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Growth Regulator

Understanding the Control of Bud Break and Fruit Ripening in Fig

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INTRODUCTION

Production and harvest costs have been increasing during the last decade to the point that the business of growing fresh fruit is becoming less attractive to farmers. In other commodities, plant growth regulators (PGRs) are being used to maximize fruit yield and quality and minimize harvest cost. These compounds are being used to accelerate or make bloom more uniform; improve fruit set and size; thin fruit or flowers to improve size and quality; and make fruit maturation more uniform. Many of these PGRs have not been tested on fig.

In general, onset of fruit ripening is controlled in part by dormancy (onset of bud break), shoot growth and fruit development. Hormone balance and heat units control bud break and fruit ripening. It is well documented that fruit ripening is triggered and controlled by production of endogenous ethylene, and it can also be triggered by exogenous ethylene application when the tissue is receptive. We have observed that fig ripening is related to training system and light exposure. Understanding and controlling factors that trigger bud break and fig ripening will be the basis to control harvest date.

Our first approach is to evaluate bud break and fruit ripening as related to ethylene by using localized applications of Ethrel, an ethylene-releasing chemical and 1-MCP and ReTain, ethylene inhibitors. During this season, we studied fig growing habits and evaluated several chemicals that have been shown to control bud dormancy, fruit set, fruit ripening and market life in other fruit species. The use of PGRs and canopy manipulation techniques could help to manage harvest date and/or compress the harvest period.

MATERIALS AND METHODS

Experiment 1.

Breba fig crop. In some instances breba figs are considered a nuisance crop as production is too low to be commercially important and the presence of dropped fruit in the orchard can attract pests (Fig. 1) and serve as a reservoir for fungi. This season, we evaluated the ability of Ethrel to abscise breba figs. Ethrel was prepared in water (no wetting agent was used) to produce four treatment rates of 0, 250 500 and 1000 ppm Ethephon (Ethephon is the active ingredient in Ethrel). These treatments were applied to individual branches of 'Black Mission' and 'Conadria' fig trees to the point of runoff with a handgun on May 3, 2005. At the time of application, each branch had one breba fig. For each treatment concentration, five branches were treated and the branches labeled with plastic nursery tags. Weekly observations of the treatments were made with respect to fruit abscission, leaf abscission, and phytotoxic response.

Main fig crop. Fig fruit tend to develop and ripen over an extended period of time creating a prolonged harvest period. This season we screened five PGRs (Table 1) to determine whether any were able to compress the harvest period. The PGRs were applied to 'Black Mission' and 'Brown Turkey' figs as previously described. Applications were made at ~10 day intervals beginning 5/26/05 and ending 8/22/05. On each application date, three branches were treated with each chemical x concentration combination and the branches labeled with plastic nursery tags. Weekly qualitative

observations of the treatments were made with respect to fruit maturation and phytotoxicity. Next Spring, percent bud break and date of fruit ripening will be measured for these treatments.

Experiment 2.

Ethrel was applied at 0, 250, 500, and 1000 ppm to 'Conadria', 'Black Mission', and 'Sierra' fig trees at 10 day intervals beginning at leaf drop and ending 11/29/2005. Next spring (2006), percent bud break, phytotoxicity, and date of fruit ripening will be measured for these treatments.

PRELIMINARY RESULTS

Experiment 1.

Breba fig crop. The effects of Ethrel could be observed within one week of treatment. On 'Black Mission,' Ethrel often caused the fruit to become dark prior to abscission (Fig. 2), while no color change was observed in 'Conadria'. In both cultivars, fruit abscission usually occurred within two weeks. The ability of Ethrel to abscise fruit was related to cultivar and Ethephon concentration. In general, 'Black Mission' was more sensitive to treatment than 'Conadria' with 100% of the fruit abscising after treatment with $\geq$ 250 ppm Ethephon. In 'Conadria', 100% fruit abscission occurred with the 1000 ppm treatment, 80% with the 500 ppm treatment, and 40% with the 250 ppm treatment. No breba fruit abscission was observed in the control treatments.

Unfortunately, Ethrel was nearly as effective in removing leaves as it was fruit. Significant epinasty (curving of the leaf petiole) and leaf abscission occurred at 500 ppm (Fig. 3), and shoot death at 1000 ppm Ethephon (Fig. 4). Phytotoxicity was more severe in 'Black Mission' than 'Conadria' figs. 'Black Mission' shoots treated with 1000 ppm Ethephon completely defoliated within two weeks, and all treated shoots eventually died. Defoliation was not as severe in 'Conadria', and mortality was below 20% at the highest Ethephon concentration. In both cultivars, some epinasty and defoliation occurred with 250 ppm Ethephon treatment, but all treated shoots recovered and continued to produce new leaves.

Based on these preliminary observations, future research on breba fruit removal should focus on using concentration $\leq$ 250 ppm Ethephon for 'Black Mission' and $\leq$ 500 ppm for 'Conadria'. Since these two cultivars had such different phytotoxic thresholds, caution should be exercised when evaluating other cultivars. Our chemical applications were

made without a wetting agent, and the chemical was applied to runoff. Changing these parameters (i.e., using a wetting agent, applying in a low volume spray) in future research would probably change the phytotoxic thresholds.

Main fig crop. With the exception of Ethrel, none of the PGRs evaluated had a noticeable effect on 'Black Mission' or 'Brown Turkey' fig fruit maturation or ripening patterns. Ethrel caused color development and abscission as described above. Next Spring, these treatments will be observed for residual effect, primarily bud development.

Experiment 2.

The effect of these treatments will be evaluated in Spring 2006.

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