2004 Report to Southern Region Small Fruit Consortium

Title: Evaluation of Wintertime Sprays of Soybean Oil to Delay Flower Bud Phenology and Thin Fruit of Rabbiteye and Southern Highbush Blueberries

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Objectives:

1) To determine if soybean oil sprays after the completion of endodormancy may delay flower bud phenology of rabbiteye and southern highbush blueberries.
2) To determine if the soybean oil treatments may thin flower buds and thus thin fruit.
3) To compare formulations of soybean oil.
4) To evaluate the concentration effects of soybean oil on bloom delay and fruit thinning

Justification: Late winter frost is a primary cause of yield reduction of rabbiteye and southern highbush blueberries. Delay of blueberry bloom by even a few days may reduce crop loss. Our research showed that sprays of 8% to 10% soybean oil in late January to early February in Tennessee can delay peach bloom by up to seven days. The oil sprays also caused peach flower bud mortality in a predictable dose-response relationship. If soybean oil sprays can thin blueberry flower buds, then costs associated with labor to reduce crop load may be reduced.

Our previous research on peach used a soybean oil formulation (TNsoy1) with the adjuvant B-1956. However, the emulsion separated quickly in the spray tank, and the adjuvant was a costly component of the formulation. Our laboratory is making new formulations that are more stable in emulsion than TNsoy1.

Methodologies: Trials comparing the effects of soybean oil formulations and concentrations were conducted on rabbiteye blueberries in two commercial plantings in Tennessee. In Experiment (Expt.) 1, mature (6 ft. pruned height) 'Climax' bushes near Spring City, Tenn. were sprayed to runoff on 10 Feb. 2004 with water (control); 9% a.i. (soybean oil) TNsoy11, TNsoy12, TNsoy13, TNsoy14; or 9% or 12% a.i. (soybean oil) Golden Natur'l (a commercial formulation). The treatments were arranged in a randomized complete (RCB) design with seven replications. In Expt. 2, a similar trial was conducted on large (8-9 ft height) 'Tifblue' plants near Unicoi, Tenn. 'Tifblue' bushes were sprayed to runoff on 11 Mar. with water (control); 9% or 12% a.i. (soybean oil) TNsoy15, TNsoy16; or at 9% or 12% a.i. Golden Natur'l (GN). The treatments were arranged in a RCB design with 5 replications and 2 bushes per plot. The TNsoy formulations were prepared in our laboratory.

Evaluations of the effects of Golden Natur'l concentration were conducted in trials on experiment research stations in Tennessee and North Carolina. In Expt. 3, concentrations of 0, 6, 9, 12, and 15% GN oil were applied on Feb. 11 to three-year-old 'Legacy' Southern highbush plants at the Middle Tenn. Expt. Station (MTES), Spring Hill, Tenn. In Expt. 4, a similar trial using young plants of various Southern highbush cultivars

as replications was conducted at the Mountain Crop Research Station, Fletcher, N.C. Treatments of 0%, 6%, 9%, and 12% GN were sprayed 5 Mar. Another treatment of 6% GN was sprayed on 5 Mar. followed with a second spray of 6% oil on 19 Mar.

Ten to twenty buds/plant were sampled at random from each plant at Fletcher, Spring Hill and Unicoi at about 35 days after treatment. The buds were dissected to determine injury of buds. Flower bud development was evaluated periodically using a scale published by Spiers (1978). Blossom opening (%) was periodically rated starting at first anthesis. The 'Tifblue' trial at Unicoi was discontinued after the farmer pruned the majority of fruit buds off of the large bushes.

Two limbs per plant of 'Climax' at MTES were enclosed in mesh bags before harvest. Fruit were harvested from the limbs at approximately weekly intervals. Mean fruit size and distribution of percentage of total harvest by dates were determined. The yield of 'Legacy' plants at MTES was confounded by bird damage thus not collected. Total yield per plant was collected from the Southern highbush plants at Fletcher.

Results: In Expt. 1, the 9% sprays of each formulation delayed flower bud development and flowering of 'Climax' rabbiteye blueberries. In Expt. 2, the 9% oil sprays of each formulation delayed flower bud development and early spring flowering of 'Tifblue' rabbiteye blueberries. The 12% oil spray further delayed bud development flowering of 'Tifblue' plants. Sprays of TNSoy16 tended to cause the greatest delay. Flower bud development and bloom of the 'Legacy' Southern highbush plants at MTES were significantly delayed with higher rates of soybean oil. While untreated 'Legacy' plants had 55% open bloom on 12 Apr., plants treated with >9% oil had less than 10% open bloom. The flower bud development and early season flowering of Southern highbush cultivars at Fletcher were not delayed by the oil treatments.

The determination of flower bud mortality may indicate the potential of oil treatments to reduce the number of flowers, thus perhaps reducing crop load. In Expt. 1, the increased concentration of Golden Natur'l in sprays only slightly reduced crop-load of 'Climax' plants with little, if any, effect on berry size. In Expt. 3, flower bud mortality was greater at 36 days after treatment on 'Legacy' plants sprayed with higher rates of oil. Plants sprayed with 0, 6%, and >9% oil had 0%, 30% and >70% bud mortality. Plants treated with 12% and 15% oil sprays had an estimated 24% and 13%, respectively, of a normal crop load compared to the estimated 100% crop load on control plants. Similar concentrations of Golden Natur'l did not affect flower bud mortality, crop-load or berry size (across cultivars) of Southern highbush cultivars at Fletcher.

Conclusions: The results were variable in different trials. The different trends may be due to differing plant maturity (age), plant size, crop load, environment factors, plant vigor, flower bud numbers, physiological stage of development, etc. The 'Tifblue' plants in Unicoi were large with dense canopy, and low in vigor. Smaller plants, at a lower elevation, were evaluated last year with more promising results. The trial on Southern highbush plants at Fletcher had less replications; used younger, smaller, and more diverse plants with relatively light potential crop loads; and the treatments were applied at a later date and probably later stage of physiological development than in other trials. A larger, more uniform population (if available) of Southern highbush plants should be evaluated in the future. Sprays of 9% oil of each soybean oil formulation delayed flowering of 'Climax' bushes a few days, and thinned fruit buds. However, yields of the entire plant were not collected. The trial on young 'Legacy' plants at MTES provided useful results. Flower bud development in late winter was significantly delayed (Fig. 1). Bloom opening was delayed by 2 to 6 days, with higher concentrations causing more delay (Fig. 2). Higher concentrations also caused more abortion of flower buds, with ≥ 9% oil causing >70% abortion. However, the bushes were not netted, thus yields were not collected and we could not determine if bud abortion resulted in reduced yield. It would appear in this trial that concentrations between 6% and 9% would be desirable for flower bud delay and thinning. Too high of bud mortality will, of course reduce yield, but determination of an oil dose-response (bud mortality) relationship may provide a means of chemically thinning blueberries in the future.

Impact Statements: Sprays of soybean oil formulations in late winter may provide means by which to delay early anthesis of blueberry flowers and to reduce the number of blueberry flowers and thus reduce crop load.