Peach X-Disease: Treatment Site Damage and Yield Response Following Antibiotic Infusion

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ABSTRACT

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X-diseased scaffolds of peach and nectarine infused with oxytetracycline hydrochloride (OTC) produced nearly normal yields. Scaffolds either immediately above treatment sites or infused directly improved most. Treatment site damage was greatest on trees with severe foliar symptoms. Trees infused by gravity and by pipets were damaged less than ones infused by Mauget cups and with concentrated OTC or injected. Calcium chloride, spectinomycin, taurolin, and tylosin caused less damage than OTC. Spectinomycin and streptomycin caused severe chlorosis and bud death above treatment sites. Erythromycin, sulfanilamide, taurolin, tylosin, and OTC caused no to moderate chlorosis. Only OTC-treated trees had significant remission of foliar symptoms.

Additional key words: mycoplasmal diseases, pathometry, *Prunus persica, P. persica* var. *nectarina*

Eastern X-disease, transmitted by leafhoppers (21), causes serious losses in eastern Canada and northeastern and midwestern United States in peaches (*Prunus persica* (L.) Batsch) and nectarines (*P. persica* var. *nectarina* (Ait.) Maxim.). Some have speculated that the resurgence of this disease in areas of the United States and Canada was coincident with the withdrawal of the persistent insecticide DDT, or 1,1'-(2,2,2-trichloroethylidene) bis[4-chlorobenzene], from orchard use (4). In Connecticut, there has been a great increase in grower concern about this disease since 1969. The pathogen of eastern X-disease is mycoplasmalike (6), and the yellow leaf roll strain of western X-disease is probably caused by a spiroplasma (18). These organisms are both susceptible to tetracyclines (14,23). Antimycoplasmal compounds other than tetracyclines have been reported (2,3,16,25) and some have been tested for X-disease control (15,16,25), but none has been rated for treatment site damage or yield response.

Oxytetracycline hydrochloride (OTC) therapy prolongs the bearing of diseased trees, but remission has been measured only by changes in foliar symptoms (1) or total fruit weight per cross-sectional area of scaffold limb (g/cm^2) (17). No reports have correlated total fruit weight, weight of individual fruit (g/fruit), and number of fruit (fruit/cm) with foliar symptom intensity or OTC treatment.

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Application of OTC has been made by large-volume, gravity-flow infusion (14); high-pressure injection (20); or a concentrate infusion method (23). Although the concentrate method causes damage at the OTC application site (1,17), data comparing the amount of damage by different application methods have not been reported.

The research reported here presents new information on: (a) treatment site damage with several methods for applying OTC; (b) correlation of OTC damage with X-disease foliar symptom intensity; (c) treatment site locations in regard to foliar symptom remission; (d) damage, yield response, and foliar symptom remission with other compounds; (e) time and cost analyses for applying OTC; (f) effect of OTC on number and average weight of individual fruit; and (g) effect of symptom intensity on peach and nectarine yield. Part of this information has been presented (8).

MATERIALS AND METHODS

Treatment site damage. Necrotic xylem tissue around the application site was exposed by removing the bark (7). Damage was expressed as the product (cm^2) of the greatest vertical and horizontal dimensions of discoloration across the application site.

Application methods and compounds. Terramycin Tree Injection Formula for Pear Decline (21.6% OTC, Pfizer Chemical Co., New York, NY 10002) was applied using the concentrate infusion method (100 mg a.i./1.0 ml per treatment site) (23). More dilute solutions were applied with pipets (100–300 mg a.i./10–15 ml) (10) or Mauget cups (Mauget Co., Burbank, CA 91504; 600 mg a.i./50 ml) (13). The most dilute solutions (500–2,000 mg a.i./1,000 ml and 333 mg a.i./1,333 ml) were applied by gravity-flow infusion (14) or pneumatic pressure (2.1 kg/cm^2) injection (5), respectively. (Refer to specific citations for details on preparing application sites.)

Other compounds were compared with OTC for foliar phytotoxicity, treatment site damage, and level of symptom remission. The following were applied by pipet: erythromycin phosphate (Abbott Laboratories, N. Chicago, IL 60024; 500 mg a.i./10 ml to 1,000 mg a.i./15 ml per treatment site); spectinomycin dichloride-pentahydrate (Abbott; 500 mg a.i./10 ml or 1,000 mg a.i./15 ml); OTC (100 mg a.i./10 ml to 300 mg a.i./15 ml); sulfanilamide (Eastman Kodak Co., Rochester, NY 14650; 500 mg a.i./10 ml or 1,000 mg a.i./15 ml); streptomycin sulfate (Sigma Chemical Co., St. Louis, MO 63178; 500 mg a.i./10 ml); taurolin (Geistlick-Wolhusen, Switzerland; 300–2,000 mg a.i./15 ml); and tylosin tartrate (Eli Lilly & Co., Indianapolis, IN 46206; 500–1,000 mg a.i./10 ml). Calcium chloride ($CaCl_2$; 2,000 mg a.i./1,000 ml), also used by Stoddard (25), was applied by gravity flow infusion. The compounds were dissolved in water ($CaCl_2$, OTC, spectinomycin, streptomycin, sulfanilamide, and tylosin); aqueous ethylene glycol (25%, v/v; erythromycin); or saline (0.85% sodium chloride [w/v] containing polyvinylpyrrolidone [5%, 2/v; 15,000–21,000 MW]; taurolin).

Foliar symptom intensity and fruit yield. Foliar symptom intensity of X-disease was indexed on scaffolds: 0 = symptomless; 1–4 = shot-holed leaves with little if any defoliation; 5–8 = some branches defoliating; 9 = most branches defoliated but retaining apical leaves; 10 = most branches defoliated totally, but living tissue evident under the bark; and 11 = dead.

Fruit was harvested from symptomless or diseased scaffolds that were untreated or treated with OTC or other compounds. Because scaffolds affected by X-disease or antibiotic treatments are not comparable to symptomless or untreated scaffolds with regard to blossom set, fruit set, fruit drop, or general vigor, none of the trees was thinned. These data, then, represent disease losses or responses to chemotherapy and are not comparable to economic losses. Yields are standardized to weight per fruit (g/fruit) or number and weight of fruit per cross-sectional scaffold area at its base (fruit/cm^2 and kg/cm^2).

RESULTS

OTC treatment site damage. All methods of applying OTC caused treatment site damage. Browned xylem tissue was observed within days after treatment, and the maximum area of discolored tissue was observed within 2 wk after treatment. The following growing season, gum production and dead tissue were evident around the treatment site.

In commercial orchards, treatment site damage was so great that some growers discontinued chemotherapy. Damage was greater on trees treated with the concentrate OTC method in October 1975 than in September 1976. In 1975, trees had been subjected to two frost periods and were defoliated at the time of treatment. The mean trunk area ($cm^2 \pm SE_{\bar{x}}$) damaged from 1975 treatments on 44 and 21 10- and 8-yr-old cv. Cavalier nectarine trees at two orchards and on 26 8-yr-old cv. Redhaven peach trees was 66.2 ± 8.0, 66.4 ± 7.4, and 75.8 ± 6.3 cm^2, respectively. The mean damage from the 1976 treatments was 28.4 ± 5.1, 52.0 ± 15.4, and 20.8 ± 3.9 cm^2, respectively. The year-to-year differences in damage for the 10-yr-old nectarines and the peaches were significant ($P \leqslant 0.001$).

Foliar symptom intensity, application method, and treatment site damage. Treatment with OTC was more injurious ($P \leqslant 0.001$) to 7-yr-old Redhaven peach trees with severe X-disease symptoms than to trees with mild or moderate symptoms. When applications of 100 mg of OTC in 10 ml were made in 20 trees with mild, 24 with moderate, and 9 with severe symptoms, 19.4 ± 4.9, 13.2 ± 2.0, and 126.0 ± 40.5 cm^2 of damage occurred at the treatment sites, respectively. Prior to OTC treatment, all trees with severe symptoms of X-disease had large, irregular areas of dead cambium on diseased scaffolds. Little dead tissue was found on scaffolds with mild symptoms and more on scaffolds with moderate symptoms. Infusion into dead areas was ineffective because the solution was not taken up from the reservoir.

The OTC application method also affected the amount of damage (Table 1). The least damage resulted from infusions by gravity flow or pipets. Most damage occurred from pressure injection, concentrate, or cup methods.

Analyses of uptake, cost, and time for making OTC applications. Uptake of the OTC solutions was complete within 30–90 min with concentrate or pipet infusion methods. In 24 hr, only 63.8 ± 9.1, 88.0 ± 3.5, or $81.9 \pm 14.4\%$ of the solution was taken up with cup or gravity-flow infusion or pneumatic pressure injection methods, respectively.

The cost of the application equipment, exclusive of a hand drill, varied widely. Only an oil can or squeeze bottle was necessary for the concentrate method (23). Reusable pipets, in 1982, cost 15 cents each (10). Cup applicators of the size used in this study, about 150 ml, are no longer available (13). The components of a reusable gravity-flow infusion apparatus (14) and of the pressure injector (5) cost \$1.99 and \$43, respectively.

The time required to apply the OTC varies greatly among the methods. Two persons using premixed solutions and a battery-operated drill treated an average of 100 trees per hour with the concentrate and pipet methods, 15–25 trees per hour with the cup and gravity-flow infusion methods, and 2–3 trees per hour with the pressure injection methcd. Most of the additional time needed to administer the last two treatments was used for attaching the apparatus to the tree and transferring OTC solutions. Two sites per tree were treated except for the pressure injection method, where three or four sites per tree were treated.

Foliar symptom remission. Almost all OTC-treated trees showed remission of symptoms the next growing season. With the concentrate, gravity flow, and pipet methods, remission on limbs was related to placement of the treatment site on the trunk. A significant ($P \leqslant 0.001$) proportion (56–82%) of the scaffolds located directly above treatment sites was remitted of all visible symptoms (100% remission), whereas complete remission did not occur on any scaffolds offset laterally above the treatment sites. Similar patterns of largely vertical OTC movement have been observed in pear trees (10,22). On peach trees where only scaffolds with symptoms were treated, some apparently healthy scaffolds subsequently developed symptoms; however, these scaffolds were offset laterally above treatment sites. Without exception, if a second postharvest OTC treatment was not made on treated diseased trees, symptoms intensified the next growing season.

Table 1. Treatment site damage ($\pm SE_{\bar{x}}$) and method of application of OTC in 7-yr-old Redhaven peach trees in two orchards

Method of application	Concentration (mg/ml)	Volume (ml) applied per treatment site	Damage ($cm^2 \pm SE_{\bar{x}}$)[x] per orchard		
			A[y]	A	B
Concentrate	100	1	41.9 ± 5.9 a	···	98.2 ± 16.2 a
Pipet	10	10	19.4 ± 4.9 b	···	13.6 ± 2.0 b
Pipet	20	15	···	29.9 ± 6.1 a	···
Cup	12	50	44.0 ± 25.9 a	···	···
Gravity flow	0.5	1,000	···	13.3 ± 2.4 b	···
Injection	0.25	1,333	···	69.3 ± 29.7 a	···
Probability level			$P \leqslant 0.05$[z]	$P \leqslant 0.02$	$P \leqslant 0.001$

[x] Damage measurements were recorded 1 mo after treatment.
[y] Treated on 7 and 21 July 1977 at orchard A and on 20 July at orchard B.
[z] Figures in a column followed by the same letter do not differ by Student's standardized *t* test of means.

Other compounds. Two weeks after infusing the various other antibiotic compounds into 7-yr-old Redhaven peach trees, no foliar chlorosis was caused by taurolin or the solvent controls (water, ethylene glycol, or polyvinylpyrrolidone in saline). Tylosin, erythromycin, and OTC caused mild to moderate chlorosis. Spectinomycin caused extreme chlorosis, and the trees defoliated quickly. The next spring, leaf and flower buds above the treatment sites died. By July, no chlorosis or foliar damage was evident with other treatments (*data not shown*).

Treatment site damage 3 wk after application was least (0.01 ± 0.01 cm^2, $P \leqslant 0.05$) with taurolin (300 mg a.i./15 ml) and the solvent controls. Tylosin (1,000 mg a.i./15 ml), spectinomycin (1,000 mg a.i./15 ml), and erythromycin (675 mg a.i./15 ml) caused 1.2 ± 0.6, 1.6 ± 0.4, and 3.9 ± 1.2 cm^2 of damage, respectively. The most damage (15.4 ± 2.8 cm^2, $P \leqslant 0.05$) was caused by OTC (300 mg a.i./15 ml).

For 15-yr-old trees rated 10 mo after infusion, erythromycin and OTC caused the most damage. Less damage was caused by taurolin, $CaCl_2$, sulfanilamide, and tylosin (Table 2). Trees treated with spectinomycin and streptomycin were killed. In a similar test, rated 9 mo after treatment, tylosin caused less damage than OTC, erythromycin; and sulfanilamide (Table 3).

In July, foliar symptom remission was observed on trees treated 10 mo earlier with erythromycin, sulfanilamide, tylosin, and OTC. By September, only OTC had maintained symptom remission. Taurolin and $CaCl_2$ did not cause remission (Table 2). Total yield (kg/cm^2), fruit weight (g/fruit), and numbers of fruit (fruit/cm^2) were greater on symptomless and OTC-treated diseased scaffolds than on diseased scaffolds either untreated or treated with erythromycin or tylosin (Table 3).

Yield vs. OTC treatment. Total yields from untreated X-diseased scaffolds of peaches and nectarines were less than from OTC-treated diseased or symptomless scaffolds (Tables 3 and 4). Losses (kg/cm^2) were reduced 56–73% on OTC-treated diseased scaffolds compared with untreated diseased scaffolds. On treated diseased and untreated symptomless scaffolds, fruit/cm^2 were similar for both peaches and nectarines. Weight of individual fruits was reduced on untreated diseased and treated diseased scaffolds in peaches but not in nectarines (Tables 3 and 4). Nectarines on untreated diseased scaffolds weighed more and were less numerous than on untreated symptomless or diseased scaffolds (Table 4).

Yield vs. foliar symptom intensity. On scaffolds with severe foliar symptoms, the number of nectarine and peach fruit (fruit/cm^2) and total yields (kg/cm^2) were reduced significantly compared with the weight of fruit (g/fruit) (Table 5). Surprisingly, fruits harvested from scaffolds with severe symptoms weighed approximately as much as those from symptomless ones. Inspection indicated that on a diseased scaffold, symptomless branches may be interspersed with diseased ones, and the symptomless branches produce apparently normal fruits. On diseased branches, however, few small, "pointed" fruits characteristic of X-disease (26) persist until harvest.

DISCUSSION

Treatment site damage by the concentrate method has discouraged its use. Damage can be avoided partially by treating only scaffolds with mild or moderate foliar symptoms or by applying OTC by gravity flow (500 mg a.i./1,000 ml) or pipet method (100 mg a.i./10 ml) (Table 1). Certainly, the gravity flow method causes less damage than infusion of 300 mg a.i. OTC using pipets (Table 1). The pipet method, furthermore, is nearly as rapid and inexpensive to use as the concentrate method.

Because foliar symptoms were incompletely remitted in parts of some trees treated by the pipet method, transport of OTC from the treatment site to all parts of the tree must be incomplete. Therefore, placement of treatment sites directly below or on each diseased scaffold is necessary for the greatest foliar symptom remission. No reports specifically indicate whether gravity flow or injection methods cause more complete remission than the pipet methods. Others have reported symptom remission extending beyond the first year after treatment (1,17). However, using commercial OTC preparations, as used in this study, they also reported more rapid reappearance of symptoms compared with analytical-grade OTC.

In this study, follow-up treatments were necessary because symptoms recurred in seasons after the first growing season following treatment. Therefore, the X-disease causal organism (XDO) must be incompletely eradicated from the treated scaffolds or it reinvades from roots, trunk, or other scaffolds. The chief effect of X-disease on fruit yield is to reduce fruit numbers on scaffolds with

Table 2. Change in foliar symptom intensity, treatment site damage, and foliar chlorosis (± $SE_{\bar{x}}$) of 15-yr-old X disease Redhaven peach trees treated with selected compounds

Compound	Concentration and volume of compound infused[t] mg/ml	ml/treatment	Chlorosis[u]	Treatment site damage (cm^2)[v]	Increase in foliar symptom intensity index[w] 1977–1978	1978–1979
Calcium chloride	2	1,000	None	4.2 ± 0.8 a[x]	1.00 ab	NT[y]
Erythromycin	67	15	Moderate	40.5 ± 20.7 b	2.33 b	1.83 a
Oxytetracycline	10	10	Moderate	59.8 ± 32.6 b	−1.50 a	−2.00 b
Spectinomycin	50	10	Severe	...[z]	3.66 b	NT
Streptomycin	50	10	Severe	...[z]	1.66 b	NT
Sulfanilamide	67	15	Moderate	9.1 ± 5.2 a	0.83 ab	0.50 ab
Taurolin	133	15	None	0.1 ± 0.1 c	0.66 ab	0.66 ab
Tylosin	100	10	Moderate	11.6 ± 0.3 a	1.00 ab	0.66 ab
Untreated	...	...	...	0.1 ± 0.1 c	2.33 b	0.33 ab

[t] Three trees were treated with each compound by large-volume gravity-flow or the pipet method at two treatment sites on 29 September 1977 and 1978. Prior to treatment, the trees had mild to moderate symptoms of X-disease (mean = 6.0 ± 0.4 foliar symptom intensity index) and no difference among the treatments ($P \leqslant 0.2$).
[u] Chlorosis was rated 2 wk after treatment.
[v] Damage was recorded on 21 July 1978.
[w] Foliar symptom intensity was rated on 29 September 1978 and 25 September 1979.
[x] Figures in a column followed by the same letter do not differ at $P \leqslant 0.05$ by Student's standardized t test of means.
[y] No treatment was made in 1978.
[z] The trees were killed above the treatment site.

Table 3. Change in intensity of foliar symptoms of X-disease, treatment site damage, and yield statistics of scaffolds (± $SE_{\bar{x}}$) on 4-yr-old Redhaven peach trees infused with selected antibiotics

Scaffold treatments[u]	Increase in foliar symptom intensity rating[v]	Treatment site damage (cm^2)[w]	Fruit number[x] (fruit/cm^2) June	August	Fruit weight (g/fruit)	Total yield (kg/cm^2)
Symptomless						
Untreated	0.4 ± 0.8 a[y]	None a	7.8 ± 0.8 ab	2.9 ± 0.2 a	103.9 ± 4.8 a	0.30 ± 0.05 a
Diseased						
Tylosin	2.4 ± 0.9 b	4.9 ± 1.2 b	9.4 ± 0.6 b	0.2 ± 0.1 b	70.6 ± 2.8 b	0.02 ± 0.1 b
Oxytetracycline	−3.8 ± 0.6 c	59.7 ± 11.7 c	8.0 ± 1.0 ab	2.3 ± 0.3 a	92.7 ± 2.8 a	0.21 ± 0.03 a
Erythromycin	3.1 ± 1.0 b	104.2 ± 30.4 c	2.1 ± 1.0 b	0.2 ± 0.1 b	73.6 ± 3.5 b	0.01 ± 0.01 b
Sulfanilamide	1.2 ± 1.1 ab	109.9 ± 26.4 c	5.8 ± 1.2 ac	...[z]	...	...
Untreated	1.3 ± 0.8 ab	None a	6.0 ± 2.4 abc	0.5 ± 0.2 b	59.2 ± 3.9 c	0.03 ± 0.01 b
Probability level	$P \leqslant 0.05$	$P \leqslant 0.01$	$P \leqslant 0.02$	$P \leqslant 0.001$	$P \leqslant 0.001$	$P \leqslant 0.001$

[u] Scaffolds (15–20) were untreated or infused with oxytetracycline (100 mg/10 ml) or another antibiotic (250 mg/10 ml) on 25 September 1978 by pipet.
[v] Scaffolds were rated on 25 September 1978 and 1979. Prior to treatment, the diseased scaffolds had mild to moderate symptoms (6.4 ± 0.5 symptom intensity index), and there was no difference among the treatments ($P \leqslant 0.3$). Some scaffolds rated as symptomless in 1978 developed symptoms in 1979.
[w] Damage was recorded on 14 June 1979.
[x] Yield data were standardized to the scaffold area at its base on 14 June and 22 August 1979.
[y] Figures in a column followed by the same letter do not differ by Student's standardized t test of means.
[z] No data taken; grower pruned "dying" scaffolds.

severe symptoms. On scaffolds with mild to moderate symptoms, loss in fruit numbers is offset somewhat by increased fruit size. Of all compounds tested, only OTC provides for foliar symptom remission and near-normal fruit yields on diseased scaffolds compared with untreated symptomless scaffolds.

The reductions of losses on OTC-treated X-diseased trees reported here (56–73%) confirm and closely resemble those reported by Pearson and Sands (17) but extend their observations by the inclusion of data on fruit/cm^2 and g/fruit. The phytotoxicity of spectinomycin was unexpectedly severe. Pearson and Meyer (16) also used 1,000 mg a.i. per tree and reported phytotoxicity, but they were able to rate trees for symptom remission 9 mo later. Perhaps differences in tree age, cultivar, spectinomycin formulation, or application method may account for these divergent results.

Selection of OTC re-treatment sites after the first postharvest treatment must be made with care. Several trees were girdled by damage from re-treatments applied next to areas damaged by the previous treatment. Another common placement error for re-treatment sites is to locate them directly on or below old treatment sites. Because transpirational flow is restricted across these sites, little if any upward OTC movement was detected by OTC-induced chlorosis in the canopy or by foliar symptom remission.

Visually, peach trees are more susceptible than pear (*Pyrus communis* L.) trees to OTC treatment site damage (10). In the present study, peach trees treated with 100 mg of OTC in 10 ml and 300 mg of OTC in 15 ml by pipet had 13.6 and 29.9 cm^2 of damage per treatment site, respectively (Table 1). In a second test, 100 mg of OTC in 10 ml caused 59.8 cm^2 of damage per treatment site (Table 2). For comparison only, data already published (Table 1 in reference 10) indicated that pear trees from two plantings treated at two sites each by the same method with 50, 250, 500, and 1,000 mg of OTC in 10 ml had 1.0, 2.4, 6.4–24.3, and 6.6 cm^2 of damage per treatment site. The wide differences in results probably indicate differences in pear tree ages and plantings, but the trend clearly indicates that peaches are more susceptible to OTC damage than pears.

Chemotherapy of eastern X-disease with OTC may have a role in integrated control of X-disease if in-orchard spread now occurs, as has recently been suggested in eastern (11; Lacy, *unpublished*) and midwestern (19) orchards. Although tree-to-tree spread seems unlikely for eastern X-disease (26), other in-orchard mechanisms, possibly involving the attractiveness of ground cover for leafhopper vectors of XDO (12), may occur. If in-orchard spread does occur, XDO inoculum in the orchard may be reduced by OTC because this antibiotic is presumed to suppress growth of mycoplasmalike organisms in plants (3).

Other X-disease control practices should be continued. OTC does not "cure" diseased trees, and treatment site damage precludes prophylactic use. Future research toward reducing pathogenic inocula in or near orchards should consider an integrated management program that includes the treatment of diseased trees with mild or moderate symptoms, removal of trees with severe symptoms (24), removal of reservoir hosts like chokecherry (*Prunus virginiana* L.) (19), control of major vector leafhopper species (21) with insecticides (9), and removal of preferred vector feeding hosts from the ground cover (12).

Table 4. Yields (means ± $SE_{\bar{x}}$) of OTC-treated and untreated X-diseased Cavalier nectarine and Summer Queen peach scaffolds

Yield statistic[x]	Symptomless untreated scaffolds	Diseased scaffolds: Treated[y]	Diseased scaffolds: Untreated	Probability level
		Nectarines		
n =	15	11	18	
Foliar symptom intensity	0.0 ± 0.0 a	0.3 ± 0.3 b	7.4 ± 0.8 c	$P \leq 0.001$[z]
Fruit number (fruit/cm^2)	6.7 ± 0.8 a	5.7 ± 0.8 a	2.7 ± 0.7 b	$P \leq 0.02$
Fruit weight (g/fruit)	56.0 ± 1.3 a	54.0 ± 1.5 a	64.2 ± 3.2 a	$P \leq 0.02$
Total yield (kg/cm^2)	0.41 ± 0.04 a	0.30 ± 0.04 a	0.15 ± 0.04 b	$P \leq 0.02$
		Peaches		
n =	9	15	25	
Foliar symptom intensity	0.0 ± 0.0 a	0.7 ± 0.3 b	6.2 ± 0.8 c	$P \leq 0.001$
Fruit number (fruit/cm^2)	1.7 ± 0.4 ab	2.6 ± 0.4 a	1.3 ± 0.3 b	$P \leq 0.02$
Fruit weight (g/fruit)	142.1 ± 7.4 a	91.4 ± 10.2 b	99.9 ± 10.7 b	$P \leq 0.01$
Total yield (kg/cm^2)	0.22 ± 0.04 a	0.19 ± 0.02 a	0.11 ± 0.02 b	$P \leq 0.05$

[x] Yields and photographs of foliar symptoms were made on 23 and 24 August 1977 in commercial orchards. Fruit number, weight, and total yield were standardized to scaffold area at its base.
[y] For 2 yr, scaffolds with mild to moderate symptoms of X-disease were treated by a single postharvest application of OTC (100 mg/1.0 ml) by the concentrate method.
[z] Figures in a row followed by the same letter do not differ at the level indicated by Student's standardized *t* test of means.

Table 5. Yields (means ± $SE_{\bar{x}}$) from scaffolds on X-diseased Cavalier nectarine and Summer Queen peach trees with various selected foliar symptom intensities

Harvest statistic[y]	Symptomless	Mild	Moderate	Severe	Dead
			Nectarines		
n =	15	4	4	5	2
Foliar symptom intensity	0.0 ± 0.0 a[z]	2.5 ± 0.6 b	6.5 ± 0.6 c	10.0 ± 0.0 d	11.0 ± 0.0 e
Fruit number (fruit/cm^2)	6.7 ± 0.8 a	4.0 ± 0.6 a	4.9 ± 1.8 a	0.6 ± 0.3 b	None c
Fruit weight (g/fruit)	56.0 ± 1.3 a	65.9 ± 5.2 b	63.1 ± 9.0 ab	68.1 ± 4.7 b	None c
Total yield (kg/cm^2)	0.41 ± 0.04 a	0.26 ± 0.04 a	0.27 ± 0.09 a	0.03 ± 0.02 b	None c
			Peaches		
n =	9	10	6	6	3
Foliar symptom intensity	0.0 ± 0.0 a	2.3 ± 0.4 b	6.7 ± 0.7 c	10.0 ± 0.0 d	11.0 ± 0.0 e
Fruit number (fruit/cm^2)	1.7 ± 0.4 a	2.0 ± 0.4 a	2.7 ± 0.5 a	0.4 ± 0.2 b	None c
Fruit weight (g/fruit)	141.1 ± 7.4 a	82.0 ± 5.9 b	89.3 ± 5.0 b	136.4 ± 36.0 a	None c
Total yield (kg/cm^2)	0.24 ± 0.04 a	0.17 ± 0.03 a	0.23 ± 0.04 a	0.05 ± 0.02 b	None c

[y] Yield measurements and photographs of foliar symptoms were made on 23 and 24 August 1977 in commercial orchards. Fruit number, weight, and total yield were standardized to scaffold area at its base.
[z] Figures in a row followed by the same letter do not differ at $P \leq 0.02$ by Student's standardized *t* test of means.

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