

PEACH FLOWER BUD THINNING BY DORMANT SEASON APPLICATIONS OF VEGETOIL™

G. L. Reighard^{1*}, D. Ouellette¹ and K. Brock¹

¹Clemson University, Department of Horticulture, Clemson, SC 29634 USA

ABSTRACT

Removal of flower buds, flowers or young developing fruit in early spring increases potential peach fruit size by reducing competition for stored carbohydrates. Peach growers often wait ~ 30 days after full bloom to start hand-thinning fruit, which can limit potential fruit size. Experiments were conducted in commercial orchards in South Carolina to determine the efficacy of Vegetoil™ (VO), an emulsified soybean oil adjuvant, for pre-bloom thinning of peach cultivars. Cultivars were sprayed in January or February of 2003 and 2004 using rates of 8 or 10% by volume of VO (a.i., 93% soybean oil). Dormant oil at 2 or 3% was the control treatment. Bloom was either delayed or advanced by VO depending on cultivar and year. VO significantly reduced the number of live flower buds at bloom in some cultivars in some years. VO also significantly decreased hand-thinning costs and for some cultivars improved fruit size and commercial pack-out. Although pre-bloom VO treatments were variable in efficacy, in every year that treatments were applied in grower orchards, one or more of the dormant Vegetoil™ applications significantly increased net returns for the grower in that orchard. VO performed similarly but not always the same as vegetable grade soybean oil (SO) mixed with an emulsifier.

INTRODUCTION

Thinning is necessary to adjust the number of fruits (i.e., peaches) on a fruit tree so that they will adequately size for commercial acceptance. Thinning practices that achieve a marketable fruit size that maximizes pack-out yield per tree increase orchard production efficiency for growers. An important component of maximizing fruit size and yield is time of thinning. Peach thinning can be done pre-bloom (e.g., floral buds), during bloom (e.g., flowers) or post-bloom (e.g., fruits/fruitlets).

Thinning at the pre-bloom stage increases the available stored carbohydrates for cell growth in the remaining flower buds. Soybean oil (SO), when applied pre-bloom, has thinned peach [*Prunus persica* (L.) Batsch] flower buds (Deyton et al., 1992; Myers et al., 1996; Moran et al., 2000). Flower bud death due to SO is concentration dependent (Moran et al., 2000; Myers et al., 1996; Deyton et al., 1992) and increases with an increase in SO concentration. The efficacy of thinning with SO from year to year is not known (Moran et al., 2000). Variability in bud thinning and bloom delay using SO can be attributed to cold injury (Moran et al., 2000) and management factors (Pendergrass et al., 2000). The objectives of this research were to determine the efficacy of both soybean vegetable oil plus an emulsifier and the commercially available soybean oil adjuvant Vegetoil™ to thin flower buds, reduce thinning expenses, and increase fruit size and improve pack-out of peach fruit in South Carolina peach orchards.

MATERIALS AND METHODS

Two and three peach cultivars at Titan Peach Farms (Ridge Spring, SC) were selected in 2003 and 2004, respectively. All trees were trained to an open-center system and were spaced

4.6 to 5.2 m apart in rows 6.1 m apart. Each treatment was applied to a minimum of 2 and a maximum 4 hectares of orchard per cultivar to obtain packinghouse data. Ten 1-year-old shoots on each of 10 trees in each treatment block were randomly selected. The total number of flower buds and number of open flowers were recorded twice for each of the six blocks between March 11 and March 19, 2003 to determine differences in timing of bloom. Fruit from these same 10 trees were commercially hand-thinned in late April. Fruits thinned from each tree were counted and weighed. The total time required for a crew to thin each treatment block was recorded to determine hand-thinning costs. For each harvest, data included percent pack-out (grade 1 fruit), weight (yield), and number of fruit in each of 5 size classes (5.4, 5.7, 6.4, 7.0 and 7.6 cm). Hand-thinning and spray application costs were subtracted from returns from fruit sales to determine gross returns per hectare minus thinning costs. Data for flower counts and fruitlets removed were replicated, but treatment thinning times, yield, and pack-out data were non-replicated and only non-statistical numbers are reported.

An airblast sprayer was calibrated to deliver 1328 L/ha for the dormant and soybean oil applications. Latron B-1956 was pre-mixed with soybean oil at 10% of its concentration (e.g., 3.785 L Latron per 37.85 L soybean oil). Latron was not mixed with Vegetoil™ (Drexel Chemical Co.), since it is a pre-mixed formulation of soybean vegetable oil and emulsifier.

An orchard of five-year-old 'Blazeprince' peach trees were sprayed either twice with 3% DO (Jan. 28 & Feb. 8, 2003), with 8% Vegetoil™ (VO) on Jan. 31, 2003, or with 8% soybean oil (SO) on Feb. 7, 2003. Four-year-old 'Fireprince' peach trees were sprayed with either 3% DO on Jan. 5, 2003, or with 8% VO on Jan. 31, 2003. The 8% VO treatment was applied at either 935 or 1328 L/ha. Fruit from each treatment block from the first 4 harvests (of 7 total) were not packed separately. Therefore, harvest totals for 'Fireprince' include data from only the last 3 harvests. Total returns from fruit sales were estimated by averaging market price for fruit in size classes 6.4 and 7.0 cm.

Ten-year-old 'Summerprince' peach trees were sprayed with either 10% Vegetoil™ (VO) (a.i. 93% soybean oil) or with 9% soybean oil (SO) on February 3, 2004. Control trees were sprayed with 2% dormant oil (DO) in early January 2004. All flower buds were re-counted and the number of open flowers recorded March 11 and March 16 to determine flower bud mortality and timing of bloom. Fruit were hand-thinned April 22-25, and again on May 5. Five-year-old 'Fireprince' peach trees were sprayed with either 8% soybean oil (SO) on January 29, 2004 or with 9% Vegetoil™ (VO) on February 3. Control trees were sprayed with 2% dormant oil (DO) in early January 2004. Flower bud numbers were re-counted and the number of open flowers recorded March 11 and March 16 to determine flower bud mortality and timing of bloom. Fruit were hand-thinned on May 6, and again May 19-21. Eight-year-old 'Flameprince' peach trees were sprayed either with 8% Vegetoil™ on February 4, 2004 or with 1% Tergitol on March 19 at 80-90% full bloom. Control and Tergitol-treated trees were sprayed with 2% dormant oil (DO) in early January 2004. Number of fruit on each of the selected shoots was recorded on April 12. Fruit in the control and Tergitol-treated blocks were hand-thinned on May 12.

RESULTS AND DISCUSSION

For the 'Blazeprince', bloom period was similar between treatments (data not shown). The 8% VO and 8% SO treatments reduced the amount of hand-thinned fruitlets by 15% and 35%, and thinning costs by 10% and 25%, respectively, compared to the DO control (Table 1). Both oil treatments slightly advanced fruit maturity. The percent pack-out was highest in the VO block (Table 2). Fruit yield was slightly lower with the oil treatments, but fruit size was about

10% larger than the control fruit. Vegetoil™ produced lower gross revenue due to a reduction in fruit yield.

For ‘Fireprince’, 8% Vegetoil™ sprayed 1328 L/ha advanced bloom and also had the greatest thinning effect (Table 1). Thirty-five percent fewer fruitlets were hand-thinned compared to the DO control. However, hand-thinning costs were similar. Vegetoil™ sprayed at 935 L/ha resulted in the highest fruit yield, twice that of the DO control, but fruit size was smaller compared with the other treatments (Table 2). However, yield data were collected only from the last 3 of 7 harvests, which may have biased the earlier ripening VO treatments. Gross dollar return was positively correlated with fruit yield.

In 2004, 9% SO slightly advanced bloom of ‘Summerprince’, with 45% more flowers open on March 16, compared to the DO control (data not shown). SO and VO also slightly reduced the number of surviving flower buds. This difference did not translate into a reduced number of hand-thinned fruitlets (Table 3), since 1% Tergitol was sprayed during bloom on all trees, including control trees. Slightly fewer fruit were thinned from control trees following the Tergitol application, resulting in the control treatment being the least expensive to hand-thin. Fruit maturity was slightly delayed with 10% VO as 25% of the total fruit in the 10% VO orchard was picked over the first two harvest dates, compared to approximately 35% of the fruit in the other orchards. Yield per hectare was 10% lower with VO, compared to the SO and control treatments (Table 4). Pack-out percent and mean fruit weight were higher with the VO and SO treatments compared to the control. Trees sprayed with 9% SO had twice as many fruit in the largest size class (7.0 cm) as other trees. Gross dollar return per hectare was highest with SO-treated trees, ~ \$4000 more than with other treatments (Table 5). Despite producing similar yields, SO-treated trees returned more than control trees due to higher percent pack-out and a higher percentage of fruit in the 6.4 and 7.0 cm size classes.

Table 1. Fruit thinning 2003 data for 5 peach cultivars at Titan Peach Farms, Ridge Spring, SC

Cultivar	Field	Treatment	Count/tree ^z	Fruit thinning			
				Total/tree	Mean	Cost @7.50/hr	per tree per ha
			(kg)	(g)	(\$)	(\$)	
Blazeprince	Davis A	8% Vegetoil	662 b	1.96 a	2.96 a	0.89	318.75
	Davis B	8% Soybean oil	489 c	1.34 b	2.76 a	0.74	265.03
	Davis C	3% Dormant oil	780 a	2.09 a	2.65 a	0.98	350.99
Fireprince	Bell 4-2A	8% Vegetoil- 1328L/ha	307 b	2.73 a	8.61 a	0.71	254.29
	Bell 4-2B	8% Vegetoil- 935L/ha	409 ab	3.48 a	8.50 a	0.79	282.94
	Bell 4-2C	3% Dormant oil	479 a	3.91 a	8.16 a	0.70	250.71

^z Mean separation within columns and cultivar by LSD, $p < 0.05$.

Table 2. Harvest data in 2003 for 2 peach cultivars at Titan Peach Farms, Ridge Spring, South Carolina.

Cultivar	Packout (%)	Yield		Mean fruit wt (g)	Gross return/ha (\$)	Costs/ha		Net return/ha (\$)
		per tree (kg)	per ha (kg)			Hand-Thinning (\$)	Spray application (\$)	
<i>Blazeprince-Davis</i>								
8% Vegetoil	90.6	47.2	16892	151	15237	318.75	128.51	14789
8% SO	85.7	51.3	18371	148	16441	265.03	144.37	16031
3% DO + 3% DO	84.4	53.2	19074	140	16217	350.99	58.51	15808
<i>Fireprince</i>								
8% Vegetoil (1328 L)	79.5	34.3	12286	182	11416	254.29	128.51	11033
8% Vegetoil (935 L/l)	80.6	41.6	14887	170	12963	282.94	90.50	12590
3% DO	72.1	25.9	9291	177	8426	250.71	29.24	8146

Table 3. Fruit thinning 2004 data for 3 peach cultivars at Titan Peach Farms, Ridge Spring, SC.

Cultivar	Treatment ^z	Fruit thinned per tree ^y	Fruitlet weight		Thinning cost/ha ^x
			Total/tree (kg)	Mean (g)	
Summerprince	10% Vegetoil (2/3/04)+ 1% Tergitol (3/18/04)	6031 a	11.8 a	2.0 b	2079
	9% Soybean oil (2/3/04)+ 1% Tergitol (3/18/04)	5192 a	16.2 a	3.0 a	2200
	2% Dormant oil (1/04) +1% Tergitol (3/18/04)	4947 a	13.2 a	2.6 a	1992
Fireprince	8% Soybean oil (1/29/04)	696 a	11.4 a	17.0 a	548
	9% Vegetoil (2/3/04)	266 b	5.0 b	19.6 a	398
	2% Dormant oil (1/04)	715 a	12.6 a	18.6 a	405
Flameprince	8% Vegetoil (2/4/04)	991 b	19.0 b	19.5 a	1092
	2% Dormant oil (1/04)+ 1% Tergitol (3/19/04)	1199 b	21.8 b	18.3 ab	659
	2% Dormant oil (1/04)	1856 a	32.5 a	17.7 b	N/A

^z Control = 2% dormant oil application

^y Mean separation within columns by Duncan's multiple range test, $P < 0.05$.

^x Tree number in Flameprince control blocks insufficient for cost analysis.

Fireprince' bloom in 2004 was delayed slightly by 9% VegetoilTM (data not shown). Significantly fewer flowers (e.g., 35%) in the VO treatment were open on March 16, compared to the SO and control treatments. The 9% VO treatment reduced the amount of hand-thinned fruitlets by 60% compared to the DO control, but thinning costs were not reduced (Table 3). Fruit maturity was delayed with 8% SO. Only 10% of the total fruit in the SO orchard was picked on the first two harvest dates, compared to 20% of the fruit in the other orchards. Fruit yield was noticeably lower with trees sprayed with 9% VO. However, mean fruit weight was highest with VO, with almost 60% of fruit 7.6 cm or greater in size (Table 4). Percent pack-out was similar with all treatments. The low-yielding VO-treated trees reduced gross dollar return per hectare by ~\$3900-4400, compared to SO-treated and control trees (Table 5).

'Flameprince' flower bud density and fruit set were not recorded for the 8% VO treatment. The fruit hand-thinned from VO trees were much less compared to the control trees (Table 3). Hand-thinning was more expensive with VO-treated trees, which did not receive the added Tergitol (i.e., chemical bloom thinner) treatment. VO slightly delayed fruit maturity compared to the DO+Tergitol treatment. VO also slightly improved pack-out, and increased fruit yield by more than 20% compared to trees sprayed with Tergitol (Table 4). VO produced a gross dollar return per hectare that was ~\$5000 higher than a Tergitol application (Table 5).

Table 4. Harvest data in 2004 for 3 peach cultivars at Titan Peach Farms, Ridge Spring, South Carolina.

Cultivar/treatment	Yield		Packout (%)	Mean fruit wt (g)	Size class (% of fruit)				
	per tree (kg)	per ha (kg)			5.4 cm (%)	5.7 cm (%)	6.4 cm (%)	7.0 cm (%)	7.6 cm (%)
<i>Summerprince</i>									
10% VO + 1% Tergitol	80.3	26967	52.7	137	0.0	18.8	74.5	6.7	0.0
9% SO + 1% Tergitol	91.3	30671	59.6	137	0.0	10.8	77.6	11.6	0.0
2% DO + 1% Tergitol	92.9	31217	46.2	133	0.0	20.7	72.9	6.3	0.0
<i>Fireprince</i>									
8% SO	103.2	36968	81.7	222	0.0	0.0	5.8	47.3	46.9
9% VO	70.3	25165	77.6	232	0.0	0.1	4.2	36.9	58.8
2% DO	100.2	35858	80.5	217	0.0	0.2	6.7	49.2	43.9
<i>Flameprince</i>									
8% VO	149.5	53552	74.6	209	0.2	3.9	7.2	53.6	35.1
2% DO + 1% Tergitol	121.5	43543	70.9	208	0.0	5.9	6.8	53.2	34.1

Table 5. Economic return data in 2004 for 3 peach cultivars at Titan Peach Farms.

Cultivar/treatment	Gross return /ha (\$)	Costs/ha		Post-thin net return /ha (\$)
		Hand-Thinning (\$)	Spray applications (\$)	
<i>Summerprince</i>				
10% VO + 1% Tergitol	12663	2079	196	10388
9% SO + 1% Tergitol	16679	2200	198	14281
2% DO + 1% Tergitol	12795	1992	42	10761
<i>Fireprince</i>				
8% SO	15696	548	176	14972
9% VO	11294	398	176	10721
2% DO	15218	405	39	14774
<i>Flameprince</i>				
8% VO	20818	1092	158	19567
2% DO + 1% Tergitol	15874	659	42	15173

CONCLUSIONS

Pre-bloom thinning treatments were variable in efficacy but did increase grower gross returns as much as \$4944/ha in one Vegetoil™ application. However, environment and cultivar interactions resulted in a gross return loss of \$3924 for another Vegetoil™ treatment. These data show that timing, peach cultivar, and likely other factors affect the efficacy of using soybean oil as a flower bud thinner, but the potential to reduce labor costs and increase fruit size is possible.

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