

## EFFECT OF ALL PURPOSE COLLOIDAL CLEANER® ON INSECT CONTROL AND GROWTH OF CONTAINERIZED RED SUGAR APPLE IN A SHADE HOUSE AND ON GROWTH, YIELD, AND FRUIT ROTS OF GREEN SUGAR APPLE AND 'GEFNER' ATEMOYA UNDER FIELD CONDITIONS

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**Abstract.** The effect of colloidal cleaner on growth and insect control of containerized one year old red sugar apple trees (*Annona* spp.) was investigated under shade-house conditions. The effect of colloidal cleaner on growth, yield, and fruit rots of green sugar apple (*Annona squamosa*) and 'Gefner' atemoya (*A. squamosa* × *A. cherimola*) trees was also investigated under field conditions at the Tropical Research and Education Center. Containerized sugar apple trees were sprayed 15 times with water or colloidal cleaner at 7-day intervals. Number of new leaves, tree trunk diameters, and height were recorded. Several scale insects and mealybugs were identified as attacking the containerized plants at initiation of the experiment. There were no significant growth differences among treatments of containerized trees and insect infestations were only temporarily controlled. Green sugar apple and 'Gefner' atemoya trees in the field were sprayed with water, colloidal cleaner or non-sprayed 3 times at a 7-day interval and 8 times at a 14-day interval. There were no significant differences among treatments for trunk diameter and shoot growth of sugar apple or 'Gefner' atemoya trees. In general, non-sprayed sugar apple and 'Gefner' atemoya trees had significantly more fruit than colloidal cleaner sprayed trees. Fruit rots were significantly more prevalent for colloidal cleaner sprayed trees compared to non-sprayed trees.

In Florida, the current commercial acreage of sugar apple (*Annona squamosa* L.) and atemoya (*A. squamosa* × *A. cherimola* Mill.) is estimated to be about 25 acres. Various scales and mealybugs along with fruit rots are constraints limiting production. There are a few registered pesticides to control insects and diseases on commercially grown sugar apple and atemoya in the U.S. and very few pest control products are available to home owners with fruit trees in the home landscape. Various soaps and oils are recommended for control of insect pests however their efficacy is not known. Recently, anecdotal evidence has suggested a colloiddally based industrial cleaner may have efficacy as a plant growth stimulant and bio-pest control product on a wide range of fruit crops. The effect of All Purpose Colloidal Cleaner® on growth and control of various scales and mealybug was investigated on container-

ized red sugar apple trees under shade-house conditions and the effect of cleaner on growth, yield, and fruit disease of field grown green sugar seedlings and 'Gefner' atemoya trees was evaluated under field conditions at the Tropical Research and Education Center.

### Materials and Methods

**Container experiment.** Containerized red sugar apple seedlings were sprayed with water (control) or All Purpose Colloidal® cleaner 15 times at a 7-d interval from 4 Feb. 2004 to 12 May 2004. Trees were sprayed at 60 psi and the colloidal cleaner was diluted to a 1:300 ratio. Trunk diameter at 6 cm from the soil surface and tree height was measured on 16 Apr. and 26 Oct. 2004 and 11 Jan. 2005. On 9 Apr. 2004, after a total of nine spray treatments the total number of new leaves per tree was counted. Long soft scale (*Coccus longulus*), pink wax scale (*Ceroplastes*), and Citrus mealy bug (*Planococcus citri*) were observed attacking the plants prior to spray treatments (Browning et al., 1995; Hamond and Williams, 1984). The effect of colloidal cleaner to control these insect pests was by inspection of the plants before, during, and after treatment applications. Vegetative growth data were analyzed by ANOVA and Duncan's Multiple Range Test at  $P \leq 0.05$  (SAS, 2005).

**Orchard experiment.** Seven-year-old green sugar apple (*Annona squamosa*) and grafted 'Gefner' atemoya (*A. squamosa* × *A. cherimola*) trees on sugar apple (*A. squamosa*) rootstock, were sprayed with water or colloidal cleaner (diluted to 1:100, cleaner:water) or non-sprayed three times at 7-d intervals and eight times at 14-d intervals beginning on 10 June 2004 and ending on 14 Oct. 2004. Trees were sprayed at a pressure of 150 psi. Treatments were arranged in a completely randomized design with four to eight trees per treatment. The shoot length of three branches per tree was measured on 17 June and 21 Oct. 2004. Trunk diameter at 10 cm from the soil level was measured on 17 June and 12 Jan. 2005. Vegetative growth data were analyzed by ANOVA and Duncan's Multiple Range Test at  $P \leq 0.05$  (SAS, 2005).

On 30 Aug. 2004 the total number of green sugar apple and 'Gefner' atemoya fruit was counted on each tree. On 16 Aug. 2004 and 15 Sept. 2004, a sample of 15 horticulturally mature green sugar apples and 'Gefner' atemoyas, respectively, were harvested and weighed. Yield for each treatment was estimated based on fruit count and mean fruit weight. A random sample of six green sugar apple and 'Gefner' atemoya fruit were submitted to UF/IFAS Plant Diagnostic Clinic, Homestead, for disease diagnosis and rating. Fruit rot incidence was rated on a scale of 0 to 4 where, 0 = no visible disease on the fruit surface, 1 = 1 to 25% of the fruit surface showed disease, 2 = 26 to 50%, 3 = 51 to 75%, and 4 = 76 to 100% of the fruit surface showed disease symptoms. Vegetative growth data and diseases ratings were analyzed by ANOVA and Duncan's Multiple Range Test at  $P \leq 0.05$  (SAS, 2005).

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Table 1. Fruit count, weight, and yield for field-grown green sugar apple and 'Gefner' atemoya trees.<sup>z</sup>

Fruit crop	Treatment	Mean fruit count	Mean fruit weight (g)	Yield per tree (kg)
Green sugar apple	Non-sprayed control	79.75 a	188.8 b	15.1 a
	Water control	47.88 b	193.5 a	9.3 b
	Colloidal cleaner	40.75 b	182.9 c	7.4 b
'Gefner' atemoya	Non-sprayed control	44.75 a	524.1 a	23.5 a
	Water control	45.50 a	335.6 b	15.3 b
	Colloidal cleaner	25.25 b	306.1 c	7.7 c

<sup>z</sup>Columns with different letters are significantly different at the  $P \leq 0.05$  by Duncan's Multiple Range Test.

## Results and Discussion

**Container experiment.** No significant growth differences were found among treatments for containerized red sugar apple trees (data not shown). The mean number of new leaves ranged from 6.8 to 10.2, trunk diameters from 7.1 cm to 5.6 cm, and tree heights from 116.2 cm to 108.0 cm, for non-sprayed control and colloidal cleaner sprayed trees, respectively. We observed that the pressure used in applying the colloidal cleaner or water provided an initial knockdown of scales and mealybugs. However, long-term, pest control was not achieved using the colloidal cleaner; once frequent applications ceased insect infestations reoccurred.

**Orchard experiment.** There were no significant differences in pre- or post-treatment trunk diameters for green sugar apple or 'Gefner' atemoya trees (data not shown). There were also no significant differences in new shoot growth among treatments for green sugar apple or 'Gefner' atemoya trees (data not shown). Green sugar apple trunk diameters ranged from 6.6 cm to 8.1 cm prior to treatment applications and 8.3 cm to 8.7 cm 7 months later. Similarly, 'Gefner' atemoya trunk diameters ranged from 8.0 cm to 8.6 cm prior to treatment applications and 8.8 cm to 9.2 cm 7 months later.

The number of green sugar apple fruit was significantly greater for non-sprayed trees compared to water or colloidal cleaner sprayed trees (Table 1). Water sprayed green sugar apple trees produced the heaviest fruit followed by non-sprayed and colloidal cleaner sprayed trees. Calculated green sugar apple crop yields were significantly greater for non-sprayed compared to water sprayed and colloidal cleaner sprayed trees. The number of 'Gefner' atemoya fruit was significantly greater for non-sprayed and water sprayed trees than colloidal cleaner sprayed trees (Table 1). In addition, mean fruit weight and calculated crop yields were significantly greater for non-sprayed compared to water and colloidal cleaner sprayed trees.

The causal disease organisms most associated with fruit rots were identified as *Colletotrichum gloeosporioides*, the causal agent of anthracnose and *Botryosphaeria rhodina* (Snowdon, 1990). However, the incidence of *B. rhodina* was very low. The amount of fruit rot (disease rating) was significantly greater for colloidal cleaner sprayed green sugar apple and 'Gefner' atemoya fruit than for non-sprayed and water sprayed trees (Table 2). Non-sprayed 'Gefner' atemoya trees had significantly less fruit rot (lower disease rating) than water sprayed trees. Higher disease incidence on water and colloidal cleaner

Table 2. Fruit rot ratings for field-grown green sugar apple and 'Gefner' atemoya fruit.<sup>z</sup>

Fruit crop	Treatment	Mean disease rating <sup>y</sup>
Green sugar apple	Non-sprayed control	0.5 b
	Water control	1.0 b
	Colloidal cleaner	2.2 a
'Gefner' atemoya	Non-sprayed control	0.2 c
	Water control	1.2 b
	Colloidal cleaner	2.7 a

<sup>z</sup>Columns with different letters are significantly different at the  $P \leq 0.05$  by Duncan's Multiple Range Test.

<sup>y</sup>Anthracnose incidence on *Annona* fruit was rated on a scale of 0 to 4 (0 = no disease, 1 = 1 to 25% of the fruit colonized, 2 = 26 to 50%, 3 = 51 to 75%, and 4 = 76 to 100% of the fruit colonized).

er sprayed trees may be due to an increase in number of hours of fruit wetness.

## Conclusions

All Purpose Colloidal Cleaner® did not have a residual control of various scales and mealybugs on containerized red sugar apple trees. There were no significant growth differences among treatments suggesting at least no short-term plant growth stimulation by the colloidal cleaner tested or the rates used. There were no significant trunk diameter and shoot growth difference among treatments for green sugar apple or 'Gefner' atemoya trees under field conditions. Fruit number and weight were significantly greater for non-sprayed compared to colloidal cleaner sprayed green sugar apple and 'Gefner' atemoya trees. Trees sprayed with colloidal cleaner had more fruit rot (greater fruit disease ratings) than non-sprayed or water sprayed control trees.

## Literature Cited

- Hamon, A. B. and M. L. Williams. 1984. The soft scale insects of Florida. Fla. Dept. Agr. Cons. Serv. p. 194.  
 Browning, H., R. J. McGovern, L. K. Jackson, D. V. Calvert, and W. F. Wardowski. 1995. Florida Citrus Diagnostic Guide. Florida Science Source, Inc., Lake Alfred. p. 244.  
 SAS Institute, Inc. 2005. SAS/STAT software: release 9.1. SAS Institute, Inc., Cary, N.C.  
 Snowdon, A. L. 1990. A color atlas of post-harvest diseases and disorders of fruits and vegetables. CRC Press, Inc., Boca Raton. pp. 164-165.