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EFFICACY OF SPECIFIC FORMULATIONS OF CUPRIC HYDROXIDE FUNGICIDES FOR CONTROL OF CITRUS MELANOSE AND GREASY SPOT

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Abstract. **Three formulations of cupric hydroxide, 2 wettable powders (Champion Wettable Powder and Kooide 101) and 1 flowable (Champ Flowable), were applied to pink grapefruit (*Citrus paradisi*) Macf., in May 1988 to evaluate control of citrus melanose (*Diaporthe citri*) (Fawc.) Wolf, and to additional pink grapefruit in early July 1988 to evaluate control of citrus greasy spot (*Mycospaerella citri*) Whiteside, in Florida. The wettable powder formulations were applied at 3.0 pounds and the flowable formulations at 1.5 pounds of metallic copper equivalent per acre for melanose and 2.0 pounds and 1.0 pound of metallic copper equivalent, respectively, for greasy spot control. The three formulations resulted in equal control and reduced melanose and greasy spot compared to the unsprayed check.**

Melanose, caused by *Diaporthe citri* (Fawc.) Wolf, produces raised pustules on the fruit, leaves and twigs of grapefruit (*Citrus paradsi*) (3). Disease severity depends on the number of pycnidiospores washed onto the fruit from the Phomopsis stage of the fungus tht sporulates on dead twigs. Melanose is seldom a serious problem on young trees. On older trees, which usually contain more dead wood, routine spraying is usually necessary (5, 8). Fruit rind remains susceptible to melanose infection for approximately 12 weeks after petal fall (2, 8). Severe melanose causes the fruit to be reduced in grade.

Copper fungicides applied in the postbloom period are the only materials recommended in Florida for the control of melanose (1).

Greasy spot, aused by *Mycosphaerella citri* Whiteside, causes premature leaf drop. Excessive defoliation of citrus may cause a reduction in the following spring growth flush and a subsequent yield reduction (6). Since 1973, defoliation data have been used to quantify greasy spot severity. Previously, disease severity was expressed only as a percentage of diseased leaves with symptoms (4).

Greasy spot severity depends upon temperatures in the fall and winter as well as the amount of infection that occurs the previous summer (7).

Copper formulations and oil, applied in June, July and August are recommended in Florida for the control of greasy spot (1).

The following experiments were initiated to compare a flowable formulation of copper hydroxide to 2 wettable powder formulations of copper hydroxide.

Materials and Methods

The following cupric hydroxide fungicides were evaluated for efficacy in controlling melanose and greasy spot: Champ Flowable (2.3 lbs. copper hydroxide per gal., 15% metallic copper) and Champion WP (50% metallic copper) (Agtrol Chemical Products, Houston, Tx.); and Kocide 101 WP (50% metallic copper) (Griffin Corp., Valdosta, Ga.). The average particle size of the Champ Flowable was 0.35 microns and of the wettable powders was 1.8 miocons. No adjuvants were applied with any of the spray mixes. The rates of the materials applied are shown in the data tables.

The cubric hydroxide fungicides were applied to 30-40 year old grapefruit (*Citrus paradisi*) Macf. located in a grove in Howey-in-the-Hills, Florida. The trees were 15-20 feet in height and were spaced 15 to 30 feet resulting in 99 trees per acre. Sprays were applied as dilute sprays using a Citrus Systems gasoline driven portable sprayer with a 100 gallon spray tank. The sprayer was equipped with a single-nozzled handgun which was operated at 300 psi. Trees were sprayed at approximately 6 gallons spray per tree. An untreated buffer tree was located on both sides of the treated trees.

The sprays for melanose were applied on 4 May 1988. Treatment plots were arranged in a randomized block design and consisted of 8 single tree replicates. When fully colored on 24 Oct. 1988, 25 randomly selected fruit from the lower part of the canopy that could be reached from the ground were picked. The fruit were evaluated in the field for the presence or absence of melanose pustules. Rainfall during the susceptible period was: May—2.7 inches; June—8.81 inches.

The sprays for greasy spot were applied on 29 June 1988 to trees different than those used for the melanose study. Treatment plots were arranged in a randomized block design and consisted of 6 single tree replicates. In early June, prior to spraying, 20 shoots of the current year's spring flush were tagged. On 29 Jan. 1989, 15 tagged flushes were examined for missing leaves and diseased leaves with one lesion equaling infected. Rainfall during the trial period was: July—9.6 inches; Aug.—4.56 inohes; Sep.—6.7 inches; Oct.—0.9 inches; Nov.—5.0 inches; Dec.—1.0 inches; Jan.—2.9 inches.

Results and Discussion

All three cupric hydroxide formulations significantly reduced melanose on the fruit when compared to the unsprayed check (Table 1). The cupric hydroxide flowable formulation resulted in melanose control equal to the two wettable powder formulations.

The three cupric hydroxide formulations significantly reduced the number of leaves infected with greasy spot when compared to the unsprayed check (Table 2). The cupric hydroxide flowable formulation resulted in greasy spot control equal to the 2 wettable powder formulations.

Table 1. Evaluation of cupric hydroxide formulations for controlling citrus melanose on the fruit of grapefruit trees. Melanose control 24 Oct. 1988.

Treatment	Formulation	Rate[z] per acre	% Fruit with Melanose
Champ	2.3Fl[x]	1.5	3.1 b[y]
Champion	50WP	3.0	5.9 b
Kocide 101	50WP	3.0	15.8 b
Control-Unsprayed	—	—	38.5 a

[z]Pound active metallio copper.
[x]Flowable containing 2.3 lb. copper hydroxide per gallon.
[y]Mean seperation by Duncan's New Multiple Range Test, 5% level of significance.

Table 2. Evaluation of spray treatments for controlling citrus greasy spot on the spring growth flush of grapefruit trees. Greasy spot control 24 Jan. 1989.

Treatment	Formulation	Rate[z] per acre	% Infected Leaves
Champ	2.3 Fl[x]	1.0	29.4 b[w]
Champion	50WP	2.0	24.4 b
Kocide 101	50WP	2.0	49.2 b
Control-Unsprayed	—	—	73.9 a

[z]Pound active metallio copper.
[y]Total leaves per flush present in June divided into the total of missing leaves plus leaves with one or more lesions.
[x]Flowable containing 2.3 lb. copper hydroxide per gallon.
[w]Mean seperation by Duncan's New Multiple Range Test, 5% level of significance.

If the performance of the flowable at these rates of metallic copper, continue in future trials, it may decrease the possible build-up of copper in the soil. Additional trials will be necessary to confirm.

Additional melanose and greasy spot trials are underway in 1989 as are numerous trials on other crops in Florida and other states.

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RELATIONSHIP BETWEEN XYLEM-LIMITED BACTERIA AND CITRUS BLIGHT

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Abstract. ***Xylella fastidiosa*** **Wells et al., a xylem-limited, gram negative bacterium, causes dieback-type diseases in many different trees in Florida. Fluorescence microscopy, enzyme-linked immunosorbent assay (ELISA), and culturing on PD3 medium were all used successfully to detect *X. fastidiosa* in extracts from citrus with blight. Using ELISA, the bacterium was detected in root homogenates and vacuum extracts from roots and stems. *X. fastidiosa* was detected in either root or stem extracts from blight trees in 8 of 12 months studied. The bacterium was also cultured from root and stem extracts of trees with blight, but only from a very low percentage of the samples that were positive by ELISA. Immunofluorescence was used to identify colonies of *X. fastidiosa* on the PD3 medium and these strains from citrus were shown to cause Pierce's disease in inoculated grapevine. These citrus strains were later shown to produce stunting and dieback symptoms in young citrus trees.**

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Xylella fastidiosa Wells et al., a xylem-limited gram-negative bacterium, has been proposed as the possible causal agent of citrus blight (5). Blight symptoms are similar to those of other diseases known to be caused by strains of *X. fastidiosa*, including phony disease of peach, Pierce's disease of grape, oak leaf scorch, and sycamore leaf scorch (3,4,7). Additional circumstantial evidence that blight may be caused by this bacterium includes microscopic detection of *X. fastidiosa* in citrus (10), success of chemotherapy experiments (11,15), prevalence of vectors of *X. fastidiosa* in areas of Florida where blight incidence is high (14), and the utilization of one of these vectors to transmit the Pierce's disease strain from citrus trees with blight to grapevine (9). Visible symptoms, dieback and leaf drop, were produced after inoculation of young citrus trees in the greenhouse with strains of *X. fastidiosa* (6). Applications of supplemental insecticides to control sharpshooter vectors of the bacterium reduced the rate of spread of blight in one Florida grove (1).

In spite of this evidence for the involvement of *X. fastidiosa* in citrus blight, the complete blight syndrome has not been reproduced in mature trees in the grove. It has also been very difficult to demonstrate a consistent association between the bacterium and blight (13). This report presents the results of immunofluorescent and enzyme-linked immunosorbent assays (ELISA) to detect *X. fastidiosa*