FINAL PROJECT REPORT
WTFRC Project Number: ST 04-413

Project Title: Apricot scion & peach rootstock evaluations

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Cooperators:

Budget History:

Item	**Year 1:** 2004	**Year 2:** 2005	**Year 3:** 2006
Salaries			
Benefits			
Wages	2000	3500	3500
Benefits	320	560	560
Equipment			
Supplies	2080	2040	2040
Travel			
Miscellaneous			
Total	4400	6100	6100

OBJECTIVES:

- Evaluate apricot scion productivity, fruit quality and horticultural traits (e.g., bloom dates, harvest dates, growth habit)

- Evaluate effects of peach rootstock genotype on tree growth habit and vigor, precocity, and fruit quality

- Engage the stone fruit industry to optimize the usefulness of this trial

SIGNIFICANT FINDINGS:

Peach rootstock evaluations (2001 planting, 12 rootstocks):

- rootstock had a tremendous impact on fruit yield; we documented ca. 10-fold difference
- SLAP was the highest yielding (158 lb/tree, Lovell + 58%), K146-44 was the lowest yielding (10 lb/tree, 9% of Lovell)
- the standard, Lovell was the fourth highest yielding at 112 lb/tree
- rootstock affected vigor; approximately 5-fold variability existed in 2006
- SLAP remains the most vigorous rootstock (Lovell + 1%), K146-44 was the least vigorous (20% of Lovell)
- VVA-1 induced good vigor control (ca. 43% of Lovell)
- rootstock induced up to a 10 day difference in fruit harvest date
- P30-135 consistently hastens fruit maturity the greatest extent (24 Aug in 2006)
- Hiawatha, Pumiselect and Lovell delayed maturity (trees picked 6 September)
- fruit quality overall was excellent in 2005 and poor in 2006
- in 2006, fruit size was good from BH-4, Bailey, SC-17, Lovell, SLAP, and K146-43 (ca 200 g/fruit, ca. 2.9″ diameter, 13 ^{o}brix)
- P30-135 yielded the poorest quality fruit (96 g, 2.2″ diameter, 13.4 ^{o}brix)
- yield was related positively and linearly to tree vigor

Peach rootstock evaluations (2002 planting, 8 rootstocks):

- 2006 was the third fruiting year for this trial
- almost 6-fold differences in yield existed, Cadaman was the highest yielding (132 lbs/tree, Lovell +18%), VSV-1 was the lowest yielding (24 lb/tree, 21% of Lovell)
- ca. 5-fold differences in vigor existed, Lovell was the most vigorous, VVA-1 was the least vigorous (20% of Lovell)
- highest quality fruit were harvested from Cadaman and Lovell 101 (204 g, 2.9″ diameter, 12.2 ^{o}brix)
- Pumiselect yielded the worst quality fruit (121 g, 2.4″ diameter, 13.2^{o}brix)
- yield was related positively and linearly to tree vigor
- there was no close relationship between tree yield and fruit quality

Apricot variety evaluations (2004 & 2005):

- Beliana, Katy, and Goldrich were the earliest blooming (first bloom on 9 Mar)
- Tilton and PA7003-2 were the latest blooming selections (first bloom on 13 Mar)
- the earliest maturing selections were Beliana, Castlebrite, Katy, and Tomcot (ca. 30 June)
- the latest maturing selections were Fantasme, Tilton, and Vulcan (ca. 28 July)

- fruit quality overall was excellent - diameter ranged from 2.0″ – 2.4″
- Goldcot, Malise and Castlebrite were the smallest (2.0″), Goldbar, Goldrich, Hargrand, Lehrman and Rival were the largest (2.4″)
- firmness ranged from 2.0 kg – 5.3 kg
- Beliana and Katy were the softest (2.0 kg)
- Helena, Goldensweet, Hargrand, Dunstan, Goldbar, PA 7005-2, and Vulcan were among the firmest (> 4.5 kg)
- fruit weight ranged from 69 g – 125 g
- Goldcot and Malise were the smallest by weight (ca. 70 g)
- Goldbar, Goldrich, and Hargrand were the heaviest (> 120 g)
- in an unofficial consumer survey, PA7003-2 was ranked as the best tasting

METHODS:

Peach rootstock evaluations (2001 & 2002 NC-140 trials):

Two rootstock trials were planted at the WSU-Roza experimental farm, one in 2001 comprised of 13 rootstocks, and another in 2002 comprised of 8 rootstocks. The scion variety is Cresthaven. Orchards were planted at approximately 15’ x 18’ in north-south rows. Soil is a silty-loam limited by basalt at a depth of approximately 4 feet. Standard orchard management practices, including hand-thinning, are followed and trees are trained to a multiple-leader open-center architecture. Trees were irrigated weekly by under-tree microsprinklers (1/tree). Vigor estimates are made from measurements of trunk circumference taken in the fall. At harvest, yield is determined and fruit quality evaluations (size, weight, soluble solids) are made on randomly-selected fruit subsamples.

Apricot variety evaluations:

The research orchard was planted in 1997 at 12 x 18’ in north-south rows. Under-tree microsprinklers and propane heaters have been installed. The block is comprised of 33 apricot (*Prunus armeniaca* L.) selections, several of which were developed at WSU-Prosser. For each selection the following data will be collected annually:

- first and full bloom dates
- fruit set rating
- tree growth habit (vigor, branch angle)
- fruit yield rating
- fruit quality (mass, soluble solids, diameter, acidity, firmness)

RESULTS & DISCUSSION:

Peach rootstock evaluations

The results from the 2001 and 2002 plantings are summarized in tables 1 and 2, respectively. Once again we recorded significant variability in two critical tree characteristics: vigor and yield. Interestingly, these characteristics were related closely and linearly (Figure 1) in both years ($r^2 = 0.85$ and 0.81 for 2001 and 2002 plantings, respectively). This is largely due to the bearing habit of peach (i.e., fruiting on one-year-old wood). There was no close relationship between fruit yield or tree yield efficiency and fruit quality in previous years. This is because trees are hand-thinned to balance crop load, irrespective of canopy/tree size. However, in 2006, trees were thinned later than they should have been and, as a result, there was a slight positive relationship between tree vigor, yield, and fruit quality. In 2006, we again documented the highest yielding trees also bore excellent quality fruit (e.g., SLAP). Overall, in both trials, fruit quality was reduced compared to the previous season. This is due to late, and perhaps insufficient thinning on some rootstocks. Fruit weight was approximately 30% lower in 2006 compared to 2005 (173 g vs. 248 g).

From these preliminary data (fourth fruiting year for 2001 planting and third for 2002 planting), we continue to consider VVA-1 and K146-43 among the most promising for higher efficiency plantings. VVA-1 induces excellent size control, tree TCSA was about 36% that of Lovell. Yield efficiency was moderate on this rootstock in 2005 and fruit quality was good. In 2006, K146-43 induced vigor control similar to VVA-1 yet had higher yields and slightly better fruit quality than VVA-1-rooted trees. At this early stage, both K146-43 and VVA-1 appear promising as rootstocks suitable for high density plantings. We recommend these rootstocks for further testing the relationship between tree density and yield and quality.

We confirmed in 2005 that the Jaspi-rooted trees do not have Cresthaven as the scion. Fruit on Jaspi were ripe a full month before the others - this is not a rootstock effect. These trees have 'Redglobe' for the scion, an earlier maturing selection that was part of the eastern cooperators' plantings. As a result, Jaspi is not listed in the dataset.

We learned recently that Pumiselect in both plantings was not thoroughly tested for viruses from where it was indexed in Europe. Apple Chlorotic Leaf Spot Virus and Cherry Virus A were identified in this clone during indexing. Because of the risk of these viruses spreading, the 2002 and 2001 NC140 peach rootstock plantings have been destroyed. Drs. Greg Reighard and Scott Johnson are preparing a 5-year summary of each trial.

Rootstock	Yield (lb)		Fruit weight (g)		Fruit diameter (cm)		Soluble solids (%)		TCSA (cm^2)		Yield Efficiency		Harvest Date	Red coloration (% surface)
K146-44	10.3	f	159	d	2.7	d	13.9	ab	19.0	d	0.45	bc	8/30	47
P 30-135	14.7	f	96	e	2.2	e	13.4	abc	21.2	d	0.29	c	8/24	37
K146-43	22.9	ef	194	abc	2.9	ab	13.2	abcd	35.3	d	0.49	abc	8/31	53
Pumiselect	46.5	ef	162	d	2.7	d	12.2	d	68.0	c	0.29	c	9/6	62
VVA-1	48.3	e	177	cd	2.8	bc	11.9	d	35.6	d	0.70	a	8/29	49
SC-17	86.8	d	197	ab	2.9	ab	13.9	ab	89.1	ab	0.46	bc	8/31	44
Hiawatha	92.5	cd	184	bc	2.8	bc	13.9	a	70.8	c	0.59	ab	9/6	44
Julior	96.2	cd	171	d	2.7	cd	12.7	cd	73.9	bc	0.60	ab	8/29	52
Lovell	112.0	cd	200	a	2.9	ab	12.9	bcd	96.8	a	0.53	b	9/6	47
Bailey	118.4	bc	202	a	2.9	a	12.5	cd	86.5	abc	0.62	ab	9/1	46
BH-4	148.2	ab	208	a	2.9	a	12.3	cd	94.1	a	0.73	a	9/2	53
SLAP	157.9	a	197	a	2.9	ab	12.6	cd	97.3	a	0.70	a	9/4	47

Table 1. Effect of rootstock on yield, fruit quality, and vigor of Cresthaven peach in 2006. Trees were planted in 2001. Means followed by the same letter within columns are not significantly different by LSD ($P < 0.05$).

Rootstock	Yield (lb)		Fruit weight (g)		Fruit diameter (in)		Soluble solids (%)		TCSA (cm^2)		Yield Efficiency		Harvest Date	Red coloration (% surface)
VSV-1	24	d	151	c	2.6	c	15.2	a	25.6	e	0.43	bc	8/30	42
VVA-1	28	d	154	c	2.6	c	12.7	bc	18.6	e	0.61	a	8/28	52
Pumiselect	38	d	121	d	2.4	d	13.2	b	55.1	d	0.30	c	9/4	58
Penta	77	c	152	c	2.6	c	12.3	c	56.2	d	0.61	a	8/31	46
Adesoto 101	89	bc	177	b	2.8	b	12.6	bc	74.2	bc	0.55	ab	9/1	38
MRS 2/5	103	bc	153	c	2.6	c	12.6	bc	65.5	cd	0.68	a	9/3	55
Lovell	114	ab	202	a	2.9	a	12.2	c	99.7	a	0.58	ab	9/7	43
Cadaman	132	a	208	a	2.9	a	12.1	c	85.1	ab	0.68	a	9/7	39

Table 2. Effect of rootstock on yield, fruit quality, and vigor of Cresthaven peach in 2006. Trees were planted in 2002. Means followed by the same letter within columns are not significantly different by LSD ($P < 0.05$).

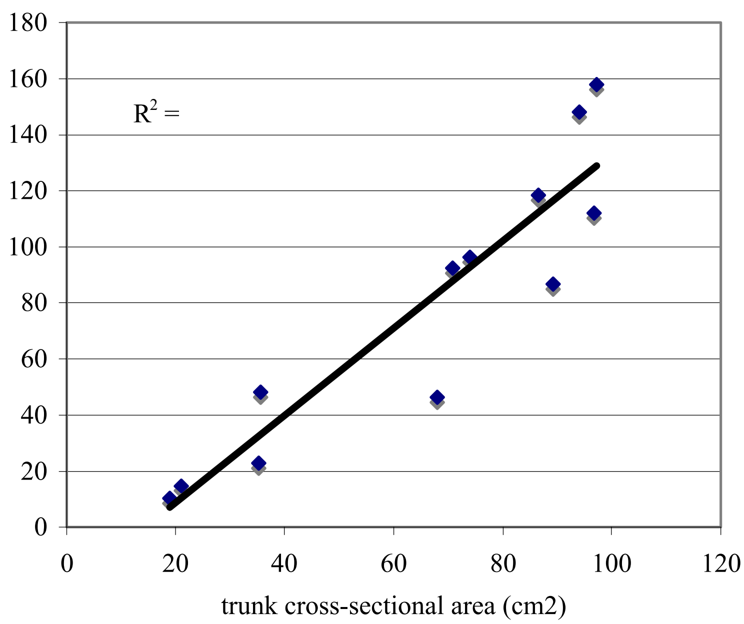

Figure 1. Relationship between tree trunk cross-sectional area (TCSA, cm^2) and fruit yield (lb/tree) from rootstocks in the 2002 NC-140 peach rootstock planting ($n = 12$).

Apricot variety evaluations

In fall 2005, we transplanted the selections from the University of California – Pom 20013, Pom 20012 and R15T15 and removed all apricot selections/varieties from the orchard due to lack of interest. Future apricot scion evaluations should target selections with late-maturing, large, firm, and flavorful fruit.

FINAL REPORT
WTFRC Project #ST-05-501 **WSU Project # 13C**-3343-6124

Project Title: Peach Twig Borer Management in Stone Fruits

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Cooperators: H. Ferguson, Extension IPM Coordinator Specialist, WSU Entomology
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Budget History:

Item	**Year 1:** 2005	**Year 2:** 2006
Salaries		
Benefits		
Wages		
Benefits		
Equipment		
Supplies		
Travel		
Miscellaneous		
Total	15,000*	10,000*

*/ These amounts correspond to the funding amount that the WTFRC provided for each of the years of the project. The allocation was substantially less then what was initially requested, so a budget breakdown is difficult to provide.

Significant Findings: Properly timed insecticide applications can control peach twig borer in stone fruit orchards. There does not appear to be any significant resistance of peach twig borer to registered insecticides. Several candidate insecticides were very effective at controlling peach twig borer. These include acetimiprid and DE-175. Acetimiprid should be registered for use on stone fruits by this coming spring. It is a neonicotinyl insecticide that also provides good control of aphids that can infest stone fruits. DE-175 is Dow Agrosciences more potent spinosyn compound. It will provide more effective control of PTB then Spinosad for conventional stone fruit growers. Spinosad in the Entrust formulation will still be the standard for organic growers.

Results and discussion:

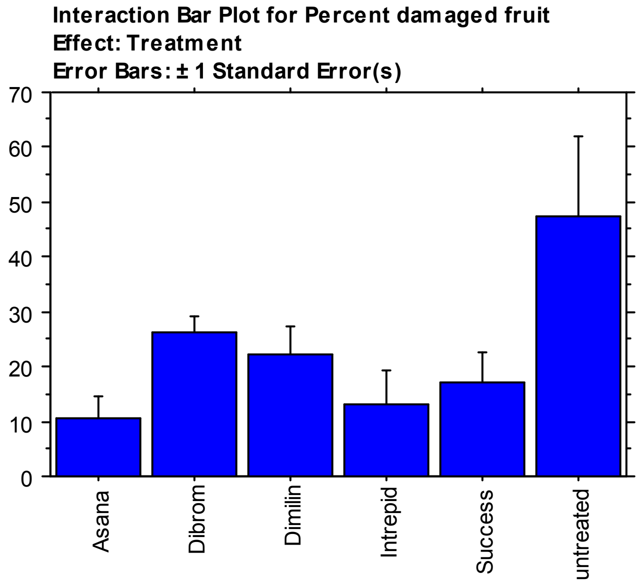
Objective 1. Test the field efficacy of registered and candidate compounds against PTB during the overwintering and subsequent summer generations.

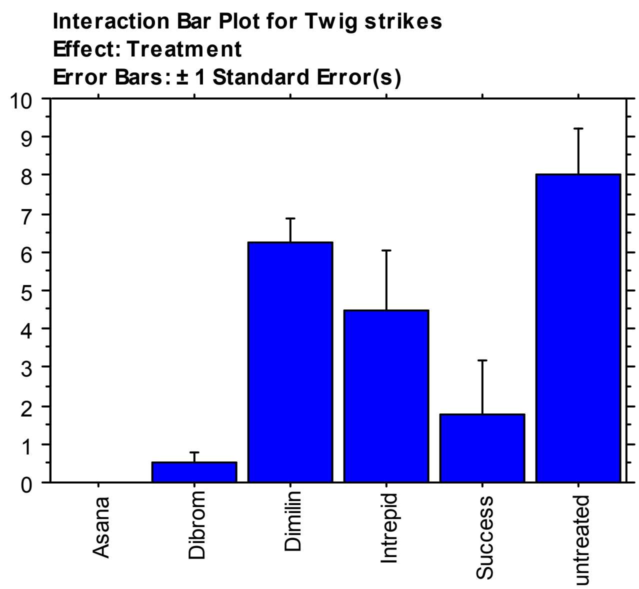
Methods and Results

In spring 2005 we attempted to evaluate the field efficacy of novaluron, imidan, dimilin, spinosad, methoxyfenozide, Bts and pyrethroids against PTB on the overwintering generation in a peach orchard location at Douglas fruit near Pasco, Washington in April 2005. Unfortunately after several sprays the pest pressure was nonexistent and the research plot proved to have very little value. We are confident that we were not accidentally treated by our cooperator because the aphid population in our study plots flared and we needed to come back through our plots and treat the aphid population with Pravado. In the adjacent orchard Lorsban had been sprayed after petal fall. There were no aphids present where Lorsban had been sprayed. There were just no PTB present.

In summer 2005 we conducted a summer field trial near Prosser WA in a small homeowner orchard. Twenty four trees in total were used. Fruit was thinned to 8 fruit per branch. The trees had been established from bare root peach trees purchased at Lowe's in Kennewick in 1999. The current and former homeowner did not remember which variety was planted. These trees were heavily infested with PTB in the spring. Five insecticide treatments and a non treated control were applied to 4 replicate trees per treatment. All treatments were tank mixed with JMS Stylet oil at 1% and applications were applied at approximately 100 gallons per acre with a gas powered duster mister backpack sprayer. The insecticides were applied on 9 June 2005. Fruit and twigs were evaluated on 13 July 2005

Treatment #	Treatment	Rate (form)
1	untreated	
2	Dimilin	12 oz
3	Success	6 oz.
4	Intrepid	10 oz.
5	Asana	8 oz.
6	Dibrom	3 pts





The pest pressure was extremely high in this home owner orchard. All of the treatments were statistically effective.

On March 30, 2006 candidate insecticides were applied to 2 yr old peach trees cv. *Elberta* in small orchard near Prosser, WA. Candidate compounds that were applied included Asana (esfenvaletrate), Assail 30 SG (acetimiprid), DE175 (a new spinosyn), Dibrom (naled), Lorsban 4E (chlorpyrifos), Success (Spinosad), Rimon (novaluron), and Warrior CS (λ-cyhalothrin). All of the treatments were tank mixed with 2% JMS Stylet Oil. Each treatment was applied to 9 single replicated trees with an Echo Duster Mister gas powered sprayer. Twig strikes per tree were evaluated on 19 April, 2006.

Anova results for

		Mean Squares
Treatment	*df*=10	10.83**
Error	*df*=88	0.80

Treatment	Rate	Twig Strikes±Std Error on 19 April
Untreated control		3.89±0.42
Asana XL	8 oz	0.22±0.22**
Assail 30 SG	5 oz	0.66±0.37**
Assail 30 SG	8 oz	0.33±0.23**
DE 175	0.045 lb ai	0.11±0.11**
Dibrom	3 pints	0.66±0.23**
Dimilin 4L	12 oz	0.88±0.31**
Lorsban 4EC	2 pints	0.66±0.37**
Rimon .083EC	12 oz	1.55±0.44**
Success	6 oz	0.33±0.23**
Warrior CS	3 oz	0**

**/ Twig strikes per tree are significantly ($P<0.01$) lower then untreated trees by pairwise *t*-test.

In September 2006 we conducted a fall field trial near Prosser WA in a small homeowner orchard. Thirty two trees in total were used. Fruit These trees were moderately infested with PTB in the spring. Five insecticide treatments and a non treated control were applied to 8 replicate trees per treatment. All treatments were applied at approximately 100 gallons per acre with a gas powered duster mister backpack sprayer. The insecticides were applied on 17 September 2005. Fruit and twigs were evaluated on 7 October 2005

Treatment	Rate	Twig Strikes±Std Error on 19 April
Untreated control		7.25±0.1.01
Asana XL	8 oz	0.37±0.0.26**
Assail 30 SG	8 oz	0.50±0.0.38**
Success	6 oz	0.62±0.0.32**

**/ Twig strikes per tree are significantly ($P<0.01$) lower then untreated trees by pairwise *t*-test.

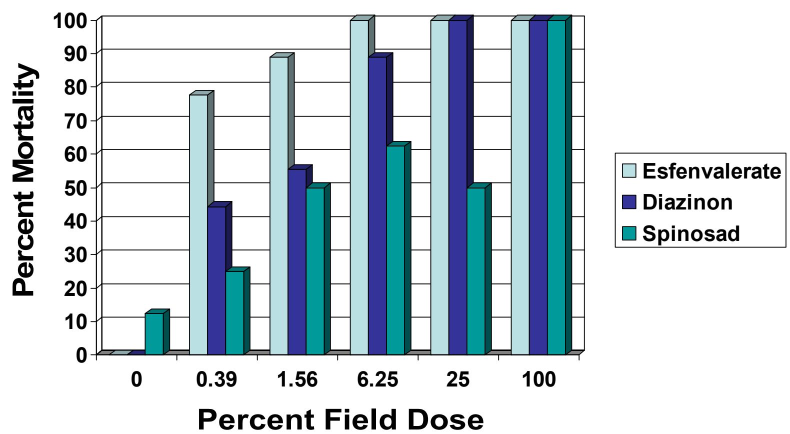
Objective 2. Determine the susceptibility of PTB to registered and candidate insecticides.

__**Methods and Results.**__

Peach twig borer larva were collected over several days in early April 2005 and removed from their twig shoots in the laboratory. Insecticides were applied directly to the larvae by syringe in 1ul of acetone for diazinon and esfenvalerate and water for spinosad. Larvae were assessed at 24 after treatment for mortality.

Insecticide	ppm	% field Rate	Live@24h	Dead@24h	Total@24h
Acetone	0	0.00	9	0	9
esfenvalerate	60	100.00	0	9	9
esfenvalerate	15	25.00	0	9	9
esfenvalerate	3.75	6.25	0	9	9
esfenvalerate	0.9375	1.56	1	8	9
esfenvalerate	0.234	0.39	5	4	9
diazinon	10480	100.00	0	9	9
diazinon	2620	25.00	0	9	9
diazinon	655	6.25	3	6	9
diazinon	164	1.56	5	4	9
diazinon	41	0.39	6	3	9
Water	0	0.00	7	1	8
spinosad	50	100.00	0	8	8
spinosad	12.5	25.00	4	4	8
spinosad	3.12	6.25	4	4	8
spinosad	0.78	1.56	6	2	8
spinosad	0.19	0.39	6	2	8

Dose Response of PTB to Esfenvalerate, Diazinon and Spinosad



PTB were susceptible to all 3 of the insecticides screened with this series of bioassays. There does not appear to be any level of tolerance to these insecticides within the PTB population in the Prosser, WA area.

Objective 3. Test the accuracy of the phenology models available for break from winter dormancy.

Two year old potted cling peach trees were placed near tree fruit orchards in Buena Naches, Prosser and Pasco growing districts during the fall of 2005. In our experience, young vigorously growing cling peach trees have proven to be the trees most susceptible to attack by PTB. These potted trees were removed from the orchard in early March and placed in close proximity to computerized weather stations in Prosser. All of the trees died. The study failed.

NEW PROJECT PROPOSAL **PROPOSED DURATION**: 1 YEAR

Project Title: IPM for borers, thrips, and mites in stone fruits

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Budget 1:

Organization: WSU Prosser	**Contract Administrator:** ML. Bricker/Stephanie Brock
Telephone: 509-335-7667/509.786.9224	**Email:** mdesros@wsu.edu / sabrock@wsu.edu

Item	**Year 1: 2007**		
Salaries	8,701		
Benefits	3,143		
Wages	960		
Benefits	110		
Equipment			
Supplies	552		
Travel	534		
Miscellaneous			
Total	14,000		

*/ Supplemental Request for $10,000 was submitted to the WSCPR on October 16, 2006

Justification

Peach twig borer (PTB) can damage stone fruits by feeding in shoots and causing shoot strikes and/or by feeding directly on the fruit. Shoot damage is most severe in young orchards on the vigorous growth of young, developing trees where PTB feeding kills the terminal growth and can result in undesirable lateral branching. Shoot damage is most prevalent during the borer's final larval growth period following winter dormancy. The subsequent summer generations can damage both fruit and shoots. Late-season fruit damage becomes prevalent as the fruit matures. Fruit is highly susceptible to attack and damage is most likely to occur from color break to harvest. Twig borer larvae generally enter fruit at the stem end or along the suture and usually feed just under the skin.

Stone fruit growers in California traditionally relied on a dormant-season application of an organophosphate (typically diazinon) mixed with a dormant season heavy oil for control of the overwintering PTB population. Pest resistance and regulatory scrutiny in California has resulted in a dramatic shift away from a dormant season application of organophosphates like diazinon and pyrethroids such as esfenvalerate to a delayed dormant/early bloom application of the spinosyn spinosad or the insect growth regulator diflubenzuron. Conventional stone fruit growers here in Washington State, on the other hand, have increased their use of pyrethroids in response to increased pest pressure. Growers have complained that spinosad has proven ineffective at controlling PTB during the summer growing season. Pyrethroids continue to play a dominant role in PTB control in conventional orchards, but their broad-spectrum properties have the effect of negatively impacting populations of secondary pests including thrips and mites. The pending registration of the nicotinoid acetamiprid by Ceraxagri and the development and potential registration of more potent spinosyns by Dow AgroSciences should aid conventional stone fruit growers in Washington State by providing more targeted chemistries and a greater variety of modes of action.

Thrips are tiny insects that cause late-season cosmetic injury to stone fruits. Nectarines are especially susceptible to thrips feeding injury. Thrips insert eggs into plant tissue. The first two instars and the adults feed by piercing and removing the contents of individual plant cells. Direct feeding damage to stone fruits results in streaking, spotting, and tissue distortion. The stippling damage caused by thrips feeding on individual cells can be confused with spider mite stippling. A number of generalist predators feed on western flower thrips. Minute pirate bugs, big-eyed bugs, and several species of predatory mites have been identified as efficient predators. Unfortunately, populations of these generalist predators are disrupted and slow to recover following the application of pyrethroid insecticides to the tree canopy.

Spider mites are also secondary pests of stone fruits. Cultural and environmental factors play a critical role in mite outbreaks in stone fruits. Outbreaks result from the biological disruption that often follows pyrethroid applications. Stone fruit growers that use pyrethroids for PTB control will budget for and then spray miticides on a calendar basis.

Objectives

1. Test the efficacy of registered and candidate compounds against PTB during the overwintering and subsequent summer generations.
2. Collect region-wide mating flight information.
3. Collect baseline data on the susceptibility of PTB to registered and candidate insecticides.
4. Conduct season-long orchard monitoring for secondary pests including thrips and mites.

Methods

Objective 1. Test the efficacy of registered and candidate compounds against PTB during the overwintering and subsequent summer generations. The compounds tested will include insect growth regulators novaluron and diflubenzuron, spinosyns spinosad and DPX 175 (next generation spinosyn), and several pyrethroids. Other candidate compounds will be included when they are identified. Treatments will be applied to 10 individual trees per treatment. Twig strikes per tree (for the overwintering generation) and percent damaged fruit (for the summer generation) will be calculated and recorded. Data will be analyzed by Analysis of Variance for significance. Mean separation will be conducted with pairwise *t*-tests.

Objective 2. Collect region-wide mating flight information. PTB pheromone lures and traps will be purchased from Trece™ and placed in grower collaborator orchards and in suburban backyard trees in Mesa, Burbank, Prosser, Buena, Yakima, and Wenatchee in late February. These trees will be monitored weekly throughout the growing season and the number of male moths captured will be quantified. This data will be incorporated into the insect model system that is being developed by Jones et al. at the Tree Fruit Research Center.

Objective 3. Collect baseline data on the susceptibility of PTB to registered and candidate insecticides. A successful technique and a substantial database on PTB susceptibility to insecticides in California has been developed by Zalom, Walsh, Krueger and Connell (2002). We will collect populations of PTB in spring 2007 and test these populations for their susceptibility to candidate insecticides. This technique involves collecting flagged twigs from infested orchards and transporting them to the laboratory. The larvae are then extracted by hand and dosed with technical-grade insecticides that are diluted in acetone. Mortality is assessed at 24 hours post treatment, data Is log transformed, a probit analysis is conducted to determine pest susceptibility and graphed to demonstrate a populations dose response..

Objective 4. Conduct season-long orchard monitoring for secondary pests including thrips and mites. The introduction of acetamiprid and DPX 175 into the orchard system should have the positive effect of preserving many of the beneficial arthropods present in stone fruit orchards. We will monitor insect and mite populations in 2 conventional orchards and 2 organic orchards. We will impose pyrethroid sprays on 25 trees within each of the conventional orchards and we will monitor these trees and 25 other trees within the orchard qualitatively and quantitatively for the presence of pest and beneficial arthropods. Twenty-five trees will be selected from the 2 organic orchards and sampled as well. Yellow sticky cards will be placed in the tree canopy to measure thrips abundance and leaf samples (10 per tree) will be collected and the number of pest and beneficial mites present will be quantified.

Proposed schedule of accomplishments

Objective 1. Efficacy trials with candidate compounds will be conducted twice. Once against the overwintering generation in early spring and a second time in mid to late summer against the second or third generation.

Objective 2. This objective will commence in late February 2007 and continue through fall.

Objective 3. This objective will be accomplished in spring 2007.

Objective 4. This objective will commence in late May 2007 and continue through fall.

Literature Review

Zalom, F. G., D. B. Walsh, W. Krueger, and J. Connell. 2002. Tolerance of peach twig borer, *Anarsia lineatella,* to organophosphate and pyrethroid insecticides. Acta Horticulturae 591:585-590.

CONTINUING PROJECT REPORT **YEAR**: 1 of 3
WTFRC Project Number:

Project Title: Fine-Tuning Time and Rate of Tergitol TMN-6 & Other Blossom Thinners
PI: Esmaeil Fallahi
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Cooperators: Dr. Jim McFerson

Budget 1:
Organization Name: University of Idaho **Contract Administrator:** Dr. Jeff Stark
Telephone: 208-722-6701 ext 225 **Email address:** jstark@uidaho.edu

Item	**Year 1:**	**Year 2:**	**Year 3:**
Salaries			
Benefits			
Wages	2000	2000	0
Benefits	500	500	0
Equipment			
Supplies	1000	1000	0
Travel	1500	1500	0
Miscellaneous			
Total	5000	5000	

Footnotes:

OBJECTIVES

To experiment with Tergitol-TMN-6 blossom thinner in peaches. This experiment will be in conjunction with Dr. Jim McFerson and peach and perhaps other stone fruit growers in Washington.

SIGNIFICANT FINDINGS:

1. Tergitol effectively thinned peaches in various orchards in Idaho and Utah during 2005 and 2006. Other than hydrogen cyanamide, Tergitol is the most effective blossom thinner we have experimented with for peach and nectarine. Application of Tergitol significantly reduced the cost of hand thinning in all orchards.
2. the most effective Tergitol concentrations for thinning are between 0.75% to 1.25%. The most effective time of application is when about 75% of blooms are open.
3. When bloom period is prolonged, using stage of bloom may be misleading as process of pollination and fruit set may continue even before blooms are completely open.
4. Bloom thinning increased as Tergitol concentrations increased. Also a double application always was more effective in thinning than a single application. Repeated application at high concentration may lead to over thinning.
5. Tergitol did not have any mark or cause russetting on peaches or nectarines in 2005. However, in 2006, repeated application of Tergitol at high concentrations increased fruit russetting in nectarine. Tergitol did not increased frit rusting in most peach cultivars in 2006.
6. For Zee Lady and Snow Giant peaches, concentrations of 0.75% to 1.25% Tergitol reduced fruit set when applied at 75% bloom in 2005 and 2006.
7. In Utah orchards, Tergitol at concentrations of 0.75% to 1.25%, applied at 75% to 80% bloom reduced fruit set in peaches.
8. Time of application is very important and we intend to continue or research with Tergitol and "fine tune" the timing of application in 2007 seasons**.**

METHODS:

<u>For Year 2005 and 2006:</u>

For all experiments in 2005 and 2006, the experimental design was completely randomized design. Two adjacent rows in two different locations were sprayed with air blast sprayers. There were several buffer rows in between sprayed rows. At least 8 trees were selected per row per treatments. Three to four limbs per tree were selected and fruit set were be measured by 2 methods: 1) counting number of flowers before spraying and counting number of fruits after fruit set and then calculating fruit set based on: fruit number/flower numbers x 100 or 2) by counting number of fruits several weeks after spraying and then calculating fruit set based on: fruit set = fruit number/branch cross sectional area. Fruit were sampled at harvest and fruit quality such as fruit size, color, and russet ting were measured. Trees were sprayed with air blast sprayer at a rate of 200 gal/acre.

Sunny Slope, Idaho: A nectarine and a peach orchard were selected in Sunny Slope, Idaho in each season during 2005 and 2006. Trees were sprayed with Tergitol at different concentrations and at various bloom stages as shown in tables and figures. The rate of application was 200 gal/acre.

University of Idaho, Pomology Research Orchards: Zee lady and Snow Giant peaches were sprayed with different concentrations of Tergitol and at different bloom stages in 2005 and 2006 with an air blast sprayer at 200 gal/acre (please see tables and Figures for rate and time of application).

Utah and Washington Experiments:
Several commercial peach orchards were selected in Ogden, Utah in 2005 and 2006 and in Ogden and Ste George Utah in 2006 and sprayed with different concentrations of Tergitol. The general methodology was similar in all experiments.

Results and Discussion:

Year 2005 (Figures 1, 2, 3, 4, 5, and 6):

Results of 2005 experiments in Idaho and Utah orchards are shown in Figures 1-6. In Zee lady peach, 0.75%, 1%, and 1.25% Tergitol significantly reduced fruit set, but 1.25% was more effective than 0.75% and 1%. For this cultivar, 0.75% to 1%, applied at 75% bloom seems to give a satisfactory level of thinning. Tergitol at all concentrations, significantly reduced needs for hand thinning (Figure 5)and increased fruit size in Zee lady peach. Yield was lower in Zee Lady trees that received 1.25% Tergitol , while no significant difference was found in fruit russetting or color in 2005.

Tergitol at 1.25% significantly reduced fruit set and reduced yield (as compared to control) in Snow Giant peach, but 0.75% and 1% were not as effective. This is because Tergitol was sprayed at a later stage on Snow Giant than on Zee lady (85% bloom in Snow Giant vs. 75% in Zee lady). 'Snow Giant' fruit size and color were not affected by any treatment because fruits in all treatments were hand-thinned in June.

Application of Tergitol at 0.75% or 1% at one application or two applications, reduced fruit set in 'July Red' nectarine without major adverse effect on fruit quality or russet ting in Idaho (Figure 3). However, two application of this chemical was significantly more effective than a single application (Figure 3). Only treatments with 0.75% Tergitol applied twice showed more "russet ting type" symptom than control. Other treatments did not cause any russet ting which is positive news for nectarine growers. Application of Tergitol at all concentrations significantly increased fruit size, although they all were hand-thinned in June. However, yield in all treatments were the same. Reduction in the number of fruits resulted in larger size, leading into the same amount of yield in all treatments.

Tergitol at 0.75%, 1%, or 1.25% significantly reduced fruit set and needs for hand thinning in all cultivars tested in Utah. That includes John Henry, O'Henry, and Angelus peaches (Figures 4, 5, 6). Application of this chemical at 1.25% was always more effective than 0.75% in Utah in 2005.

Year 2006 (Figures 7, 8, 9, and 10):

Several comprehensive studied were conducted on peaches in Sunny slope area in 2006. At Symms Fruit Ranch, various times and concentrations of Tergitol on Peach blossom thinning were studied. The degree and severity of blossom thinning increased as the concentration of Tergitol increased, regardless of time of spray (Figure 9). Also, within each concentration, a double application of Tergitol resulted in higher thinning than a single application of that concentration. Therefore, the highest level of blossom thinning was achieved when Tergitol was applied at one of the following combinations: 0.75% Tergitol at 30% and then 80% bloom; 1.5% Tergitol at 80% bloom; 1.5% Tergitol at 100% bloom, or 1% Tergitol at 30% and again at 80% bloom (Figure 9). Tergitol application increased fruit size as compared to control (Table 1). Double applications of Tergitol at 1% decreased total yield (Table 1). Considering all factors, a single application of Tergitol at 0.75% or 1% at 80% bloom or applications of Tergitol at 1% at 100% bloom or 1.5% at 80% or 100% bloom resulted in an optimum yield and fruit size while significantly reducing the fruit set and the cost of subsequent hand thinning.

Tergitol was also an effective blossom thinner for Zee Lady and Snow Giant peaches when applied at 0.75% to 1.25% at 75% to 100% bloom stages (Figure 7 and 8).
Tergitol, applied either as a single or double application at 0.75% to 1% also reduced fruit set in Diamond Ray nectarine in 2006 (Figure 10). However, high concentrations and repeated application of Tergitol may increase fruit russeting in nectarine in 2006 (Table 2). Thus, a single application of 0.75% to a maximum of 1% seems to be a safer practice for blossom thinning of nectarines.

Overall, results with Tergitol are extremely positive for stone fruit (peaches and nectarines) and we would like to follow our experiments with this chemical during 2007, to verify our previous experiments and fine-tune for the precise timing and concentration of application for maximum efficiency. As a result of our experiments, peach and nectarines growers who have visited our research plots are becoming interested in this chemical and there might be a great chance for registration of this chemical, although it is currently labeled as a "surfactant". Details of data will be presented at the Washington stone fruit meeting and questions will be answered.

Figure 1. Effects of Tergitol on Zee Lady Peach Blossom Thinning, 2005.

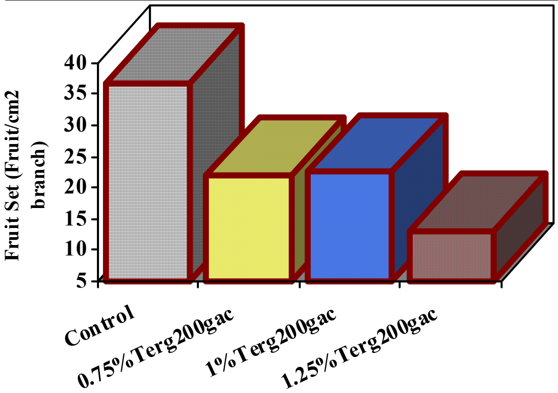


Figure 2. Effects of Tergitol on Snow Giant Peach Blossom Thinning, 2005.

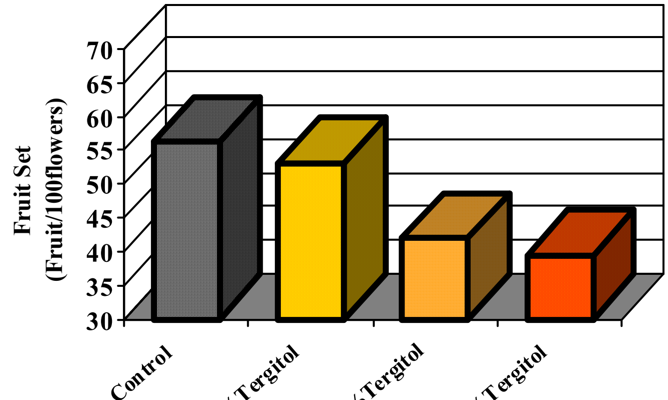


Figure 3. Effects of Tergitol on Nectarine Blossom Thinning, Sunny Slope, Idaho 2005.

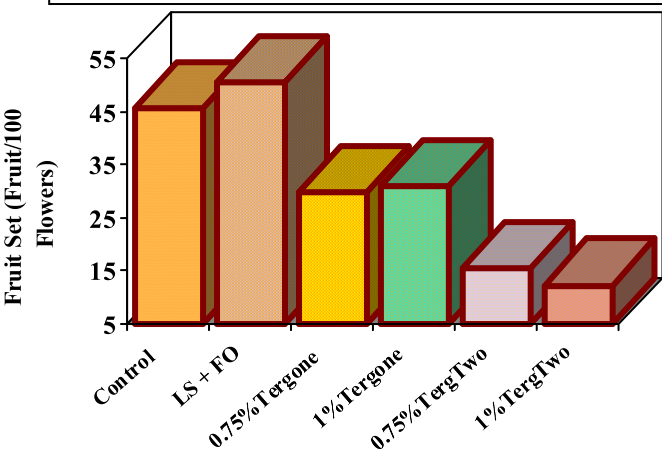


Figure 4. Effects of Tergitol on 'John Henry Peach, Utah, 2005.

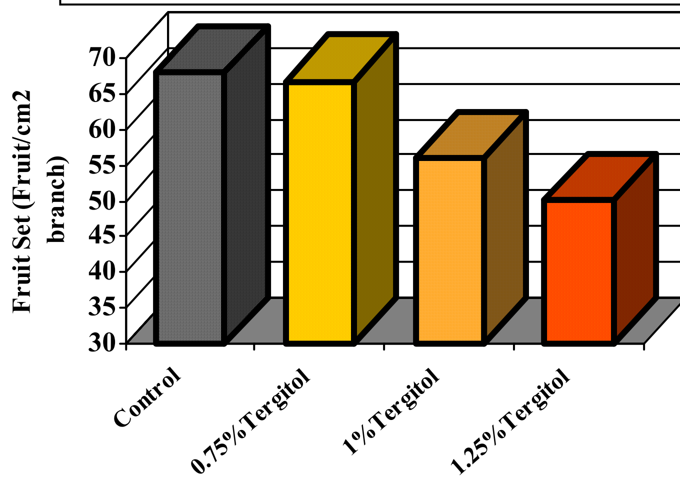


Figure 5. Effects of Tergitol on 'Angelus' Peach Blossom Thinning, Utah, 2005.

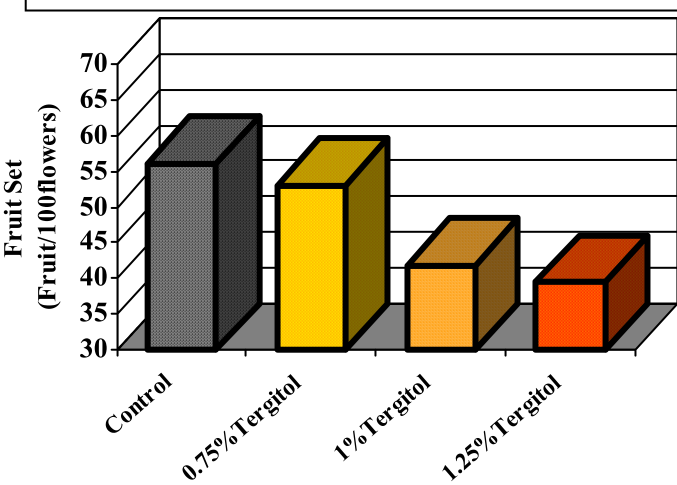


Figure 6. Effects of Tergitol on 'O' Henry Peach Blossom Thinning, Utah 2005.

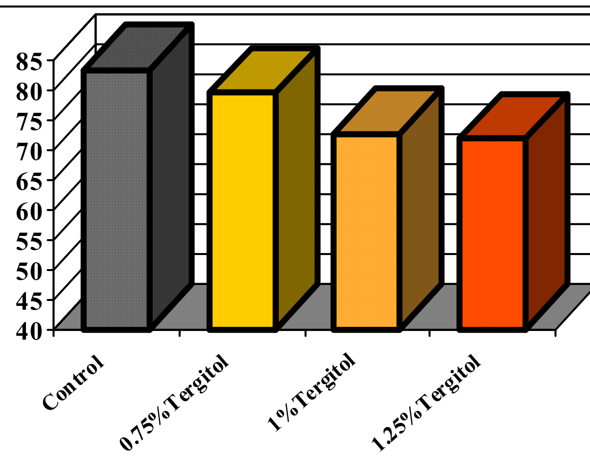


Figure 7. Effects of Tergitol on Zee Lady Peach Blossom Thinning, 2006.

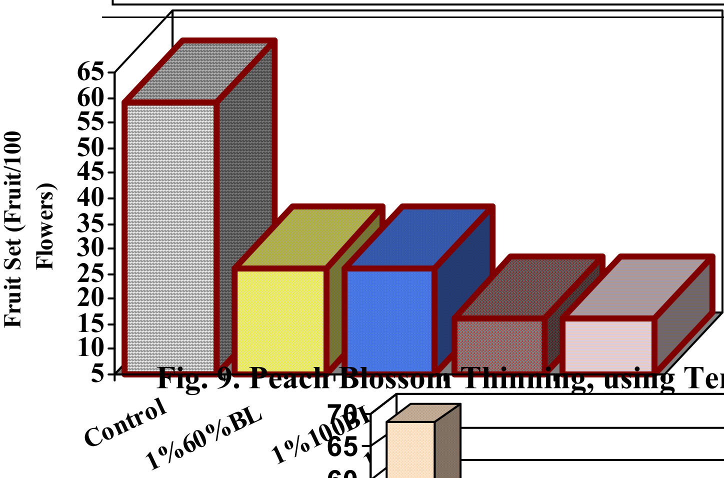


Figure 8. Effects of Tergitol on Snow Giant Peach Blossom Thinning, 2006.

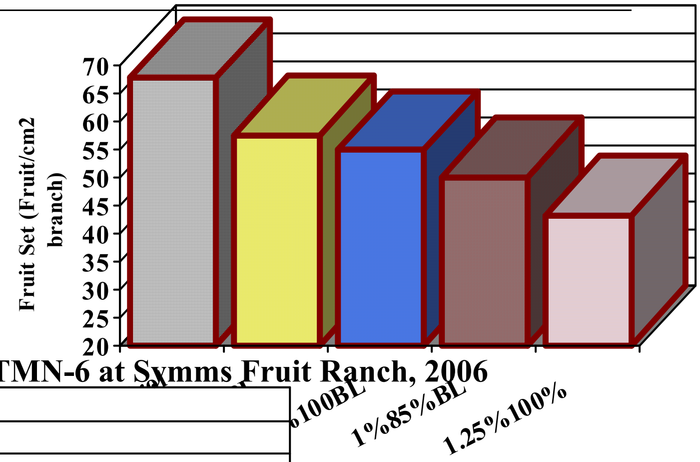


Fig. 9. Peach Blossom Thinning, using Tergitol TMN-6 at Symms Fruit Ranch, 2006

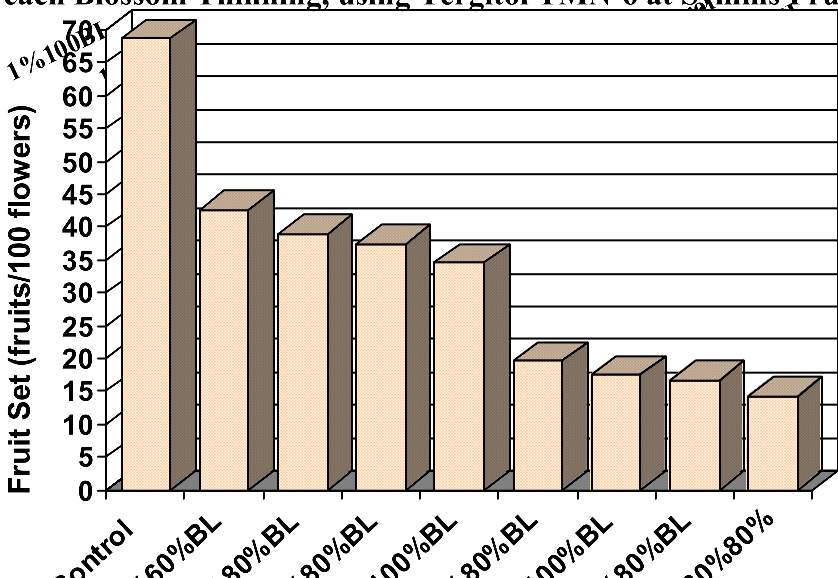
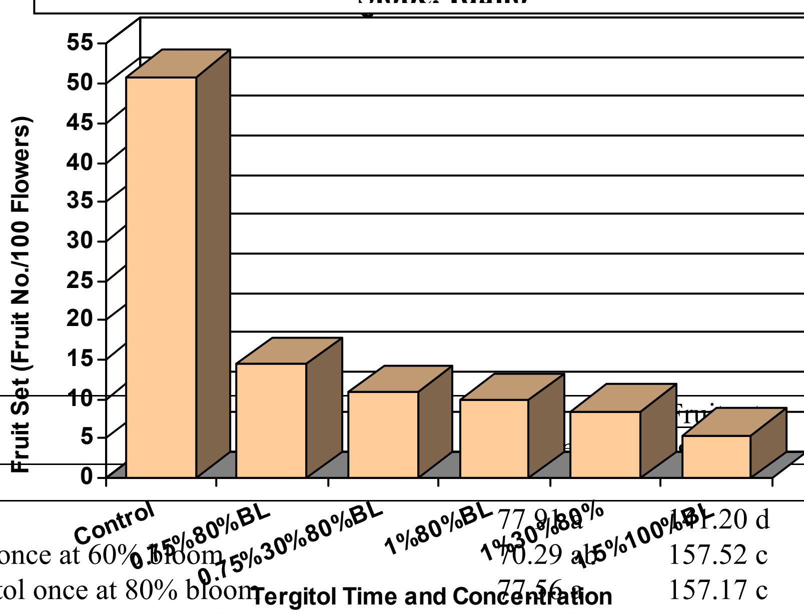


Figure 10. 2006 Blossom Thinning, Nectarine, Sunny Slope, Idaho



Treatment	[illegible]	[illegible]	Fruit Color	Russett (%)
Control	77.9[illegible] a	[illegible]1.20 d	2.70 c	5.36 a
1% Tergitol once at 60% bloom	70.29 ab	157.52 c	3.83 a	7.50 a
0.75% Tergitol once at 80% bloom	77.56 a	157.17 c	3.28 b	2.58 a
0.75%Tergitol once at 30% and once at 80% bloom	56.44 bc	180.11 ab	3.60 ab	5.91 a
1% Tergitol once at 80% bloom	76.18 a	156.91 c	3.98 a	3.33 a

1%Tergitol once at 30% and once at 80% bloom	52.43 c	190.09 a	4.04 a	6.06 a
1% Tergitol once at 100% bloom	84.49 a	166.04 bc	3.65 ab	4.17 a
1.5% Tergitol once at 80%	76.87 a	181.43 ab	3.93 a	7.50 a
1.5% Tergitol once at 100%	72.72 ab	182.93 a	3.92 a	5.13 a

Means are separated by LSD at 5%. Note: No russetting was observed in any treatment

Table 2. Effects of Tergitol on 'Diamond Ray Nectarine' Fruit Quality, at Williamson Orchard 2006

Treatment	Yield (kg/tree)	Fruit wt (g))	Color	Russett (%)
Control	43.71 a	136.06 c	2.50 c	9.87 c
0.75% Tergitol at 80% bloom	29.17 b	156.67 ab	2.75 abc	20.83 b
0.75% Tergitol at 30% & 80% bloom	28.47b	149.04 ab	2.92 abc	21.49 b
1% Tergitol at 80% bloom	22.91 bc	145.98 bc	2.64 bc	22.99 b
1% Tergitol at 30% & 80% bloom	16.65 c	159.05 a	3.00 ab	32.57 a
1.5% Tergitol at 100% bloom	21.53 bc	151.44 ab	3.16 a	24.61 ab

Means are separated by LSD at 5%. Note: No russetting was observed in any treatment

Means are separated by LSD at 5%. Note: No russetting was observed in any treatment

Table 3. Effects of Tergitol on 'Snow Giant' fruit yield and quality, U of I, 2006

Treatment	Fruit wt (g)	Yield (kg/tree)	Fruit Color	Russett (%)
Control	216.8 b	23.22 a	2.28 a	1.39 b
1%Tergitol@60%Bloom	243.9 a	23.33 a	2.39 a	4.72 ab
1%Tergitol@75%Bloom	236.1 a	23.39 a	2.33 a	5.84 a
1%Tergitol@100%Bloom	242.0 a	23.45 a	2.41 a	3.95 ab
1.25%Tergitol@100%Bloom	242.5 a	22.05 a	2.42 a	6.95 a

Table 4. Effects of Tergitol on 'Zee Lady' fruit yield and quality, U of I, 2006

Treatment	Fruit wt (g)	Yield (kg/tree)	Fruit Color	Russett (%)
Control	191.5 a	23.11 b	3.38 a	2.14 a
1%Tergitol@60%Bloom	197.9 a	30.36 a	3.50 a	1.43 a
1%Tergitol@75%Bloom	194.8 a	24.84 b	3.60 a	0 a
1%Tergitol@100%Bloom	199.9 a	23.46 b	3.30 a	0 a
1.25%Tergitol@100%Bloom	186.8 a	23.46 b	3.65 a	1.43 a