**Progress Report for 2009**

Weed and other pest control systems for cranberries

**Project No:** Continuing 13C-4167-1215

**Title:** Weed and other pest control systems for cranberries

**Year Initiated:** 1991 **Current Year:** 2010 **Terminating Year:** 2010

**Personnel:** Kim D. Patten, WSU-Long Beach, Extension Specialist

**Justification**:
Weeds, insects and disease are major problems facing cranberry growers in Washington. The registration of new pesticides for use in the PNW on cranberries is critical to the survival of the industry. Research to help the registration of new pesticides and improve the efficacy of current registration is needed to help solve these major pest problems in the industry.

**Objectives:**
1) Screen and evaluate new herbicides for their effectiveness in controlling perennial weeds in established cranberry bogs.

2) Evaluate alternative controls for blackvine weevil.

3) Evaluate biorational insecticides for control of blackheaded fireworm and tipworm.

4) Implement new cranberry disease management alternatives for domestic and export markets for fresh fruit production.

**Procedures:**

*Objective 1: Screen and evaluate new herbicides for their effectiveness in controlling perennial weeds in established cranberry bogs.*

Several studies were conducted to assess the efficacy of new herbicides on a series of annual and perennial weeds in cranberries. Results are presented in Tables 1 to 8. Quinstar (quinclorac) was only marginally effective. Matrix (rimsulfuron) was very efficacious and did not damage the crop.

**Table 4. Effects of Rimsulfuron on control of perennial weeds in cranberries.**

**Table 1. Effects of several herbicides on perennial grass control in cranberries.**

| Treatment | % control Lotus | Sour-dock | False gromwell | Marsh St. John Wort. |
|---|---|---|---|---|
| | | | Reed Canary Grass | |
| Control - White | 0.0 b | 0.0 b | 0.0 b | 0.0 a |
| Treatment | May 18 | June 3 | | June 29 |
| Rimsulfuron | 78.3 a | 92.5 a | 90.0 a | 62.5 a |
| Clethodim 0.5% w/ 1% crop oil | 61.27 | 68.3 A | 68.3 a | 65.0 ab |
| LSD (P=.05) | | 4.59 | 11.25 | 68.89 |
| Rimsulfuron 2 oz/a + Clethodim 0.5% w/ 1% crop oil | 0.0315 | 71.7 A | 56.7 a | 85.0 a |
| Treatment Prob(F) | | 0.0001 | 0.0001 | 0.0632 |
| Quinclorac 8 oz/a + Rimsulfuron 2 oz/ac w/ w/ 1% crop oil | | 30.0 B | 70.0 a | 56.7 b |
| Quinclorac 8 oz/a + Rimsulfuron 2 oz/a + Clethodim 0.5% w/ 1% crop oil | | 76.7 A | 70.0 a | 78.3 ab |
| Control | | 0.0 C | 0.0 b | 0.0 c |
| LSD (P=.05) | | 6.88 | 19.67 | 19.90 |
| Treatment Prob(F) | | 0.0001 | 0.0001 | 0.0001 |

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

**Table 2. Effects of several herbicides on perennial grass control in cranberries.**

| Treatment | Six-weeks fescues | | | Bentgrass | | | | |
|---|---|---|---|---|---|---|---|---|
| | % Control | | | % cover | % Control | | | % cover |
| | May 5 | June 6 | June 29 | Aug 8 | May 5 | June 6 | June 29 | Aug 8 |
| Control | 0.0 d | 0.0 d | 0.0 c | 76.3 a | 0.0 c | 0.0 d | 0.0 c | 68.8 a |
| Rimsulfuron 1 oz/ac w/ 1% Agridex | 93.3 a | 93.0 a | 73.8 a | 42.5 a | 68.8 a | 27.5 b | 2.5 c | 75.0 a |
| Clethodim 0.5% w/ 1% Agridex | 97.8 a | 86.3 ab | 65.0 ab | 48.8 a | 98.5 a | 97.8 a | 92.3 a | 21.3 b |
| Quinclorac 8 oz/ac w/ 1% Agridex | 30.0 c | 0.0 d | 5.0 c | 71.3 a | 30.0 b | 18.8 c | 0.0 c | 86.3 a |
| Rimsulfuron 1 oz/ac + Clethodim 0.5% w/ 1% Agridex | 95.5 a | 78.8 bc | 48.8 b | 80.0 a | 97.8 a | 96.5 a | 82.5 b | 33.8 b |
| Quinclorac 8 oz/ac w/ 1% Agridex | 75.0 b | 72.5 c | 2.5 c | 91.3 a | 20.0 bc | 5.0 d | 0.0 c | 95.0 a |
| Quinclorac 8 oz/ac + Clethodim 0.5%+ Rimsulfuron 1 oz/ac w/ 1% Agridex | 94.5 a | 86.3 ab | 42.5 b | 45.0 a | 96.5 a | 100.0 a | 96.0 a | 20.0 b |
| LSD (P=.05) | 14.38 | 7.74 | 19.38 | 32.75 | 23.62 | 5.12 | 5.43 | 35.32 |
| Treatment Prob(F) | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0001 | 0.0001 | 0.0001 | 0.0504 |

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)

**Table 3. Effects of rimsulfuron rates (Rimsulfuron) on cranberry yield.**

| Treatment | Yield bbl/ac | |
|---|---|---|
| | Site 1 | Site 2 |
| Control | 188.3 b | 71.1 a |
| Rimsulfuron 2 oz wt/a twice | | 104.0 a |
| Rimsulfuron 4 oz wt/a twice | 353.4 a | 98.9 a |
| Rimsulfuron 8 oz wt/a twice | 450.1 a | 92.7 a |
| LSD (P=.05) | 157.68 | 43.61 |
| Treatment Prob(F) | 0.0180 | 0.4191 |

| Table 5. Effects of several herbicides on control of annual and perennial weeds in a new cranberry planting. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Treatment | % Control | | | | | | | |
| | Corn Spurry | | Smartweed | | Horsetail | | Silver leaf | |
| | June 12 | July 14 | June 12 | July 14 | June 12 | July 14 | June 12 | July 14 |
| Control | 0.0 b | 0.0 b | 0.0 b | 0.0 b | 0.0 c | 0.0 c | 0.0 c | 0.0 b |
| Rimsulfuron 1 oz/a | 30.0 ab | 83.0 a | 94.5 a | 100.0 a | 86.3 a | 53.3 ab | 10.0 bc | 66.7 a |
| Rimsulfuron 2 oz/a | 51.5 ab | 96.3 a | 33.3 b | 100.0 a | 56.7 ab | 81.7 a | 68.8 ab | 85.0 a |
| Quinclorac 8 oz/a | 0.0 b | 0.0 b | 0.0 b | 0.0 b | 0.0 c | 70.0 a | 30.0 abc | 12.5 b |
| chlorimuron 0.75 oz/a | 86.0 a | 100.0 a | 99.8 a | 77.5 a | 55.0 ab | 72.5 a | 78.8 a | 96.3 a |
| Callisto 8 oz/a + Clethodim 8 oz/a | 89.3 a | 100.0 a | 99.5 a | 100.0 a | 26.3 bc | 20.0 bc | 85.0 a | 100.0 a |
| Clethodim 8 oz/a + Callisto 8 oz/a +Classic 0.75 oz/a | 82.5 a | 98.8 a | 99.3 a | 100.0 a | 75.0 a | 86.0 a | 78.3 a | 100.0 a |
| Rimsulfuron | 35.0 ab | 87.5 a | 95.0 a | 100.0 a | 50.0 ab | 90.0 a | 30.0 abc | 66.7 a |
| LSD (P=.05) | 45.01 | 13.47 | 32.59 | 25.53 | 30.44 | 35.28 | 43.70 | 31.60 |
| Treatment Prob(F) | 0.0008 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0004 | 0.0028 | 0.0001 |
| Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls) | | | | | | | | |

| Table 6. Effects of Rimsulfuron on control of perennial weeds in cranberries. | | |
|---|---|---|
| Treatment | % control August 18 | |
| | Willow | St John Wort |
| Control | 0.0 b | 0.0 b |
| Rimsulfuron 2oz/a twice | 92.5 a | 100.0 a |
| Rimsulfuron 4 oz/a - | 85.0 a | 85.0 a |
| LSD (P=.05) | 28.98 | 23.78 |
| Treatment Prob(F) | 0.0004 | 0.0001 |
| Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls) | | |

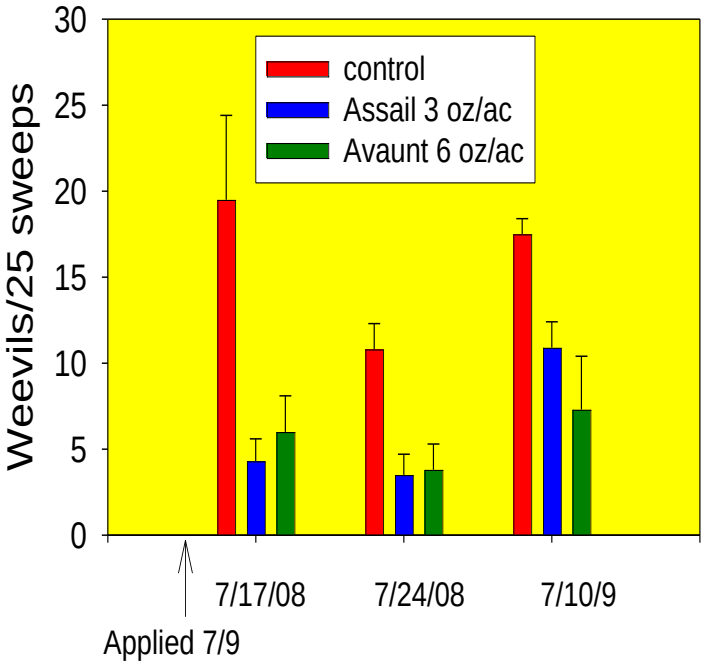
| **Table 7. Effects of rimsulfuron and quinclorac on control of perennial weeds in cranberries.** | | |
|---|---|---|
| Treatment | % Control July 27 | |
| | Willow | Yellow Weed |
| Control | 0.0 b | 0.0 b |
| Rimsulfuron 2oz/ac | 41.7 a | 76.7 a |
| Quinclorac 8 oz/a + Callisto 8 oz/a | 81.7 a | 68.3 a |
| Rimsulfuron 2 oz/ac Quinclorac 8 oz/a + Callisto 8 oz/a | 75.0 a | 70.0 a |
| LSD (P=.05) | 36.97 | 29.92 |
| Treatment Prob(F) | 0.0057 | 0.0023 |
| Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls) | | |

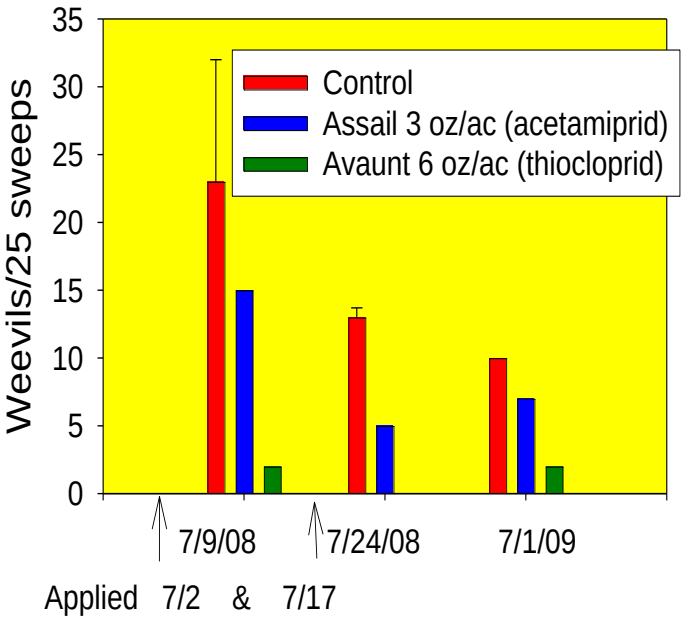
| **Table 8. Effects of rimsulfuron and quinclorac on control of perennial weeds in cranberries.** | | | |
|---|---|---|---|
| Treatment | % control | | |
| | Buttercup | Silver leaf | Horsetail |
| Control | 0.0 c | 0.0 a | 0.0 b |
| Rimsulfuron 4 oz/a | 78.3 ab | 40.0 a | 25.0 b |
| Rimsulfuron 2 oz/a tiwice | 100.0 a | 40.0 a | 17.5 b |
| Quinclorac 8 oz/a twice | 0.0 c | 0.0 a | 0.0 b |
| Quinclorac 8 oz + Callisto 8 oz/a twice | 42.7 b | 75.0 a | 55.0 ab |
| Rimsulfuron 2 oz/a + Quinclorac 8 oz + Callisto 8 oz/a twice | 100.0 a | 53.3 a | 96.7 a |
| Rimsulfuron 4 oz/a + Quinclorac 8 oz + Callisto 8 oz/a | 70.0 ab | 92.5 a | 93.3 a |
| LSD (P=.05) | 34.29 | 69.95 | 46.04 |
| Treatment Prob(F) | 0.0001 | 0.1035 | 0.0053 |
| Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls) | | | |

*Objective 2: Evaluate biorational insecticides for control of blackvine weevil:*

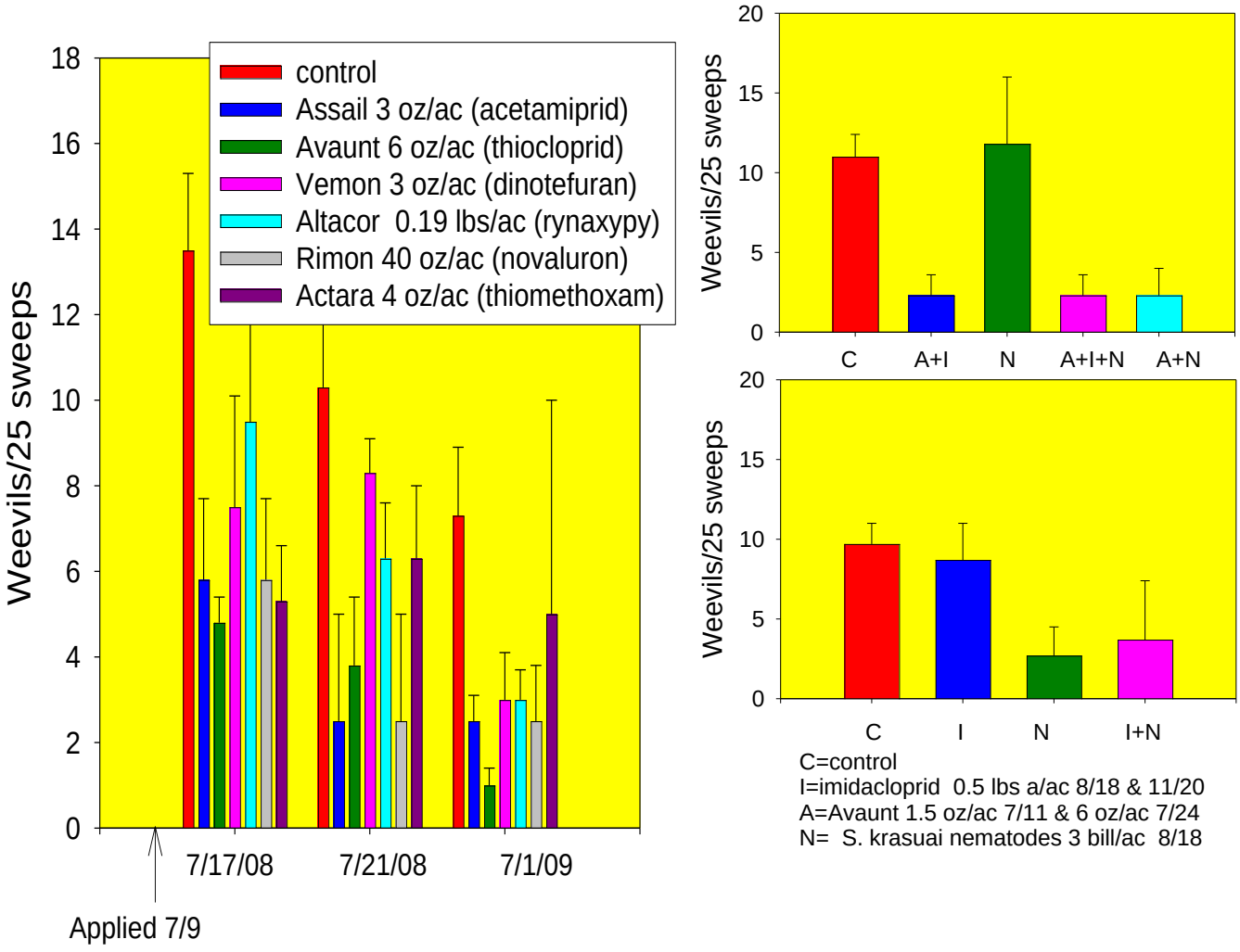
In 2008 we evaluated Assail, Avaunt, other insecticides, beneficial nematodes and various formulations of baits for adult blackvine weevil control. Additional follow-up data on Avaunt and Assail were collected in 2009. (Figures 1 to 4). Excellent control was achieved with Avaunt. It is now the industry standard for weevil control. New trials were implemented in 2009 and efficacy from those studies won't be available until 2010.

Figures 1 and 2. Effects of Avaunt and Assail on adult weevil populations in cranberries in 2008 and 2009.



Figures 3 and 4. Effects of several insecticides and biocontrols on adult weevil populations in cranberries in 2008 and 2009.



Objective 3: *Evaluate biorational insecticides for control of blackheaded fireworm:*

Several studies were conducted to assess efficacy of different chemistries using chemigation. Mixed results were obtained, but in most studies at least one of the biorational chemistries was as effective as Diazinon (Figure 5 to 7).

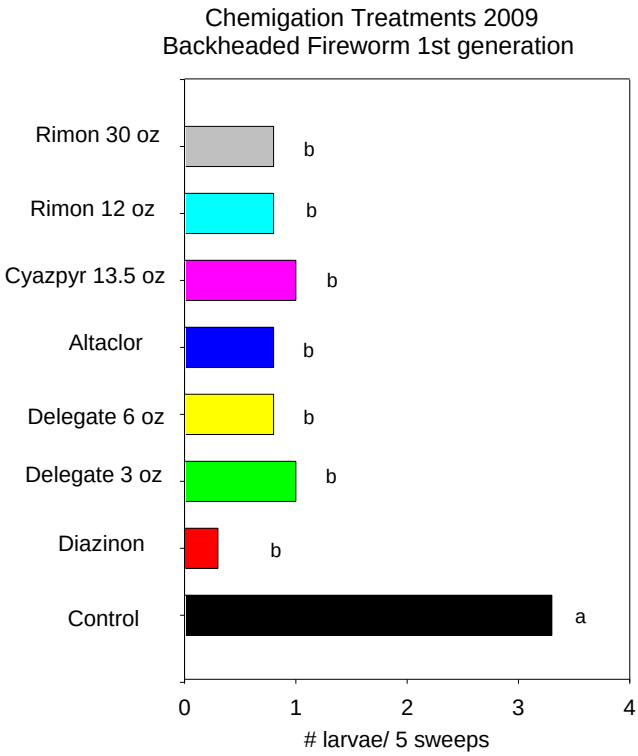
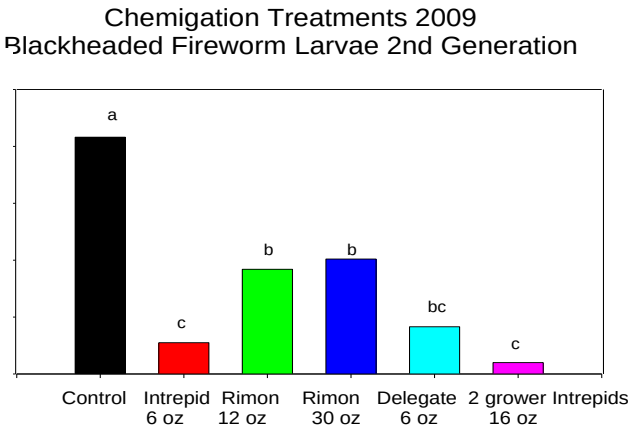
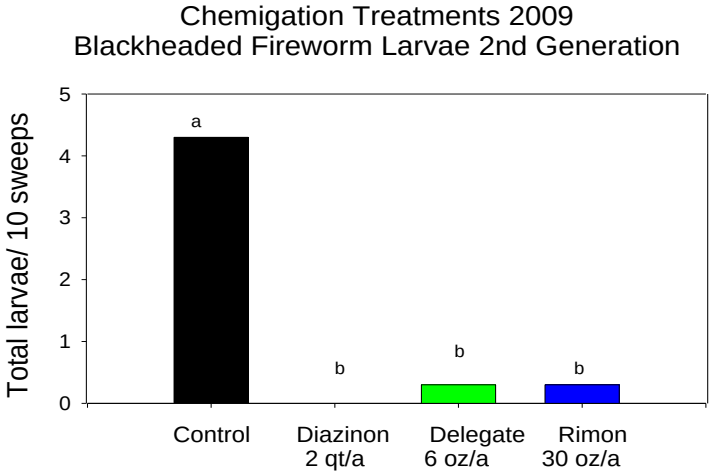



Figure 5. Efficacy of chemigated insecticide on first generation fireworm control.

*Figure 6.* Efficacy of chemigated insecticides on second generation fireworm control based on fruit damage assessments.

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In 2008 we assessed the effects of different timings of Indar and Abound on three Pilgrim and one Stevens beds. In 2009 we assessed mid-bloom timing on eight farms in comparison with whatever treatment the grower applied. Each farm was selected because it had high rot in 2008. In 3 out of 8 beds, Indar+Abound treatment significantly improved yield and the total amount of good fruit at harvest and after storage. The percent rot values were not significant (data not shown). The difference in yields on the three farms is considerable and would make it profitable to treat with Indar + Abound. But the lack of consistent effect across farms is concerning and similar to what we found last year. We are still trying to determine the reason for the difference between farms. Additional studies will have to be done in this regard.

**Table 9. Effect of mid-bloom application of Indar and Abound on total yield, yield of good fruit at harvest and total yield after six weeks storage from eight cranberry farms in Long Beach WA in 2009.**

| | Stevens (AG) | | | Pilgrim (BM) | | | Stevens (CM) | | | Pilgrim (CrM) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BBL/AC | | | | | | | | | | | |
| Treatment | total harvest | good @ harvest | good @ 6wks | total harvest | good @ harvest | good @ 6wks | total harvest | good @ harvest | good @ 6wks | total harvest | good @ harvest | good @ 6wks |
| Grower Std.* | 319 | 296 | 270 | 386 | 363 | 363 | 63 | 49 | 44 | 452 | 394 | 372 |
| Indar + Abound + Grower standard | 428 | 403 | 378 | 399 | 365 | 365 | 64 | 48 | 42 | 424 | 392 | 376 |
| Treatment significance** | 0.005 | 0.007 | 0.009 | 0.4 | 0.9 | 0.7 | 0.5 | 0.2 | 0.8 | 0.2 | 0.8 | 0.8 |

| | Pilgrim (G) | | | Pilgrim (J) | | | Pilgrim (P3) | | | Pilgrim (P7) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BBL/AC | | | | | | | | | | | |
| Treatment | total harvest | good @ harvest | good @ 6wks | total harvest | good @ harvest | good @ 6wks | total harvest | good @ harvest | good @ 6wks | total harvest | good @ harvest | good @ 6wks |
| Grower Std.* | 213 | 191 | 171 | 193 | 178 | 146 | 100 | 79 | 74 | 124 | 87 | 76 |
| Indar + Abound + Grower standard | 216 | 177 | 164 | 166 | 157 | 127 | 131 | 67 | 99 | 207 | 157 | 142 |
| Treatment significance** | 0.9 | 0.5 | 0.8 | 0.5 | 0.5 | 0.5 | 0.05 | 0.02 | 0.03 | 0.08 | 0.1 | 0.09 |

* Grower standard was Bravo at Fruit Set and Manzate 14 days after fruit set, applied by the grower. WSU applied Indar + Abound over the grower treatment at 50% out of bloom and followed by a retreatment in 7-10 days. Indar was 4oz/ac and Abound 0.2 lb ai/ac. Treatment timings by grower and WSU were slightly different at each site.

** Probability of significant difference between treatments: if number is < 0.10 treatments were significantly different at the 90% significance level.