SIX-YEAR RESULTS OF THINNING PEACH FLOWER BUDS WITH ETHEPHON PLUS VEGETOIL®

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ABSTRACT

Early removal of flower buds, flowers or small fruitlets enhances the potential for increased peach fruit size and market value. Experiments were conducted near Clemson, South Carolina to determine the efficacy of combining Vegetoil® (VO), an emulsified soybean oil adjuvant (93% soybean oil), with Ethrel® (E) (a.i. 21.7% ethephon) for pre-bloom killing of peach flower buds. Contender, Cresthaven and Rubyprince trees were treated in 2005 through 2010 (winter months) with treatments consisting of 8-10% VO and E at 25, 50, 75, 100, or 150 ppm depending on year. After 2008, 10% VO plus 75 ppm ethephon was selected as the most consistent combination and used exclusively for 5 application times (i.e., treatments). Three percent Superior oil in December was the control. Flower bud mortality was significantly increased with most treatments in all years. Rates of 75 ppm ethephon or higher and earlier applications (i.e., December) were the most effective. However, irregular and/or excessive thinning resulted in fruit yields significantly less than the control in most years. Fruit size sometimes was increased, but this effect was inconsistent to compensate for the reduced yields.

INTRODUCTION

Thinning is necessary to adjust the number of fruits on the tree so that they will adequately size for commercial acceptance. An important component of maximizing fruit size and yield is time of thinning (Day and DeJong, 1999). This can be done pre-bloom (floral buds), during bloom (flowers), or post-bloom (fruitlets). Yield and fruit size may be increased if thinning is performed before or at bloom, compared with the typical commercial timing of 50 days after full bloom (Stover, 2000). Dormant applications of soybean oil kills weak flower buds and can potentially reduce early competition between flower buds (Myers et al., 1996; Moran et al., 2000). Early thinning is desirable for maximum fruit size but current early thinning options and their benefits are not always reliable or predictable. Therefore, thinning is carried out in a timely but conservative manner (before pit hardening, but later than ideal). Implementing partial early thinning with chemicals like ethephon and/or vegetable oil can reduce follow-up hand-thinning costs, avoid over-thinning due to frost, and increase ultimate fruit size compared to the one-time thinning approach currently done late in the thinning window.

Previous observations with dormant applications of soybean oil (e.g., Vegetoil®) to thin peach flower buds indicate timing influences the amount of flower bud mortality (Reighard unpublished data). Therefore, determining the optimal time to apply soybean oil with ethephon may improve thinning efficiency without overthinning. The objectives of this study were to develop an economical, cost-saving, early partial thinning method using soybean oil, alone or in combination with ethephon, as a dormant oil spray and to determine the optimal time of application.
MATERIALS AND METHODS

Experiments were conducted with mature peach trees [Prunus persica (L.) Batsch] of Contender, Cresthaven, and Rubyprince planted in 1996 and 1998 at the Musser Fruit Research Center near Clemson, South Carolina to evaluate the efficacy of combining Vegetoil® (VO), an emulsified soybean oil adjuvant (a.i. 93% soybean oil; Drexel Corp.), with Ethrel® (E) (a.i. 21.7% ethephon) for pre-bloom killing of peach flower buds. For years (winters) 2005 to 2010, Contender, Cresthaven and/or Rubyprince peach trees were sprayed with treatments consisting of 8-10% VO and ethephon at 25, 50, 75, 100, or 150 ppm depending on year. After 2008, 10% VO plus 75 ppm ethephon was selected as the most consistent combination and used exclusively for 5 application times (i.e., treatments). A 3% dormant petroleum oil (DO) application via an airblast sprayer calibrated at 1403 L/ha (150 gals. per acre) in December was the control except for 2007.

Spray treatments each year consisted of 75.7 L (20 gal.) tank of spray solution (VO, ethephon) with ~ 7.6 L (2 gals.) applied per tree. All Vegetoil® plus Ethrel® treatments were handgun sprayed to drip on all sides of the tree via a 5 horsepower, gasoline-powered engine with a 2-piston pump. Treatments were arranged in a randomized complete block design with 4 replicates, each consisting of four or five 2-tree plots (= treatments). Guard trees were situated between plots to impede drift. All trees were trained to an open-center system.

Prior to beginning spray treatments each winter, ten 1-year-old shoots were randomly selected from each tree and tagged. Shoot length and number of flower buds on each shoot were determined at this time. In mid-March, the number of live flower buds on each shoot was recorded to determine flower bud survival. The number of open flowers was also recorded in March during bloom to determine the percentage of flower buds open on a specific date. Date (Julian days) of full bloom (90% flowers open) for each tree was recorded. In all years, commercial maturity date and fruit set, size and yield were taken. Yield for 2007 was not taken due to a late freeze event.

RESULTS AND DISCUSSION

Bloom was delayed consistently though only slightly with any combination including ethephon (data not shown). Vegetoil® (VO) at 10% with Ethrel® (E) at 100 and/or 150 ppm significantly delayed bloom in Contender and Cresthaven in 2006 and in Cresthaven and Rubyprince in 2007. In 2008, 10% VO plus 75 ppm ethephon but not 50 ppm delayed bloom in Contender and Cresthaven. Rubyprince bloom date was not affected. For 2009, Cresthaven full bloom was delayed by the 10% VO plus 75 ppm ethephon treatment on 3 application dates, but there was no effect on full bloom date for Rubyprince. In 2010, 10% VO plus 75 ppm ethephon delayed initial bloom of Rubyprince and Cresthaven for all spray dates except the last one for Rubyprince. Full bloom for all years was delayed by less than 2 days.

Flower bud mortality was significantly increased with most treatments in all years (data not shown). In 2005, 2006 and 2007, VO (10%) significantly reduced the number of flower buds alive at bloom for Contender and Cresthaven, and the addition of E to the VO spray significantly increased flower bud mortality when compared to the 10% VO application. There were no differences observed among the Rubyprince treatments in 2006, but the addition of 75 and 100 ppm ethephon slightly increased flower bud death in 2007. In 2008, VO reduced Contender, Cresthaven and Rubyprince flower bud survival by 10, 20, and 30%, respectively compared to the DO control and by 20-25, 50-60, and 45-55%, respectively when VO was
combined with different ethephon concentrations. In both 2009 and 2010, 10% VO plus 75 ppm ethephon significantly decreased flower bud number of Rubyprince and Cresthaven on all 5 dates compared to the 3% DO control. The highest flower bud mortality for both cultivars occurred on the earliest (first) application date (treatment).

The VO plus E treatment reduced fruit yield for Contender in 2005 by 43% but increased fruit size by 26% or 55 g (data not shown). In 2006, the VO plus E treatments had no effect on yield for Contender and Rubyprince and only slightly decreased yield for Cresthaven at 100 ppm ethephon. However, Contender and Cresthaven fruit weights were significantly larger by as much as 13 and 33%, respectively. No fruit were harvested in 2007. In 2008, the VO plus E treatments reduced yield by 25-35% in Cresthaven and 45-60% in Rubyprince compared to the DO control. Rubyprince yield was also negatively affected because of a spring freeze. Contender fruit yield was only slightly reduced by the VO plus E treatments. Cultivar mean fruit size increased 7-13% with the VO and E treatments.

In 2009, all 5 treatment dates significantly reduced fruit yield (i.e., overthinned) for both cultivars (data not shown). However, fruit size was not affected (i.e., not increased) with the thinning treatments. Fruit set and crop load was less than normal in 2009 due to poor pollination weather, so control trees did not have much excess crop to thin off and thus overall fruit size was large. In 2010, all treatments reduced fruit yield for Cresthaven and Rubyprince. Yields were numerically lower for all spray treatment dates and significantly lower for Cresthaven and Rubyprince the first and first 3 spray dates, respectively. Fruit size was only slightly affected (i.e., increased) by the earliest VO + E treatment date for Rubyprince, but was significantly increased for Cresthaven in all but one treatment. Increase in fruit size was related to the reduction in crop load, which was excessively thinned for commercial production.

CONCLUSIONS

Six years of results show that rates of 75 ppm ethephon or higher with 10% Vegetoil® and earlier application times (i.e., December) were the most effective in killing peach flower buds. However, unequal and/or excessive thinning resulted in fruit yields significantly less than the control in most years. Fruit size sometimes was increased, but this effect was inconsistent to compensate for the reduced yields. Future work should focus on the period of endodormancy in early to mid-winter to determine why peach flower buds were more sensitive at that time to soybean oil and ethephon. Also adopting better spray technology, which can more evenly distribute and stick the VO and E on the fruiting wood, might reduce uneven thinning throughout the tree structure.

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LITERATURE CITED

