Leaf vs. Fruit Coverage with Antitranspirants for Sizing Fruit[1]

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Abstract. **A film-forming antitranspirant sprayed on trees of olive (*Olea europa* L. cv. Sevillano) increased equally the growth of bagged (to prevent spray contact) and unbagged fruit. Hence, enhanced fruit growth depends upon film formation on stomata-bearing leaf surfaces, rather than direct contact of fruit by the spray.**

Previous experiments (1, 2, 3) have shown that plant water potential and fruit size can be improved by spraying a film-forming antitranspirant on peach, cherry, or olive trees. We supposed that the enhanced fruit growth was a response principally to antitranspirant coverage of the stomata-bearing surfaces of the *leaves,* not a direct effect of *fruit* coverage. That is a reasonable supposition since the resistance to water-vapor diffusion from the abaxial surface of an untreated olive leaf is only about 0.07 min cm^{-1} (3), whereas the untreated olive fruit surface shows an extremely slow response on the diffusion porometer, i.e., resistance may be more than 10 × greater than for leaves. This paper provides experimental evidence supporting our supposition, and discusses the flow of water to leaves, relative to fruit, during the day.

The experimental procedures have been detailed elsewhere (3). Briefly, 20 'Sevillano' olive fruit were tagged on each tree, and fruit diam was measured periodically before and after spraying. On Oct. 20, 1971, just before the trees selected for antitranspirant treatment were sprayed, small plastic bags were put on 10 individual tagged fruits to prevent contact with the spray, leaving 10 tagged fruit exposed to the spray. The 10 bagged and unbagged fruit were selected on the basis of equal growth prior to spraying, and were distributed around the tree. Antitranspirant[4] was applied at 30 liters per tree, and the bags were removed within 12 hr of spraying.

Effect of antitranspirant. Table 1 clearly shows that antitranspirant applied to the trees increased fruit growth between Oct. 19 (1 day before spraying) and Oct. 22 (2 days after spraying). Strong north winds and low humidity between Oct. 22 and Oct. 28 resulted in fruit shrinkage (negative growth), which was significantly less on sprayed trees.

Table 2 compares growth data for the bagged and unbagged fruit on the antitranspirant-treated tree of Table 1. Fruit contacted by spray did not differ significantly in growth (or shrinkage) from fruit not contacted.

Hence when an entire tree, including the stomata-bearing leaf surfaces, is sprayed with antitranspirant, growth of fruit is greater than on unsprayed trees (Table 1). The enhancement, however, does not depend upon direct contact of fruit by the spray (Table 2). Antitranspirant incidentally applied to fruit can, however, be useful by reducing post-harvest water losses, thereby prolonging shipping life (2).

Water pathway. Since fruit shrinkage was noted in this experiment with olives and in other investigations with citrus (4) and peaches[5], the question has been raised whether water is "sucked" from the fruit to the leaves. Elfving and Kaufmann (4) pointed out that such action would require a water-potential gradient from the fruit to the leaves, adding that there is no information "which supports or disproves the existence of uninterrupted water potential gradients from fruits to leaves."

Although it is possible for potential gradients to exist which would cause water to move from fruit to leaves, a more likely explanation for daytime shrinkage of fruit is that the leaf-air pathway offers less resistance to water movement than the fruit-air pathway. Consequently, water is preferentially diverted to the leaf-air pathway, leaving a flow rate to the fruit which is insufficient to replenish even a low rate of fruit water loss. Therefore, the stomata-bearing leaf surface is the logical area for the antitranspirant film. The larger fruit and reduced fruit shrinkage after antitranspirant treatment probably occurred because of an increased leaf water potential resulting from a greater increase of resistance in the leaf-air, than in the fruit-air, water pathway. The data presented here support that theory.

Table 1. Effects on growth of 'Sevillano' olive fruit of spraying an entire tree with antitranspirant on Oct. 20, 1971. (Based on 20 fruit/tree.)

	Fruit growth (mm diam)	
Treatment	Oct. 19-22	Oct. 22-28
Control	0.10	−0.44
Antitranspirant	0.22	−0.10
Pooled SD ±	0.09	0.12
P	< 0.1%	< 0.1%

Table 2. Effects on growth of 'Sevillano' olive fruit of bagging fruit to prevent contact with antitranspirant sprayed on Oct. 20, 1971. (Based on 10 fruit/tree.)

	Fruit growth (mm diam)	
Treatment	Oct. 19-22	Oct. 22-28
Bagged	0.23	−0.11
Unbagged	0.20	−0.09
P	NS[z]	NS

[z]Nonsignificant.

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[4]The data presented are for CS-6432 (2%, ai) an experimental wax-latex emulsion prepared by Chevron Chemical Co., Richmond, California. Results were similar with Mobileaf (1:8, v/v) a wax emulsion manufactured by Mobil Chemical Co., Richmond, Virginia.

[5]Davenport, D. C., and R. M. Hagan. 1970. Potential Usefulness of Antitranspirants for Increasing Water Use Efficiency in Plants. Technical Completion Rpt. 1967-1970, OWRR B-054-CAL, WRC 174. Water Resources Center, University of California, Los Angeles.

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