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Effect of Staggered Copper Sprays on Pre and Post-harvest Diseases of Avocado in KwaZulu-Natal Midlands

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ABSTRACT

Copper sprays were applied at monthly intervals in a staggered-type sprays experiment in order to determine the optimum period for control of pre-and post-harvest diseases in Fuerte and Hass avocado cultivare. The critical periods for black spot on Fuerte appear to be later at Everdon Estate, KwaZulu-Natal than generally accepted for the rest of the industry. Anthracnose, *Dothiorella / Colletotrichum* fruit rot complex and stem-end rot were readily controlled with copper sprays on both cultivars. Copper sprays applied from November onwards should therefore be efficient for the control of post-harvest diseases. Neither production of Hass and Fuerte, nor fruit size distribution of Hass were significantly influenced by any amount of copper sprays.

INTRODUCTION

The development of an export-based avocado industry in the KwaZulu-Natal midlands is fairly new. The main reason for this is that this area offers a supply of avocados to the export market later than the main avocado-growing areas in the Northern Province and Mpumalanga. It is generally accepted that KwaZuluNatal and the Transvaal provinces differ in maturity standards (Mans *et al.,* 1995) due to different climatic conditions. Similarly, the incidence and occurrence of post-harvest diseases differ between different climatic producing areas (Korsten *et al.,* 1994)

Up to 1982 benomil (Benlate®) was the standard pre-harvest spray for the control of black spot on avocado (Darvas *et al.,* 1982), but was largely replaced with copper-oxychloride, mainly due to build-up of pathogen resistance to Benlate (Darvas & Kotzé, 1987). Darvas *et al.,* (1982) found that copper sprays not only controlled *Cercospom* (black spot) but also sooty blotch and anthracnose. Copper fungicides cover a broad spectrum and effectively control a whole range of pathogens on many hosts. Furthermore, its ability to adhere to plant surfaces renders it an effective protective fungicide (Horsfall, 1956). For these reasons it was used in this trial and sprayed at monthly intervals in order to attain protective windows in the season and to determine sequential critical periods of infections of *Pseudocercospora purpurea* eke (Deighton) (black spot) and post-harvest diseases. The effects of copper sprays on production of Fuerte and Hass avocado, and its potential role in the Hass small-fruit problem, were also investigated.

MATERIALS AND METHODS

Copper-oxychloride was sprayed during the 1994/95 season at monthly intervals from September to March 1995 (table 1). Randomized block designs on Hass and Fuerte cultivars were used in this trial. Trees were eight years old and uniform in condition, and orchards were treated as commercial producing orchards except for an altered copper spray programme. Each treatment covered five trees, and unsprayed trees were included as controls. Fuerte fruit were harvested in June 1995 and Hass in August 1995 at 75 % moisture content for both cultivars. Fruit were weighed for each individual tree and thereafter pooled per treatment and sized on a commercial packline. Ten cartons of count 14 were sampled for each treatment and cold-stored at 5,5 °C for 28 days to simulate export conditions. After cold storage fruit was rated for black spot severity using a scale of 0-3, where:

0 no spots,

1 < 5 spots,

2 5-10 spots, and

3 > 10 spots.

Table 1
Design of staggered copper sprays on Hass and Fuerte cultivars

Treatment	*Sep. 94*	*Oct. 94*	*Nov. 94*	*Dec. 94*	*Jan. 95*	*Feb. 95*	*Mar. 95*
1	Cu	Cu	Cu	Cu	Cu	Cu	Cu
2	—	Cu	Cu	Cu	Cu	Cu	Cu
3	—	—	Cu	Cu	Cu	Cu	Cu
4	—	—	—	Cu	Cu	Cu	Cu
5	—	—	—	—	Cu	Cu	Cu
6	—	—	—	—	—	Cu	Cu
7	—	—	—	—	—	—	Cu
Untreated ontrol	—	—	—	—	—	—	—

Cu = Copper-oxychloride sprayed at 3 g/ℓ water
— = No copper sprays

Post-harvest diseases were rated at ready-to-eat stage according to a method described by Bezuidenhout & Kuschke (1982) on a scale of 0-10 (0 = healthy fruit; 10 = totally affected fruit). Data was analyzed statistically using Duncan's multiple range.

RESULTS

Black spot

The incidence of black spot was very low (figure 1). A significant increase in black spot was found in fruit that received no sprays prior to March 1995. The severity of black spot in the March-only spray treatment was similar to that recorded for the unsprayed treatment.

Post-harvest diseases on Fuerte

All copper spray treatments significantly reduced severity of SE and DCC but had no effect on anthracnose (figure 2). The most effective treatment for reducing SE and DCC severity was the monthly sprays from September to March. However, this treatment was not significantly better than spraying from October to March for control of SE and DCC, and spraying from January to March, February to March and March, for control of SE.

Post-harvest diseases on Hass

All copper spray treatments effectively controlled SE (figure 3), but anthracnose was controlled only by copper spray treatments from September to March, November to March, December to March and March.

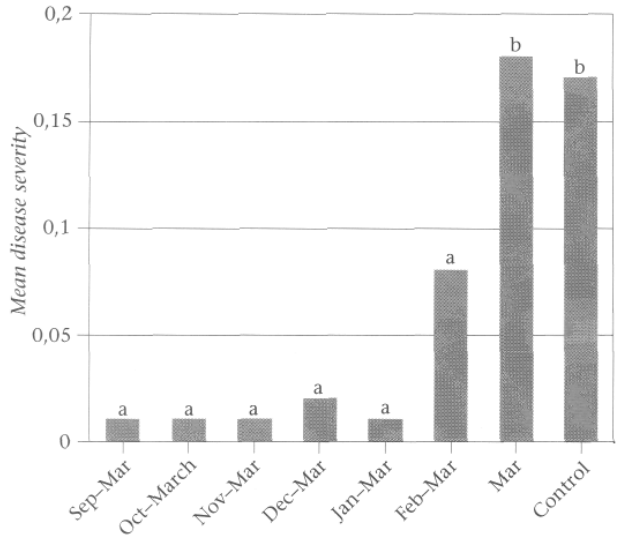

Figure 1
Effect of staggered copper sprays on the severity of black spot on Fuerte avocado fruit

Bars not followed by the same letter differ significantly according to Duncan's multiple range test (P = 0,05)

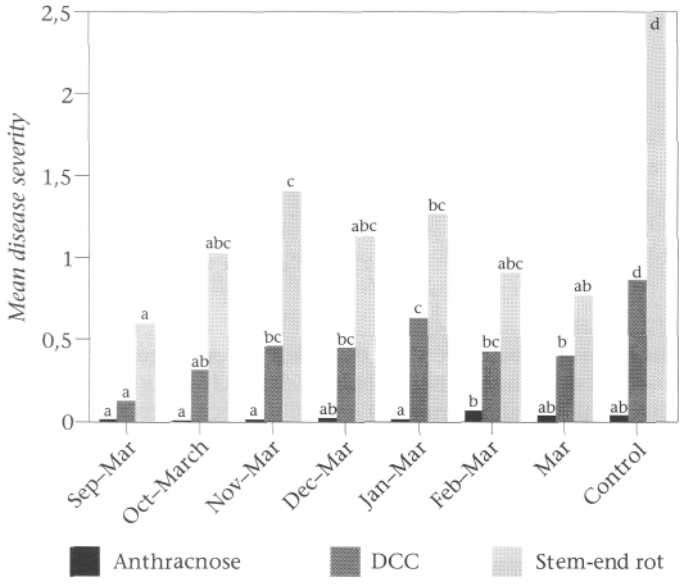

Figure 2
Effect of staggered copper sprays on the severity of post-harvest diseases on Fuerte avocado fruit

Bars not followed by the same letter differ significantly according to Duncan's multiple range test (P = 0,05)

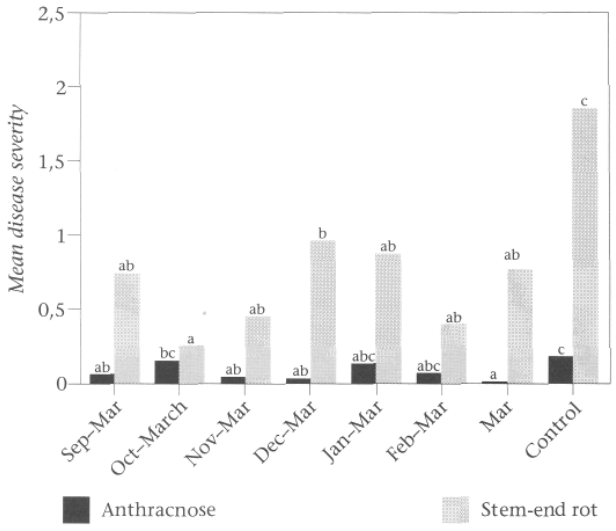

Figure 3
Effect of staggered copper sprays on the severity of post-harvest diseases of Hass avocado fruit.

Bars not followed by the same letter differ significantly according to Duncan's multiple range test (P = 0,05)

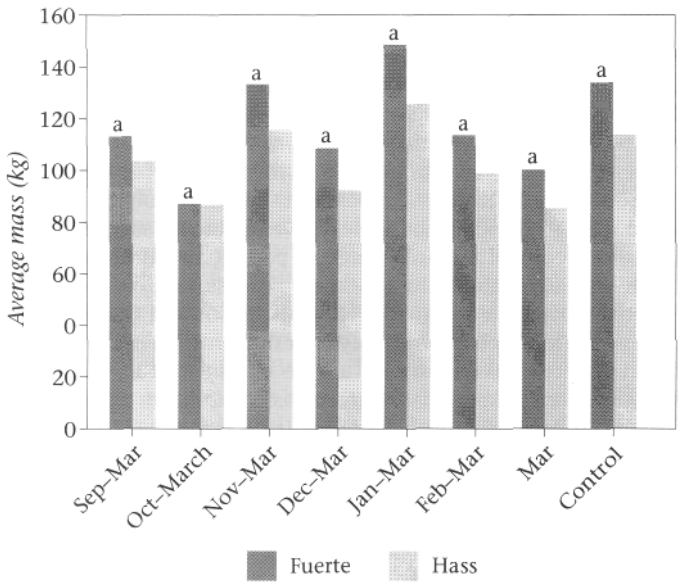

Figure 4
Effect of staggered copper sprays on the production of Hass and Fuerte avocado trees

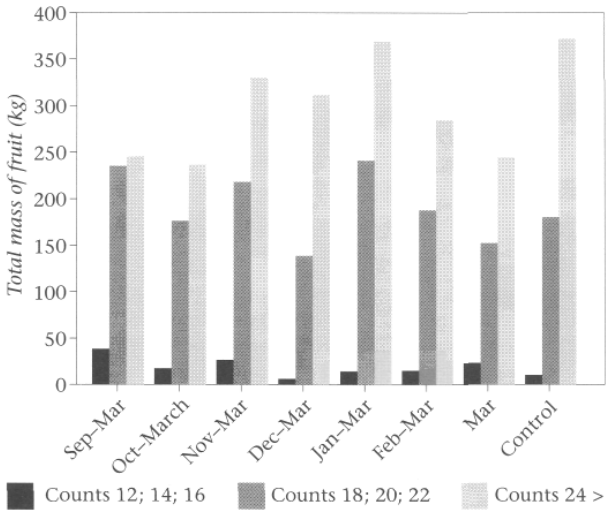

Figure 5
Effect of staggered copper sprays on fruit size distribution of Hass avocado fruit

Production of Hass and Fuerte fruit

Copper had no significant effect on production of either Fuerte or Hass cultivars (figure 4).

Hass small-fruit problem

None of the treatments had any effect on fruit size distribution (figure 5).

DISCUSSION

At Everdon Estate the critical infection period for black spot appears to be February to March .Severity of black spot has previously been correlated to humidity/rain and temperature (Darvas, 1982). It was concluded that black spot disease severity was determined by two factors:

- the high-risk infection period or availability of conidia, along with weather conditions favourable for infection; and
- the time or latent phase which must elapse between infection and symptom development.

Infection and symptom development may thus be delayed if moisture and temperature conditions are not optimal. It is, however, important to note that black spot was recorded with treatments where copper was applied after November, although it was significantly less. In view of this it is recommended that spray programmes should start when humidity/rain and temperature conditions increase. This is usually around mid-November in the KwaZulu-Natal midlands.

The results clearly indicate that post-harvest diseases are frequently controlled with copper sprays on both Fuerte, and Hass. SE and DCC can be controlled on Fuerte as well as SE on Hass. Copper sprays aimed at controlling black spot would be adequate in reducing these diseases. The effectiveness of copper sprays in controlling anthracnose on Fuerte shows more variation, but control on Hass is achieved with as little as one application between November and early January.

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