duced CEV transmission (Table 1). Blades dipped briefly in milk and then rinsed three times in water did not transmit CEV, indicating the effect was on the virus. Powdered milk, reconstituted as directed, was not as effective as fresh milk (Table 1). However, higher concentrations could presumably have an effect comparable to fresh milk. Milk cannot be considered as effective against CEV as HB or FSH solutions, but is readily available, very safe to use, non-corrosive, and may be useful in some situations. Fresh milk is more expensive than HB or FSH solutions and would require refrigeration for prolonged storage.

Effectiveness of disinfectants and other agents: —Contaminated knife blades dipped briefly in 1% Bromodine, 1 and 10% Triodine, 1% Roccal, 2% sodium hydroxide, 10% trisodium phosphate, 95% ethyl alcohol, or diesel fuel still transmitted CEV, although the transmission rate was reduced in some instances (Table 1). A brief dip in 10% Bromodine did prevent CEV transmission, but this concentration would be expensive and unpleasant to use. A 5-minute exposure of contaminated blades to 2% sodium hydroxide also prevented transmission, but this time period is impractical for many field situations. Our results, plus those reported earlier (6, 10), demonstrate that CEV is resistant to many types of chemical inactivation.

Effectiveness of washing or cleaning:—Dipping blades in water, a 2% detergent solution, or wiping them with a dry paper tissue after a water rinse did not prevent CEV transmission (Table 1). When blades were dipped in a 1% detergent solution and rinsed vigorously in water, no transmission occurred. This probably indicates removal of the virus from the blade rather than inactivation, since mixing equal parts of a 2% detergent solution with a 1/5 buffer extract of CEV-infected tissue did not inactivate CEV after a 2-minute exposure (data not shown). In other tests, repeated rinsing of contaminated blades in water alone did not prevent transmission, but a substantial increase in incubation period was noted, indicating some removal of the virus had occurred.

Washing procedures may remove some or all of CEV from contaminated tools and reduce or prevent transmission. Inactivation of CEV with HB or FSH solution is, however, a more reliable control procedure.

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FIELD TESTING OF CYCLOHEXIMIDE FOR ABSCISSION OF ORANGES GROWN IN THE INDIAN RIVER AREA

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ABSTRACT

Moderate to severe damage to citrus trees from 20 ppm cycloheximide (CHI or Acti-Aid) was observed during the 1968-69 fruit season in some tests with midseason oranges in the Indian River area. Experiments were subsequently conducted to determine if trees growing in this area were abnormally sensitive to CHI.

Good fruit loosening of 'Pineapple' oranges was obtained consistently with dilute sprays of 5 to 25 ppm. Little or no phytotoxicity was noted at these concentrations, but leaf drop increased as tree dormancy terminated and young flush growth and blooms appeared.

Florida Agricultural Experiment Stations Journal Series No. 4179.

Abnormally low temperatures delayed, and slightly reduced, the effectiveness of CHI, but did not prevent successful fruit loosening of 'Pineapple' oranges. Fruit from trees in poor condition and with low Brix/acid ratios loosened following sprays of CHI, but showed a high degree of variability.

Introduction

During the 1968-69 fruit season, several reports were received of severe foliage and wood damage to some early and midseason orange trees from preharvest sprays of cycloheximide (CHI) applied as fruit loosening sprays. Most of the reports originated from tests conducted in the Indian River area (1). In most cases, similar injury had not been observed on groves located on the deep sands in the central Florida area. Therefore, a series of experiments was undertaken in the Indian River section to determine if these trees were abnormally sensitive, or whether the injury might have been the result of other causes.

Materials and Methods

Experiments were conducted on both young and mature 'Pineapple' orange trees which were growing on 2-tree beds under typical conditions for the region.[1] In addition, 1 test was conducted on trees in a sub-marginal growing condition in a poorly drained area of a grove. Results represent 4-tree averages from randomly selected trees. Concentrations of CHI used ranged from 5 to 25 ppm. Sprays were applied dilute with a hand sprayer to obtain thorough coverage. Pull tests were taken as a measure of the effectiveness of the applied chemical, and percentage leaf drop was estimated. 'Pineapple' oranges were sprayed at approximately monthly intervals beginning December 11, 1970. Results of 'Valencia' orange experiments are included in another paper (2).

Results

Statistical analyses confirmed that there were no significant pull force differences between performance of CHI on either young or mature trees, hence these results were combined. In most cases, concentrations of CHI differed significantly at the 7-day post-treatment period for trees sprayed December 11, 1970, and January 18, 1971, but not for trees sprayed February 16, 1971 (Fig. 1). There were no differences in pull forces for trees sprayed February 16, 1971, as all the fruit had

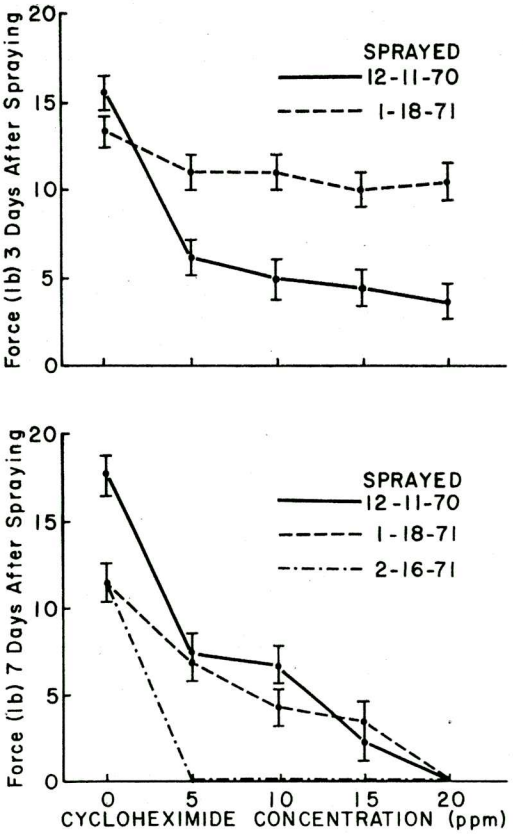

Figure 1.—The effect on fruit pull force of different spray dates and varying concentrations of cycloheximide (Acti-Aid) applied to 'Pineapple' oranges growing in the Indian River area.

fallen from the trees regardless of the concentrations of CHI used. A significant drop in pull force of untreated fruit was recorded between the experiments of December 11, 1970, and the subsequent experiments. No 3-day pull force measurements were taken for trees sprayed February 16, 1971.

Different dates of spray produced highly significant 7-day pull force differences between trees sprayed February 16, 1971, and those sprayed on December 11, 1970, and January 18, 1971. However, except for the 10 ppm concentration, no significant differences occurred between the latter treatment dates, although the controls differed significantly. Highly significant 3-day pull force differences were observed for trees sprayed December 11, 1970, and January 18, 1971. The spray applied January 18, 1971, was followed by a very cold period (unofficial temperature of 26°F re-

ported for the morning of January 20, 1971), but the latter portion of the period was mild, and mild temperatures occurred throughout the 7-day period of the other 2 spray dates. The official temperature records for Ft. Pierce for the first 3 days following spraying showed average high temperatures were only 65.5°F for trees sprayed January 18, 1971, as compared to 78.8°F and 76°F respectively for trees sprayed December 11, 1970, and February 16, 1971. Average lows for the first 3 days were 33°F vs. 58°F and 59°F.

There was no significant difference between reaction of trees in good and poor condition to equal concentrations of CHI (Fig. 2), although wide variations in fruit loosening were observed (which is the cause of the large standard deviations in Fig. 2). Brix/acid ratio was 10.49 for the trees in poor condition, and 13.17 for the healthy trees. Further, it was obvious that fruit from 2 or more different blooms was present on the poorer trees.

Leaf drop on all treatments was negligible at the beginning of the period, and increased with the advent of the new spring flush. Observed leaf drop varied from 0-1/2% for trees sprayed December 11, 1970, to ½% for those sprayed January 18, 1971, to 1-2% for those sprayed February 16, 1971. Although the average leaf drop was not excessive even on trees sprayed February 16, 1971, individual trees on which growth was more advanced had more mature leaf drop than would be desired, and young flush and flowers present were injured, particularly at the higher concentrations.

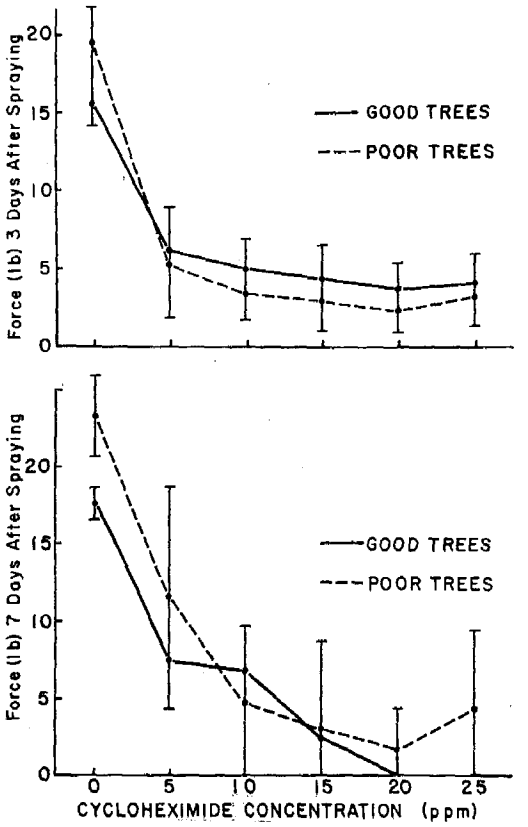

Figure 2.—The effect on fruit pull force of varying concentrations of cycloheximide (Acti-Aid) applied to 'Pineapple' orange trees in good or poor condition growing in the Indian River area. Sprays were applied December 11, 1970.

Discussion

The extreme injury noted with CHI sprays in previous seasons was not observed in these tests. However, conditions which might have been considered abnormal were noted on trees sprayed on February 16, 1971, with some of the higher concentrations. Although some buds and bloom were showing, these trees were not completely leafed out. Additional field data collected on early and midseason oranges in central Florida during February-March, 1970, showed that spraying trees after the spring flush had begun could cause moderate to severe tree injury with substantial reduction in fruit production for at least the next season (4). The trees on the East Coast which were injured during the late winter of 1969 were probably in varying stages of growth at the time the sprays were applied. Also, most of the spraying at that time was under an experimental label which called for 20 ppm of CHI, a concentration which now appears to be excessive in some circumstances, and particularly with the advent of the spring growth flush.

When winter weather conditions were generally mild, CHI produced fruit loosening within 3 days (see Fig. 1). For most effective handling of CHI, the grower should avoid spraying if weather forecasts indicate the high probability of rain and cold temperatures (3). However, as the nature of fruit loosening sprays requires their continuous application during the harvest season, unfavorable application periods undoubtedly will occur at various times. It has been reported (1) that one grower, who normally shakes his trees 5 days following spray application, does not count as days-to-harvest any where daytime temperatures do not exceed 55°F. Until further research is