Alternative control of Cercospora spot on Fuerte – progress report

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ABSTRACT

In 2003 lower volumes of Demildex were sprayed using a mist-blower and volumes as low as 3 500 L/ha were found to be effective when applied to pruned trees. In 2004, alternative products and low copper content products were tested in order to reduce the amount of copper applied to orchards.

The experiment was carried out at Westfalia Estate, and 10 Fuerte trees pruned into hedge rows were used for each treatment. Treatments were applied using an Ultima mist-blower at volumes of 3 500 or 5 000 L/ha.

Fruit were evaluated for incidence of black spot, sooty blotch and visible spray residues at the end of May 2004. Fruit samples from each treatment were cold-stored for 28 days, and evaluated for postharvest diseases and disorders upon ripening. Demildex applied 4 times at 5 000 L/ha with a mist-blower was as effective as hand gun applications of Demildex twice in the season at much higher volumes.

Other treatments that provided equally good levels of control of black spot were Nordox; Demildex alternated with Bravo and Demildex (2 g/L) with Agromos.

Treatment with Nordox also resulted in virtually no visible spray residues on the fruit. Copstar and Kocide performed badly under the testing conditions, although both hold a registration for black spot control. Postharvest disease incidence was relatively low, and no significant differences between treatments were observed.

INTRODUCTION

The control of Cercospora spot or black spot on Fuerte is usually achieved by well timed applications of copper fungicides, such as copper oxychloride, during the rainy season. This however results in large amounts of copper being applied to orchards which leads to a build up of copper in our soils.

Alternative products to copper oxychloride have been evaluated at Westfalia Estate from 1999 to 2002 (Willis and Duvenhage, 2003; Duvenhage, 2002). Products such as Bion (salicylic acid compound) and Avogreen (*Bacillus subtillus*) were effective when tested in a program with copper oxychloride, however Bion was not developed further due to expense and Avogreen remains an option under certain conditions (Duvenhage, 2002). Much research has been done to optimise the efficacy of the biocontrol agent Avogreen and guidelines have been determined to improve the successful application of this product (Van Eeden and Korsten, 2003; 2004).

Besides Avogreen, the only feasible treatments which may replace copper oxychloride thus far are alternative copper containing fungicides (Willis and Mabunda, 2004; Willis and Duvenhage, 2003; Duvenhage, 2002).

In the 2002/03 season lower volume application with a mist-blower was assessed under high disease pressure conditions. Results indicated that good black spot control, could be achieved on large Fuerte trees, when copper oxychloride was applied at 5 000 L/ha four times in the season.

Volumes could be further reduced to 3 500 L/ha per application if Wenfenix (0.25%v/v) was included in the first two applications (Willis and Mabunda, 2004). Based upon these results, alternative fungicides such as Bravo 500SC and Agromos™, and low copper content products such as Nordox, were evaluated at volumes of 5 000 L/ha or 3 500 L/ha applied four times during the 2003/04 season.

Bravo is a broad spectrum protectant fungicide which holds a registration for control of Cercospora leaf spot on Groundnuts (Nel *et al*., 2003). Agromos™ is a plant activator which contains a yeast cell wall extract and may work by inducing systemic resistance in the host plant. Induced resistance could provide systemic protection against infection to substitute for, or supplement control by standard fungicides (Johnston *et al*., 2004). Nordox is an organically acceptable cuprous oxide product containing 75% active copper, which could become very useful in lowering the amount of copper applied annually per hectare (Table 1).

The aim of this project was therefore to reduce the amount of copper applied to orchards by evaluation of alternative fungicides and copper products at lowered volumes for the control of black spot (*Pseudocercospora purpurea*) and postharvest diseases on Fuerte.

MATERIALS AND METHODS

The application volumes employed in this trial were based upon results from the trial conducted in the 2002/03 season (Willis & Mabunda, 2004).

Nordox 750WP (Cuprous oxide, Avima [Pty] Ltd); CuProtect (Copper acetate, Novon [Pty] Ltd); Kocide 2000 (Copper hydroxide, Plaaskem [Pty] Ltd); Copstar 120 SC (Copper hydroxide, Agchem Africa [Pty] Ltd); Bravo 500SC (Chlorothalonil, Syngenta [Pty] Ltd) alternated with Demildex (Copper oxychloride, Delta Chemicals [Pty] Ltd) and Agromos (Yeast cell wall extract, Improcrop cc) applied with a lowered rate of Demildex (2 g/L) were compared with the standard Demildex rate applied with a mist-blower and with hand-gun applicators (Table 1).

The experiment was carried out at Westfalia Estate near Duiwelskloof, Limpopo Province. A new orchard was selected in the same area as the previous trial, which also has a history of high disease pressure.

This was done in order to reduce the chance that inoculum build-up in the orchard would influence the result. Trees were about 24 years old and planted at a spacing of 10 m x 10 m (100 trees / ha).

A row of about 10 trees (height +/- 9-10 m) was used for each treatment and treatments were applied using an Ultima mist-blower.

Two buffer rows were allowed between each treated row in the

block. The Z values for the season were monitored and the first spray was applied when Z value = 14.7 and approximately 50% of the fruit were pigeon egg size (Fig. 1).

The trial was harvested at the end of May 2004 in order to allow for maximum disease pressure, so that products were tested under the most strenuous conditions. In each treatment, 20 fruit from each quarter of the tree canopy from each of 10 data trees were evaluated.

Fruit were evaluated in the orchard for the incidence of black spot, sooty blotch and visible spray residues and a rating scale of 0 to 3, as described previously by Duvenhage (2002), was used for the evaluations. Fruit samples from each treatment were stored at 5.5°C for 28 days and evaluated for postharvest diseases and disorders after ripening at 20°C.

Statistical analysis of data was done using StatSoft, Inc. (2003), STATISTICA (data analysis software system), version 6 (www.statsoft.com).

RESULTS AND DISCUSSION

Demildex applied four times with the mist-blower was as effective as Demildex applied twice with high pressure hand guns, both resulting in excellent black spot control (Fig. 2). However, mist-blower application reduced the amount of copper applied by approximately a third (Table 1).

These two treatments served as the commercial controls. Demildex alternated with Bravo, lowered Demildex (2 g/L) with Agromos and Nordox were all as effective as the commercial controls in controlling black spot (Fig. 2).

Bravo has been tested previously for black spot control (Willis and Duvenhage, 2003) but was not effective probably due to the very high volumes of fungicide applied, resulting in run-off (Dr. G Swart, pers. comm.). Results from this season indicate that Bravo may be effective in controlling black spot when applied in a program with Demildex (Fig. 2) and resulted in half the amount of copper being applied to the orchard (Table 1).

The addition of Agromos™ to a lowered rate of Demildex was as effective as the standard rate and resulted in a third less copper being applied (Table 1).

Therefore Agromos™ could have a role in an integrated control strategy and permit a reduction in fungicide inputs, as was demonstrated in this trial.

Table 1. Treatments and amount of copper applied per ha per year in the 2003/04 season.

Tmt	17-Oct	07-Nov	05-Dec	09-Jan	Cu applied kg / ha / yr
1	CuOCl 3g/L 5000L/ha	CuOCl 3g/L 5000L/ha	CuOCl 3g/L 5000L/ha	CuOCl 3g/L 5000L/ha	30
2	Untreated				
3	CuOCl 3g/L 5000L/ha	Bravo 3ml/L 3500L/ha	CuOCl 3g/L 5000L/ha	Bravo 3ml/L 3500L/ha	15
4	CuOCl 2g/L + Agromos 5ml/tree 5000L/ha	CuOCl 2g/L + Agromos 5000L/ha	CuOCl 2g/L + Agromos 5000L/ha	CuOCl 2g/L + Agromos 5000L/ha	20.08
5	Nordox 1g/L 5000L/ha	Nordox 1g/L 5000L/ha	Nordox 1g/L 5000L/ha	Nordox 1g/L 5000L/ha	15
6	Cuprotect 5ml/L 5000L/ha	Cuprotect 5ml/L 5000L/ha	Cuprotect 5ml/L 5000L/ha	Cuprotect 5ml/L 5000L/ha	2.1
7	Kocide 2.25g/L 5000L/ha	Kocide 2.25g/L 5000L/ha	Kocide 2.25g/L 5000L/ha	Kocide 2.25g/L 5000L/ha	15.75
8	Copstar 3.5ml/L 5000L/ha	Copstar 3.5ml/L 5000L/ha	Copstar 3.5ml/L 5000L/ha	Copstar 3.5ml/L 5000L/ha	8.4
9		CuOCl 3g/L 15000L/ha-hand		CuOCl 3g/L 15000L/ha-hand	± 45

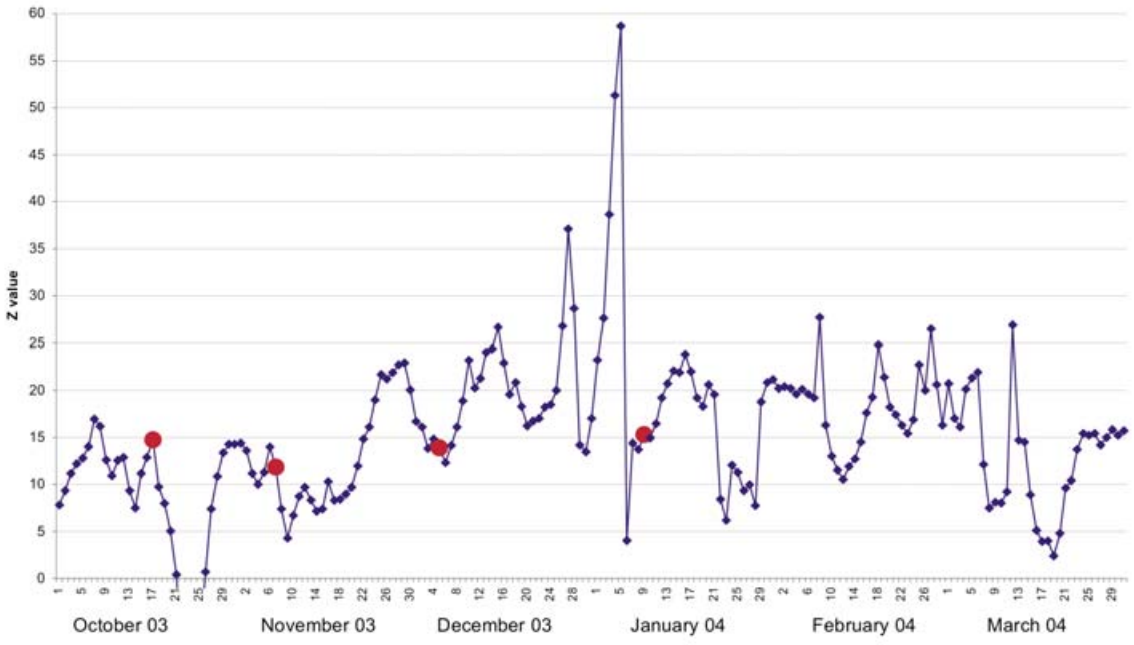


Figure 1. Z-values recorded at Westfalia Technological Services for the 2003/04 season, showing application dates of treatments (red dots).

Copstar and Kocide performed badly under the testing conditions, while both hold a registration for black spot control (Fig. 2). Although Copstar performed well in the 2002/03 season, it did not offer much control of black spot in the 2003/04 season (Willis and Mabunda, 2004).

This may be due to the fact that some heavy rain fell in February, March and April 2004, as opposed to the much drier season in 2003 (Fig. 3). The Z values (Darvas, 1982; Darvas and Kotze, 1987) during February and March indicated that infection could have taken place as late as the end of March 2004 (Fig. 1), therefore products would have had to offer more than 60 days protection.

It is possible that the later rains contributed to higher disease incidence in these treatments in two ways: firstly by prolonging the period during which infection could have taken place (Fig. 1); and secondly by washing a substantial amount of the fungicide off the fruit, thereby exposing fruit to a late infection. Products such as Demildex and Nordox have a much higher concentration of active copper and are perhaps therefore less affected by the washing effect of the rain, as enough active copper remains on fruit surfaces to protect during the periods of late infection.

Sooty blotch was most effectively controlled by Demildex applied with a mistblower or with hand-guns, and by the Bravo / Demildex combination treatment (Fig. 4).

Visible spray residues were observed on all treatments containing Demildex whereas Nordox resulted in virtually no visible spray residues on the fruit (Fig. 5).

Postharvest disease incidence was relatively low, and no significant differences were observed in incidence of anthracnose and stem-end rot (results not shown), however Cuprotect,

Figure 2. Percentage clean fruit from black spot in 2003/04.

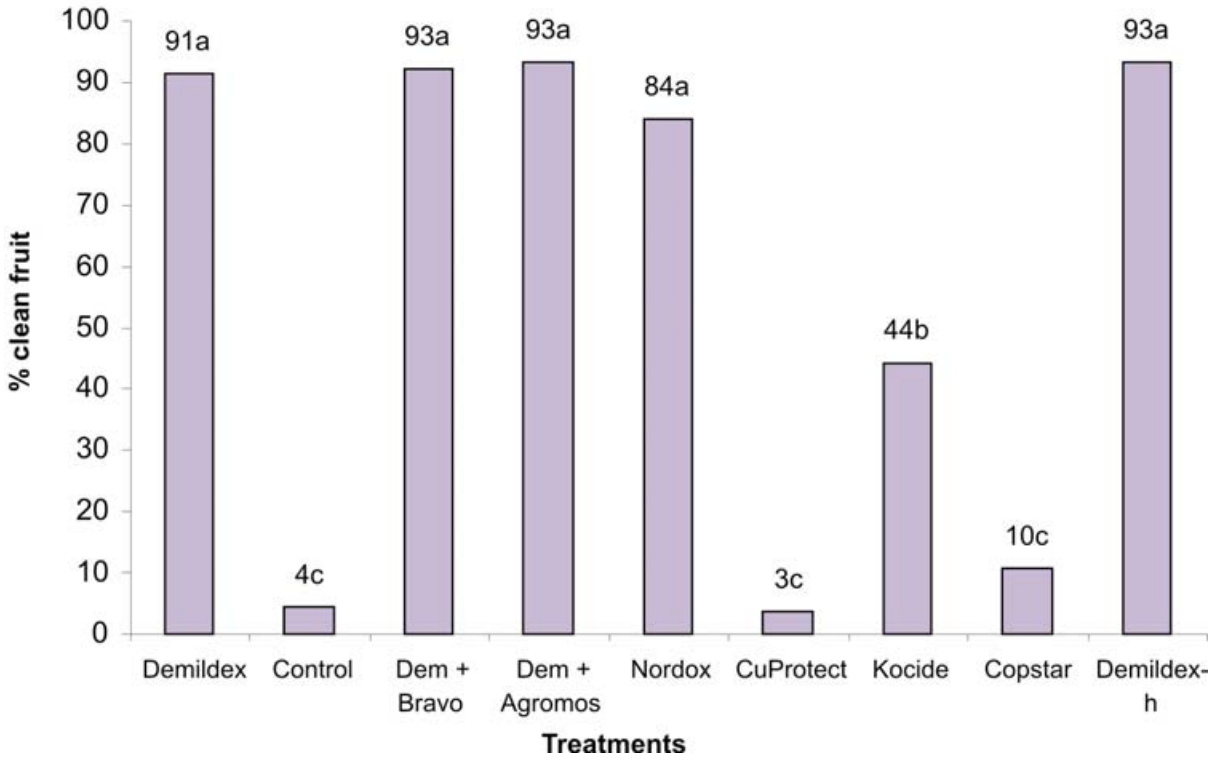
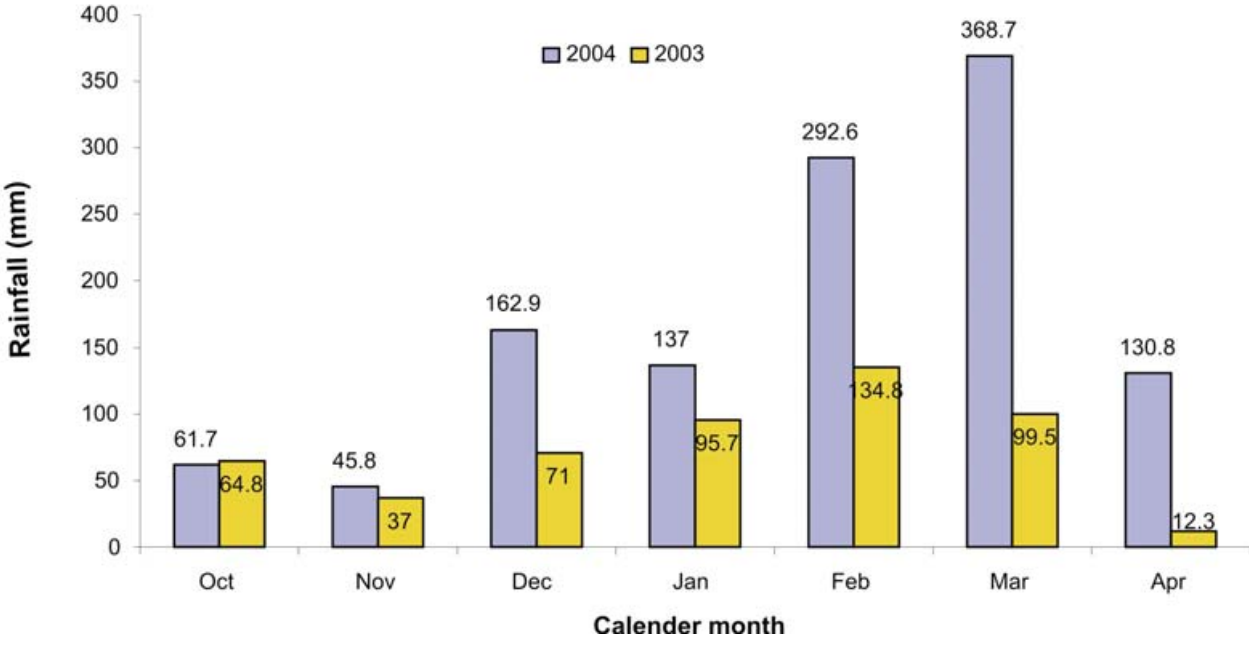


Figure 3. Rainfall (mm) recorded at Westfalia Technological Services from October to April in 2003 and 2004.



lowered Demildex with Agromos, and Nordox were all similar to Demildex in controlling anthracnose (Fig. 6).

CONCLUSIONS

Demildex alternated with Bravo, lowered Demildex (2 g/L) with Agromos and Nordox were all as effective in controlling black spot as the standard application of Demildex with either hand-guns or a mist-blower.

These treatments also reduced the amount of copper applied per ha by 50%, 33% and 50% respectively, when compared to the standard application with a mist-blower.

Two registered products, Copstar and Kocide, performed poorly under the trial conditions, probably due to an extended infection period and late heavy rainfall.

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Figure 4. Percentage clean fruit from sooty blotch in the 2003/04 season.

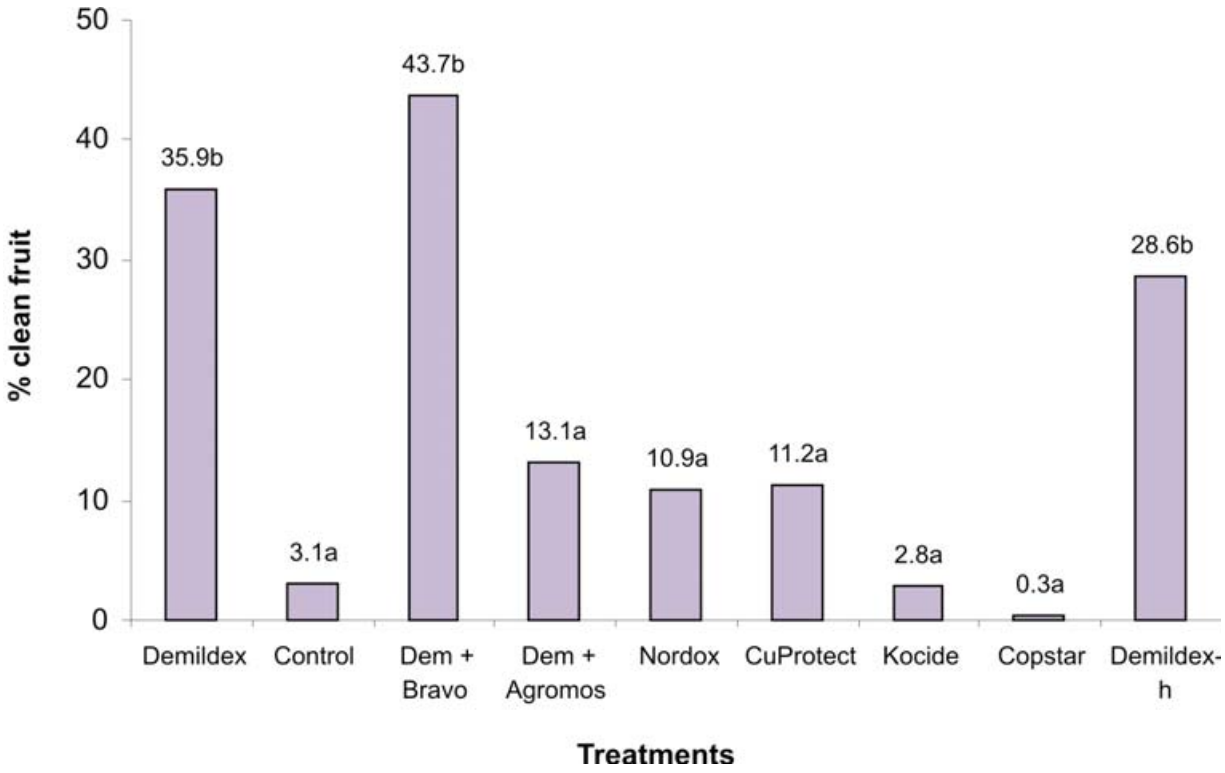


Figure 5. Percentage clean fruit from visible spray residues in 2003/04.

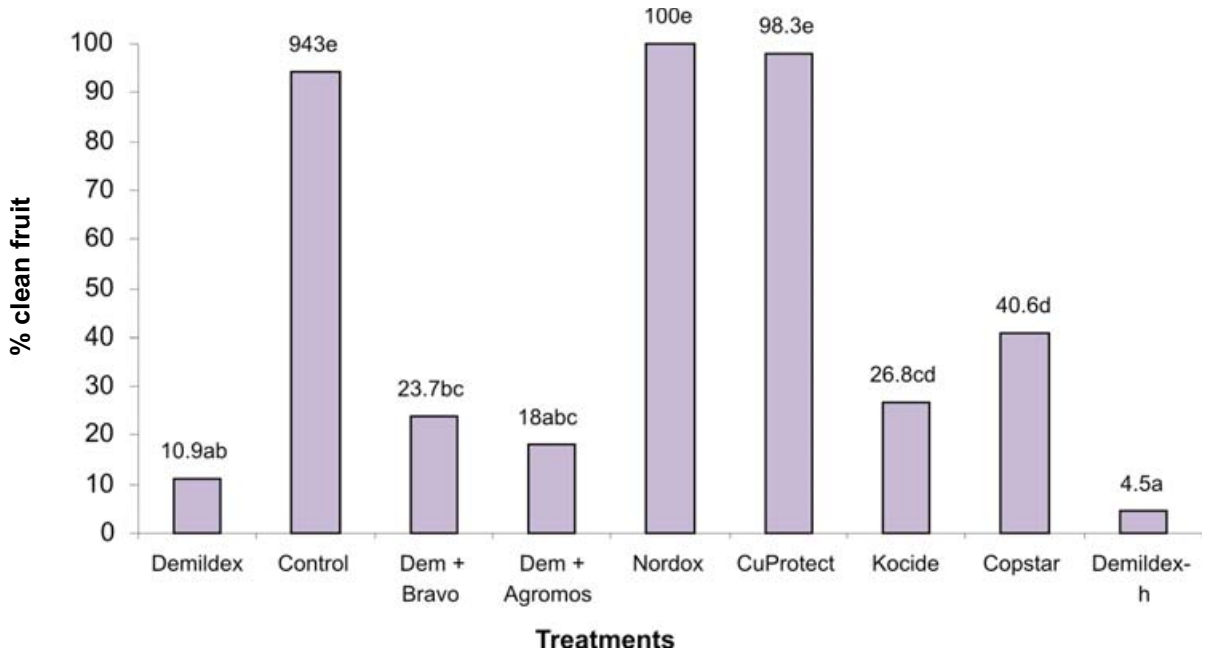
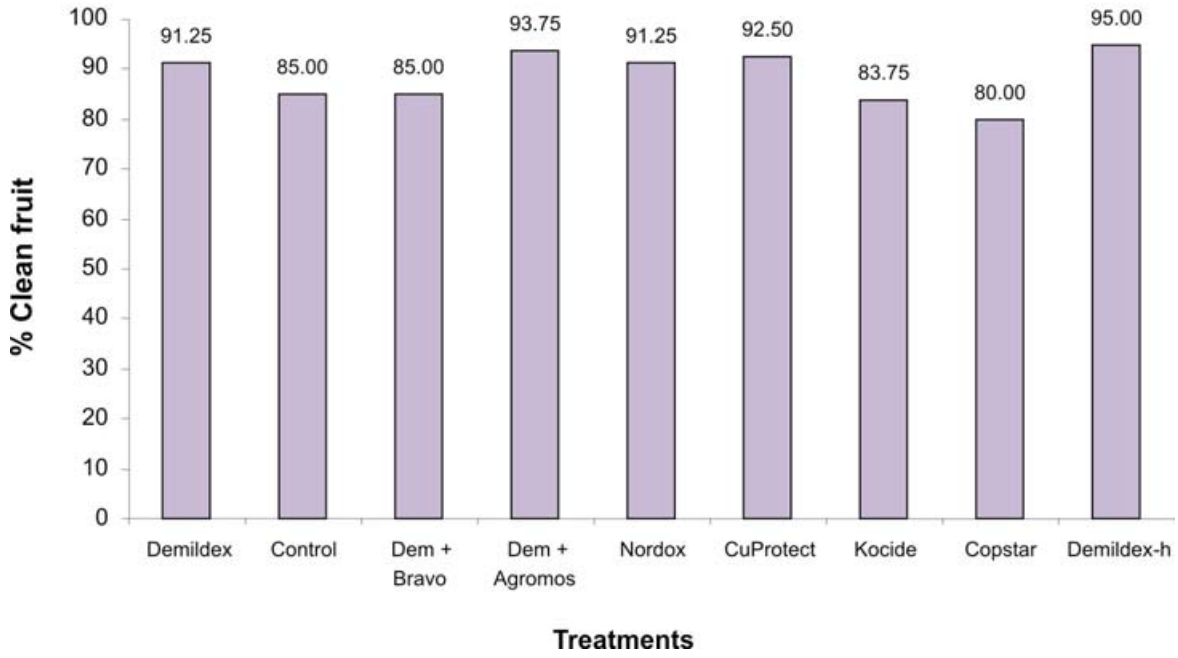


Figure 6. Percentage clean fruit from Anthracnose in 2003/04.



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