

FINAL REPORT

WTFRC Project #PR-02-228

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Project title: Branch induction in pear trees with bioregulators

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Objectives:

1. Determine the effectiveness of cyclanilide for induction of lateral branch development in young, vigorous pear trees under orchard conditions.
2. Determine whether the effects of cyclanilide are enhanced by applying the material in combination with other bioregulator products that affect apical dominance, such as proprietary cytokinin/gibberellin mixtures.
3. Establish a trial to determine whether chemically induced branching in pear trees results in improved orchard production.

Significant findings:

- Cyclanilide is effective for induction of lateral branching in pear trees. Regardless of the method of application, the amount of active ingredient required to produce substantial branching is much less than needed for apple or sweet cherry.
- Cyclanilide produces lateral branching in the commercial pear cultivars ‘Bartlett’, ‘Bosc’, ‘d’Anjou’, ‘Kalle’ (Clapp’s Favorite), and the ornamental pear cultivar ‘Bradford’. Rootstock appears to have no effect on product efficacy on the scion cultivar.
- Sprays of cyclanilide at 5-20 ppm (mg/liter) produce excellent branching when applied after shoot growth has begun; comparable branching in apple or sweet cherry requires spray concentrations of 50-150 ppm.
- Cyclanilide applied in paint directly to pear buds on 1-year-old wood in early spring prior to budbreak has little effect on stimulating the treated buds to become active and develop into either lateral shoots or spurs the year of treatment but appears to translocate to the tips of the new growth, where it induces substantial lateral bud activity in a second growth flush that season.
- Cyclanilide demonstrates this translocated effect when applied to buds on last year’s shoots, when sprayed on trunks or when applied as a trunk drench in either the fall after growth has stopped or in spring before budbreak.
- This translocated effect has only a small influence on the dormant buds that break in spring following a trunk spray or trunk drench treatment but produces a lot of secondary branching when the first growth flush produces a second flush in late June or early July. This actual interruption of apical dominance and appearance of new branches can occur up to 8 months after the cyclanilide is applied as a trunk spray or trunk drench.

- Trunk drenching young ‘Bosc’ trees in fall or spring with as little as 50 mg (0.002 oz. active ingredient) of cyclanilide per tree increased lateral branching throughout the canopy the following season by several-fold.
- When cyclanilide increases branching in pear trees, bloom the following year is reduced because of the increased vegetative growth activity.
- In one trial, cyclanilide, Promalin, or the combination applied once to third-leaf ‘Kalle’ trees (2002) resulted in improved branching from cyclanilide but little effect from Promalin and produced a reduction in bloom the next season (2003, first year of flowering, little or no yield). The second year after treatment (2004), flowering was slightly improved by Promalin, but yield was not affected by any branching treatment.

Methods:

Over the three-year period of this project, trials were established in non-cropping pear trees to determine effects of various bioregulator products on both growth and fruiting behavior. All trials employed single-tree plots in randomized complete block designs.

Results and discussion:

During the course of this project, progress was made on all objectives. The following results and conclusions have been obtained during the three years of this project:

A. Dormant-season or green-tip applications of cyclanilide directly to pear buds.

1. Cyclanilide at up to 5,000 ppm was painted onto buds on 1-year-old wood of ‘Kalle’ and ‘Bosc’ pear trees before budbreak or at green-tip (2002). Painting buds had virtually no effect on inducing treated buds to become active and develop into shoots or spurs. However, in all cases, when a second flush of vegetative growth began in early July the painted treatments induced a substantial increase in budbreak and lateral-shoot development from newly formed buds on the first vegetative flush that season. This “translocated” effect occurred 3-4 months after the cyclanilide was applied. Further tests were carried out to evaluate the potential for the “translocated” effect to be exploited in a much more labor efficient way.
2. Flowering the second season following cyclanilide treatments (2003) was reduced due to increased vegetative development the previous year. In the next season (2004), there were no treatment effects on flowering.

B. Dormant-season applications to trunks and soil of young pear trees.

1. Cyclanilide at up to 15,000 ppm sprayed onto trunks of young ‘Bosc’ and ‘Kalle’ trees in either October 2002 or early March 2003 produced little effect on the development of shoots in the first flush of growth in 2003 that originated from buds formed the previous year.
2. Despite the minimal effect on the first shoot growth flush, trunk-spray treatments substantially increased secondary branching in the second vegetative flush in 2003, in direct proportion to the amount of cyclanilide applied.
3. Trunk spray treatments were effective for inducing second-flush branching up to 8 months after the treatments were applied.
4. Again, flowering was reduced the year following the observation of growth effects (2004) due to increased vegetative activity in treated trees the previous year.
5. Based on the results of the trunk spray trials, a new trial was established in 2004 on second-leaf ‘Bosc’ trees. In this trial, 50, 100 or 150 mg of cyclanilide was applied as a trunk drench in 50 ml water per tree in either October 2003 or March 2004.

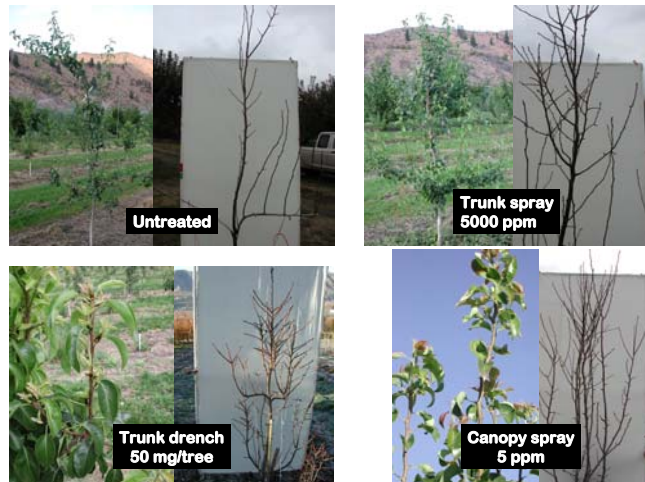
- Branch development followed a similar pattern to that reported here for trunk spray treatments, in that there was little effect on the first vegetative flush but a very large increase in lateral branching in the second flush. The 50-mg/tree treatment proved to be more than adequate for branching; the 100- and 150-mg treatments produced excessive lateral-bud activity and poor shoot development.

C. Cyclanilide and Promalin sprays during the growing season.

- Sprays of cyclanilide at 5-20 ppm were found to be very effective on ‘Bosc’ and ‘Kalle’ pear for inducing lateral branching in the second vegetative flush when applied in late May to late June, while the first vegetative growth flush was active but before the second flush had begun.
- Promalin was effective on ‘Bosc’ but less so on ‘Kalle’ for inducing branching. There was no benefit on branch development from combining the two products.
- Cyclanilide and Promalin spray treatments resulted in reduced flowering the following year in both cultivars due to increased vegetative activity.
- In one study where cyclanilide and/or Promalin was sprayed on third-leaf ‘Kalle’ trees, there was no effect on flowering or yield two years later (first crop).

Summary:

Cyclanilide is very effective for branch induction in pear trees at low concentrations or amounts per tree. This highly sensitive response has made possible the discovery and initial exploration of the so-called “translocated” effect on branching, in which a cyclanilide application made even several months before shoot growth begins produces its effect on lateral branch development months later, after the first growth flush is complete. Interestingly, no



matter how cyclanilide is applied, it has its major branching effect on the second vegetative flush; a second growth flush is typical in young, nonfruiting pear trees in Washington and begins normally in late June or early July. The mechanism by which cyclanilide itself or a metabolite is translocated and becomes effective for interrupting apical dominance several months later is unknown. However, this kind of response offers the potential for a very labor efficient method for treatment, should this product become registered for use. Applying cyclanilide as a trunk drench in fall or spring is fast, efficient, occurs when other work requirements are reduced, and requires no follow-up for the branching effect to occur. Important questions that still remain unanswered include how much cyclanilide is actually needed per tree to produce an optimal response, does the amount required depend on tree age or tree size, and what are the effects of repeat treatments in successive years on canopy development and the onset of production.

Promalin can be used for branching of pear trees; its effect is less strong than cyclanilide and there is no benefit on lateral branching by combining the two products together in a tank mix. Both products reduce flowering in the next growing season after treatment effects are observed. The significant increase in vegetative growth activity and stimulation of lateral buds appears to be the principal reason for this observation. There is no evidence to suggest that cyclanilide inhibits flowering directly.

In one trial in which both cyclanilide and Promalin were applied as sprays to third-leaf 'Kalle' pear trees, no effects were observed on flowering or production two years later (the first cropping year). This absence of an effect may be due in part to the fact that a single spray in one growing season only affected a portion of the total canopy volume. It may be necessary to apply repeat treatments during the canopy development phase of tree growth to produce a canopy capable of greater production. The potential for such branch induction treatments to reduce the need for heavy pruning, especially the heading-back pruning so typical in young, vigorous pear trees, may also allow a "calmer" tree to enter the transition to fruiting more rapidly. Studies should be carried out to assess the longer term effects of a systematic lateral-branch induction program on flowering and fruiting behavior in young pear trees.

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Summary of total project costs:

Project duration: Three years
 Total project costs: \$31,512