Growth Control in Eastern Thornless Blackberry with NAA

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Abstract. NAA at 0.25% to 1.0% applied in late May on the basal portion of thornless blackberry (*Rubus*, subgenus *Eubatus*) primocanes inhibited lateral shoot growth in the treated area and reduced the number of primocanes. However, regrowth occurred near or below ground from axillary buds not contacted by NAA. Rates of (0.25% and 0.12570 NAA did not affect the terminal or lateral growth above the treated area. The reduced number of basal lateral shoots facilitated machine harvesting. Chemical name used: naphthaleneacetic acid (NAA).

Eastern thornless blackberries are highly productive, with the potential of high-quality fruit for the processed food industry. Development of an effective machine-harvesting system is important to expedite commercialization of this crop. The eastern thornless

blackberry is semi-erect and vigorous and therefore requires a trellis. Using a prototype bramble harvester, we demonstrated that 80%

or more of the mature fruit trained to a trellis can be detached by mechanically shaking the vines (Peterson et al., 1989).

The primocane growth of eastern thornless blackberry plant is excurrent and produces much lateral growth at the base. By the end of summer, a blackberry plant may have as many as 10 primocanes longer than 2 m, and each cane can have several basal laterals. In developing the machine harvest system, it became necessary to remove basal lateral shoots to limit the fruit-bearing surface to distal two-thirds of the 2-m floricanes. Thinning the shoots improved positioning of the mechanical catching surface at the base of floricanes and minimized loss of harvested fruit during the harvest operation. Hand removal of the basal lateral shoots is labor intensive and expensive.

NAA is an effective sprout inhibitor when applied to trunks and pruning cuts of various fruit trees and grapevines (Boswell et al., 1976; Miller, 1977; Morris and Cawthon, 1981; Takeda et al., 1983). NAA "burned

Table 1. Effect of NAA sprays on growth suppression of eastern thornless blackberry (data for 1987 and 1988 combined).

NAA concn (%)	Mean floricanes ht (m)	Basal lateral shoots/cane (no.)	Fruiting laterals/cane ¹ (no.)
0	2.0	3.7	10.9
0.25	1.8	0	1.9
0.50	1.6	0	1.2
1.0	1.4	0	0.4
Significance	L***, Q**	Q***	Q***

¹Number of lateral shoots (> 30 cm) above the NAA-treated cane portion.

***Significant at *P* = 0.01 or 0.001, respectively. L, Q = linear or quadratic trends, respectively.

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Table 2. Effect of NAA sprays on shoot and sucker suppression in thornless blackberry, 1989.

NAA concn (%)	Floricanes/plant ^a	Basal laterals/cane	Dead canes/plant ^b	Fruiting laterals/cane ^c	Root suckers/plant
0.0	5.0	3.1	0.0 b	9.1	2.2
0.125	4.2	0.8	3.7 ab	8.3	1.0
0.250	4.2	0.3	6.2 a	6.7	1.8
0.500	2.8	0.9	4.3 ab	10.5	3.0
Significance	L*, Q	L**, Q*	---	NS	NS

^aNumber of canes reaching 2 m in height.

^bMean separation in the column by Dunnett's procedure at $P = 0.5$.

^cNumber of lateral shoots (>30 cm) above the NAA-treated cane portion.

***NSSignificant at $P = 0.05$ or 0.01 or nonsignificant, respectively. L, Q = linear or quadratic trends, respectively.

back" emerging primocanes of 'Boyne' red raspberry (Fear and Hertz, 1982). Our study was designed to determine if NAA would control lateral shoot growth in eastern thornless blackberries.

'Black Satin' thornless blackberries planted in 1983 at the Appalachian Fruit Research Station, Kearneysville, W.Va., were used in the study. In 1987 and 1988, single applications of 1.0%, 0.5%, 0.25%, or 0% NAA in 10% white water-base latex paint (Associated Technical Consultants, Toledo, Ohio) were made from ground level to a height of 0.7 m with a paint brush when four to five primocanes were 1.0 m high (25-29 May). In late May 1989, NAA concentrations at 0.5%, 0.25%, 0.125%, or 0% in 10% water-base latex paint were applied with a backpack sprayer from the ground to 0.6 m. In all 3 years, treatments were arranged in a completely randomized design with six single-plant replicates per treatment. Data were analyzed using SAS General Linear Model procedures.

Growth measurements were taken in October of each year. In 1987 and 1988, 1.0% and 0.5% NAA reduced the number of 2.0-m-long primocanes to less than one per plant (Table 1). Loss of yield can be expected due to reduction in cane population and cane height. Three rates of NAA (1.0%, 0.5%, and 0.25%) inhibited the development of the axillary buds in the treated area and the more distal cane portion. Canes between 0.6 and 1 m high at-application time showed signs of epinasty and died soon afterward. Canes that were shorter than 0.6 m showed leaf cupping and epinasty within 1 week. These canes eventually withered and died. Several primocanes emerged after treatments were applied, but they lacked vigor and grew to

<2 m in height. These results suggested that NAA concentrations should be reduced and the height of NAA application lowered.

In 1989, NAA decreased the number of 2.0-m floricanes and basal lateral shoots per cane (Table 2). All NAA rates inhibited the growth of canes that were <1.0 m in height at treatment time. Many of these canes exhibited leaf and shoot epinasty in response to NAA treatment and eventually died. According to Dunnett's procedure (Steel and Torrie, 1960), which compares treatment means and the control, only 0.25% NAA differed from 0% NAA at the 95% confidence level. No reduction in the growth of axillary buds in the portion above the treated area was observed on 1-m or taller canes ($P = 0.46$). Several lateral shoots per plant developed at or below ground level, and some root suckers appeared 0.3 to 1.0 m from the crown in August (Table 2). This result suggests that little or no basipetal movement of NAA in the cane and into the root system occurred. A second, low rate of NAA applied in midsummer likely would control these root suckers and basal lateral shoots.

Fruit samples were collected in 1988 from vines treated the previous year. Treatments did not affect total soluble solids content, titratable acidity, fruit size, or the number of berries per cluster (data not presented).

NAA applications used in this study effectively controlled suckers in eastern thornless blackberry. Low rates of NAA (0.1% to 0.25%) should be applied from ground level to ≈ 0.5 to 0.6 m above ground when three to five primocanes have reached 1.0 m in height. Our results suggest several potential useful effects from NAA treatment. Basal lateral shoot control will facilitate mechanical harvesting and reduce the amount of cane

thinning and lateral shoot pruning required later in the season. Reduction in the number of vegetative shoots will increase light interception in the primocane canopy and enhance the fruiting potential of the buds on the shoots. Improved light exposure of shoots increased yield in grapes (Shaulis et al., 1966) and blackberry floricanes productivity (Swartz et al., 1984).

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