

related to vascular cambial death. The older wood of the xylem becomes disfunctional through time, and this disfunctionality is marked by the intrusion of gum into the vessel elements (3). Peach trees seem to be dependent upon the yearly production of new water-carrying vessel elements (Carter, unpublished). If this production is prevented by cold injury to the vascular cambium, the sudden severe water stress of bloom or leaf, or both, may place the tree in a water deficit condition from which it cannot recover. Nesmith and Dowler (7) found that some injured trees in PTSL site did not collapse immediately, but were weakened and declined slowly during the summer. It is suggested that in cases like these, injury to the vascular cambium results in loss of vessel element production insufficient to cause death, but sufficient to diminish the

water-carrying capacity of the tree. This condition may then result in a weakened tree that undergoes a summer-long slow decline similar to that previously reported (7).

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Response of Phony-infected Peach Trees to Gibberellic Acid¹

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Abstract. Peach trees (*Prunus persica* (L.) Batsch) dwarfed by phony disease responded to 2 summer applications of 264 ppm gibberellic acid (GA) by breaking the disease-induced rest period and resuming nearly normal twig growth. No twig growth was produced on untreated trees and no significant growth occurred on phony trees treated with combinations of cytokinins, sodium isoascorbate, calcium nitrate, urea, or citric acid.

Peach trees infected with phony peach bacterium, a rickettsia-like organism (3), appear dwarfed in comparison to healthy trees of the same age. Infected trees flower and leaf out earlier than normal and retain their leaves later in the fall (4). Twigs grow slowly (2 to 15 cm/yr) and become quiescent by mid-summer while normal twigs continue to grow more or less continuously (30 to 90 cm/yr) until fall. Although some occlusions do occur in xylem elements of phony trees (1), there is an absence of foliar wilting, chlorosis, and necrosis which are often associated with restricted vascular transport. Phony symptoms indicate that the disease is caused by alterations in the endogenous levels of plant growth regulators. Application of growth substances may overcome dwarfing without directly affecting the pathogen. Stunting symptoms associated with corn stunt, aster yellows, and wound tumor have been partially overcome by spraying the plants with GA (7). Citrus trees affected with young tree decline were reju-

venated with applications of cytokinins (8) and sodium isoascorbic acid (6). This paper reports the use of GA in breaking the summer rest period of peach trees which had phony peach disease (PPD) symptoms.

Seven-year-old peach trees of the 'June Gold' cultivar were selected for their well developed PPD symptoms. Pretreatment measurements of 10 twigs per tree were recorded on June 16. Current season's growth (March to June) was measured on upright branches on the periphery of the upper crown. None of the phony trees in the test were actively producing new shoot growth at that time; all spring growth had become woody and terminal buds had formed, or were beginning to form. Healthy trees were actively growing and were measured as a comparison.

Treatments are listed in Table 1. Each treatment was applied to 1-tree plots replicated 3 times. Sprays were applied on June 22 and July 26 with a handgun at a pressure of 14.1 kg/sq cm. Sprays were applied to runoff (about 9 liters/tree). One and 2 months after the second treatment, trees were examined for new growth and 10 terminals per tree were measured.

GA stimulated new growth on almost all terminal buds on the phony trees (Table 1). New twigs appeared nearly normal in color, as did leaf shape and size. Internodes were slightly longer in GA treatments and leaf margins slightly more wavy. The twigs were thinner than normal; however, the previous season's growth was also thinner than comparable healthy trees. No shoot growth occurred on untreated trees or those treated with urea and calcium nitrate. On the GA treatments, new twig growth on the outer periphery of the crown was upright rather than horizontal or decumbent, as is typical of phony trees. Symptomless trees maintained continuous twig growth throughout the summer but at a reduced rate during mid-June and July, when dry weather prevailed. When daily rain occurred during mid-August, twig growth resumed at about the same rate in GA treated trees as in healthy trees.

While these data are preliminary in nature, they clearly indicate that partial remission of phony peach symptoms can be achieved through the use of GA. Although the rate of new twig growth on GA-treated trees appeared equal to that of healthy trees, the total new growth was actually less. While normal trees produced some twig growth all summer, the treated trees did not respond to GA for over 2 months. Further tests will be required to determine the most effective rate and timing of GA applications to sustain normal twig growth throughout the growing season. Combination of GA with other growth regulators may be needed.

Another consequence of phony disease is the reduction of fruit size and number. The effects of GA and other growth regulators on the fruiting char-

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Table 1. Response of phony peach trees to treatments applied as foliar sprays on June 22 and July 26.

Treatment ^z	Rate g/liter ai	Shoot length (cm) ^y	
		Pretreatment June 16	Response Sept. 19
Water	—	21.1a	0a
Sodium isoascorbate	27.0		
Urea	9.6	19.5a	1.5a
Calcium nitrate	5.9		
Sodium isoascorbate	27.0	17.0a	0.3a
Urea	9.6		
Calcium nitrate	5.9	19.1a	0.1a
Sodium isoascorbate	54.0		
Urea	9.6	17.0a	2.1a
Calcium nitrate	5.9		
Cytokinin ^x	.00125	19.3a	0.4a
Sodium isoascorbate	27.0		
Urea	9.6		
Calcium nitrate	5.9	19.8a	1.0a
Citric acid	3.5		
Gibberellic acid	0.264	19.2a	12.5b
Healthy, untreated	—	45.1b	19.0c

^zSource of materials: sodium isoascorbate (Mycoshield) Pfizer, Inc. NY; cytokinins (Cytex) Atlantic and Pacific Research, Inc., N. Palm Beach, FL; gibberellic acid (Pro Gib Plus) Abbott Laboratories, Chicago, IL.

^yMean separation in columns by nonparametric procedure of Kruskal and Wallis (5).

^xCytex contains mixed cytokinins, mostly zeatin-like. Cytokinin activity is 100 ppm kinetin equivalent based on bioassay (8).

acteristics of phony affected trees will be evaluated in future studies.

The use of growth regulators to reverse disease symptoms without affecting the pathogen would offer only a

temporary solution to this difficult problem. The pathogen is apparently not affected by GA treatments. Post-treatment examinations (2) of root and stems from GA and water treatments

showed no significant differences between treatments in the numbers of bacteria present. This indicates that the trees are still infectious. It is, therefore, important to continue the practice of removing diseased trees to prevent the further spread of PPD throughout the orchard.

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Chemical Thinning of Prune: Relation of Assimilate Deprivation to Ethylene-mediated Fruit Abscission¹

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Abstract. Dry matter accumulation by immature 'French' prune (*Prunus domestica* L. cv Agen) fruit was reduced significantly within 7 days by (A) branch girdling plus defoliation (G+D), or (B) 300 ppm ethephon. Ethephon, but not G+D, reduced fruit removal force (FRF) significantly over the same interval. These data do not support the hypothesis that ethylene (C₂H₄)-induced thinning is initiated by assimilate deprivation. We propose that reduced mobilization of assimilates by ethephon-treated fruit is a consequence of the incipient fruit senescence which precedes abscission rather than the causative factor.

Competition for metabolites is frequently invoked to explain June drop in deciduous fruit trees (1, 5, 7, 9, 11-15). It has also been suggested that the effects of certain chemical thinning agents, i.e., NAA and ethephon, are mediated by a reduction of assimilates reaching young apple and peach fruit (14, 15).

The requirement of rapidly enlarging fruit for assimilates (6) is not in

question, nor is the reduced mobilization of nutrients by senescing fruit (11). These observations, however, do not preclude the possibility of direct effects of chemical thinning agents on fruit independent of assimilate deprivation.

Post-bloom ethephon applications stimulate abscission of French prunes (8). The objective here was to determine whether substrate deprivation was sufficient to reduce FRF over the time course of ethephon-induced abscission. If C₂H₄-induced fruit abscission (Fig.

1, Step 3) is a direct consequence of carbon stress (Fig. 1, Step 2), then other treatments, e.g., limb defoliation, which generate carbon stress comparable to that of ethephon should initiate fruit abscission during the same time interval as that affected by ethephon. In other words, if ethephon-induced thinning is mediated by assimilate deprivation, assimilate deprivation *per se* should initiate abscission over the same time interval in the absence of exogenous C₂H₄.

The experiment comprised a factorial combination of 3 dosage levels of ethephon with 3 dosage levels of carbon deprivation. Each of the 9 treatments (Table 1) was applied 25 days after full bloom (11 mm seed length) to 6 limbs randomized among 8 ten-year-old 'French' prune/Marianna 2624 trees. Reduction of assimilates available to fruit (carbon stress) was attempted by 2 different means: (A) girdling plus defoliation (G+D) or (B) shading. In treatments which combined ethephon plus carbon stress, ethephon was sprayed to run off after G+D or just before shading. Limbs (Table 1; S₁E₀, S₁E₁₀₀, S₁E₃₀₀) were shaded with black polyethylene bags which were, in turn, enclosed in white cloth bags to reflect incident radiation. Achievement of carbon stress was

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