

Comparison between SmartFresh™ and generic 1MCP

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ABSTRACT

In the 2012 avocado season, a generic 1-methyl-cyclopropene (1MCP) formulation was compared to the commercial standard SmartFresh™, using 'Fuerte', 'Hass' and 'Ryan' avocado fruit cultivars. Two different dosages of each 1MCP treatment were compared. While this generic formulation did elicit some response, compared to the untreated control, it was inferior to SmartFresh™, in terms of reducing grey pulp, preventing colour development of 'Hass' during cold storage and delaying ripening. Further development of this product is required before it can be used commercially for avocados.

INTRODUCTION

1-methyl-cyclopropene (1MCP) has been tested on South African avocados since the early 2000s (Lemmer *et al.*, 2002; Maré *et al.*, 2002). 1MCP, under the trademark SmartFresh™ (Agrofresh, Dow Chemical Company, Midland, MI), is used extensively by avocado pack houses in South Africa to prevent – or at least reduce – ethylene-induced disorders during cold storage, *i.e.* ripening (commonly termed soft landings) and grey pulp, as well as delay ripening and reducing the spread in days to ripen, once fruit are removed from cold storage.

In recent years, a number of generic 1MCP products have been touted as a cheaper alternative to SmartFresh™. These products have had mixed success in comparison to SmartFresh™. A promising generic was obtained from a supplier in Pietermaritzburg in 2012. The aim of this trial was to determine the efficacy of this generic 1MCP product in comparison to SmartFresh™ at commercial dosage rates for 'Fuerte', 'Hass' and 'Ryan' fruit.

MATERIALS AND METHODS

Fruit: Count 16 'Fuerte', 'Hass' and 'Ryan' fruit were obtained from Westfalia pack house between the 7th of June and 12th of September, 2012.

Treatments and storage: Fruit were pre-cooled before being treated with 1MCP. The experiment had three treatments: SmartFresh™, generic 1MCP and an untreated control (details in Table 1). Twenty cartons per treatment were stored at 5.5°C for 28 days and then ripened at 18°C. Two cartons per treatment were directly ripened at 18°C. The two 1MCP treatments were done simultaneously for 18 hours

at 5-6°C in different treatment rooms in the pack house. The experimental fruit treated with SmartFresh™ was treated together with commercial consignments, while the fruit treated with the generic was treated alone.

Maturity and firmness: Ten fruit were sampled from each batch to determine the moisture content. The percentage of moisture in an avocado declines as it matures, *i.e.* the percentage dry matter increases. Of the twenty cartons that were stored, two cartons per treatment were used for firmness determination, using a handheld densimeter. Firmness was measured at intake, two weeks into cold storage, and again at removal from cold storage. Firmness was measured in the cold store, so the cold chain was not broken.

Quality parameters: At ripeness, fruit were cut in half longitudinally and the internal quality evaluated.

RESULTS AND DISCUSSION

It was evident from fruit removed from cold storage, that SmartFresh™ had a more pronounced effect on fruit physiology than the generic 1MCP product, however, the generic did elicit some response from the fruit, because ripening and grey pulp development was inhibited when compared to the untreated control.

Fungal diseases: The incidence of anthracnose was low (<5%) in all batches. The incidence of stem-end rot (SER) was generally low; higher SER incidences were observed in batch 1 ('Hass') and 9 ('Ryan') at 43% and 35% respectively, but the



Table 1. Details of the nine batches of this experiment, providing cultivar, the date of harvest, the fruit origin, the maturity (% moisture content), and the concentration of both 1MCP formulations.

Batch	Cultivar	Harvest date	Block	Maturity (% MC)	Generic (ppb)	SmartFresh (ppb)
1	Hass	07 Jun 2012	Quantock 10	72.1	300	300
2	Hass	05 Jul 2012	Werne 10	69.0	300	300
3	Fuerte	05 Jul 2012	Boschpoort BA15	62.5	300	300
4	Hass	31 Jul 2012	Westfalia 30	67.7	300	300
5	Fuerte	31 Jul 2012	Belvedere 35A	66.1	300	300
6	Hass	21 Aug 2012	Westfalia M32D	63.4	800	500
7	Ryan	21 Aug 2012	Waterval 7B	58.4	800	500
8	Hass	12 Sep 2012	Westfalia 9D	63.9	800	500
9	Ryan	12 Sep 2012	Westfalia 13	64.7	800	500

infection was not severe. Vascular browning increased concomitantly with SER.

Days to ripen: Generally, the generic 1MCP did not have an effect on days to ripen. The ripening pattern of the fruit treated with generic 1MCP being very similar to that of the untreated control, except for the first batch where ripening was delayed by three days compared to the control (Table 2). SmartFresh™ generally delayed ripening by one to three days. The information on the days to ripen in Table 2 is summarised as: (i) the day it took 10% of the fruit to ripen; (ii) the day of peak ripening; and (iii) the day it took 90% of the fruit to ripen, because this type of summary is valuable to a ripening facility to analyse the spread in ripening.

Grey pulp: The incidence of grey pulp (termed 'diffuse discolouration' by White *et al.*, 2004 in the International Avocado Quality Manual) in 'Hass' fruit that was treated with SmartFresh™ was minimal, while the fruit treated with the generic was variable, but only similar to the Smart-Fresh™ treatment in the eighth batch (Table 3). It must be highlighted that 'Hass' is much less prone to developing grey pulp than 'Fuerte'. In this trial, 'Fuerte' had a high incidence of grey pulp, but the severity was mild (Table 4). Little difference between the treatments was noticed in the two batches of 'Fuerte', because these fruit were very mature and should have been treated at the higher dose of 1MCP, but preference was given to the 'Hass' fruit in the second and fourth batches. In the fifth batch, a higher percentage of fruit without grey pulp was observed in SmartFresh™ treatments, but the percentage of fruit without grey pulp was still low (57%). The generic 1MCP significantly reduced the incidence and severity of grey pulp in 'Ryan' fruit, compared to the control. It was as effective as SmartFresh™ in less mature 'Ryan' fruit (batch 9) than in more mature fruit (batch 7).

Table 2. The number of days that it took for 10% and 90% of the fruit to ripen, and the day of peak ripening after 28 days of storage at 5.5°C and ripening at 18°C.

Batch	Treatment	Days to ripen		
		10%	Peak	90%
1. Hass	Control	5	10	10
	Generic	5	13	13
	Smartfresh™	8	11	11
2. Hass	Control	5	6	8
	Generic	5	8	8
	Smartfresh™	6	10	10
3. Fuerte	Control	2	4	5
	Generic	3	3	5
	Smartfresh™	4	6	7
4. Hass	Control	5	5	6
	Generic	5	6	6
	Smartfresh™	7	11	11
5. Fuerte	Control	4	4	4
	Generic	4	4	4
	Smartfresh™	7	8	11
6. Hass	Control	5	6	8
	Generic	5	6	7
	Smartfresh™	6	9	9
7. Ryan	Control	5	5	19
	Generic	6	6	8
	Smartfresh™	7	10	12
8. Hass	Control	6	6	12
	Generic	6	6	9
	Smartfresh™	8	12	16
9. Ryan	Control	6	6	16
	Generic	7	12	12
	Smartfresh™	11	17	17

Table 3. Percentage fruit without grey pulp (diffuse discolouration) from all nine batches.

Cultivar	Hass					Fuerte		Ryan	
Batch	1	2	4	6	8	3	5	7	9
Moisture content (%)	72.1	69.0	67.7	63.4	63.9	62.5	66.1	58.4	64.7
Control	88	76	100	95	74	35	36	57	47
Generic	84	85	99	99	97	39	39	63	91
Smartfresh™	95	98	99	100	100	37	57	76	89



Firmness during cold storage: The greatest difference between the treatments, with respect to firmness loss during cold storage, was noticed in the thin-skinned 'Fuerte', where the SmartFresh™-treated fruit was 5 to 6 densimeter units firmer than the control and the generic 1MCP (Fig. 1). The effect was less apparent in 'Hass' and 'Ryan', but the fruit treated with SmartFresh™ were firmer than control fruit and the fruit treated with generic 1MCP intermediate.

Colour development in Hass: SmartFresh™ was effective in preventing colour development of 'Hass' during cold storage and as observed with the other parameters of interest, the generic 1MCP was either similar to the control or intermediate with the other treatments (Fig. 2).

CONCLUSION

While this generic formulation did elicit a response when compared to the control, it was inferior to SmartFresh™. Further development of this product

is required before it can be used commercially for avocados.

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Table 4. Severity of grey pulp (diffuse discolouration) of the two batches of 'Fuerte'.

Treatment	Clean	Very slight	Slight	Bad	Severe
Control	36%	37%	20%	6%	1%
Generic	39%	34%	21%	5%	0%
SmartFresh™	47%	31%	20%	1%	0%

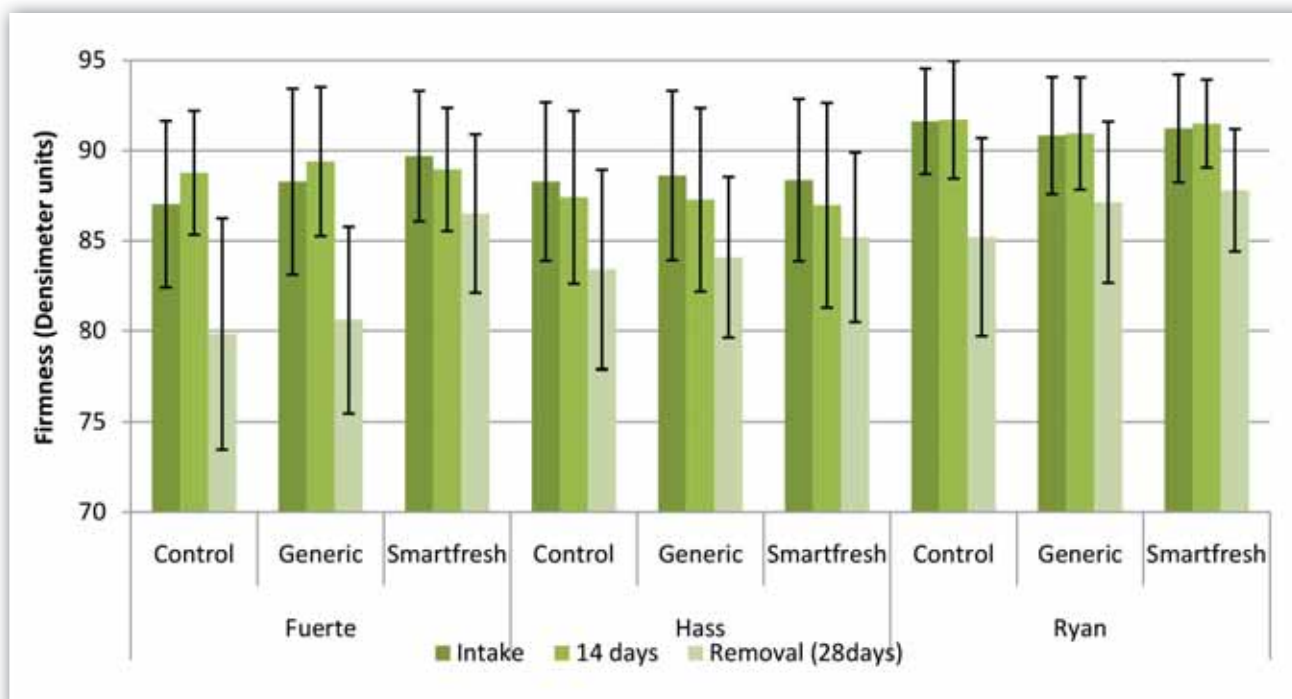


Figure 1. Change in firmness from intake to removal from cold storage at 5.5°C for 28 days. Results are presented for each cultivar and each treatment. Vertical lines are equal to one standard deviation.



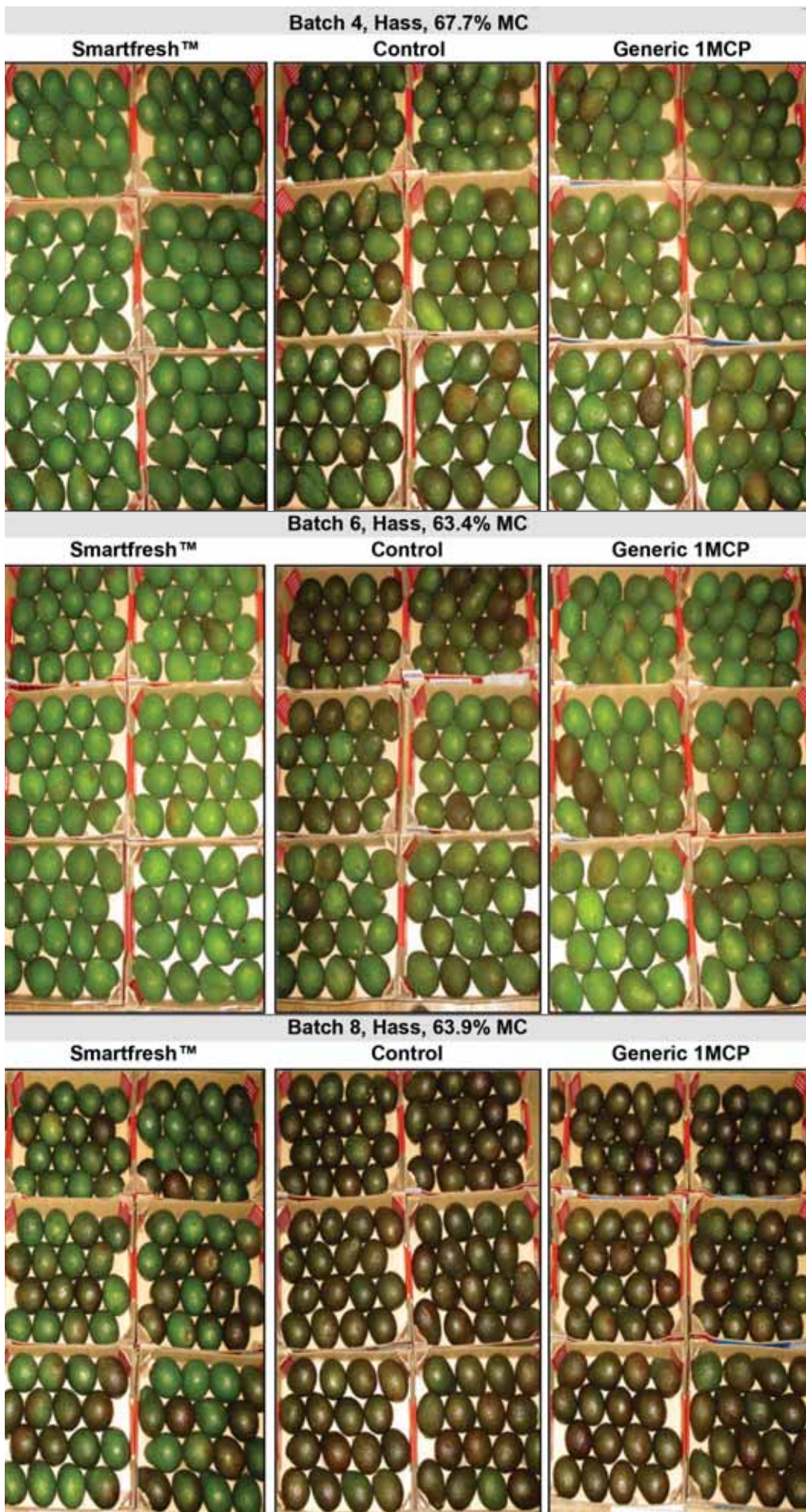


Figure 2. Colour development of 'Hass' during cold storage at 5.5°C for 28 days from batches 4, 6 and 8. Photos were taken immediately after removal from cold storage.

