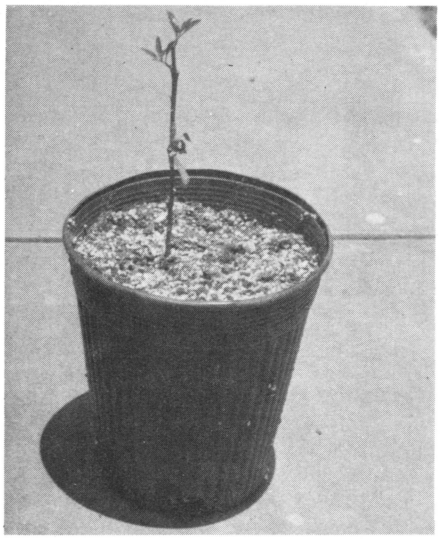

Fig. 2. Stage of growth at which plants were removed from humidity chambers after graft unions were healed.

container nursery using the technique described in this manuscript. Seedlings used were grown from sour orange seed planted in March 1975 in raised seedbeds containing peat moss and perlite. Clear polyethylene tents were used as humidity chambers.

In April 1976, 200 trees were selected at random from the nursery. One hundred trees were placed outside the shadehouse in a protected area receiving full sun and the remaining 100 under 60% shade. The heights of the 100-tree sample in partial shade and the 100-tree sample in full sun were compared 60 days after exposure of the latter to full sun. The trees were trained to a single shoot with laterals removed. Plants placed in full sun grew 47% more than those in 60% shade, an average growth of 39 cm compared to 26 cm. Foliage on the trees receiving full sun was larger and more luxurious in appearance.

Table 1. 3-Year summary of cleft grafting 'Redblush' grapefruit on sour orange rootstock in containers.

Type of humidity chamber[z]	No. successfully grafted trees	Total grafts	Successful grafts (%)
Grafted in January 1975			
Polyethylene tent	115	125	92
Polyethylene bag	125	140	89
Grafted in October 1976			
Polyethylene tent	102	112	91
Polyethylene bag	104	116	90
Grafted in January 1977			
Polyethylene tent	460	512	90
Polyethylene bag	463	512	90

[z]Difference between mortality of grafts placed in polyethylene tents of covered with plastic bags not significant, 1% level.

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HortScience 14(1):57–59. 1979.

Reduction of Rootstock Sprouts on Young Grafted Avocados with NAA[1]

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Additional index words. Persea americana, growth regulator, naphthaleneacetic acid

Abstract: **Naphthaleneacetic acid (NAA) ethyl ester was applied as 0.5% aqueous spray 7 cm below the grafts of 9-month-old avocado (*Persea Americana* Mill.) prior to graft growth. No growth occurred on the grafts and plants were dead 4 months after treatment. Volatilization of ethyl ester of NAA applied as 0.3% to 1.0% aqueous spray, 7 cm below grafts that had grown out 12 cm, caused the new growth to wilt for 36 hours. The 0.4% spray caused slight bark burn of the seedling trunk. The higher the concentration the greater the burn. Sprays of 0.3 or 0.4% sodium salt NAA did not cause wilting or bark burn. Both formulations of 0.3 and 0.4% gave good control of sprouts on the seedlings trunks. The 0.3 and 0.4% ethyl ester treatments reduced total graft growth.**

Rootstock-scion desiderata for fruit trees generally may be grouped under three headings: a) availability and graftability of the rootstock itself, b) scion productivity, and c) scion fruit quality. The rootstock-scion combination should impart reasonable precocity, high average productivity, longevity, and adequate vigor to facilitate heavy fruit production over a long period. Grafting is practiced on a large scale in the California avocado industry to convert seedlings, or otherwise commercially less desirable trees, to superior cultivars. Trunk sprouts must be removed repeatedly to permit good growth of the grafts until the grafts have grown sufficiently to suppress regrowth by shading of the trunks and by apical dominance of the new top. Removal of sprouts is costly and, in addition, growth of trunk sprouts may inhibit that of the grafts.

Control of unwanted sprouts by NAA[2] on many species of woody plants has been reported (1-7, 9). Translocation of NAA from the treated site inhibited growth of citrus buds several cm distance from the treatment (8). No reference was found to volatilization effects of NAA in literature search and very little information on the use of NAA in production of nursery trees. This work was initiated to determine if rootstock sprouts on avocado seedlings grown under standard commercial conditions could be controlled by NAA without inhibition of growth of the inserted scions.

'Topa Topa' avocado seedlings were planted in 4-liter cans in December 1976. Trunks had an average circumference of about 4 cm at the graft site. Eighty 'Topa Topa' trunks were cut off at about 45 cm above can height and grafted with 'Bacon' scions on Sept-

[1]Received for publication June 26, 1978. Acknowledgments are made to C. K. Huszar for statistical analyses and K. W. Dunster of Amchem Products, Inc. for supplying the NAA.

The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper must therefore be hereby marked *advertisement* solely to indicate this fact.

[2]This report does not constitute a recommendation, nor does it imply that materials tested are registered for use.

ember 15, 1977, using the whip and tongue procedure (10).

In experiment 1, 20 vigorous grafted trees on 'Topa Topa' were selected for uniformity on October 3, 1977, at which time some buds on the graft had begun to swell and trunks sprouts were 1 to 4 cm long. All plants were moved outside the greenhouse to a shaded, protected, windless area for treatment. Ten plants were sprayed to run-off with 0.5% NAA ethyl ester in a water solution on October 3, 1977, with a hand pump sprayer. The entire trunks were sprayed 7 cm below the graft; plastic bags that covered the grafts prevented any NAA solution from contacting the graft. Ten control trees were sprayed with water, also to run-off, and they were kept 10 m from NAA treatments. A 2-cm layer of lint cotton was put on top of the soil in each can to prevent soil contamination by NAA and later uptake by the roots. All grafted plants were returned to the greenhouse completely dry 2 hr after treatment. The 2 treatments were kept 8 m apart in the greenhouse for 36 hr and then randomized on the same bench. All of the water-treated grafted avocado plants grew; all of the 0.5% ethyl ester NAA treated plants died. NAA was evidently translocated to the grafts of the treated plants. It also caused bark burn on the seedling trunks.

Fifty of the original grafted avocado plants were used in Experiment 2. Grafts had grown an average of 12 cm and trunk sprouts were 1 to 8 cm long when treated November 10, 1977. Four treatments of 2 formulations, Na salt and ethyl ester, at 2 concentrations, 0.3 and 0.4%, of NAA in aqueous solutions were applied with a hand pump to run-off. Each NAA treatment consisted of 10 single trees; a 10-tree water treatment was also included. Grafts were protected during spraying with paper bags extending 7 cm below the graft union. A 2-cm layer of lint cotton was placed in each can to prevent soil contamination by NAA spray and later uptake by the roots. Plants were sprayed outside the greenhouse in a shady, windless area. Treatments were kept 10 m apart during spraying. Paper bags were removed 2 hr after spraying when the plants were completely dry and plants were returned to the greenhouse. Treatments were kept 8 m apart in the greenhouse for 36 hr, then randomized on the same bench.

Previous trials in 1976 (Table 1) showed that caution should be taken when randomizing young grafted avocado plants whose treatments include NAA formulations. Avocado seedlings grafted to 'Bacon' had 10 to 12 cm of graft growth protected from NAA sprays with paper bags when the seedling trunks were treated with various concentrations of ethyl ester and sodium salt of NAA. Plants were sprayed outside the glasshouse and returned when dry. Wilting of the graft growth occurred on all plants, even the control plants, and lasted for about 36 hr. This wilting of control plants was assumed to be caused by volatization of ethyl ester NAA.

Additional experiments with 'Topa-Topa' seedlings were conducted to see if ethylene might be a factor in the wilting of control plants. A plant was placed in a polyethylene enclosure and treated with a flowing stream of air containing 10 ppm ethylene gas for 24 hr. The gas in the chamber was checked by gas chromatography to insure the presence of ethylene. No wilting was observed at any time.

Next, a beaker containing a solution of the ethyl ester of NAA was placed on the bottom of the chamber and the polyethylene on top rolled back so that only the sides of the plant was enclosed, with the top open to the atmosphere. The plant wilted after 18 hr. The air in the enclosure was tested and found to have only background levels of ethylene.

The 36-hr delay in randomization-mixing in the present experiments resulted in no wilting of control or Na salt-tested plants. Trunk sprouts were counted and graft growth was measured at time of treatment, November 10, 1977 and 9, 17, and 22 weeks later (Table 1). Trunk sprouts showed symptoms of wilting and shrivelling 2 hr after treatment with both concentrations and formulations of NAA. No live sprouts were seen on the trunks of NAA treated avocado plants at the 9-week inspection or thereafter. Some bark burn was observed on the 0.4% ethyl ester-treated trunks. Sprouts were removed from the trunks of the controls on each counting date. Control trees averaged 21.0 sprouts removed as compared with zero sprouts on sprayed trees. Young, tender sprouts sprayed on November 10, 1977 were killed back to the trunk and no new sprouts developed. Grafts on control trees had produced an average of 4.5 shoots and the 2 longest shoots averaged 50.0 cm, while trees sprayed with 0.4% ethyl ester produced an average of 4.0 shoots with 44.1 cm average length of the 2 longest shoots 22

Table 1. Effectiveness of 2 formulations NAA in aqueous solution for sprout control below the scion of newly grafted avocados.

NAA[y] treatments	Mean no. live sprouts per trunk				Mean scion growth per plant (cm)				Shoots per scion at 22 weeks
	Time after treatment				Time after treatment				
	0 wk	9 wk	17 wk	22 wk	0 wk	9 wk	17 wk	22 wk	
				Applied Oct. 28, 1976					
Control	7	8	–	–	13.5	22.5A[z]	–	–	–
0.1% Na salt	7	9	–	–	14.0	22.4A	–	–	–
0.3% Na salt	8	1	–	–	14.1	22.2A	–	–	–
0.5% Na salt	7	0	–	–	13.9	22.1A	–	–	–
1.0% Na salt	7	0	–	–	14.0	19.1B	–	–	–
0.1% ethyl ester	7	8	–	–	13.9	22.0A	–	–	–
0.3% ethyl ester	8	0	–	–	14.1	18.1B	–	–	–
0.5% ethyl ester	6	0	–	–	14.1	18.0B	–	–	–
1.0% ethyl ester	7	0	–	–	13.9	17.0B	–	–	–
				Applied Nov. 10, 1977					
Control	8.0[y]	8.5	3.5	1.0	12.0	26.0A[z]	40.0A	50.0A	4.5
0.3% Na salt	8.5	0.0	0.0	0.0	12.0	25.6A	39.5A	49.5A	4.0
0.4% Na salt	8.0	0.0	0.0	0.0	12.0	25.0A	39.0A	49.3A	4.0
0.3% ethyl ester	9.0	0.0	0.0	0.0	12.0	20.6B	32.3B	45.2B	4.0
0.4% ethyl ester	9.0	0.0	0.0	0.0	12.0	20.0B	32.2B	44.1B	4.0

[z]Means separated in columns by Duncan's multiple range test, 1% level.

[y]Sprouts were removed from control plants after counting Nov. 10, 1977, Jan. 12, 1978, March 9, 1978, and April 13, 1978. These were new sprouts.

weeks after treatment. These differences were significant and indicate that a combination of volatilization and translocation of ethyl ester is the cause of reduced shoot growth. Three-year-old field-grown avocado trees topworked to 'Bacon' with some graft-bud growth graft were treated with 1% ethyl ester NAA 10 cm below the graft without causing wilting or reducing total growth in a previous experiment (1).

A precise cost comparison of the chemical and hand methods of sprout control has not been made. Our experience indicates that NAA treatment should reduce total control costs by at least a third.

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HortScience 14(1):59–60. 1979.

Vase Life of Cut Flowers Treated with Rhizobitoxine Analogs, Sodium Benzoate, and Isopentenyl Adenosine[1]

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Additional index words. Rosa hybrida, Iris xiphium, Narcissus pseudonarcissus, Chrysanthemum morifolium, ethylene

Abstract. **Addition of rhizbitoxin analogs to holding solutions extended vase life of bulbous iris flowers (*Iris xiphium* L), daffodils (*Narcissus pseudo-narcissus* L.) and chrysanthemums (*Chrysanthemum morifolium* Ramat). Sodium benzoate also increased vase life of daffodils but not of irises and chrysanthemums. Isopentenyl adenosine delayed senesence of irises but not of chrysanthemums. None of the chemicals tested extended the vase life of roses (*Rosa hybrida* L). Ethylene production in rose petal tissue was reduced by rhizobitoxine analogs indicating that roses do not have a rhizobitoxine-resistant ethylene producing system. Results suggested that either roses are sensitive to low levels of ethylene or their senescence is triggered by factors other than ethylene.**

The ethoxy analog of rhizobitoxine, L-2-amino-4-(2-aminoethoxy)-*trans*-3-butenoic acid (RO), and sodium benzoate (SB) inhibited ethylene production and increased the vase life of carnations (3). RO and the methoxy analog of rhizobitoxine, L-2-amino-4-methoxy-*trans*-3-butenoic acid (MRO), also reduced ethylene production and delayed the senescence of snapdragons (8). The beneficial effects of these compounds were over and above the effects of sucrose, 8-hydroxyquinoline citrate, and acid pH of the preservative solution. Because RO, MRO and SB did not enhance the capability of flowers to absorb the holding solution, it was suggested that they increased the longevity of carnations and snapdragons by inhibiting ethylene production. We, therefore, evaluated the effect of these compounds and another senescence inhibitor, isopentenyl adenosine (IPA), on the vase life of some cut flowers other than carnations and snapdragons.

Sources and conditions of flowers. Daffodils ('King Alfred' and 'The First') were grown at the Beltsville Agricultural Research Center. Hydrid tea roses ('Forever Yours' and 'Samantha') and chrysanthemums ('Iceberg' and 'Bright Golden Anne') were obtained from a local greenhouse. Irises ('Wedgwood', 'Blue Ribbon', 'Yellow Fantasy' and 'Hildegard') were bought from wholesale flower markets in the vicinity of Washington, D.C. The daffodils, roses and chrysanthemums were picked in the morning the experiment started. The irises were picked on the day before the experiment started. Daffodils were harvested at the goose-neck stage. Both, irises and roses were in the loose bud stage at the beginning of the experiment. All flowers opened within 24 hr at 20°C in the holding solutions under continuous fluorescent light. Chrysanthemums were picked at full open stage. All cultivars were treated as replicates and the data were subjected to Duncan's multiple range test (4).

Preservative solutions. All preservative solutions, including the control, contained 2% sucrose, 0.02% 8-hydroxyquinoline citrate, and 0.02 M potassim citrate buffer with a pH of 4.6. In addition to the above preservatives, one of the following test chemicals was added to each treatment: 0.1 mM RO, 0.1 mM MRO, 1 mM SB or 0.1 mM IPA. The solutions were made up with deionized water. Each flower jar contained 500 ml preservative solution.

Handling of flowers. Each flower stem was re-cut to 30 cm length, and immediately placed in the preservative solution. Leaves on the lower portion of stem were removed. For chrysanthemums, each stem was trimmed to the 3 dominant flowers and 3 stems were placed in each glass jar. Vase life was determined separately for each of 3 flowers on each stem. For the other flowers, 5 or 6 single-stem flowers were placed in each jar. Three jars of flowers were used for each treatment. Vase life was determined independently for each single flower. The jars containing preservative solutions and flowers were placed randomly in a room maintained at 20°C, 50 to 60% relatively humidity and with ca. 1100 1x continuous fluorescent light.

Determination of vase life. Vase life was considered terminated when flowers lost their decorative value. For daffodils and irises, excessive curl of the tips of petals or shrivelling of the bloom was considered to be the end of vase life. In roses, the discoloration of petals or the drooping of the neck terminated the vase life. The chrysanthemum flowers were discarded when half of the petals wilted or when the neck bent.

[1]Recieved for publication August 12, 1978. The rhizobitoxine analogs were kindly provided by Dr. A. Stempel of the Research Division, Hoffmann-LaRoche, Inc., N.J. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper must therefore be hereby marked *advertisement* solely to indicate this fact.