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SEMI-COMMERCIAL EVALUATION OF SMARTFRESH™ WITH SOUTH AFRICAN EXPORT AVOCADOS IN STATIC CONTAINERS AT A PACKINGHOUSE DURING 2002.

D Lemmer[1], J.Bezuidenhout[2], S. Sekhune[2], P. Ramokone[2], L. Letsoalo[2], T.R. Malumane[1], P. Chibi[1], Y. Nxundu[1] , & F.J. Kruger[1].

[1]ARC-ITSC, Private Bag X11208, Nelspruit, 1200, South Africa. danie@itsc.agric.za or frans@itsc.agric.za

[2]Westfalia Estates, P.O Box 14, Duivelskloof, 0835, South Africa

ABSTRACT

During the 2000 and 2001 seasons, intensive laboratory testing was done with 1-methyl cyclopropene (1-MCP), an ethylene blocker, on avocado fruit. All the major South African cultivars were tested and aspects such as storage potential, respiration rate and fruit quality upon ripening were covered. The results were extremely positive and the manufacturer (Rohm & Haas, USA) has subsequently registered the powder formulation of the product in South Africa at an application rate of 500 ppb and an exposure period of 12 hours. During 2002, a tablet formulation of 1-MCP, SmartFresh™ was tested under semi-commercial conditions on 'Fuerte' and 'Hass' at the Westfalia packhouse in Tzaneen. The product was applied in a static reefer container. SmartFresh ™ was found to effectively inhibit the ripening process of 'Hass' and 'Fuerte' under the semi-commercial conditions described above. The inhibition of ripening was more intense in 'Fuerte' than in 'Hass'. Furthermore, the inhibition of ripening was more intense in the smaller count 18 fruit than in the bigger count 10-12 fruit. The increase in storage life was found to be comparable to that attained with controlled atmosphere storage (CA) when Smartfresh ™ was applied at the optimum dosage. The most appropriate packhouse based dosage regime for all sized fruit of both cultivars was 300 ppb applied for 16 hours. The period may be prolonged to 36 hours if done in a refrigerated truck *en route* to the port of export and the treatment must preferably be started within 3 days after harvest.

Key Words: Avocado, Hass, Fuerte, 1- methyl cyclopropene, 1-MCP, Smartfresh

INTRODUCTION

During the 2000-2001 seasons, the ARC-ITSC has been evaluating the effectiveness of SmartFresh ™ a product containing an ethylene inhibitor, 1 -methyl cyclopropene (1-MCP), on avocados (Lemmer *et al.*, 2002). The trials were done in the laboratory using all the major export cultivars and covered aspects such as storage potential, respiration rate and fruit quality upon ripening.

Due to the extremely positive results, the manufacturer (Rohm & Haas, USA) has registered the powder formulation of the product on avocados in South Africa. During 2002, a tablet formulation, SmartFresh™ was tested under semi-commercial conditions on 'Fuerte' and 'Hass' at the Westfalia packhouse in Tzaneen. The product was applied under packhouse conditions in a static reefer container. The research aimed to determine suitable application periods and optimum dosage regimes for 'Fuerte' and 'Hass' avocado fruit.

MATERIAL AND METHODS

In the case of 'Fuerte' count 18 (211-235g) and count 10 (366-450g) fruit were used. In the case of 'Hass' count 18 (211-235g) and count 12 (306-365g) fruit were used. Freshly harvested and packed export fruit were sampled for the trials.

Taking our previous results into consideration, it was decided to include two SmartFresh™ concentrations (300 ppb and 500 ppb) and to treat the fruit for 16 hours. On packhouse management request, an 8 hour regime was also included in one of the trials. In all cases, the SmartFresh™ treated fruit were compared with untreated control fruit from the same batch.

Smartfresh™ treated fruit were also compared with CA stored fruit (CO_2 = 6% and O_2= 4%). A flow-through CA system (consisting of a 100*l* drum connected to gas regulators and a CA control board) was installed in a Westfalia cold room for this purpose.

Two 58m^3 reefer shipping containers were parked at Westfalia packhouse for the duration of the 2002 season. One container was air-tightened and used for treating the fruit while the second was used for cool storage.

A total number of 11 container loads were treated during the 2002 season. 'Fuerte' fruit were treated on 18 April, 25 April, 5 June, 23 July, 24 July, 31 July, 2 August and 'Hass' fruit were treated on 5 June, 23 July, 24 July, 2 August, 26 August, 27 August, 28 August, 29 Augus and 30 August.

Individual fruit were comprehensively evaluated as they ripened. The following criteria were included when evaluating the fruit upon ripening: No. of days to ripen, bruising, black cold damage lenticel damage, dusky browning, greypulp, pulpspot, vascular browning, anthracnose, stem-end-rot. The physiological and pathological disorders were scored on a scale of 1-3 where 1 depicted a mild and 3 a severe disorder.

RESULTS AND DISCUSSION

Figure 1 demonstrates the effect of pallet position within the container during the application and storage period on the ripening of 'Fuerte' count 18 fruit. Pallet position did not make a difference. This indicates that Smartfresh™ diffused effectively through the container.

The number of days required to ripen 'Fuerte' fruit during the various trials, is displayed in Figure 2. Treatment with SmartFresh™ led to a significant increase in the average number of days to ripen, throughout the season. This was true for the count 18 and count 10 fruit. However, the inhibition of ripening was more pronounced in the smaller count 18 fruit than in the bigger count 10 fruit. When comparing the 300 and 500 ppb treatments, it is clear that the higher concentration of Smartfresh™ more drastically inhibited ripening than the lower concentration. Nevertheless, the effect attained with the 300 ppb treatment was still satisfactory.

The 'number of days until ripe' recorded for 'Hass' fruit is shown in Figure 3. A trend similar to 'Fuerte' was observed. However, the Hass fruit, especially the bigger count 12 fruit, reacted less favourably than 'Fuerte' to the SmartFresh™ treatment. This might be contributed to the higher metabolic rate of 'Hass' fruit. The general effect was nonetheless acceptable and, as will be shown later, very similar to that attained with CA.

The percentage 'Fuerte' fruit with greypulp (a type of mesocarp discolouration) is portrayed in Figure 4. The untreated fruit showed an increasing prevalence as the season progressed and this trend started earlier and manifested to a greater extent in the bigger count 10 fruit. It is promising to note that the Smartfresh™ treatments led to a significant decrease in the greypulp incidence of, especially, the count 10 fruit. The reduction was more prominent and consistent in the higher dosage treatments (500ppb) of 24 July and 2 August.

The incidence of anthracnose in 'Hass' is represented in Figure 5. As the season progressed, the incidence of the infection increased. Only one SmartFresh™ treatment showed a significant increase in anthracnose infection (count18; treated on 30 August). This treatment was done at the higher dosage (500ppb) and the ripening period was considerably longer in this specific case. The intensity of the infection was also influenced. With the control, all 16% of infected fruit scored 1. With the SmartFresh™ treatment 16% of the fruit obtained a rating of 1, while 7.4% scored 2 and 3.7% scored 3. Care must therefore be taken not to overextend the shelflife period by using a too high dosage. This was also noticed in the laboratory trials conducted during the previous 2 seasons (Lemmer *et al.*, 2002).

The percentage of 'Fuerte' fruit with stem-end-rot is displayed in Figure 6. The control fruit did not show a significant increase in infection towards the end of the season. However, the Smartfresh™ treatments did. This increase was earlier and more prominent in the count 10 fruit and was again caused by the lengthening of the storage period. A similar trend was noticed with the CA treatments (data not shown due to restrictions placed on the length of this article).

CONCLUSION

The results clearly showed 1-MCP to have the necessary potential to reduce the incidence of soft landings of South African avocados exported to Europe. The first commercial exports are to take place during the 2003 season.

REFERENCE

LEMMER , D., KRUGER, F.J. MALUMANE, T.R. & NXUDU, Y. 2002. 1-Methyl cyclopropene: an alternative for controlled atmosphere storage of South African export avocados. *South African Avocado Growers' Association Yearbook,* 25:28-39.

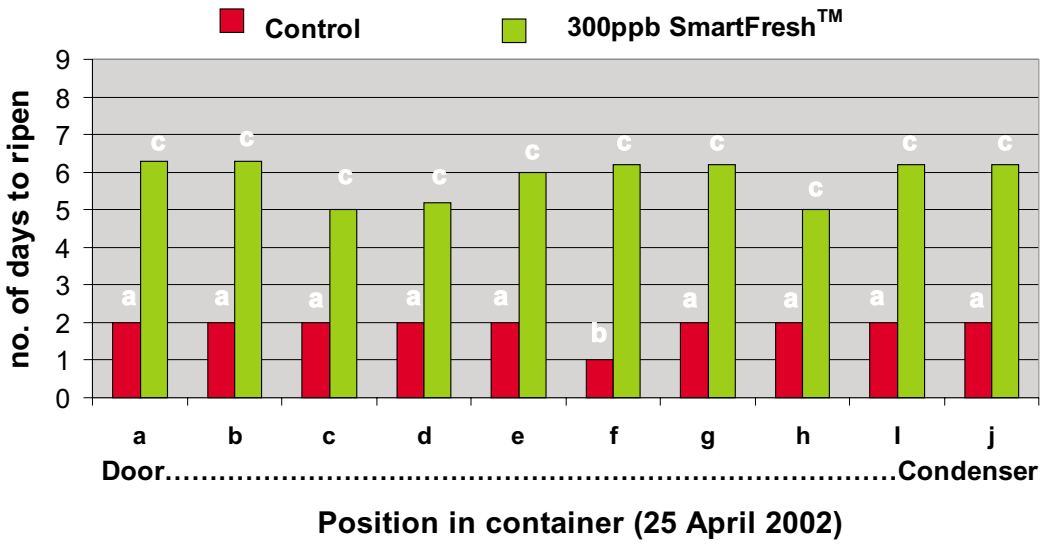

Figure 1: Mean number of days required to ripen count 18 'Fuerte' fruit treated and stored in different pallet positions within the container. The fruit were treated on 25 April with 300 ppb Smartfresh™ for 16 hours before being stored with untreated samples for 28 days at 7ºC. Bars marked with the same symbol are not significantly different (Student t-test, P>0.05).

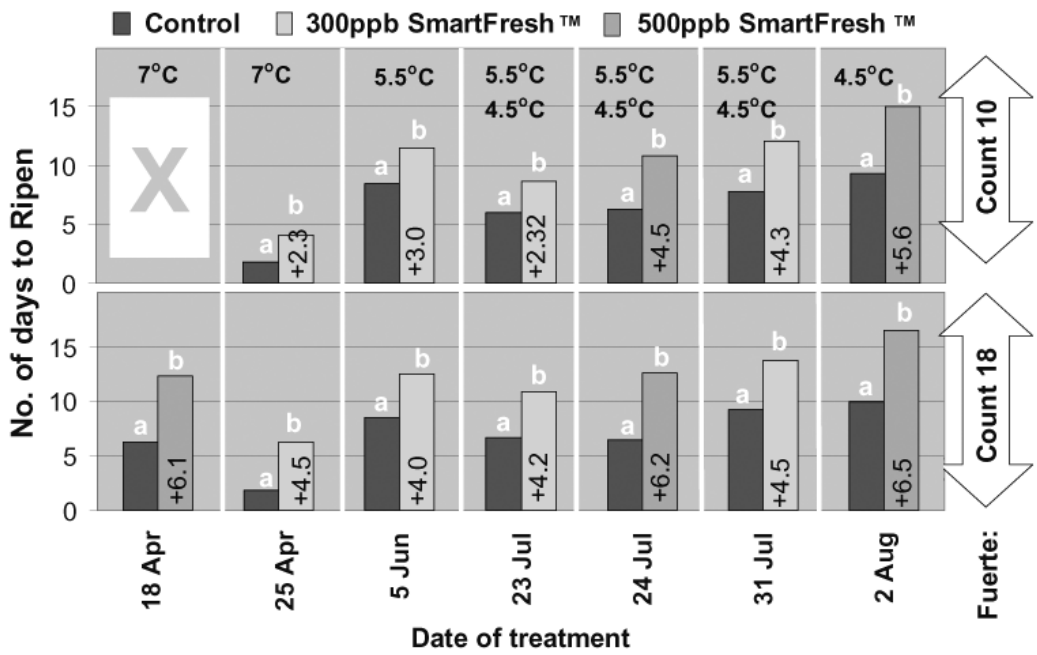

Figure 2: Mean number of days taken to ripen counts 10 and 18 'Fuerte' fruit at 18ºC. The fruit were treated on the listed dates inside a 58 m^3 refrigerated sea freight container with either 300 or 500 ppb Smartfresh™ for 16 hours, before being stored with untreated samples for 28 days at the indicated export temperatures used at the time. Bars marked with the same symbol are not significantly different. The statistics apply separately for each treatment date and fruit count (Student t-test, P>0.05).

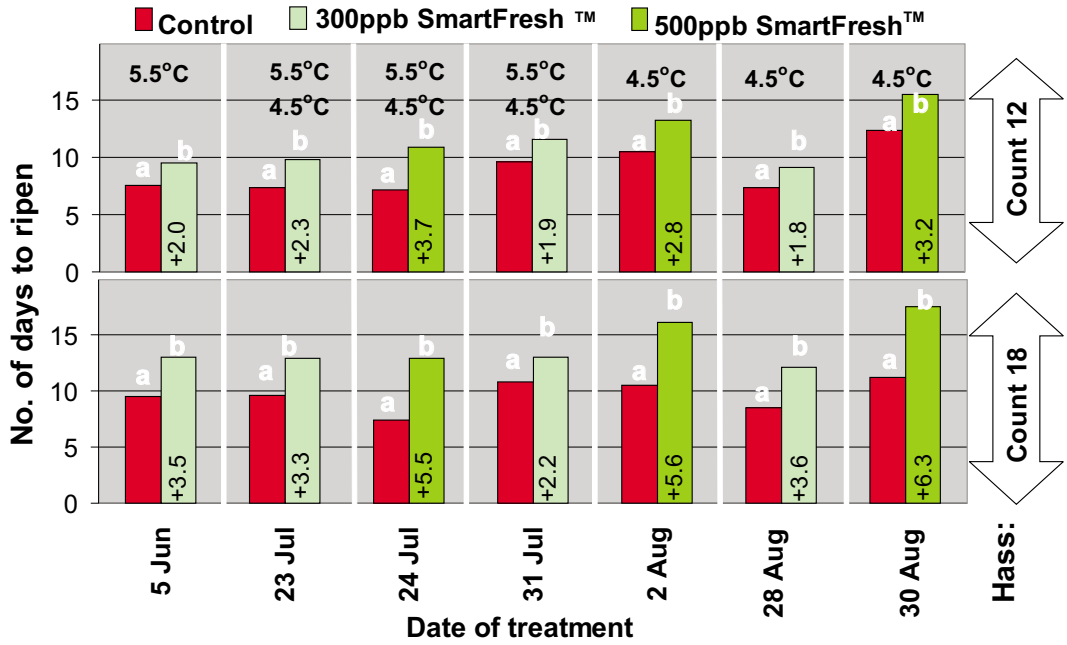

Figure 3: Mean number of days taken to ripen counts 12 and 18 'Hass' fruit at 18°C. The fruit were treated on the listed dates inside a 58 m^3 refrigerated sea freight container with either 300 or 500 ppb Smartfresh™ for 16 hours before being stored with untreated samples for 28 days at the indicated export temperatures used at the time. Bars marked with the same symbol are not significantly different. The statistics apply separately for each treatment date and fruit count (Student t-test, P>0.05).

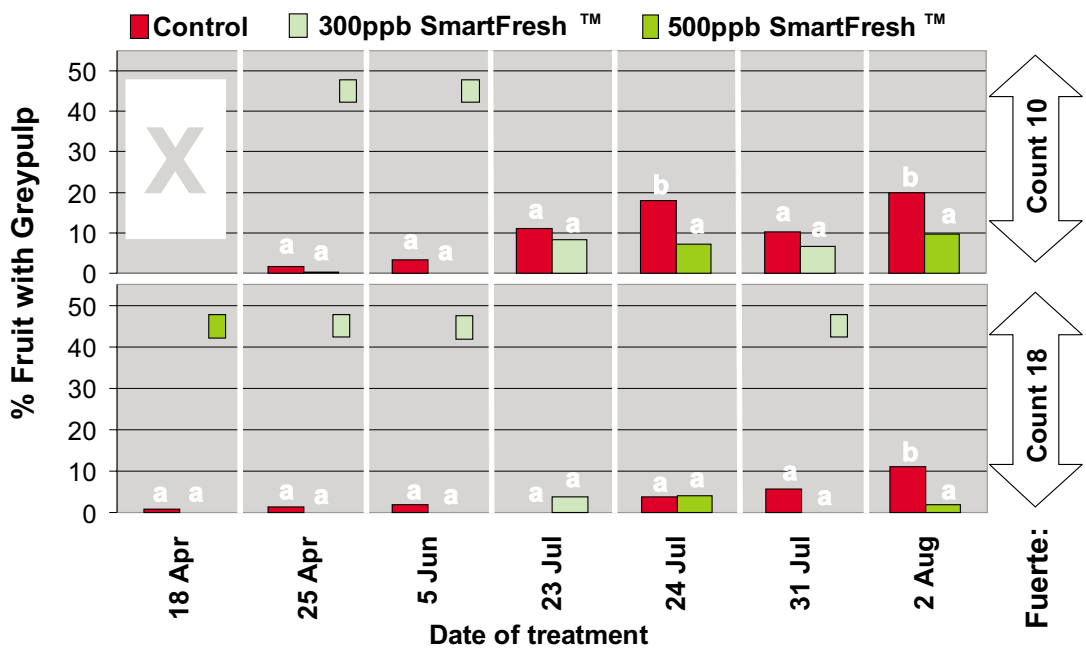

Figure 4: Percentage counts 10 and 18 'Fuerte' fruit with greypulp as recorded when the fruit ripened. The fruit were treated on the listed dates inside a 58 m^3 refrigerated sea freight container with either 300 or 500 ppb Smartfresh™ for 16 hours before being stored with untreated samples for 28 days at the SAAGA export temperatures used at the time. Bars marked with the same symbol are not significantly different. The statistics apply separately for each treatment date and fruit count (χ^2-test, P<0.95).

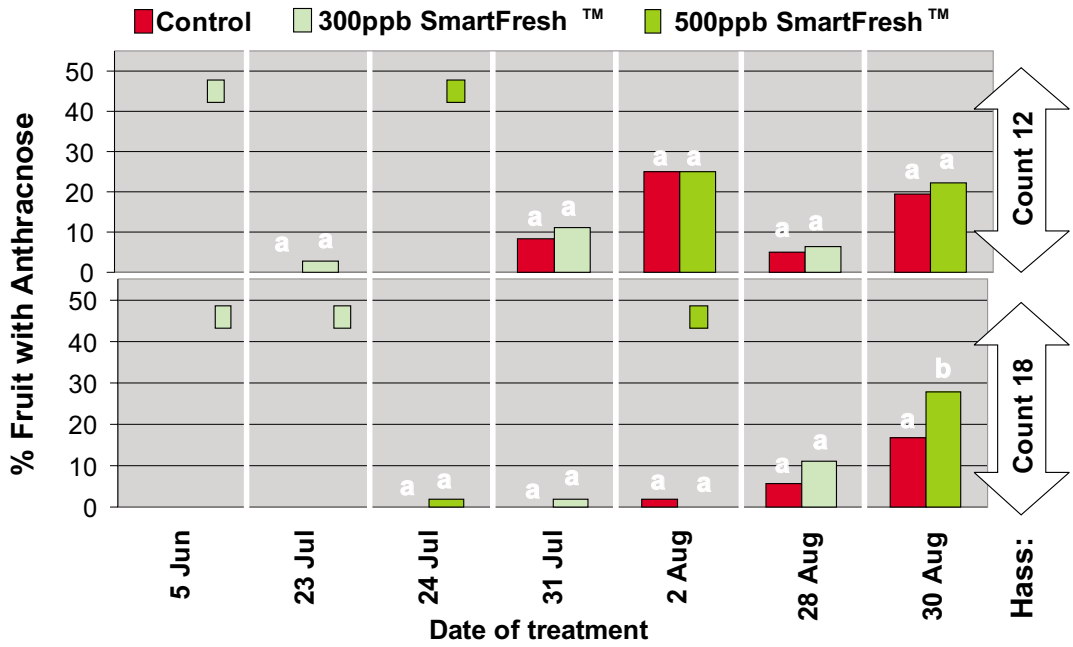

Figure 5: Percentage counts 12 and 18 'Hass' fruit with anthracnose, as recorded when the fruit ripened. The fruit were treated on the listed dates inside a 58 m^3 refrigerated sea freight container with either 300 or 500 ppb Smartfresh™ for 16 hours, before being stored with untreated samples for 28 days at the SAAGA export temperatures used at the time. Bars marked with the same symbol are not significantly different. The statistics apply separately for each treatment date and fruit count (χ^2-test, P<0.95).

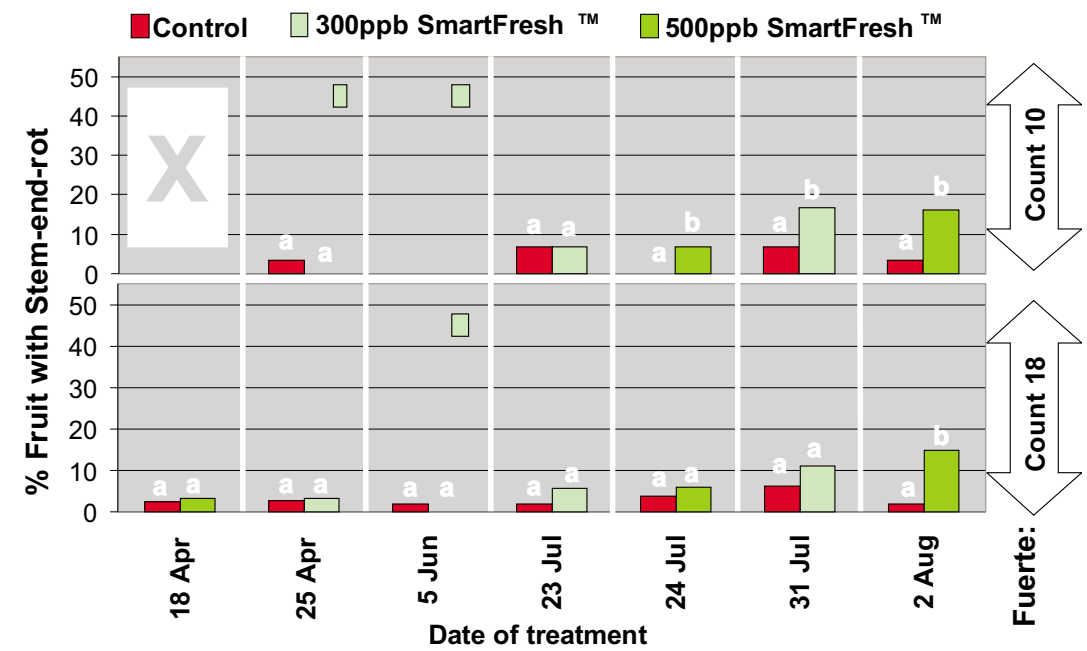

Figure 6: Percentage counts 10 and 18 'Fuerte' fruit with stem-end-rot, as recorded when the fruit ripened. The fruit were treated on the listed dates inside a 58 m^3 refrigerated sea freight container with either 300 or 500 ppb Smartfresh™ for 16 hours, before being stored with untreated samples for 28 days at the SAAGA export temperatures used at the time. Bars marked with the same symbol are not significantly different. The statistics apply separately for each treatment date and count fruit (χ^2-test, P<0.95)