters, have potential for encouraging additional budbreak in stagnant orchards like Arbuckle, and have exciting potential for moving harvest timing for growers with a lot of Chandler acreage. We'll keep working in these same orchards for a few more years to gather data after more, different chill winters.