

FINAL REPORT

WTFRC Project # AH-01-82

WSU Project # 3298

Project Title: Bioregulators for management of vegetative growth and fruit quality in apple

PI: Don C. Elfving, Horticulturist

Organization: WSU Tree Fruit Research and Extension Center, Wenatchee, WA
(509) 663-8181 ext. 252; delfving@wsu.edu

Cooperators: Eric A. Curry, Horticulturist, USDA/ARS, TFRL, Wenatchee, WA
Stephen R. Drake, Horticulturist, USDA/ARS, TFRL, Wenatchee, WA
Dana Faubion, Extension Horticulturist, Yakima County Cooperative Extension
Dwayne Visser, Agricultural Research Technologist II, WSU-TFREC, Wenatchee, WA

Accomplishments: Over the three-year period of this project, 25 separate trials were undertaken to assess various aspects of bioregulator use for management of vegetative growth, flowering and fruiting in apple trees.

Two trials initiated in 2000 were carried over into 2001 to collect final data. Seven new trials were initiated in 2001 in grower orchards in north-central Washington. Five of these trials were designed to extend our knowledge of effects of prohexadione-Ca (Apogee®) on apple tree return bloom, pruning time (cost), to examine effects of various surfactant supplements on the efficacy of Apogee for control of vegetative growth, to assess Apogee effects on postharvest behavior of 'Fuji' apple, and to initiate study of effects on growth of a new bioregulator product, cyclanilide™ (Aventis CropScience). Based on preliminary and successful pilot trials in 1999 and 2000, two trials were established in 2001 to examine a new strategy for controlling alternate bearing in difficult cultivars such as 'Fuji.' This strategy involves the use of gibberellic acid applied in the "off" year to reduce flower initiation so that trees come into the "on" year with a significant percentage of "resting" spurs (spurs with no flower clusters). Differential "on"-year thinning programs will be incorporated with or without "off"-year GA treatments to assess whether controlling flower initiation can be used as a viable strategy for control of alternate cropping, to determine the best combination of treatments to accomplish that goal, and to assess the economic viability of such strategies. These two trials are long term in nature, planned for at least four years (two complete alternating cycles) and will be carried on into the new project.

Results: During the course of this project, all objectives have been met except for the development of an effective protocol for control of a second growth flush (see item 4 below). The following results and conclusions have been obtained during the three years of this project.

A. Vegetative Growth

1. Apogee can be used successfully to control vegetative growth in apple under WA conditions, but there are significant complications of which growers need to be aware that may alter this outcome.
2. No benefit in growth control has been observed when Apogee doses in excess of 6 oz./100 gallons (dilute basis) have been used, even under high vigor conditions.

3. Multiple applications of Apogee appear to be essential for best control of growth. Two applications approximately three weeks apart appear to be the minimum necessary for achievement of growth control when trees are at least moderately vigorous.
4. In very vigorous trees, a second, strong growth flush beginning in early to mid-July can be stimulated by a spring program of Apogee-based growth control. The growth of this second flush can be sufficiently vigorous to negate all previously achieved control of shoot growth from spring Apogee applications that year.
5. We have not yet been successful in developing a specific protocol for when to apply Apogee, how much to apply or how often to apply in order to control or eliminate this second flush. This component needs further work and will be included as a goal in the successor to this project.
6. No benefit in terms of development of secondary branching has been observed when an induced second growth flush takes place in apple. Apparently the apical dominance system in apple is not interrupted when a second flush takes place, even when that flush begins after several weeks of little or no shoot growth extension.
7. Apogee works effectively using low volume, concentrate applications when the required Apogee dosage is calculated using appropriate Tree Row Volume estimates of canopy size.
8. Where growth control with Apogee is obtained, Apogee use reduces dormant pruning times, thereby reducing pruning costs. Reduction in pruning costs may not offset cost of the material itself, however.
9. Apogee can be used to control vigorous shoot growth in the tops of apple trees with targeted applications to that area of the tree.
10. Apple cultivars appear to respond somewhat differently to Apogee. In our tests, 'Fuji,' 'Gala,' 'Cameo' and 'Honeycrisp' have been quite responsive to Apogee. The cultivar 'Granny Smith' appears less responsive and requires higher doses or more applications of Apogee for effective growth control.
11. Apogee effects on growth are not improved or changed by substituting an organosilicone surfactant or any of a variety of other adjuvants (stylet oil, vegetable oil emulsion, Raynox™) for Regulaid™ in the spray solution.

B. Flowering and fruiting

1. Apogee does not appear to affect return bloom under WA conditions, neither promoting nor inhibiting the initiation or development of flowers.
2. There is no evidence in any of our trials of any effect of Apogee on stimulation of fruit set under WA conditions. This phenomenon has been reported in other growing districts.
3. Apogee does not affect apple fruit size in WA, even when repeat applications are made during the cell division phase of fruit development. Apogee might reduce apple fruit size if an increase in fruit set takes place following Apogee application.
4. Apogee does not affect the incidence of bitter-pit in sensitive cultivars such as 'Honeycrisp' or 'Hokuto.'
5. Apogee has no effects on apple postharvest condition or behavior in either regular air (RA) or controlled atmosphere (CA) storage when applied either in the spring or later in the season, closer to harvest.
6. Ethrel can substantially increase return bloom in poorly cropping 'Fuji' apple trees when applied at the equivalent of 1 pt./100 gallons (dilute basis) around 45 days after full bloom with no crop loss or quality impairment.
7. Gibberellic acid (GA) treatments appear to effectively reduce blossom cluster formation in 'Fuji' apple trees in their "off" year of cropping (low crop load, high flower initiation potential).
8. In one preliminary trial with 'Fuji,' treatment with GA did not appear to affect fruit quality.

Acknowledgments: We gratefully acknowledge the support and assistance provided over the past three years by the following individuals and organizations that helped make this project possible: Apple-Eye Orchards, Lalo Arizmendi, Tom Auvil, Aventis CropScience, BASF Corp., Curt Bollinger, Gordon Brandt, Bart Brinkman, Joe Bulleri, Felipe Castillo, Bruce Clark, Columbia River Orchards, Rommel Corral, Heidi Cousens, Matt Ehlhardt, Dr. Dana Faubion, Doyle Fleming, Jim Fleming, Tye Fleming, Mike Hargrove, Dr. Don Heinicke, Bill Howell, Dr. Chris Ishida, Richard Janney, Dr. Bruce Kirksey, Lucky Bohemian Orchards, Karen Maguylo, Dr. Jim McFerson, Kent Meline, Mike Mrachek, Northern Fruit Co., Dwayne Nunley, Dale Olsen, Peters Orchards, Chris Peters, Fred Plath, John Rasch, Mike Robinson, Tory Schmidt, Farrah Shirley, Matt Smith, Earl Talley, Upper Valley Tractor, Valent BioSciences, Rob Valicoff, Dr. Gary Van Ee, Dwayne Visser, Jim Walker, WA Fruit and Produce Co., WA Tree Fruit Research Commission, and Tim Witter.

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