Controlling Growth in the Top of Dwarf Trees

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Successful growing of dwarf apple trees requires control of both vegetative and reproductive growth. If trees grow too tall, it seems natural to remove the excessive growth with dormant pruning. The result often is a vigorous, vegetative response and no fruiting in the top of the tree. Over the last several years, we have studied some alternatives, including bending, scoring, and ringing. All work to some degree to reduce vegetative growth and potentially reduce the need for pruning and the subsequent disruption of the balance of vegetative and reproductive growth in the top of the tree.

A few Massachusetts growers and Jon Clements attended the IDFTA-sponsored tour to the tree-fruit-growing regions of Italy in the winter of 2004. They noticed that orchardists were using naphthalene acetic acid (NAA) mixed in a flexible pruning paint as a way to suppress growth in the top of high-density, dwarf apple trees. Mo Tougas (Tougas Family Farm) was on the tour and suggested that we give it a try under our conditions. Therefore, four trials at the UMass Cold Spring Orchard Research & Education Center began in 2004, with the objective of determining the best way to control vegetative growth in the tops of dwarf trees and to particularly determine if high concentrations of NAA may be effective.

Materials & Methods

All trees used in these studies were planted in May 2002 (Orchard Block B3) and trained as super spindles. Spacing was 2 feet x 10 feet. The year of treatment (2004) was the third leaf of these trees. See the previous article to see additional details of this super-spindle block. At the initiation of the experiments, each tree was marked with a dot of red paint at about 5.5 feet from the ground (in 2-year old wood). All treatments were applied immediately above this point or to the whole tree above. Trunk cross-sectional area was also determined at this point, and all growth, set, and bloom were assessed above this height. Total growth produced in 2003 above the treatment point was used to allocate trees in to blocks in the spring of 2004.

The first experiment utilized 20 Cameo/G.16 trees. Treatments included an untreated control. NAA was applied at 1.5% in standard, interior, white, latex paint as a 3-inch wide band completely around the trunk. The source of NAA was Tre-hold Sprout Inhibitor A112 (15.1% NAA) provided by Amvac Chemical Corporation (also sold by Monterey Chemical Company as Sucker Stopper Concentrate). Ethephon was applied to the top of trees at 500 ppm (1.7 pints/100 gallons) with 0.1% Regulaid. Apogee was applied to the top of trees at 250 ppm (12 ounces/100 gallons) with 0.1% Regulaid and 0.25% Choice (1 quart/100 gallons). The last treatment was a single score made with a linoleum knife completely through the bark (to the wood) and encircling the trunk. NAA, Apogee, and scoring were applied at full bloom on May 13, 2004, and ethephon was applied 1 week later on May 20, 2004.

The second experiment utilized 30 Brookfield Gala/M.9 NAKBT337. Treatments included an untreated control and four NAA treatments, all at 1.5%. All NAA treatments were applied as 3-inch bands encircling the trunk. The first was NAA in water with 0.1% Regulaid. The second was in water with 1% Pentra-Bark (a bark penetrating surfactant). The third was in standard, interior, white, latex paint, and the last was in interior, texture, latex paint (used to create textured surfaces). All treatments were applied at full bloom on May 13, 2004.

The third experiment utilized 30 Buckeye Gala/G.16. Treatments included an untreated control and four NAA treatments, all at 1.5% in standard, interior, white, latex paint. Differences were in the width of the band applied to the trunk: 1 inch, 2 inches, 3 inches, and 4 inches wide. Applications were all made at full

Table 1. Fruit set and growth in 2004 and bloom in 2005 as affected by treatments applied to the tops of super spindle apple trees at or near bloom in 2004 (third leaf).

Treatment	Fruit set 2004 (no./cm^2 TCA)	Leader growth (cm)	Total growth (cm)	Return bloom (2005, no./cm^2 TCA)		
				Spur	Lateral	Total
Cameo/G.16						
Control	3.8 bc	56 a	643 a	4.1 b	1.5 a	5.6 a
NAA in latex paint – 3" band	5.1 ab	51 ab	420 ab	4.9 b	4.5 a	9.4 a
Ethephon in water with Regulaid	6.8 ab	51 ab	476 a	4.1 b	0.3 a	4.4 a
Apogee in water with Regulaid & Choice	1.0 c	13 c	236 b	9.3 a	0.2 a	9.5 a
Score	8.5 a	43 b	480 a	3.7 b	0.7 a	4.4 a
Brookfield Gala/M.9 NAKBT337						
Control	5.0 a	34 a	503 a	19.4 a	39.0 a	58.4 a
NAA in water with Regulaid – 3" band	7.2 a	35 a	435 a	15.7 a	30.1 a	45.7 b
NAA in water with Pentra-Bark – 3" band	5.2 a	38 a	448 a	13.6 a	30.2 a	43.8 b
NAA in latex paint – 3" band	6.8 a	35 a	352 a	16.7 a	29.3 a	46.0 b
NAA in texture latex paint – 3" band	7.4 a	33 a	465 a	14.3 a	29.1 a	43.4 b
Buckeye Gala/G.16						
Control	2.8 a	42 a	580 a	11.2 a	15.3 a	26.5 a
NAA in latex paint – 1" band	3.3 a	38 a	596 a	13.8 a	24.0 a	38.9 a
NAA in latex paint – 2" band	3.0 a	44 a	488 a	12.5 a	15.6 a	28.2 a
NAA in latex paint – 3" band	3.8 a	34 a	440 a	12.1 a	17.9 a	30.1 a
NAA in latex paint – 4" band	2.1 a	35 a	452 a	11.9 a	14.4 a	26.3 a
Redmax/B.9						
Control	8.3 a	41 a	284 a	23.2 a	12.8 a	36.0 a
NAA in water with Regulaid – 3" band	6.3 a	31 a	252 a	18.8 a	8.2 a	27.0 a
NAA in water with Sylwet – 3" band	7.1 a	35 a	199 a	21.5 a	9.2 a	30.7 a
NAA in latex paint – 3" band	7.4 a	29 a	152 a	23.7 a	9.2 a	33.0 a
NAA in grafting compound – 3" band	5.8 a	32 a	178 a	14.2 a	7.5 a	21.7 a
Cultivars Combined						
Control	5.1 a	42 a	490 a	15.4 a	18.6 a	34.0 a
NAA in latex paint – 3" band	5.8 a	36 b	334 b	15.2 a	16.2 a	31.4 a

All NAA treatments were at 1.5% and were applied at full bloom (May 13, 2004). Regulaid and Sylwet were at 0.1%, and Pentra-Bark was at 1%. Latex paint was standard, white, interior latex, and texture latex was white, interior paint used to create textured surfaces. Apogee was applied at full bloom at 250 ppm (12 ounce/100 gallons) along with Choice at 0.25% (1quart/100 gallons). Ethephon was applied one week after full bloom (May 20, 2004) at 500 ppm (1.67 pints/100 gallons). All treatment bands were applied at about 5.5 feet above ground in 2-year-old wood. Scoring was performed at the same point, and Apogee and ethephon were applied to all foliage above the same point. Means within cultivar and column not followed by the same letter are significantly different at odds of 19 to 1.

bloom on May 13, 2004.

The fourth experiment utilized 30 Redmax/B.9. Treatments included an untreated control and four NAA treatments, all at 1.5% and applied as 3-inch bands around the trunk. The first was in water with 0.1% Regulaid. The second was in water with 0.1% Sylwet. The third was in standard, interior, white, latex paint, and the fourth was in black grafting compound. All were applied at full bloom on May 13, 2004.

Final fruit set was assessed in the summer of 2004. During the winter of 2005, all shoot growth was measured, and bloom was counted in the spring of 2005.

Results & Discussion

Table 1 presents all of the results from these four experiments. In the Cameo experiment, Apogee reduced fruit set, leader growth, and total shoot growth and increased return bloom on spurs. Scoring enhanced fruit set and reduced leader growth. In the Brookfield Gala experiment, the NAA treatments did not affect fruit set or growth significantly, but reduced total return bloom, primarily through a reduction in lateral bloom (on 1-year-old wood). In the Buckeye Gala and Redmax experiments, NAA treatments did not affect any measurement significantly.

Looking at these experiments individually, it is possible to take home the message that NAA does not have an impact on growth, at least when applied in the manners used here. If you study the means, however, there appears to be a numerical, even though not statistically significant, reduction in growth caused by the NAA treatments. The lack of statistical significance likely occurred due to a relatively high degree of variability and small number of replications in all of these experiments. In an attempt to come to terms with this trend and variability, data for the control treatment and NAA in latex paint (3-inch band) were combined across cultivar, since every experiment had these two treatments. When assessed in total, the NAA treatment significantly reduced leader growth (-14%) and total growth (-32%) in the tops of these trees. Set and bloom were not affected. The effect on total growth is likely substantial enough to make the treatment worthwhile, but it is also possible that the primary effect on growth occurs in subsequent years rather than the year of treatment (as suggested by Mo Tougas). One of the visible responses to these treatments is that the trunk under the application swells. The swelling is occurring primarily in the bark and phloem area. It is conceivable that the altered tissues disturb normal flow of materials through the vascular system at the point of application, possibly acting like a score or ring.

Additional work is beginning in 2005, first of all to follow the trees' responses to 2004 treatments, but additional treatments are also planned, including application to 1-year-old wood versus 2-year-old wood and use of materials that may enhance absorption of NAA.

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