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Flower Bud Removal with Surfactants for Peach Thinning[1]

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Abstract. **Limb applications of 5% or 10% alkaryl polyoxyethylene alcohols (X-77 or X-45) caused flower bud removal when applied to peach trees [*Prunus persica* (L.) Batsch] with a hand pump sprayer from first pink to 90% bloom. Applications made in late pink or bloom period caused a greater reduction in fruit set than earlier treatments. Applications made at 90% bloom caused some phytotoxicity to the tips of the first small leaves but did not affect the growth of the terminal vegetative primorida or of larger leaves produced on later terminals. Thinning appeared to be commercially acceptable when applied between 30% and 90% bloom. Fruit size at harvest was greater than the unthinned control. Airblast applications of 10% X-77 on the 'Loring' cultivar reduced fruit set about 40%.**

Investigators have shown that surfactants can cause flower bud abscission in *Lilium longiflorum* Thunb. (1, 2). In Easter lilies, X-77 applied at any stage of bud development shortly after flower bud initiation or during visible flower bud development caused flower abortion. Flower buds not aborted produced abnormal flowers (2).

We initiated a series of trials to determine if surfactants would abort peach flower buds. The first treatments were applied when 20–40% of the flower buds were showing first-pink. Cultivars selected for the first-pink sprays were 'Harbrite' and 'Clayton' since they were in a similar stage of bud development and since insufficient numbers of a single cultivar were available for all treatments.

Four limbs were selected and tagged on each of 3 trees for each cultivar and/or timing. Limb 1 and 2 were sprayed with X-77 at 5% and 10%, and on limb 1 and 2 of another 3 trees were sprayed with X-45 in aqueous solutions with a 6 liter hand pump sprayer. The dates and stages of bud development are indicated in Table 1. Treatments were compared to the third limbs as untreated controls. The fourth limb was hand thinned to about 85% of a full commercial crop along with the remainder of the tree on May 26. Fruit numbers, weight, and size measurements were taken near harvest as each cultivar ripened.

Since limb treatments appeared to have an effect on early bud development and fruit set (Table 1), we selected a commercial block of 'Loring' for airblast treatments of X-77 at 0%, 1%, 2%, 5%, and 10%. Treatments were applied on April 8 when 90% of the flowers were open to 5 single whole-tree replicates in a randomized complete block design using an untreated control. Treatments were applied at the rate of 253 liters/ha (165 gal/acre) with a Swanson airblast 3-point hitch sprayer with both fans delivering to one side. Fruit numbers and size were measured on 3 pre-selected limbs per tree prior to hand thinning on May 26. Fruit were not sized later since the experiment was terminated at hand thinning time so that the grower could thin all trees.

Each experiment presented in Table 1 was conducted either on a different cultivar (Table 1, A and B) or on a different set of 3 tree units (Table 1, C, D, E). Data should not be compared among experiments. Three trees thought to be 'Harbinger' (Table 1 F) were three different cultivars ('Harbinger', 'Suncrest' and 'Red Gold') and each cultivar represents a replicate in this experiment. The use of hand gun limb applications have considerable error and limitations which may be associated with dosage, coverage, droplet size, etc; thus more accurate high pressure hand gun applications to whole tree replicates in grower orchards should be made.

Peach flower buds treated at first-pink (Table 1 A and 1 B), as with Easter lily flower buds (2) caused the petals and calyx cup to be deformed and smaller than normal through petal fall. The fruit, however, were not deformed in any way. In addition, flower buds which did not set fruit did not abscise like untreated buds and some remained attached to twigs until fruit were harvested. No phytotoxicity to leaves was observed except in the 90% bloom treatments. In the bloom treatments the tips of the first small leaves became necrotic and approximately 30% of the leaf tip abscissed within 2–3 weeks. The portion of the leaf which remained appeared functional. The vegetative primorida and larger leaves produced after the first and second node were not affected by the treatments.

Table 1. Effect of surfactants on peach fruit set (1981).

Treatment	Rate (%)	Stage of flower development	Date treated	Fruit/limb	Fruit/cm² cross sectional limb area	Fruit wt (g)	Fruit size (cm)
			A. Clayton				
Hand thinned			May 27	27 c[z]	2.8 c	98 c	5.7 b
Control	0	---	---	143 a	20.0 a	52 a	4.8 a
X-77	5	First-pink	April 3	99 ab	13.2 ab	73 ab	5.1 ab
	10	First-pink	April 3	50 bc	5.9 bc	83 bc	5.3 ab
			B. Harbrite				
Hand thinned			May 27	26 b	6.0 b	98 b	5.7 b
Control	0	---	---	156 a	19.9 a	59 a	5.1 a
X-45	5	First-pink	April 3	163 a	22.3 a	56 a	5.0 a
	10	First-pink	April 3	90 b	10.0 ab	68 a	5.2 ab
			C. Harbinger				
Hand thinned			May 27	32 c	7.1 b	79 a	5.4 a
Control	0	---	---	110 a	35.9 a	63 a	5.1 a
X-77	5	30% bloom	April 7	102 a	10.5 b	67 a	5.3 a
	10	30% bloom	April 7	65 b	14.4 b	74 a	5.4 a
			D. Harbinger				
Hand thinned			May 27	36 b	3.5 b	91 c	5.8 c
Control	0	---	---	123 a	15.5 a	60 a	5.1 a
X-45	5	30% bloom	April 7	53 b	5.6 b	82 bc	5.5 b
	10	30% bloom	April 7	55 b	6.2 b	74 b	5.4 ab
			E. Harbinger				
Hand thinned			May 27	44 ab	8.3 a	84 ab	5.6 b
Control	0	---	---	130 a	17.9 a	68 a	5.1 a
X-77	5	90% bloom	April 10	78 ab	10.9 ab	92 b	5.6 b
	10	90% bloom	April 10	29 b	3.2 b	107 b	5.8 b
			F. Harbinger-Suncrest-Red Gold				
Hand thinned			May 27	38 b	3.3 b	119 ab	6.1 b
Control	0	---	---	93 a	10.0 a	89 a	5.5 a
X-45	5	90% bloom	April 10	22 bc	1.9 bc	135 ab	6.4 b
	10	90% bloom	April 10	11 c	0.8 c	148 b	6.6 b

[z]Mean separation within columns and cultivar by Duncan's multiple range test, 5% level.

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An occasional 1-year-old terminal on the inside of the tree was killed by X-45 at the 10% rate (but not at 5%). This should not be of commercial significance.

The 10% rate of X-77 reduced fruit set of 'Loring' trees about 40%. Fruit size, though not statistically different, showed some upward trend. The 10% rate of X-77 caused severe burning of flower buds and some leaf tip injury similar to that found with limb treatments. Additional hand thinning was required on all treatments.

While analyzing data from experiments summarized in Table 1 and 2, we found a highly significant negative correlation between the cross sectional area of the limbs and the fruit number per cross sectional area (Table 1, unthinned control limbs, r = –0.82; Table 2, treatments 1, 2, 3, r = –0.63). Fruit per limb measurements are presented in Table 1 and 2 since small differences in limb diameters increased the variation between limbs of similar volume and reduced statistical separations compared to fruit per cross sectional area.

Table 2. Effect of X-77 on 'Loring' peach flower bud set (1981).

X-77 Rate (%)	Fruit/ limb	Fruit/cm^2 cross sectional limb area	Fruit size (cm)
0	148 a[z]	26 ab	2.34 ab
1	140 a	26 ab	2.39 ab
2	160 a	34 a	2.29 b
5	127 ab	23 ab	2.46 a
10	91 b	20 b	2.46 a

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

Since the airblast application did not appear to be as effective as the hand sprayer treatments, airblast and hand gun applications should be compared in future studies. Further comparisons of rates, compounds, and timing will be required to identify the most cost effective surfactants for use. The potential for these materials appears to be great since many surfactants are exempt from clearance as wetting agents and should require only a minimum of expense in order to obtain the appropriate labels.

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Sprout Control of Nonbearing Peach with NAA[1]

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Abstract. **Naphthaleneacetic acid (NAA) ethyl ester formulation at 0.25% plus 20% flat white latex paint applied to nonbearing peach [*Prunus persica* (L.) Batsch] tree trunks reduce sprouting, had no effect on tree growth, and did not induce gummosis.**

Removal of undesirable vegetative growth on nonbearing peaches is needed to insure proper development of scaffolds and reduce possible herbidical uptake. Extensive work with NAA has proven effective in eliminating sprouting of various crops (2, 4, 5, 6, 8). NAA on peaches as a sprout inhibitor following summer pruning proved to be phytotoxic (3). Earlier work by the authors concluded 0.5% NAA with latex on 1st leaf 'Flordaking' resulted in equivalent sprout inhibition as 1.0% but with no tree mortality (1). Though this previous study found no significant effect on tree growth from a single NAA application; NAA usage to train nonbearing peach trees should extend for 2 years. The dual purpose of this experiment was to: 1) determine if 0.25% NAA would adequately inhibit sprouting and reduce gummosis on 1st and 2nd leaf trees compared to 0.5%, and 2) determine if 2 consecutive annual applications would affect tree growth.

An ethyl ester formulation of NAA (A-112)[3] at 0.25 or 0.5% and 20% exterior latex paint was applied with a hand sprayer February 8, 1980. Care was taken to apply the minimum amount of material that insured coverage. NAA was applied from the soil line up the trunk 46 cm to 1st leaf 'Rio Grande' peach (planted January 18) in a randomized complete block design of 3 trees per replication and 3 replications per treatment. 'Rio Grande' vegetative buds were 1–2 cm long at application. Two other treatments were included. The first was removal of all sprouts from the soil line up 46 cm, 0, 1, 3, 5, 7 and 9 months after application. The second treatment was no removal of sprouts during the evaluation period.

Treatments of 0.25 and 0.5% NAA plus 20% exterior latex in 1980 were superimposed over 1979 treatments of 0.5 and 1.0% and paint, respectively, on 2nd leaf 'Flordaking' peach with the same statistical design and application date as above. 'Flordaking' trees had buds which were at first swell during treatment. The control trees were pruned once on May 8th. This was to determine the effect pruning had on sprouting.

Tree height and trunk diameter were measured 0, 3, 5, 7 and 9 months after treatment for both cultivars. The number of sprouts from the soil line up 46 cm on 'Rio Grande' and on the trunk and 30.5 cm of 3 major scaffold branches per tree of 'Flordaking' and a subjective rating of 0 (no gummosis) to 10 (severe gummosis) were determined 1, 3, 5, 7 and 9 months following application.

The 0.5% NAA concentration caused tree mortality by the 5th month to 78% of the 'Rio Grande' trees and so is not discussed below. There was no difference among the remaining treatments in tree height or diameter throughout the duration of the experiment (Table 1). Gummosis was not significant at anytime during the experiment. An average of 0.1 sprouts or less per tree resulted from 0.25% NAA. The number of sprouts of the trees without sprout removal naturally decreased during the experiment as it did in another study (1).

Trunk diameter and tree height of the 'Flordaking' trees were not statistically different for either NAA treatment compared to the check trees for the duration of the experiment (Table 2). Some NAA-induced gummosis 1 month after application was evident but it was not statistically different from the check. Gummosis was reduced to 0 by the 9th month rating date. The number of sprouts was significantly reduced by both NAA concentrations over the untreated check for all ratings except the fifth month. This was due to the manual sprout removal on the check trees following the third month's rating. This single pruning of these trees greatly reduced the number of sprouts while in an earlier study on 2 different cultivars in 2nd leaf, unpruned check trees had an 18 to 74% increase in sprouting with no effect on vegetative growth from the 3rd to the 7th month (1). There was no advantage of the 0.5% concentration in control of sprouts over 0.25% NAA.

Tree death from the 0.5% concentration and the excellent sprout control with only slight gummosis resulting from the 0.25%

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