

## FINAL PROJECT REPORT

**Project Title:** Branch induction in young sweet cherry trees without injury to bark

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**Other funding sources:** None

**Total Project Funding:**      **Year 1:** 12,266      **Year 2:** 13,441

### Budget History:

Item	Year 1: 2008	Year 2: 2009
Salaries	6,000	6,500
Benefits	2,100	2,275
Wages	1,000	1,000
Benefits	166	166
Equipment	0	0
Supplies	500	500
Travel	2,500	3,000
Miscellaneous	0	0
<b>Total</b>	<b>12,266</b>	<b>13,441</b>

**Objectives:**

1. Re-evaluate penetrants and/or high concentrations of BA/GA formulations to confirm the efficacy of either or both approaches for inducing lateral branching in sweet cherry trees without the requirement of damaging the bark.
2. Examine these modified treatment strategies for any undesirable effects on phytotoxicity in treated tissues of sweet cherry trees.
3. Confirm the branch-inducing properties of gibberellic acid alone; compare the branching responses from GA with the responses to standard BA/GA formulation treatments.
4. Test GA formulations to determine if any can be used for successful branch induction without the need for bark injury.
5. Assess whether applications to one side of one-year-old wood, without the use of bark cuts can produce one-sided branch induction, as is the case when small “nicking” cuts are used in conjunction with application of cytokinin/GA mixtures.

**Significant findings 2008:**

1. Promalin (PR, 5,000 ppm) mixed with Pentra-bark surfactant (2% v/v) and painted on one-year-old vertical leader shoots of ‘Skeena’/G.6 trees without nicking cuts was as effective as PR at the same concentration mixed with Regulaid (0.1% v/v) and applied to nicking cuts in the bark.
2. The best branching treatment in this trial was PR (5,000 ppm) + Syl-Tac surfactant (4% v/v) without nicking cuts. The higher concentration of Syl-Tac appeared to improve the response.
3. PR alone at 20,000 ppm (straight formulation) without nicking cuts was no better than control.
4. The cytokinins thidiazuron (TDZ) or forchlorfenuron (CPPU) at 5,000 ppm + Pentra-bark (2% v/v) applied without nicking cuts had no effect on branch development.
5. The GA formulations Novagib (Fine Americas) and ProVide (Valent Biosciences) were mixed with either Regulaid (0.1% v/v) or Pentra-Bark (2% v/v) and then applied to one-year-old shoots with or without nicking cuts. When combined with Regulaid, both formulations improved branching only when applied to nicking cuts. When combined with Pentra-bark, both formulations at concentrations of either 2,500 or 5,000 ppm improved branching to the same degree with or without nicking cuts. A control trial showed clearly that Pentra-Bark at 2% v/v alone or Syl-Tac at 4% v/v alone had no direct effect on branching.
6. No phytotoxic symptoms were observed in any of the treatments described above.
7. Second-leaf, UFO-trained trees of ‘Early Robin’ and ‘Santina’/G.6 were treated on each of two dates (24 March or 9 April) with 3 cm bands of bioregulator solutions every 20-30 cm along the horizontal leader. PR was applied as follows: PR 5,000 ppm + Pentra-bark (2% v/v) banded on nicking cuts into the bark, the same solution banded without nicking cuts, PR 10,000 ppm + Pentra-bark (2% v/v) banded without nicking cuts or PR as the undiluted formulation (20,000 ppm) with no surfactant banded without nicking cuts.
8. Treatment on 24 March produced no branching effect at all from any treatment on either cultivar. During the ten day period following these treatments, the maximum daily temperature in the test orchard averaged about 45°F (7C) and the nightly minimum about 32°F (0C), with freezing temperatures every night but two during that period.
9. Treatment on 9 April resulted in all treatments more than doubling shoot formation on ‘Early Robin’ while only the nicking treatment increased branching on ‘Santina’. During the ten day period following these treatments, the maximum daily temperature averaged about 62°F (17C) and the nightly minimum about 38°F (3C), with freezing temperatures on only one night during that period.

**Significant findings 2009:**

1. Pro-Vide (GA<sub>4+7</sub>, Valent Biosciences, Walnut Creek, CA) at 5,000 ppm supplemented with 0.1% v/v Regulaid and applied to nicking cuts on one-year-old wood of ‘Selah’/G.6 sweet cherry successfully induced lateral branching on treated shoots. Pro-Vide at the same concentration

supplemented with 2, 4 or 6% v/v Pentra-bark surfactant and applied as similar bands to non-nicked one-year-old wood did not result in lateral branch development in 2009. Temperatures following treatment were considered as suitable for the formation of lateral branches.

2. An identical set of treatments was applied to two-year-old wood of 'Selah'/G.6 trees; in this case the cut treatment involved scoring cuts made every 6 inches down the woody stem with a linoleum knife. No treatment resulted in branching, but fruiting buds on scored and painted two-year-old sections showed strongly elongated fruit pedicels, indicating that the GA did enter the bark tissues and did translocate.

### **Results and Discussion:**

Research in 2008 confirmed observations in 2007 that appropriate surfactants can substitute for cutting the bark in assuring that branch-inducing bioregulator products penetrate into living tissues in shoots. Several questions remain to be explored; perhaps the most important of those has to do with the relative importance of surfactant type vs. applied concentration. It may be that a variety of commonly-used surfactants will work if applied in high enough concentration. In 2009 we tested surfactant concentrations up to 6% v/v, but the treatments were unsuccessful. Difficulties in test solution preparation may have contributed to the lack of results in 2009.

Gibberellic acid alone again proved effective for branch induction in one-year-old wood. In addition, GA was effective without the need for bark-cutting when either GA<sub>4</sub> (Novagib) or GA<sub>4+7</sub> (ProVide) was combined with an effective surfactant, in this case Pentra-bark (2% v/v). In 2007, we showed that GA<sub>3</sub> (Pro-Gibb) was not a very effective inducer of lateral branching in sweet cherry; we have discontinued work with this formulation. We also observed that the cytokinins thidiazuron (TDZ) and forchlorfenuron (CPPU) were ineffective when applied at 5,000 ppm with a surfactant but without GA. In 2008, PR as the undiluted formulation (20,000 ppm) banded without the benefit of either surfactant or nicking was not impressive; this treatment induced branching in only one of five trials. In 2009, GA had no effect on branching in two-year-old wood, even when applied in conjunction with scoring. The observation that scored two-year-old branch sections treated with GA produced fruits with greatly elongated pedicels indicates that the GA entered living tissues under the scoring cut and also translocated a short distance to developing flowers. Unlike one-year-old wood, however, even high concentrations of GA did not induce bud activity and branch development.

The work with UFO-trained trees in Buena allowed us to obtain at least a limited sense of differences in cultivar response as well as the effect of ambient temperatures on branch induction. 'Santina' proved to be generally less responsive in terms of branching than did 'Early Robin' to the same treatments applied on the same days. Temperature regimes following the two application dates were quite different; extended daytime cold temperatures and freezing overnight temperatures prevailed for the ten days following the first application date. For the comparable interval after the second set of applications, nighttime minima were not a great deal different from the same interval after the first application date. However, the daytime maxima averaged about 17°F (10C) higher than during the first interval, with the highest daytime maximum reaching 78°F (25C). These results indicate how critical it is that daytime warm temperatures follow immediately after a branch induction treatment. Growers planning to use this approach for branch induction should consult weather forecasting services and prepare to take advantage of any predicted warm periods while trees are in the green-tip stage. Waiting for optimum temperatures must be tempered with the knowledge that we have developed that if trees advance much beyond the green-tip growth stage, they become insensitive to branch-inducing bioregulator treatments.

**References:**

- D.C. Elfving and D.B. Visser. 2009. Stimulation of lateral branch development in young sweet cherry trees in the orchard without bark injury. **Int=l. J. Fruit Sci. 9:166-175.**
- D.C. Elfving, T.D. Auvil, F. Castillo, S.R. Drake, H. Künzel, E.M. Kupferman, B. Lorenz, J.R. McFerson, A.N. Reed, C. Sater, T.R. Schmidt and D.B. Visser. 2009. Effects of preharvest applications of ethephon and ethylene antagonists to sweet cherry trees on fruit loosening for mechanical harvest and on fruit quality. **J. Amer. Pomol. Soc. 63:84-100.**
- Schrader, L.E., J.G. Zhang, J.S. Sun, J.Z. Xu, D.C. Elfving and C. Kahn. 2009. Changes in internal fruit quality with sunburn browning. **J. Amer. Soc. Hort. Sci. 134:148-155.**

## EXECUTIVE SUMMARY

Research in 2008 confirmed observations in 2007 that appropriate surfactants can substitute for cutting the bark in assuring that branch-inducing bioregulator products penetrate into living tissues in shoots. Difficulties in test solution preparation may have contributed to the lack of results in 2009.

Gibberellic acid alone again proved effective for branch induction in one-year-old wood. In addition, GA was effective without the need for bark-cutting when either GA<sub>4</sub> (Novagib) or GA<sub>4+7</sub> (ProVide) was combined with an effective surfactant, in this case Pentra-bark (2% v/v). In 2007 GA<sub>3</sub> (Pro-Gibb) was not a very effective inducer of lateral branching in sweet cherry and is no longer being tested. We also observed that the cytokinins thidiazuron (TDZ) and forchlorfenuron (CPPU) were ineffective when applied at 5,000 ppm with a surfactant but without GA. In 2008, PR as the undiluted formulation (20,000 ppm) banded without the benefit of either surfactant or nicking was not impressive; this treatment induced branching in only one of five trials. In 2009, GA had no effect on branching in two-year-old wood, even when applied in conjunction with scoring. The observation that scored two-year-old branch sections treated with GA produced fruits with greatly elongated pedicels indicates that the GA entered living tissues under the scoring cut and also translocated a short distance to developing flowers. Unlike two-year-old wood, however, even high concentrations of GA did not induce bud activity and branch development.

Temperature regimes following branching applications on UFO-trained trees in Buena were quite different; extended daytime cold temperatures and freezing overnight temperatures prevailed for the ten days following the first application date. Branch development in this trial was poor. For the comparable interval after the second set of applications, nighttime minima were not a great deal different from the same interval after the first application date. However, the daytime maxima averaged about 17°F (10C) higher than during the first interval, with the highest daytime maximum reaching 78°F (25C). In this case branching was good. Waiting for optimum temperatures must be tempered with the knowledge that if trees advance much beyond the green-tip growth stage, they become insensitive to branch-inducing bioregulator treatments.