Evaluation of Stone Fruit Thinning Compounds

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Abstract

Six potential chemical thinning treatments were compared to non-thinned controls in both Rich Lady peach and Summer Fire nectarine blocks. All treatments showed some degree of thinning; however, three treatments stood out as being worthy of commercial testing in 2007. These three treatments are:

- 20% cottonseed oil plus 5% Activator 90
- 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90
- 2% Tergitol®

The percent peach fruit set was reduced from 51.7% in the control to 35.1% with the cottonseed oil, to 31.9% with the ATS, and to 22.4% with the Tergitol®. The nectarine block was sprayed with cottonseed oil earlier in its phenological development and the cottonseed oil thinned better than it did in the peach block, which was more advanced into the bud swell and bloom. The nectarines were reduced in percent set from 19.9% in the control to 10.3% with the cottonseed oil, 13% with the ATS, and 12.2% with the Tergitol®. Cottonseed oil, ammonium thiosulfate, and Activator 90 are registered and available in California, but the Tergitol® is currently not registered in California and is a very expensive product. The ammonium thiosulfate and the Tergitol® were applied when 80% of the flowers were open.

Introduction

The cost of thinning is second only to the cost of harvest in fresh shipping stone fruit production. Growers are currently faced with increasing production costs, increased regulation, shortages in labor supply, and the high cost of labor in the United States. For over 60 years, researchers have attempted to isolate products that could reduce or eliminate the need for hand thinning in order to reduce their labor costs. During this period, only the di-nitro compounds produced repeatable thinning responses, but the last of these products was eliminated in 1987, when they were found to produce cataracts and blindness. Since that time, many new approaches have be tested to determine if various products could successfully reduce or eliminate fruits early in their development without the burden of utilizing hand labor. Among the categories of products tested are pre-emergent weed killers, plant growth regulators, cell division inhibitors, carbamate pesticides, desiccating agents, wetting agents, fertilizers, embryo abortion caused by ethylene producing compounds, photosynthetic inhibitors, pollen killing agents, and inhibitors of gibberellin biosynthesis. None of these products have been successful in thinning tree fruit crops

nor have they been registered for use in California. From 1943 to 1983, Clemson University in South Carolina screened over 100 chemicals for peach thinning. Of these 100 products, only two received Environmental Protection Agency (EPA) approval, and the companies producing these products ceased production in the 1970's due to a lack of demand and poor performance in some areas of the United States (including California). Recent studies conducted in the eastern and southern areas of the United States showed some thinning benefits from spraying soybean oil combined with a wetting agent on trees during the dormant and late dormant period. It was believed that the oil suffocated the weaker buds by building up high concentrations of CO_2. Based on this work, extensive research was conducted during the 2004 and 2005 seasons to determine if similar results could be achieved under California growing conditions. These trials demonstrated that soybean and cottonseed oils could not be used at the same timings and rates as those used in the eastern and southern states of the United States. Sprays of these oils at various rates and timings showed little promise for thinning and also produced severe phytotoxicity under California conditions. Based on the 2004 and 2005 research results, modifications of treatments, timings, and products were evaluated during the 2006 season. This 2006 trial produced promising results from three of the six compounds tested. Two of the three treatments have current California registrations (though not for thinning), and one product is registered for agricultural use, but not in California.

Methods

Two orchards were selected at the University of California's Kearney Agricultural Center for the 2006 thinning trial. A 3.07 acre block of Rich Lady peaches was selected for the peach thinning trial, and a similar 3.07 acre block of Summer Fire nectarines was selected for the nectarine thinning trial. Both blocks were planted in 2001 with a north-south row orientation with 6' X 16' tree spacing and trained to a perpendicular V. Irrigation was with micro-sprinklers. The experimental design was a randomized block utilizing eight replications of seven treatments. Each plot consisted of four trees, with the center two trees used for data collection.

The seven treatments and dates of sprays applied to the Rich Lady peach block were:

Treatments

1. Control = no thinning sprays applied
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956
   (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006
   (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)
4. 20% cottonseed oil applied February 24, 2006 (10% open flowers)
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006
   (10% open flowers)
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006
   (full bloom = 80% open flowers)
7. 2% Tergitol® applied on March 1, 2006,
   (full bloom = 80% open flowers)

The seven treatments and dates of sprays applied to the Summer Fire nectarine block were similar to the Rich Lady Peach block, but the phonological stage of growth was less advanced. The treatments were:

Treatments

1. Control = no thinning sprays applied
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956
   (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006
   (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)
4. 20% cottonseed oil applied February 24, 2006 (0.5% flowers open)
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006
   (0.5% open flowers)
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006
   (full bloom = 80% open flowers)
7. 2% Tergitol® applied on March 8, 2006
   (full bloom = 80% open flowers)

All spray treatments were applied with a commercial 500-gallon Aero-Fan sprayer at a rate of 100 gallons per acre. In spite the unusual heavy rainfall pattern in 2006, our treatments were applied timely with a period of at least 24 hours following each application without rainfall. The Rich Lady peach produces showy flowers while the Summer Fire nectarine produces non-showy flowers. The phonological stage of bud or bloom development is described below for each of the treatments listed above. The peaches were slightly more advanced in their flower development at the time of spraying than were the nectarines.

Prior to the treatment spray applications, the two center trees in each four-tree plot were evaluated and twenty shoots were flagged, numbered, and their shoot lengths were measured. The two center trees had ten shoots flagged in the upper canopy of the trees and ten shoots flagged in the lower canopy of the trees. Ten shoots were located on the east side of the trees, and ten shoots were located on the west side of the trees. The bud swell and bloom development was monitored, and the flower buds were counted on each of the measured shoots to provide data on the number of flowers and percent fruit set per centimeter of shoot length. This information is provided in Tables 1-11. Harvest data was collected. The Summer Fire Nectarine block had similar shoots marked and evaluated as in the peach block. The data collected from the Summer Fire nectarine block are presented in Tables 12-22.

Results and Discussion

Out of the seven treatments tested during the 2006 season, three treatments show considerable industry promise and are worthy of larger scale commercial testing in 2007. Despite the freeze injury and the persistent rains, which occurred during the 2006 season, these three treatments significantly reduced the fruit-set in both the Rich Lady peach and the Summer Fire nectarine blocks. Two of the treatments (20% cottonseed oil plus 5% Activator 90 and 1.5% ammonium thiosulfate plus 5% activator 90) contain inexpensive registered materials commonly used in California, while the third and most effective material (2% Tergitol®) is expensive and not currently registered in California. Fruit set in the Rich Lady peach block was reduced from

51.7% in the control to 22.4% set with 2% Tergitol and to 31.9% set with 1.5% ammonium thiosulfate plus Activator 90, and to 35.1% set using 20% cottonseed oil plus 5% Activator 90. The Summer Fire nectarine block set fewer fruit numbers, but the chemical treatments reduced the fruit set from 19.9% in the control to 10.3% with the cottonseed oil treatment and to12.2% set with the Tergitol® and to 13% with the ammonium thiosulfate. The cost of the 1.5% ammonium thiosulfate plus 5% Activator 90 is approximately $71 per treated acre, but has the potential to reduce the hand thinning costs by about one-third.

**Table 1. Number of Flowers Per Centimeter of Shoot Length
Shoots Located In The Upper Canopy, Rich Lady Peach, 2006**

Treatments	Flower Number
1. Control = no thinning sprays applied	.18 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	.20 a
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	.18 a
4. 20% cottonseed oil applied February 24, 2006 (10% open flowers)	.19 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (10% open flowers)	.16 a
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006 (full bloom = 80% open flowers)	.19 a
7. 2% Tergitol® applied on March 1, 2006, (full bloom = 80% open flowers)	.19 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

**Table 2. Number of Flowers Per Centimeter of Shoot Length
Shoots Located In The Lower Canopy, Rich Lady Peach, 2006**

Treatments	Flower Number
1. Control = no thinning sprays applied	.15 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	.14 a
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	.13 a
4. 20% cottonseed oil applied February 24, 2006 (10% open flowers)	.15 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (10% open flowers)	.11 a
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006 (full bloom = 80% open flowers)	.13 a
7. 2% Tergitol® applied on March 1, 2006, (full bloom = 80% open flowers)	.13 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 3. Percent Fruit Set On Shoots Located In The Upper Canopy, Rich Lady Peach, 2006

Treatments	Percent Fruit Set
1. Control = no thinning sprays applied	57.1 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers	46.3 abc
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	50.9 abc
4. 20% cottonseed oil applied February 24, 2006 (10% open flowers)	52.4 ab
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (10% open flowers)	43.3 bc
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006 (full bloom = 80% open flowers)	40.0 c
7. 2% Tergitol® applied on March 1, 2006, (full bloom = 80% open flowers)	26.1 d

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 4. Percent Fruit Set On Shoots Located In The Lower Canopy, Rich Lady Peach, 2006

Treatments	Percent Fruit Set
1. Control = no thinning sprays applied	45.1 a
2. 10% 2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers))	39.5 a
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	35.1 a
4. 20% cottonseed oil applied February 24, 2006 (10% open flowers)	39.4 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (10% open flowers)	21.9 b
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006 (full bloom = 80% open flowers)	19.8 b
7. 2% Tergitol® applied on March 1, 2006, (full bloom = 80% open flowers)	17.8 b

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 5. Combined Percent Fruit Set On Shoots Located In The Upper and Lower Canopy, Rich Lady Peach, 2006

Treatments	Percent Fruit Set
1. Control = not thinning sprays applied	51.7 a
2. 10% 2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	43.6 bc
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling and pink showing, 2^{nd} spray at 10% open flowers)	44.3 a
4. 20% cottonseed oil applied February 24, 2006 (10% open flowers)	47.1 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (10% open flowers)	35.1 b c
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006 (full bloom = 80% open flowers)	31.9 c
7. 2% Tergitol® applied on March 1, 2006, (full bloom = 80% open flowers)	22.4 d

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 6. Average Number of Fruit Harvested Per Tree On Four Thinning Treatments, Rich Lady Peach, 2006

Treatments	Average Number Of Fruit Per Tree
1. Control = not thinning sprays applied	239 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (10% open flowers)	190 ab
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006 (full bloom = 80% open flowers)	177 b
4. 2% Tergitol® applied on March 1, 2006, (full bloom = 80% open flowers)	117 c

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 7. Average Weight Per Fruit In Grams On Four Thinning Treatments, Rich Lady Peach, 2006

Treatments	Average Weight Per Fruit In Grams
1. Control = not thinning sprays applied	169.7 b
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (10% open flowers)	169.7 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 1, 2006 (full bloom = 80% open flowers)	176.0 ab
4. 2% Tergitol® applied on March 1, 2006, (full bloom = 80% open flowers)	180.4 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 8. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Rich Lady Peach, 2006

Fruit Size 36	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	9.6 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	5.6 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	11.3 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	7.4 a

Fruit Size 42	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	19.6 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	15.0 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	14.8 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	13.9 a

Fruit Size 48	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	32.5 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	29.6 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	30.6 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	21.1 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 9. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Rich Lady Peach, 2006

Fruit Size 50	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	38.5 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	30.1 ab
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	25.6 b
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	20.9 b

Fruit Size 54	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	32.9 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	27.4 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	25.6 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	15.0 b

Fruit Size 56	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	32.6 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	21.9 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	20.8 b
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	14.4 b

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 10. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Rich Lady Peach, 2006

Fruit Size 60	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	24.2 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	17.0 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	13.9 bc
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	8.4 c

Fruit Size 64	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	14.5 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	10.5 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	9.8 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	4.4 b

Fruit Size 70	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	9.5 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	8.3 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	6.9 ab
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	3.4 b

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 11. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Rich Lady Peach, 2006

Fruit Size 72	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	25.1 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	24.5 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	17.9 ab
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	8.1 b

Mean Separation by Dunan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 12. Number of Flowers Per Centimeter of Shoot Length, Shoots Located In The Upper Canopy, Summer Fire Nectarine, 2006

Treatments	Flower Number
1. Control = no thinning sprays applied	0 .19 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	0.18 a
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	0.17 a
4. 20% cottonseed oil applied February 24, 2006 (0.5% flowers open)	0.20 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	0.20 a
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	0.20 a
7. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	0.19 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 13. Number of Flowers Per Centimeter of Shoot Length, Shoots Located In The Lower Canopy, Summer Fire Nectarine, 2006

Treatments	Flower Number
1. Control = no thinning sprays applied	0.17 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	0.1.5 a
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	0.13 a
4. 20% cottonseed oil applied February 24, 2006 (0.5% open flowers)	0.15 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	0.16 a
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	0.17 a
7. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	0.14 a

Mean Separation by Dunan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 14. Percent Fruit Set On Shoots Located In The Upper Canopy, Summer Fire Nectarine, 2006

Treatments	Percent Fruit Set
1. Control = no thinning sprays applied	22.9 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	15.7 a
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	14.3 a
4. 20% cottonseed oil applied February 24, 2006 (0.5% open flowers)	21.1 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	13.3 a
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	16.4 a
7. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	14.8 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 15. Percent Fruit Set On Shoots Located In The Lower Canopy, Summer Fire Nectarine, 2006

Treatments	Percent Fruit Set
1. Control = no thinning sprays applied	6.7 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	11.5 a
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	8.9 a
4. 20% cottonseed oil applied February 24, 2006 (0.5% open flowers)	10.6 a
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	6.9 a
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	9.2 a
7. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	9.3 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 16. Combined Percent Fruit Set On Shoots Located In The Upper and Lower Canopy, Summer Fire Nectarine, 2006

Treatments	Percent Fruit Set
1. Control = no thinning spray applied	19.9 a
2. 10% soybean oil applied on February 9 and 24, 2006 plus 6 oz. Latron B-1956 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	13.4 bc
3. 10% emulsified cottonseed oil applied on February 9 and 24, 2006 (1^{st} spray = buds swelling no pink, 2^{nd} spray at 0.5% open flowers)	11.4 bc
4. 20% cottonseed oil applied February 24, 2006 (0.5% open flowers)	15.9 ab
5. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	10.3 c
6. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	13.0 bc
7. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	12.2 bc

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 17. Average Individual Fruit Weight In Grams For Four Thinning Treatments, Summer Fire Nectarine, 2006

Treatments	Average Fruit Weight In Grams
1. Control = no thinning spray applied	142.7 b
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	155.4 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	142.3 b
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	148.2 ab

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 18. Total Fruit Weight (Yield) Per Tree For Four Thinning Treatments, Summer Fire Nectarine, 2006

Treatments	Total Fruit Weight Per Tree In Kilograms
1. Control = no thinning spray applied	18.75 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	12.25 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	15.55 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	14.95 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 19. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Summer Fire Nectarine, 2006

Fruit Size 36	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	0.3 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	1.1 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	0.4 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	0.4 a

Fruit Size 42	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	3.1 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	7.1 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	2.5 b
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	2.6 b

Fruit Size 48	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	19.4 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	27.8 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	17.6 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	21.4 a

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 20. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Summer Fire Nectarine, 2006

Fruit Size 50	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	46.0 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	44.4 a
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	39.4 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	52.9 a

Fruit Size 54	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	86.9 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	44.3 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	72.6 ab
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	68.4 ab

Fruit Size 56	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	40.3 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	12.8 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	37.8 a
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	24.8 ab

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 21. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Summer Fire Nectarine, 2006

Fruit Size 60	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	30.5 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	7.8 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	21.9 ab
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	15.0 ab

Fruit Size 64	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	18.1 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	3.8 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	11.0 ab
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	7.3 b

Fruit Size 70	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	9.0 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	1.8 b
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	5.9 ab
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	2.3 b

Mean Separation by Duncan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other

Table 22. Number of Fruit (Per Two Tree Plot) In Each Size Category For Four Thinning Treatments, Summer Fire Nectarine, 2006

Fruit Size 72	Average Number Of Fruit From Two Trees
1. Control = no thinning spray applied	13.4 a
2. 20% cottonseed oil plus 5% Activator 90 applied February 24, 2006 (0.5% open flowers)	6.4 ab
3. 1.5% ammonium thiosulfate (ATS) plus 5% Activator 90 applied on March 8, 2006 (full bloom = 80% open flowers)	10.0 ab
4. 2% Tergitol® applied on March 8, 2006, (full bloom = 80% open flowers)	6.0 b

Mean Separation by Dunan's Multiple Range Test LSD .05
Values followed by similar letters are not statistically different from each other