

## ***Alternatives to Polyethylene Wax as Post-Harvest Treatment for Avocados***

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### **ABSTRACT**

*Alternatives to polyethylene wax as post-harvest treatment for avocados were evaluated during the 1996 season. Stafresh, a natural wax emulsion containing shellac and carnauba, gave the best results with regard to effect on physiological disorders, external appearance and shelf-life.*

### **INTRODUCTION**

For the past 20 years a polyethylene wax has been used by most South African avocado packhouses to prolong the storage life and improve the shine of avocado fruit. However, as from 25/03/1997, fruit treated with polyethylene waxes may no longer be imported into the European Union. The purpose of this study was therefore to evaluate post-harvest treatment alternatives to polyethylene waxes.

### **MATERIALS AND METHODS**

During the 1996 season several treatments were tested in the laboratory and in the packhouse under experimental and commercial conditions. The treatments are listed in table 1 and an overview of the 12 trials conducted is given in table 2. Each trial included the standard commercial treatment, Tag wax (Sanachem (Pty.) Ltd.), and an untreated control.

The fruit coatings were applied in the following way. In preliminary tests the materials were applied with sponges in the laboratory and the fruit were left to dry prior to cold storage (experiments 3-9). In other experiments the fruit coatings were applied by means of spray bottles in the packhouse; the fruit subsequently ran over the rollers and through the drying tunnel, after which the fruit were collected and put into cold storage (experiments 1, 2, 11). Finally, the most promising fruit coatings were applied in the packhouse using the full commercial procedure, i.e. the wax was applied by means of a spinning disc applicator, followed by commercial drying, sorting and packing (experiments 10 and 12).

In all experiments, the fruit were stored for four weeks at 5.5°C to simulate sea shipment to Europe. Thereafter the fruit were ripened at 18°C. In addition to these simulated shipments, one test consignment was exported to Europe, where the SAAGA

Overseas Technical Officer evaluated the fruit (experiment 10). Ripe fruit were inspected and assessed for anthracnose, stem end rot, black and brown cold damage symptoms as well as lenticel damage and the internal physiological disorders pulp spot and grey pulp. Symptoms were rated on a scale of 0 (no symptoms) to 3 (severe symptoms). The external appearance and shelf-life of the fruit were evaluated. All results were analysed by analysis of variance, and treatment comparisons were made using Duncan's multiple range test (  $P = 0.05$ ).

## **RESULTS**

All the new treatments were compared to the standard commercial Tag wax treatment. With regard to cold damage symptoms, physiological disorders and post-harvest diseases, most of the treatments gave equal or better results than Tag wax. Differences occurred in the external appearance, and in some treatments in the shelf-life (table 3).

Untreated control or polished fruit were dull upon ripening and had a short shelf-life. Fruit treated with avocado or sunflower oil stayed oily, and these treatments were therefore discontinued. Fruit treated with Nutri-Save had a slimy feeling when condensation occurred upon removal of fruit from cold storage; this later disappeared when the condensation moisture evaporated. Hass treated with 2% Nutri-Save did not colour well. Fruit treated with Nature Seal had a dull appearance. Treatment with Tropical Fruit coating resulted in fruit less shiny than those treated with Tag wax. Shellac-treated fruit were very glossy, however Shellac took a long time to dry in the packhouse. Stafresh.a gave a shine similar to that of Tag wax, and it dried faster than Tag wax.

## **CONCLUSION**

Stafresh, a natural wax emulsion, was found to be the most suitable alternative to polyethylene wax. Stafresh was equal to or better than Tag with regard to cold damage, physiological disorders, post-harvest diseases, external appearance and shelf-life. It meets all the requirements of the EU markets.

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**Table 1**  
Post-harvest treatments evaluated during the 1996 avocado season

<i>Treatment</i>	<i>Abbreviation</i>	<i>Description</i>
Untreated control	C	
Polished	P	soft brushes
Avocado oil	AP/AC	pure and crude avocado oil
Sunflower oil	SF	household grade
Tag wax	Tag	polyethylene wax
Nutri-Save	NuS	water soluble chitosan derivative produced from crustaceans, tested at concentrations of 1 and 2%
NatureSeal 2020	NaS	polysaccharide-based edible with cellulose as the main component
Tropical Fruit Coating 213	T	water-based carnauba emulsion (carnauba is a wax gathered from the leaves of the Brazilian carnauba palm)
Shellac	SH	natural substance made from secretions of the lac insect
Stafresh	ST	natural wax emulsion containing shellac and carnauba (developed for the Japanese market which sets very high standards)

**Table 2**  
Overview of trials conducted in the 1996 season

<i>Exp. No.</i>	<i>Date</i>	<i>Cultivar</i>	<i>No. of fruit<sup>1</sup> per treatment</i>	<i>Treatments</i>
1	22.04.96	Fuerte	140	C, P, Tag, NaS, T, AP, AC, SF
2	13.05.96	Fuerte	140	C, P, Tag, NaS, T, AP, AC, SF
3	06.05.96	Fuerte	56	C, NuS (1%), NuS (2%), Tag
4	16.05.96	Fuerte	56	C, NuS (1%), NuS (2%), Tag
5	11.07.96	Hass	56	C, NuS (1%), NuS (2%), Tag
6	19.07.96	Hass	56	C, NuS (1%), NuS (2%), Tag
7	28.05.96	Fuerte	70	C, SH, ST, TAG
8	26.06.96	Fuerte	56	C, SH, ST, TAG
9	28.05.96	Hass	70	C, SH, ST, TAG
10	12.06.96	Fuerte	140	C, Tag, T
11	24.06.96	Fuerte	140	C, Tag, NaS, T, ST, SH, NuS (1%)
12	29.08.96	Fuerte, Hass, Ryan	140 each	C, Tag, T, ST, SH

<sup>1</sup>Count 14 fruit

**Table 3**  
Post-harvest treatments giving equal or better results when compared to Tag wax

<i>Exp. No.</i>	<i>Cul-tivar</i>	<i>Cold damage</i>	<i>Physiological Disorders</i>	<i>Post-harvest Diseases</i>	<i>External Appearance</i>	<i>Shelf Life</i>
1	F	C, P, NaS, T, AP, AC	C, P, NaS, T, AP, AC, SF	C, P, NaS, T, AP, AC, SF	NaS, T	NaS, T, AP, AC SF
2	F	C, P, NaS, T, AP, SF	C, P, NaS, T, AP, AC, SF	C, P, NaS, AP, Ac, SF	NaS, T	NaS, T, AP, AC, SF
3	F	C, NuS (1%), NuS (2%)	C, NuS (1%), NuS (2%)	C, NuS (1%), NuS (2%)	-	NuS (1%), NuS (2%)
4	F	C, NuS (1%), NuS (2%)	C, NuS (1%), NuS (2%)	C, NuS (1%), NuS (2%)	-	NuS (1%), NuS (2%)
5	H	C, NuS (1%), NuS (2%)	C, NuS (1%), NuS (2%)	C, NuS (1%), NuS (2%)	-	C, NuS (1%), Nus (2%)
6	H	C, NuS (1%), NuS (2%)	C, NuS (1%), NuS (2%)	C, Nus (1%)	-	C, NuS (1%), NuS (2%)
7	F	C, ST	ST	C, ST, SH	ST, SH	SH
8	F	C, ST, SH	C, ST, SH	C, ST, SH	ST, SH	ST, SH
9	H	C, ST, SH	C, ST, SH	C, ST, SH	ST, SH	ST, SH
10	F	T	T	C, T	T	C, T
11	F	NaS, ST, SH, NuS (1%)	C, NaS, T, ST, SH, NuS (1%)	C, NaS, T, ST, SH, NuS (1%)	T, ST, SH	C, NaS, ST, SH, NuS (1%)
12	F	T, ST, SH	C, T, ST, SH	C, T, ST	T, ST, SH	C, T, ST, SH
	H	C, T, ST, SH	C, T, ST, SH	C, T, ST, SH	T, ST, SH	C, T, ST, SH
	R	C, T, ST, SH	T, ST, SH	C, T, ST, SH	T, ST, SH	C, T, ST, SH