Influence of Superior Oil Sprays on Growth and Bark Necrosis of 'Delicious' Apple Trees[1]

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Abstract. **Formulations of superior oil applied to the developing buds and bark of 'Delicious' apple trees in the greenhouse inhibited bud break and growth. Bud break was significantly affected by oil concn, viscosity, and unsulfonated residue (UR). Total fresh wt of shoots was adversely affected by increasing concn and decreasing UR. Severity of bark injury increased with decreasing viscosities and increasing concn.**

Reports of oil injury to the bark of deciduous fruit trees have appeared recently, including enlarged lenticels on twigs of 'Bartlett' pear following foliar oil sprays against pear psylla (3), proliferation of lenticels in the epidermis of shoots and in the bark of limbs and trunks of oil-sprayed 'Anjou' pear (5), and lenticel swelling on 'Delicious' apple trees following prebloom oil applications (2). This investigation was undertaken to evaluate the effects of 9 formulations of superior oil to the buds and bark of 'Delicious' apple trees in the greenhouse.

The superior oils[3] used were of 60-, 70- and 100- second viscosity and 92, 95 and 97 or 98% UR; all contained 1% emulsifier. The formulations were diluted with tap water to various concn and painted onto 19 cm sections of shoots of 1-year-old 'Richared Delicious' trees growing in the greenhouse. Treatments were applied on Feb. 4, 1970 when most buds were in the green-tip stage of development. Tree-shoot plots were used in a factorial design with 5 replications. Growth measurements were made on April 15 and the degree of bark injury was rated visually on April 24.

Growth. All oil treatments inhibited bud growth (Fig. 1 and Table 1). In control shoots, 81.4% of the buds grew whereas bud inhibition increased with oil concn, increasing viscosity, and decreasing UR. Less growth inhibition occurred with 60- or 70-second oil when the UR were at least 95% and concn no greater than 8%. The effect of oil characteristic on fresh wt of new shoots and leaves showed a similar trend to % bud break.

Bark injury. All oil treatments produced some degree of lenticel enlargement or bark blistering. Injury began to appear 3 weeks after the initiation of treatment at 16, 32 and 64% concn but all concn showed injury after 5 weeks. After 6 weeks bark began to crack around the blistered areas at 16, 32 and 64% concn and increased in severity with time. Injury increased significantly as oil concn increased from 8 to 16% but there was no significant difference from 2 to 8% or 16 to 64% (Table 1 and Fig. 2). Injury decreased

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Table 1. Effects of concn, viscosity, and unsulfonated residue (UR) of superior oil on bud inhibition, new growth, and bark necrosis on 'Delicious' apple trees in the greenhouse.[y]

Characteristics of oil treatment	% bud break	Fresh wt of new growth (g)	Bark injury score[z]
Concn (%)			
2	60.0 b	3.1 b	2.1 b
4	65.3 b	3.8 b	2.2 b
8	44.4 c	3.2 b	2.3 b
16	24.8 d	1.1 c	3.4 c
32	26.1 d	1.0 c	3.7 c
64	16.7 d	0.7 c	3.8 c
Viscosity (second)			
60	44.0 b	2.4 b	3.3 d
70	39.8 bc	2.0 b	2.9 c
100	32.7 c	2.0 b	2.6 b
UR (%)			
92	29.2 c	1.5 c	3.0 b
95	39.3 b	2.6 b	2.8 b
97-98	48.4 b	2.3 b	3.0 b
Control	81.4 a	7.2 a	0.0 a

[y]Means of groups within columns followed by the same letter do not differ significantly from each other or control at the 5% level according to Duncan's Multiple Range test.

[z]0 (no injury) to 5 (severe injury)

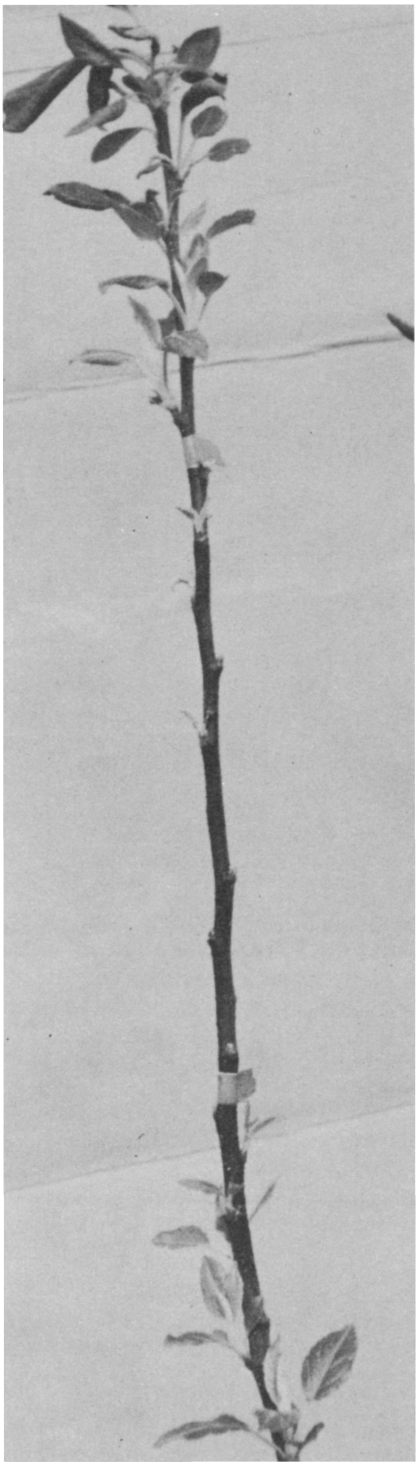

Fig. 1. Bud inhibition of 'Delicious' apple tree 41 days after application of 70 sec. oil at 16% concn (treated portion between tags).

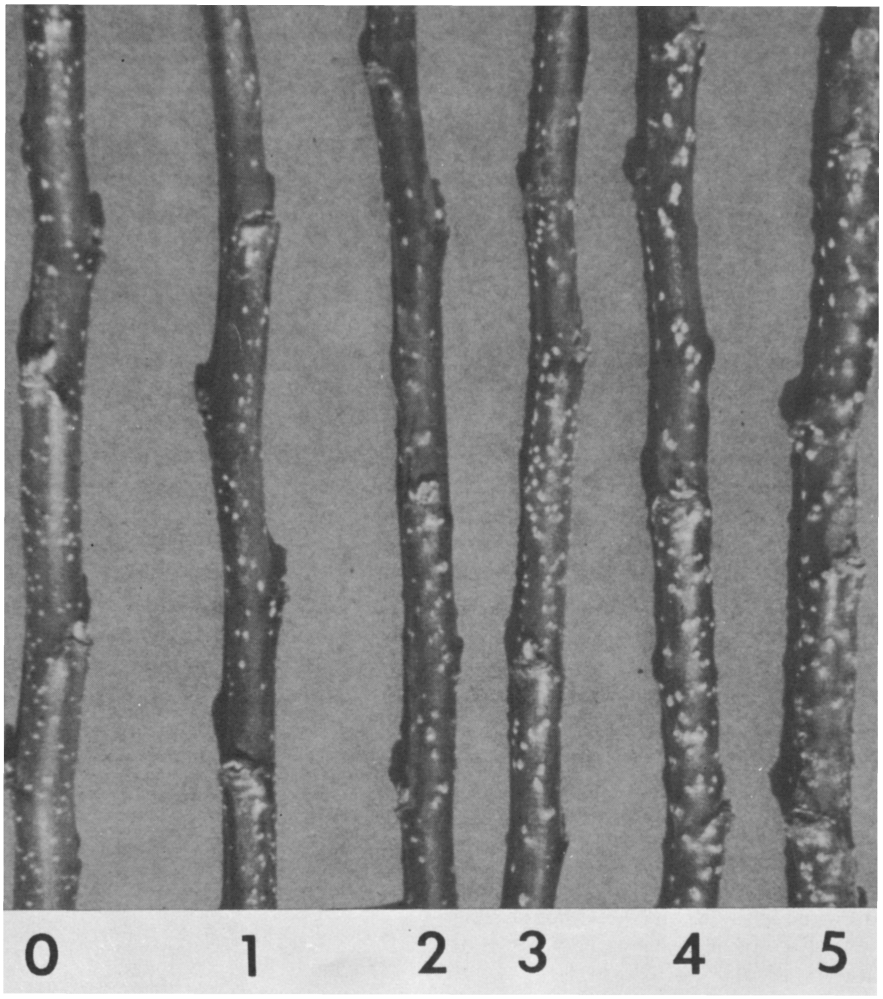

Fig. 2. Bark injury to 'Delicious' apple tree stems 79 days after oil application. Rating scale = 0 (no injury) to 5 (severe injury).

significantly with increasing viscosities but there were no significant differences among the UR.

Apparently 'Delicious' apple trees are injured by superior oils. These results verify observations of severe bark necrosis following concentrate airblast and aerial application of oil in commercial orchards (4). The symptoms of the oil-induced bark necrosis are similar to the measles disorder that has been widespread on 'Delicious' apple trees in the northeastern U. S. over the past several years and attributable to various nutritional imbalances. It may be of interest that Berg (1) reported a bark necrosis disorder in 1934, before 'Delicious' was widely planted in the eastern U. S. and at the time miscible oils were in use as an insecticide.

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Restriction of ^{45}Calcium Translocation into Apple Fruit by 2,3,5-Triiodobenzoic Acid[1]

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Abstract. **Calcium translocation into the fruit of the 'Golden Delicious' apple was restricted by applications of 2,3,5-triiodobenzoic acid (TIBA) applied 2, 4, and 6 weeks after anthesis whereas Ca translocation into the leaves and into the shoots was virtually unaffected. Ca translocation was measured by introducing 0.01 M $CaCl_2$ + ^{45}Ca into the cut end of previously sprayed shoots and by measuring ^{45}Ca translocation into various parts. TIBA applied nearer to anthesis was more effective in decreasing Ca translocation.**

Interest in Ca translocation in apple trees has been stimulated by the discovery that bitter pit, a metabolic disorder of fruit, is always associated with fruits of low Ca content. Soil applied Ca seldom affects bitter pit whereas sprays applied directly to the fruit are at least partially beneficial (2).

We have shown that TIBA causes a disorder in 'Golden Delicious' apple fruits closely resembling bitter pit (6) and that TIBA-treated fruits had low Ca levels (5). Preliminary work indicated that TIBA may decrease ^{45}Ca transport into developing apple fruits. This report describes the influence of TIBA on the transport of ^{45}Ca into developing 'Golden Delicious' apple fruits.

Eighteen comparable 'Golden Delicious' apple trees were sprayed with 50 ppm TIBA, 2, 4 and 6 weeks after anthesis. Five fruiting spurs from each spray treatment plus a control were cut at least 10 cm below the cluster base and placed immediately in water. These