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# Control of Basal Sprout Regrowth in 'Bradford' Pear with NAA[1]

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## Abstract

Suppression of basal sprout development in *Pyrus calleryana* Decne. 'Bradford' was achieved with naphthaleneacetic acid (NAA) applied as a dormant, directed trunk spray. Nearly complete sprout control was achieved with all test rates (2875 to 11,500 ppm) through 120 days after treatment (DAT), with a slight increase in total sprout number occurring between 120 and 210 DAT. The 5750 ppm rate provided optimal sprout control and resulted in 15% more increase in tree height and 20% more increase in caliper than in control trees. No phytotoxicity was observed on trees in any treatment.

**Index words:** auxin, naphthaleneacetic acid, growth regulator.

**Growth regulator used in this study:** Tre-Hold RTU (NAA), 1-naphthaleneacetic acid.

**Species used in this study:** 'Bradford' pear (*Pyrus calleryana* Decne. 'Bradford').

## Significance to the Nursery Industry

Considerable expense is incurred in hand pruning basal sprouts from budded 'Bradford' pears. Although not labeled for 'Bradford' pear, a dormant application of NAA as a directed trunk spray at 2875 to 11,500 ppm provided excellent sprout control; application of NAA at 5750 ppm provided optimal sprout control and increases in tree height and caliper compared to control trees. Although all sprouts were not controlled by NAA application, the few that did form could quickly and easily be removed by hand.

## Introduction

'Bradford' pear (*Pyrus calleryana* Decne. 'Bradford') is typically propagated from stem cuttings or by budding. Trees grown on their own roots have been reported to lack a fibrous, well-branched root system, making them difficult to transplant and prone to lodging (4). The vast majority of 'Bradford' pears are therefore budded in the field onto callery pear seedlings in August. Shoot growth from the rootstock is removed above the bud union at the end of the following winter. Unbranched 1.2 to 2.4 m (4-8 ft) budded whips are typically dug bare root at the end of the first growing season and sold based on height to wholesalers for growing on or re-spaced in the field. Terminal shoots of whips are removed to induce branching; however, lateral shoots on the lower 61 to 91 cm (2 to 3 ft) of trunk are undesirable. During the growing season, numerous shoots or sprouts develop on the lower trunk, especially below the bud union, necessitating repeated hand removal.

Naphthaleneacetic acid (NAA) has been effective in controlling watersprouts and rootsuckers on several fruit and nut crops (5, 6, 9, 10), grapevines (11), and woody landscape plants (1, 3, 7). NAA is currently labeled as Tre-Hold (Amvac Chemical Corp., Newport Beach, CA) to control sprouts and sucker growth on apples, olives, pears, non-bearing citrus and nectarines, and 12 woody landscape tree species. NAA is not labeled for use on 'Bradford' pear. The objective of this study was to evaluate the effectiveness of NAA in controlling basal sprout development on 'Bradford' pear following terminal shoot removal.

## Materials and Methods

Bare root, budded [10 cm (4 in) bud union height, *Pyrus calleryana* understock], 1.4- to 1.7-m (4.5 to 5.5 ft) tall, unbranched whips of 'Bradford' pear were potted on February 26, 1997, into 56.8 liter (#15) containers of 100% milled pine bark. The growth medium was amended per $m^3$ ($yd^3$) with 3.6 kg (6 lb) dolomitic limestone, 1.2 kg (2 lb) gypsum and 0.9 kg (1.5 lb) Micromax (Scott's Chemical Co., Marysville, OH). Containers were topdressed at potting and at 60 day intervals with 43.5 g (15.3 oz) of 12N–2.6P–5K (Nursery Special 12–6–6). Plants were grown outdoors at the Ornamental Horticulture Substation, Mobile, AL, in full sun and watered as needed by hand.

On March 11, 1997, the terminal shoot of each whip was pruned at 125 cm (49.2 in) above the substrate surface, and NAA (ethyl ester formulation, Tre-Hold RTU, 1.15% a.i., Amvac Chemical Corp., Los Angeles, CA) was applied as a directed spray to the lower 75 cm (29.5 in) of each trunk using a trigger-type hand sprayer. When pruned, terminal buds were swollen but no leaves had emerged. Treatments were NAA at 0, 2875, 5750, 8625 and 11,500 ppm a.i.; these treatments were equivalent to Tre-Hold RTU at 0 (water), 0.25×, 0.5×, 0.75× and 1×, respectively. Weather conditions at treatment were clear, 26.7C (80F), and 45% relative humidity. Treatments were applied in a 200-ml (6.8 oz) volume to 10 single-plant replications in a completely randomized design that was blocked by initial caliper 15.2 cm (6 in) above the bud union. Initial caliper ranged from 1.1 to 1.9 cm (0.4 to 0.7 in). Sprout numbers and lengths from the lower 75 cm (29.5 in) of trunk both above and below the bud union were recorded at 30, 60, 120, 180 and 210 days after treatment (DAT). Plant height and caliper 15.2 cm (6 in) above the bud union were measured at 240 DAT. Data analyzed for caliper

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Table 1. Sprout numbers on 'Bradford' pear treated with NAA as Tre-Hold RTU.

| NAA conc. (ppm) | Trunk sprout number[z] DAT[x] | | | | | Rootstock sprout number[y] DAT | | | | | Total sprout number DAT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 | 60 | 120 | 180 | 210 | 30 | 60 | 120 | 180 | 210 | 30 | 60 | 120 | 180 | 210 |
| 0 | 5.2 | 5.3 | 5.3 | 5.3 | 5.3 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 6.8 | 6.9 | 6.9 | 6.9 | 6.9 |
| 2875 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.6 | 0.6 | 0.6 | 0.9 | 1.0 | 0.9 | 0.9 | 0.9 | 0.9 | 1.4 |
| 5750 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 |
| 8625 | 0.1 | 0.2 | 0.2 | 1.1 | 1.2 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 1.2 | 1.3 |
| 11,500 | 0.0 | 0.0 | 0.0 | 0.8 | 0.8 | 0.0 | 0.0 | 0.4 | 1.4 | 1.4 | 0.0 | 0.0 | 0.4 | 2.2 | 2.2 |
| Significance[w] | | | | | | | | | | | | | | | |
| Linear | *** | *** | *** | *** | *** | *** | *** | ** | NS | NS | *** | *** | *** | *** | *** |
| Quadratic | *** | *** | *** | *** | *** | * | ** | ** | ** | * | *** | *** | *** | *** | *** |
| Cubic | *** | *** | *** | *** | *** | NS | NS | NS | NS | NS | *** | *** | ** | NS | NS |

[z]Sprouts that developed on the lower 7.5 cm (29.5 in) of each trunk above the bud union.

[y]Sprouts that developed from the rootstock.

[x]DAT = days after treatment.

[w]Nonsignificant (NS) or significant regression response at $P \leq 0.05$ (*), 0.01 (**) or 0.001 (***).

was the difference in caliper at 240 DAT and time of treatment. Single degree of freedom contrasts were used to test the rate response to NAA concentration at given times. Numerous missing values for sprout length and rootstock sprout dry weight (where no sprouts had developed) prevented the use of contrasts; hence, treatment means were separated by the Least Significant Difference (LSD) test.

## Results and Discussion

Trunks of trees sprayed with Tre-Hold developed an oil soaked, darkened appearance following treatment that increased with concentration but diminished with time. Appearance was apparently due to the emulsion wax carrier but did not detract from overall plant quality. No other abnormal symptoms were observed on treated or non-treated trees. Sprouts on the trunk and rootstock and total sprout number decreased with increasing NAA concentration; highest order significant regression responses were either quadratic or cubic in all cases (Table 1). The most dramatic reduction in sprout numbers occurred between control plants and those receiving the lowest rate of NAA, with similar levels of sprout control for all rates. These results are consistent with previous studies showing excellent sprout control with NAA (1, 3, 5, 6, 7, 9, 10, 11).

Essentially all sprouts that developed on control plants were present 30 DAT with no change thereafter; although not compared statistically, more sprouts developed on trunks than on rootstocks. Very few trunk or rootstock sprouts developed on treated plants throughout the study, although there was a noticeable increase in total sprout numbers between 120 and 180 DAT in plants receiving the two highest NAA rates. This response may in part relate to the more viscous nature of solutions of higher concentrations. Spray solutions of higher concentrations foamed more and spread less readily when applied than those of lower concentrations which may have reduced coverage. NAA is not translocated when applied to uncut bark (2) necessitating thorough coverage for complete

Table 2. Sprout length on 'Bradford' pear treated with NAA as Tre-Hold RTU.

| NAA conc. (ppm) | Trunk sprout length (cm)[z] DAT[x] | | | | | Rootstock sprout length (cm)[y] DAT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 30 | 60 | 120 | 180 | 210 | 30 | 60 | 120 | 180 | 210 |
| 0 | 12.8a[w] | 29.0a | 30.3a | 32.8 | 33.7 | 7.7a | 17.0a | 23.3a | 29.5a | 29.6b |
| 2875 | 0.3b | 0.6b | 1.0b | 3.3 | 13.3 | 0.6a | 10.5a | 15.2a | 15.1a | 31.2b |
| 5750 | —[v] | — | — | 3.7 | 29.3 | — | — | — | — | — |
| 8625 | 0.3b | 0.3b | 2.3b | 8.2 | 21.2 | — | — | 38.0a | 38.0a | 38.5b |
| 11,500 | — | — | — | 9.4 | 35.4 | — | — | 39.8a | 46.3a | 92.8a |
| Significance[u] | | | | | | | | | | |
| Linear | — | — | — | * | NS | — | — | — | — | — |
| Quadratic | — | — | — | * | NS | — | — | — | — | — |
| Cubic | — | — | — | NS | NS | — | — | — | — | — |

[z]Mean length of sprouts that developed on the lower 75 cm (29.5) of each trunk above the bud union.

[y]Mean length of sprouts that developed from the rootstock.

[x]DAT = days after treatment.

[w]Regression analysis not possible due to the number of missing values; mean separation by LSD at P = 0.05.

[v]No sprouts developed on plants in this treatment.

[u]Nonsignificant (NS) or significant regression response at $P \leq 0.05$ (*).

Table 3. Sprout dry weight, tree height and change in caliper of 'Bradford' pear 240 days after treatment with NAA as Tre-Hold RTU.

| NAA concn. (ppm) | Sprout dry weight (g) | | | Tree height (cm) | Caliper[x] change (mm) |
|---|---|---|---|---|---|
| | Trunk[z] | Rootstock[y] | Total | | |
| 0 | 60.3 | 5.6b[w] | 66.0 | 168 | 8.6 |
| 2875 | 3.2 | 9.3b | 12.5 | 188 | 8.7 |
| 5750 | 6.7 | —[v] | 6.7 | 193 | 10.3 |
| 8625 | 12.7 | 2.0b | 12.7 | 191 | 10.0 |
| 11,500 | 16.4 | 52.1a | 68.5 | 183 | 7.8 |
| Significance[u] | | | | | |
| Linear | *** | — | NS | NS | NS |
| Quadratic | *** | — | *** | ** | * |
| Cubic | *** | — | NS | NS | NS |

[z]Dry weight/plant of sprouts that developed on the lower 75 cm (29.5 in) of each trunk above the bud union.

[y]Dry weight/plant of sprouts that developed from the rootstock.

[x]Difference in caliper 15.2 cm (6 in) above the bud union when treated and 240 days later.

[w]Regression analysis not possible due to the number of missing values; mean separation by LSD at P = 0.05.

[v]No sprouts developed on plants in this treatment.

[u]Nonsignificant (NS) or significant regression response at $P \leq 0.05$ (**), 0.01 (**) or 0.00 (***).

sprout control on severely pruned trees or on trees that normally produce abundant sprout growth on the trunk or scaffold limbs (8). Larger application volumes than the 20 ml (0.7 oz) per tree may have provided more complete sprout control, especially in plants receiving the two highest concentrations.

Trunk sprout length was greater at 30, 60 and 120 DAT in control plants than in treated plants that formed sprouts and decreased quadratically at 180 DAT as rate increased (Table 2). However, between 180 and 210 DAT, elongation of sprouts in treated plants accelerated such that sprout lengths were similar among treatments at 210 DAT. In plants where sprouting from rootstocks occurred, sprout lengths were similar among treatments through 180 DAT. Between 180 and 210 DAT sprout length doubled in plants that had received the highest NAA rate; at 210 DAT average sprout length was three times that of control plants.

Sprout dry weights at 240 DAT mirrored sprout length data at 210 DAT. Dry weight per plant of trunk sprouts decreased with low NAA rates and increased with higher rates. Trunk sprout dry weight with the lowest and highest NAA rates were 95% and 73%, respectively, less than that of control plants. Total sprout dry weight followed a similar trend except at the highest NAA rate in which dry weight was 4% more than that of control plants. Rootstock sprout dry weight was similar among treatments that formed sprouts except with the highest NAA rate in which dry weight exceeded that of control plants by 830%.

Tree height and change in caliper responded quadratically to increased NAA rates; both increased up to 5750 ppm NAA before decreasing at higher rates (Table 3). With 5750 ppm, trees were 15% taller and increased 20% more in caliper than control plants. With the highest NAA rate, trees were 9% taller but change in caliper was 9% less compared to control plants. The stimulatory effects on tree height and change in caliper were inversely related to total sprout dry weight. Perhaps by channeling less photosynthate into developing sprouts, more was available for height and caliper increase in treated trees.

Results of this study indicate that NAA at concentrations less than that in the Tre-Hold RTU formulation (1.15% ai) can provide excellent control of basal sprout in 'Bradford' pear. Concomitant to excellent sprout control, which should reduce expense incurred is hand pruning, was an increase in tree height and caliper with an application of NAA at 5750 ppm.

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