Effects of Post-Bloom Alar Sprays on 'Spigold' Apples[1]

JAMES N. CUMMINS[2], R. L. LABELLE[3] AND W. J. KENDER[2]

Abstract. Eleven-year-old Spigold apple trees were sprayed with either 0, 500, 1000 or 2000 ppm alar (SADH) (daminozide) (butanedioic acid mono-(2,2-dimethylhydrazide) three weeks after full bloom. No change in fruitlet abscission during July and August was detected. Typical ribbing of fruits was not reduced. Preharvest fruit drop was almost eliminated by all daminozide treatments. Red skin color was significantly greater and flesh color slightly more yellow on daminozide-treated fruit. No differences in fruit firmness or skin punctures were detected, but harvest bruising was slightly less on daminozide-treated fruit.

Spigold, a triploid seedling of Red Spy X Golden Delicious, is considered highly desirable for dessert apples in commercial production. Furthermore, dehydro-frozen slices and sauce made from Spigold are of very high quality (8). Spigold trees are sturdy, winter-hardy and productive; it is one of the few cultivars that can be readily propagated on its own roots. Unfortunately, Spigold exhibits a number of serious faults as follows: (1) Trees begin bearing relatively late (although earlier than Northern Spy); (2) Vegetative growth is excessive; (3) A pattern of biennial bearing can be readily established and then is persistent; (4) Spigold fruits tend to be poorly colored, too light; (5) Fruit is susceptible to bitter pit, especially on young trees or when crop load is light; (6) Large fruit size and prominent "ribs" make commercial peeling more difficult; (7) Fruits are easily bruised and punctured; (8) A large % of the fruit drops before or during commercial harvest.

Sprays of daminozide have reduced similar problems on other cultivars, and preliminary trials indicated that daminozide sprays could be helpful for Spigold. On Delicious and McIntosh, daminozide sprays curtailed excessive shoot growth (3, 7, 17). Enhancement of red color of the fruit was reported in most cases (4-7, 13, 15) but not in all (10). Change of ground color from green to lighter shades was delayed (15). Fruit firmness was significantly increased both at harvest and after refrigerated storage (2-5, 7, 9, 11, 13, 17). Bruising and skin punctures were reduced in daminozide-treated Delicious fruit but not in Golden Delicious (16). Fruit shape of Delicious was altered slightly (11). McIntosh fruit size was reduced by daminozide applied 14 days after bloom (7, 9), but response of other cultivars has been variable (1). Flowering has been promoted by daminozide sprays, both on young trees and in response to thinning applications (1). Late applications of daminozide made no difference in content of pectins or protopectins (15). Onset of respiratory climacteric, considered the most accurate estimator of maturity, was delayed by daminozide (4, 10, 14).

MATERIALS AND METHODS

In an 11-year-old Spigold block at Geneva, 8 sets of 4 trees each were selected for uniformity of tree size and bloom. Three weeks after full bloom, in each 4-tree set the following whole-tree treatments were applied by spraying to runoff:

A. Control (water only);
B. daminozide 500 ppm;
C. daminozide 1000 ppm;
D. daminozide 2000 ppm.

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[2]Dept. of Pomology and Viticulture.
[3]Dept. of Food Science and Technology.

In late August, we compared numbers of abscised fruitlets with numbers present after June drop to obtain estimates of the crop-thinning effects of daminozide. Vegetative growth was estimated by measuring 20 shoots per tree at the 2 m level.

The crop was picked and stored at 0.5°C when about 20% of the fruit on the control trees had fallen. From each tree, 10 representative fruits were examined for flesh firmness, for flesh color and for soluble solids and acids. After 2 weeks in storage, individual fruits were scored visually for skin color, for bruises and for punctures. From each tree, 3 bushels from the lowest 2 m of the tree and 1 bushel picked above 2 m were sorted into 5 color classes and numbers of bruises and punctures on each apple were counted. A 20-apple sample from each bushel was tested for Magness-Taylor pressure and for color. A Hunter color-difference meter was used to read reflected color of fruit flesh exposed by making a 5 cm slice from the area between 2 pressure punctures, unless this area was bruised or otherwise atypical. The instrument was set for small area illumination with glass plates to provide constant distance from light source and was standardized, using tile No. 14, $L = 76.2$, $a = -1.1$, $b = 24.0$. Opposite segments from 10 apples were ground and the juice expressed by hand. Soluble solids content was determined by duplicate readings on a hand refractometer, pH was read directly on a pH meter, and total acids (as malic acid) were determined by duplicate titration using 0.100 N NaOH to pH 8.2. Specific gravity and average fruit weight were determined for 20 kg samples from each tree at harvest and after 3 months in either common storage or refrigerated storage. Return bloom the following year was compared by visual estimation into 5 classes.

RESULTS AND DISCUSSION

Three of the described deficiencies of Spigold were alleviated by the daminozide applications and 4 were not (Table 1). Red skin color was significantly increased by daminozide treatment, and flesh color was slightly more yellow. Harvest bruising was slightly less on treated fruit, although fruit firmness, as expressed by Magness-Taylor pressure testing, was not changed, and there was no effect on skin punctures. Preharvest fruit drop was reduced to insignificance by the daminozide sprays; there were no differences among effects of the 3 concentrations used.

The daminozide applications made 3 weeks after full bloom had no directly discernible effect on crop thinning, and none of the trees in the experiment had more than a trace of bloom the following spring. Similarly, we detected no reduction in vegetative growth in response to the daminozide sprays. The pronounced ribbing characteristic of Spigold was not altered by the daminozide treatments. Daminozide has been shown to decrease mitosis but not cell extension; we assume that the time of application was too late to influence mitosis leading to fruit growth or vegetative growth (3). We observed practically no bitter pit in any treatment.

Acidity and soluble solids attributes were altered little or not at all by daminozide applications. Specific gravity of the apples was not influenced by the daminozide treatments.

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Table 1. Effects of SADH sprays on Spigold apples.

Criterion	SADH Concentration 0	500 ppm	1000 ppm	2000 ppm
Orchard Effects				
Fruits abscissed 20 June-20 August (%)	37.1a[z,y]	41.5a	42.6a	44.0a
Return bloom following year[x]	1.1a	1.0a	1.2a	1.0a
Preharvest drop (%)	20.9a[z]	3.0b	1.5b	1.3b
Fruit size (g)	194 a	227 a	222 a	226 a
Maturity Attributes				
Skin color: % U.S. Fancy	2.0a[z]	9.0b	7.1b	13.0c
Skin Color: % U.S. No. 1	18.3a[z]	39.0b	36.5b	44.4b
L (Flesh color)	83.08a	83.88a	83.51a	83.80a
a/b (Flesh color)	−.117a	−.140b	−.151bc	−.173c
Saturation (Flesh color)	30.40a	29.49b	29.41b	28.97b
Juice pH	3.54a	3.50a	3.48a	3.47a
Soluble solids (%)	12.4a	11.1a[1]	12.7a	12.6a
Titratable acids (as malic acid) (%)	.38b[z]	.41ab	.44a	.45a
Soluble solids/Titratable acids	33. a	27. a	29. a	28. a
Fruit firmness (Magness-Taylor pressure) (kg)	5.0a	5.1a	5.2a	5.3a
Damage and Processing Attributes				
Specific gravity at harvest	.84a	.85a	.85a	.85a
Specific gravity after common storage	.84a	.84a	.83a	.85a
Specific gravity after cold storage	.84a	.84a	.84a	.84a
Fruits punctured (%)	24.1a[z]	21.0a	21.5a	20.4a
Punctures per fruit	.30a	.27a	.27a	.28a
Fruits with 1 or more 1-cm bruises (%)	98.0a[z]	92.9b	91.0b	86.2c
Yield of peeled fruit (as % original weight)	80.2a[z]	81.4ab	82.1ab	82.6b
Fruits requiring trimming after peeling (%)	17.5a[z]	16.4a	24.8a	24.5a

[z]Data analyzed after arcsin transformation.
[y]On a given line, values followed by the same letter are not significantly different at the 5% level.
[x]Scale 1 = no bloom, 2 = trace, . . . 5 = "snowball" bloom.

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Book Review

The Strawberry—Norman F. Childers, Editor; Horticulture Publications, 3906 N.W. 31st Place, Gainesville, Florida 32601. Price — Domestic: send check on U.S.A. bank: $19.95 plus $1.95 postage-packaging, or Foreign: an International money order for $25.00 total.

A comprehensive compilation of up-to-date information on the strawberry was presented by 40 worldwide authorities at the National Strawberry Conference held at St. Louis, MO, in 1980 and edited in this volume by Dr. Norman Childers.

This 514-page book is divided into five sections devoted to the following topics: Section 1—strawberry production trends in the United States, Canada, Europe, Mexico, China and other strawberry production areas; Section 2—cultural systems including spacing, operations schedule, mechanization, plant nutrition, drip irrigation, frost protection, mulch application and removal, mist cooling, and geese for weeding; Section 3—strawberry breeding was emphasized for progress, fruit quality, high productivity, cultivars in England, disease and insect resistance, rapid propagation, nursery production and plant certification; Section 4—this section was related to diseases, soil fumigation, viruses, fungal diseases, weeds and their control, misshapen fruits and post harvest diseases; Section 5—strawberry mechanization and marketing was presented as related to quality utilization of machine harvested strawberries. Other topics are the influence of immature fruit on strawberry puree quality, pick your own, strawberry production costs and a strawberry reference list which has been updated for the past 10 years.

This text is a valuable guide for experienced growers as well as to those who are contemplating entering the production of strawberries. Also, this is an important reference text for students.

—R. K. Simons