HortScience 11(2):113–114. 1976.

Control of Sprouts on Topworked Avocado Stumps with NAA Formulations[1]

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Additional index words. growth regulator, shoot inhibition and *Persica americana* naphthaleneacetic acid

Abstract. **A 1% ethyl ester or sodium salt formulation of naphthaleneacetic acid (NAA) in 30% aqueous solution of white latex paint sprayed below the grafts effectively controlled trunk sprouts in topworked avocados (*Persea americana* Mill). Regrowth was suppressed over a 7-month growing period with no adverse effects on the grafts.**

Topworking is practiced on a large scale in the avocado industry to convert seedling or otherwise commercially less desirable trees to superior cultivars. Considerable stump sprouting is stimulated when avocado trees are pruned for topworking. To permit good growth of the grafts, the sprouts (suckers) must be removed repeatedly until the grafts have grown sufficiently to suppress trunk regrowth, by shading of the trunks and by apical dominance of the new top. Removal of sprouts is costly and in addition, the growth of stump sprouts may inhibit the grafts.

Satisfactory control of trunk and scaffold sprouts on fruit trees and other woody plants have been reported (1–8). Boswell and Nauer (unpublished data) found that NAA applied to the trunks of topworked fig trees resulted in reduced growth of the grafts. The present work was initiated to determine if NAA[3] treatments would control sprouts on topworked avocados without affecting the grafts.

'Fuerte' on 'Topa Topa' avocado seedling rootstocks were planted in San Diego County in the spring of 1972 and topworked to 'Bacon' scions in March 1975. Trunks had an average circumference of about 30 cm. 'Fuerte' trunks were cut off at about 60 cm above ground level, and 'Bacon' scions inserted using a saw-kerf procedure (9). A collar of white butcher paper was wrapped around the grafts from about 10 cm below to about 30 cm above to protect them from sunburn (Fig. 1).

We selected 105 trees for uniformity in height and girth with 35 single-tree plots per treatment in a completely randomized design. Some buds on the grafts had begun growth and trunk sprouts were 1 to 8 cm long. Two formulations, Na salt and ethyl ester of 1% NAA in 30% aqueous solutions of white latex paint were applied on April 4, 1975 with a hand pump sprayer. White latex paint was used as a carrier because it is commonly applied to prevent sunburn. The entire trunks were sprayed below the collar of white butcher paper to the soil level a length of 50 cm. Check tree trunks were brush painted with undiluted white latex paint. Trunk circumferences were measured 15 cm above soil level and sprout counts were initially on April 4, and at 6, 24 and 28 weeks following application. Scion height were measured 28 weeks after application. One replicate of each treatment was excluded from the analysis because of graft failure (Table 1).

Sprouts on the trunks showed symptoms of wilting and shriveling, 2 hr after treatment with both formulations of NAA and no live sprouts remained in either NAA treatment after 45 days. Check trees averaged 19.9 sprouts. Sprouts were removed from the check trees 6 and again 24 weeks after trial initiated to increase scion growth. Wounds produced by removal of sprouts over 25 cm in length were treated with a tree seal formulation to minimize entrance of disease organisms. Check trees averaged 12.5 sprouts 24 weeks after treatment, while treated trees showed no sprout growth. Measurements made 28 weeks after treatment showed average scion heights of 127, 128, and 126 cm for the Na salt, ethyl ester and check trees, respectively. Differences were not statistically significant. Measurements of trunk circumference at 28 weeks all averaged 32. These data indicate that applications of NAA inhibited sprout growth without visible or reduction in scion and trunk growth.

Table 1. Effectiveness of 2 formulations of NAA in white latex paint for sprout control on topworked avocado tree trunks, applied April 4, 1975.

Treatments	Mean live sprouts per trunk[y] Time after treatment (weeks) 0	6	24	28
Check	19.1a[z]	19.9a	12.5b	0.0
1% Na salt NAA	18.8a	0.0c	0.0c	0.0
1% ethyl ester NAA	19.2a	0.0c	0.0c	0.0

[z]Different letters indicate significance at 1% level.

[y]Means of 34 single-tree replicates. Sprouts were removed from the check trees after the counts at 6 and 24 weeks after applications.

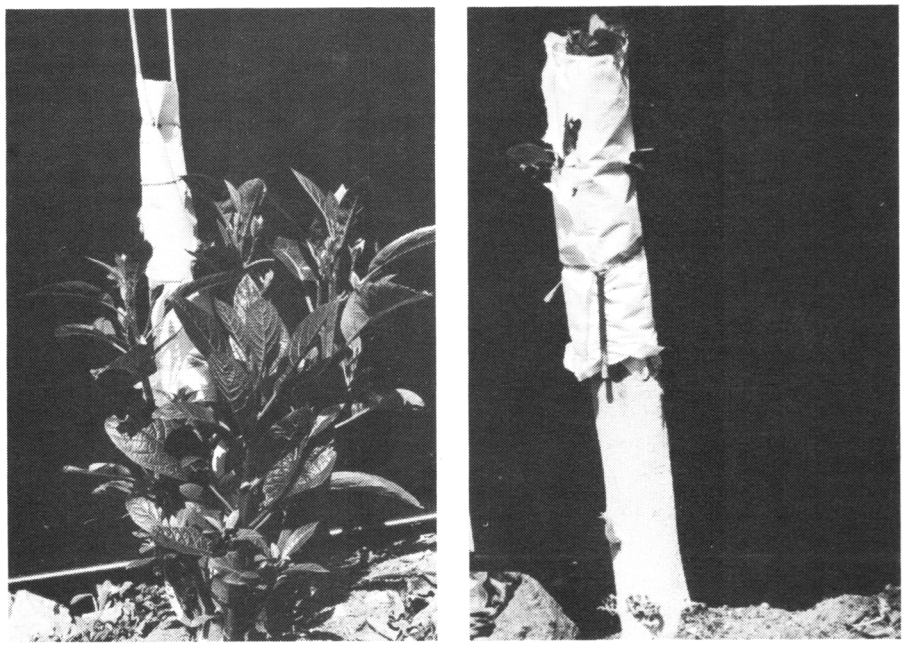

Fig. 1. Typical avocado topworked trunk 45 days after treatment. Tree treated with white latex paint only (left) tree treated with 1% ethyl ester in 30% aqueous white latex paint (right).

[1]Received for publication December 10, 1975.

[2]Acknowledgements are made to C. K. Huszar for the statistical analyses and K. W. Dunster of Amchem Products, Inc. for supplying the NAA.

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

A precise cost comparison of the chemical and hand methods of sprout control has not been made; such will depend on a more accurate determination of optimum spray concentration and thoroughness, under various conditions, as well as on better knowledge of optimum sprout removal frequency. Our experience indicates that NAA treatment should reduce total control costs by at least one-third. Furthermore, hand removal can always be carried out later without harm to the graft, if spray treatment is delayed.

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HortScience 11(2):114–115. 1976

Effect of Reduced Ethylene Levels in Storage Atmospheres on Lemon Keeping Quality[1]

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Additional index words. postharvest decay, controlled atmosphere, *Citrus limon*

Abstract. **Lemons (*Citrus limon* (L.) Burm. f.) were stored for up to 27 weeks at 10°C in air and in an atmosphere of 3 to 5% O_2 and 0.1 to 0.2% CO_2, with and without an ethylene absorbent. Mold incidence was high in controlled atmosphere (CA) storage where ethylene accumulated, but removal of ethylene reduced its development. CA storage improved retention of green color in lemons.**

Development of a technique for the successful storage of lemons for a period of up to 6 months would provide the Australian lemon growing industry with marketing flexibility and help overcome "glut" situations that often occur when the winter crop becomes available (6). Problems of green mold [*Penicillium digitatum* (Sacc.)] and stem end rot [*Diaporthe citri* (Faw.) Wolf.] control, which have prohibited storage in the past, have been reduced with the development of the fungicide 1-(butylcarbamoyl)-2-benzimidazole carbamic acid (benomyl)[5] (8), but fruit quality generally declined during these long storage periods and was unacceptable to the fresh fruit markets.

Use of 2,4-dichlorophenoxyacetic acid[6] (2,4-D) and gibberellic acid[7] (GA) in citrus wax coatings was shown to improve keeping quality and appearance of stored lemons (2), but further improvements were needed to make fruit commercially acceptable. Use of controlled atmosphere (CA) storage as a way of obtaining this improvement has not been successful to date with lemons, principally because of excessive breakdown (1). Improved responses to CA treatments were obtained, however, in oranges and bananas by reducing ethylene levels in the CA storage atm (4, 7). Preliminary studies at this Laboratory and reports of increased decay within degreening environments (3, 5) suggested that lemons would also benefit if ethylene levels were reduced in the storage atm. This trial, therefore was to examine more closely the effects of reduced ethylene levels in storage atm on lemon color and mold decay.

Main crop 'Eureka' lemons were obtained from a grower in the Gosford region of New South Wales and dipped within 24 hr of harvest for 30 sec in a 500 mg per liter suspension of benomyl. A citrus polyethylene water-wax emulsion[8], which contained 16% solids and 2,4-D and GA, both at a concn of 500 mg per liter, was then applied by a foam-wax applicator and dried on the fruit under a hot air flow for 2 mins. Fruit of a uniform silver green color were then selected and graded into 3 size groups. Each size group was randomized into 8 units, each containing approx 40 fruits.

Each unit of fruit was carefully placed in a 25-liter steel drum, and 1 of the following storage atm applied to each of 2 units, which were coupled together in the same circulation system: (A) *Air,* flow through system at 60 liters per hr; (B) *Air, ethylene scrubbed,* flow through system at 60 liters per hr; (C) *CA storage, 5% O_2, nil CO_2,* circulated between drums at 90 liters per hr; (D) *CA, 5% O_2, nil CO_2, ethylene scrubbed* in a circulation flow of 90 liters per hr.

Air movement within treatment units was obtained with a 7-watt aquarium pump. CO_2 levels were controlled with 1 kg of $Ca(OH)_2 \cdot 7H_2O$ per CA treatment unit. Vermiculite moistened with a saturated solution of potassium permanganate absorbed ethylene. Two trays each containing 200 g of this material were then added to each treatment unit. All drums were placed in a 10°C storage room.

Oxygen and CO_2 levels were monitored with an "Orsat" absorption analyser, and ethylene concn was determined with a gas chromotograph fitted with a flame ionization detector (4).

Fruit was examined after 13, 21 and 27 weeks storage. Skin color was assessed with a color index system based on sorting fruit into several color classes. Each class was assigned a numerical value, which was multiplied by the no. of fruit in the class; the color index was determined by dividing the sum of the products by the total no. of fruit assessed. Color classes were 1, deep yellow; 2, yellow; 3, light yellow; 4, silver green; and 5, green. The % fruit affected by mold was also determined. Data were analysed by use of an angular transformation with 3 replicates being used for each storage atm tested.

The concn of CO_2 sampled from both the air and CA treatments varied

[1]Received for publication November 24, 1975.

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[5]Marketed by DuPont (Aust.) Ltd. as Benlate 50% w/w benomyl.

[6]Marketed by Land Ltd., Sydney as Nocweed, containing 80% w/w 2,4-D sodium salt.

[7]Marketed by ICI Aust. Ltd. as Grocel containing 10% w/w gibberellic acid.

[8]Marketed by S. C. Johnson & Son Pty. Ltd., Rosebery as Primafresh.