Can You Reduce Tree Height of Super Spindle Apple Trees with Pruning? Naphthalene Acetic Acid May Help

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We have presented several *Fruit Notes* articles (the most recent in Summer, 2006) describing the results of experiments studying the potential growth-reducing effects of naphthalene acetic acid (NAA) mixed with paint and applied as a band to the central leader of super spindle apple trees. If utilized on young wood and before the tree reaches its final height, 1.5% NAA in paint is very effective at slowing the growth of the central leader, making it much easier to keep the tree's height within the constraints of the system. Unfortunately, when this or other growth-controlling techniques are not used, trees can often exceed their optimal height, causing significant shading on the lower parts of trees in adjacent rows.

The only way that overgrown trees can be brought back down to their optimal height is through some type of pruning or breaking. If the trees are simply stubbed back into older wood during the dormant season, the general response is to grow vigorous unproductive wood which needs to be removed later. This problem is why modern, high-density systems, such as the super spindle and tall spindle, discourage this kind of pruning.

So what can you do when faced with overly tall trees in a super spindle or tall spindle training system? To help answer this question, we conducted a study in 2007 at the UMass Cold Spring Orchard Research & Education Center in Belchertown, Massachusetts, and the Rutgers Snyder Research & Extension Farm in Pittstown, New Jersey. Five-year-old Cameo/G.16, Buckeye Gala/G.16, and Golden Supreme/M.9 Pajam 2 trees in both Massachusetts and New Jersey and Lindamac/M.9 NAKBT337 trees in New Jersey were used for this study. All trees were trained as super spindles at an in-row spacing of 2 feet. All trees also had exceeded their optimal height and required containment.

The optimal pruning location (appropriate tree-height reduction down to a reasonably weak lateral branch) was identified for all trees in the experiment. One tree within each replication was not pruned (UTC). For another tree in each replication, the leader was stubbed at the optimal location (PRN). For the last tree in each replication, the leader was stubbed, and 1.5% NAA (manufactured by AMVAC Chemical Corporation and marketed as Sucker Stopper Concentrate by Monterey Chemical Company) mixed in Tanglefoot Tree Wound and Grafting Compound was applied to the cut surface and to about 1 inch down the central leader immediately below the cut (PRN+NAA). Treatments were performed between the green tip and pink stages of development in April. This arrangement of three treatments were replicated between five and nine times, depending on location and variety.

Table 1. Leader and total growth (cm) originating from the five branches immediately below the pruning cut or below the projected cut location in the case of the untreated control.[z]

	New Jersey		Massachusetts	
Treatment	Leader	Total	Leader	Total
		Cameo		
UTC	18 b	65 b	46 b	206 b
PRN	119 a	439 a	286 a	568 a
PRN+NAA	4 b	11 b	94 b	510 a
		Buckeye Gala		
UTC	42 b	91 b	48 b	124 c
PRN	271 a	791 a	128 a	304 a
PRN+NAA	73 b	275 b	62 b	218 b
		Lindamac		
UTC	5 b	39 b	---	---
PRN	79 a	235 a	---	---
PRN+NAA	30 b	94 b	---	---
		Golden Supreme		
UTC	28 b	146 b	66 ab	314 a
PRN	168 a	583 a	126 a	322 a
PRN+NAA	113 ab	466 a	20 b	136 a

[z] Means within variety and column not followed by the same letter are statistically different at odds of 19 to 1.

After the 2007 growing season, all new shoots were measured from the five limbs immediately below the optimal pruning location (note that there was not pruning at that location in UTC). The topmost limb is referred to as the leader, since in the pruning treatments (PRN and PRN+NAA) it was the new leader.

The results show clearly that NAA can reduce the excessive growth which occurs after pruning (Table 1). The nature of the response varied from variety to variety and from location to location. Specifically, Cameo trees responded to pruning with about 6 times the growth from the leader and 6 times and 2.5 times the total growth from the five measured limbs in New Jersey and Massachusetts, respectively. NAA application to the pruned trees almost eliminated new growth in New Jersey, and most prominently near the cut (Table 2). In Massachusetts, NAA reduced leader growth by two thirds to only about double the control, but

total growth of the five limbs was not significantly reduced. A closer look at the distribution (Table 3) shows that NAA reduced the response of the leader (branch 0) and branch 1, had no impact on branch 2, and appeared to stimulate growth of branches 3 and 4. The latter stimulation was not statistically significant, but should be studied further.

For Buckeye Gala, both leader and total growth were stimulated dramatically by pruning, particularly in New Jersey (Table 1). That stimulation was largely mitigated by NAA (Table 1), with similar responses in Massachusetts and New Jersey and through the five measured limbs (Tables 2 and 3).

Lindamac in New Jersey likewise, responded to pruning with significantly more growth, but NAA reduced the response significantly (Tables 1 and 2).

The response of Golden Supreme to the treatments varied somewhat. In both locations, NAA reduced the impact of pruning (Table 1), In New Jersey, the effect was modest at best (Table 2). In

Table 2. Total growth (cm) originating from the branches immediately below the pruning cut or below the projected cut location in the case of the untreated control. Branch 0 is the branch at the cut, Branch 1 is the next one progressing downward, Branch 2 is the next one down the trunk, etc. Data from New Jersey only.[z]

Treatment	Branch 0	Branch 1	Branch 2	Branch 3	Branch 4
			Cameo		
UTC	18 b	8 b	11 b	15 a	13 a
PRN	112 a	75 a	50 a	70 a	76 a
PRN+NAA	6 b	0 b	5 b	28 a	17 a
			Buckeye Gala		
UTC	41 b	11 b	22 b	4 b	12 b
PRN	277 a	141 a	102 a	120 a	76 a
PRN+NAA	73 b	27 b	41 b	44 ab	76 a
			Lindamac		
UTC	5 b	12 a	5 b	11 a	6 b
PRN	70 a	46 a	20 a	22 a	37 a
PRN+NAA	30 b	29 a	14 ab	9 a	12 b
			Golden Supreme		
UTC	28 b	30 a	28 a	26 b	35 a
PRN	167 a	93 a	54 a	115 a	80 a
PRN+NAA	113 ab	67 a	80 a	98 ab	96 a

[z] Means within variety and column not followed by the same letter are statistically different at odds of 19 to 1.

Table 3. Total growth (cm) originating from the branches immediately below the pruning cut or below the projected cut location in the case of the untreated control. Branch 0 is the branch at the cut, Branch 1 is the next one progressing downward, Branch 2 is the next one down the trunk, etc. Data from Massachusetts only.[z]

Treatment	Branch 0	Branch 1	Branch 2	Branch 3	Branch 4
			Cameo		
UTC	46 b	24 b	28 a	31 a	76 a
PRN	286 a	86 a	76 a	54 a	67 a
PRN+NAA	94 b	60 ab	76 a	131 a	150 a
			Buckeye Gala		
UTC	48 b	24 a	22 a	14 b	16 a
PRN	128 a	46 a	36 a	58 a	35 a
PRN+NAA	62 b	61 a	32 a	21 b	41 a
			Golden Supreme		
UTC	66 ab	64 a	92 a	68 a	24 a
PRN	126 a	51 a	54 a	46 a	45 a
PRN+NAA	20 b	22 a	29 a	23 a	41 a

[z] Means within variety and column not followed by the same letter are statistically different at odds of 19 to 1.

Massachusetts, on the other hand, the growth of branch 0 was reduced to about one third of the unpruned treatment. Likewise, the growth of the lower branches after NAA treatment was numerically less than the pruned treatment and the control (Table 3).

It is clear from this research that NAA can reduce the undesirable response to pruning. More work needs to study varietal differences, appropriate concentrations, and long-term development of treated trees.

At this point, we can recommend reasonably comfortably the use of 1.5% NAA in tree-wound paint applied directly to pruning cuts in the spring. The concentrated NAA originally sold by AMVAC Chemical Corporation as Tre-hold Sprout Inhibitor A-112 is now available as Sucker Stopper Concentrate from Monterey Chemical Company. If you use this approach, realize that in some cases, reductions in growth may be minimal and in other may be dramatic.

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