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SHRINK-WRAP OF AVOCADOS IN COMBINATION WITH WAXING AND FUNGICIDE

A W G POWELL
H L Hall & Sons Limited, P O Mataffin 1205

INTRODUCTION

Extension of shelf-life of South African avocados is important, due to the great distances from the European markets. Temperature control and Controlled Atmosphere have received much attention as methods of extending shelf-life and improving fruit quality. The use of high and low density polythene, shrink-wrapped around individual fruit to modify the gaseous exchange of the fruit, has received attention from several workers. A trial using the shrink-wrap materials of Cryovac and Clysar (USA) as well as Jaffa (Israel), was conducted on avocados in South Africa by Durand (1984). He found that Cryovac and Clysar greatly extended the shelf-life of avocados, but also resulted in an unsatisfactory level of disease development. The Jaffa material, which also extended shelf-life, although considerably less than Cryovac and Clysar, resulted in better quality and less diseased fruit,

In this study shrink-wrap material of various porosities, in combination with wax, were used to study the effects of shelf-life and quality. In addition a fungicide, Prochloraz, which has been shown to reduce postharvest diseases on avocados (Le Roux *et al,* 1985; Rowell, 1983), was used in an attempt to reduce the disease levels associated with extending shelf-life, as found by Durand (1984).

MATERIALS AND METHODS

Three film-wrap materials were used. Their moisture transmission rates at a relative humidity of 100 per cent and temperature of 30 °C, are as follows:

Type PY85 – 470 g/m^2/24 hours
Type PY30 – 320 g/m^2/24 hours
Type MY – 4 g/m^2/24 hours

The PY85 and PY30 materials are very porous compared to the MY material, which is a multi-layered film compound and quoted as having an oxygen permeability of 1750 cc/mV24 hours at one atmosphere and 22 °C.

The fruits were wrapped by first sealing the shrink-wraps around the fruit with a heat sealer, and then shrinking the wrap with hot air from a blow-drier.

Other treatments used in combination with the wraps were:

(a) Wax: Fruits were coated with Tag Wax, using a brush and rollers.

(b) Fungicide: Fruits were dipped into Prochloraz (0,06 g ai/100 ℓ) for three minutes and then air-dried.

(c) Wax and Fungicide: After the fungicide treatment and drying, the fruits were waxed.

The experiment was set up on July 29 and 30, 1986 on Fuertes. They were therefore, very late season fruit. The fruits were then placed in the cold room at 5,5°C for periods of four, six and eight weeks. On removal from the cold room, they were ripened with and without the wrappers on. Ripe fruits were assessed externally for cold damage and anthracnose, and internally for anthracnose, vascular bundle browning, grey pulp and pulp spot,

TABLE 1 Effects of storage time, wax and fungicide treatments on self-life and internal and external disorders of avocados treated with shrink-wrap materials

	Wrap:	Unwrapped			PY85			PY30			MY			Averages		
Storage time (weeks):		4	6	8	4	6	8	4	6	8	4	6	8	4	6	8
Ripening Time – days	Control	3,8	3,5	3,8	3,9	3,0	3,7	4,0	3,9	3,0	5,7	6,1	5,2	4,35	4,1	3,9
	Wax	3,7	4,4	3,7	3,3	4,5	3,0	3,3	4,0	3,0	5,5	6,4	5,8	4,0	4,8	3,9
	W & F	4,9	4,4	4,4	5,2	4,7	4,7	5,0	5,2	5,0	6,0	6,7	5,5	5,3	5,3	4,9
	F	3,3	3,6	4,0	3,4	4,0	3,1	3,7	4,4	3,3	4,7	5,9	5,2	3,8	4,5	3,9
	Average	3,9	4,0	4,0	4,0	4,1	3,6	4,0	4,4	3,6	5,5	6,3	5,4			
Cold Damage %	Control	0	19,6	93,0	0	50,0	78,6	0	63,4	100,0	0	42,3	66,3	0	43,8	84,5
	Wax	10,0	60,0	96,1	15,0	66,7	100,0	15,0	75,0	100,0	10,0	61,3	81,2	12,5	65,8	94,3
	W & F	11,9	79,8	88,7	0	91,7	69,2	7,7	75,0	93,7	8,3	73,8	91,6	7,0	80,1	85,8
	F	0	48,9	89,3	0	64,3	84,6	7,1	64,3	100,0	0	67,7	87,8	1,8	61,3	90,4
	Average	5,5	52,1	91,8	3,8	63,2	83,1	7,5	69,4	98,4	4,6	61,3	81,7			
External Anthracnose %	Control	0	12,5	21,0	17,9	14,3	21,4	0	63,6	0	3,6	15,4	35,2	10,8	26,5	19,4
	Wax	53,2	65,0	44,0	25,0	22,2	10,0	45,0	35,0	10,0	45,0	75,0	54,5	42,1	49,3	29,6
	W & F	15,5	0	22,2	21,4	8,3	0	19,1	25,0	31,2	14,6	27,4	37,5	17,7	15,2	22,7
	F	0	0	0	3,6	21,4	0	0	0	8,3	7,1	12,5	28,8	2,7	8,5	9,3
	Average	17,2	19,4	21,8	17,0	16,6	7,9	32,1	30,9	12,4	17,6	32,6	39,0			
Internal Anthracnose	Control	0	0	21,0	10,7	0	7,1	0	9,1	0	3,6	7,7	0	3,6	4,2	7,0
	Wax	48,2	55,0	27,2	20,7	22,2	0	30,0	20,0	0	35,0	57,5	54,5	33,3	38,7	20,4
	W & F	7,1	0	18,4	10,7	8,3	0	7,1	0	25,0	10,4	14,9	0	8,8	5,8	10,9
	F	0	0	0	0	21,4	0	0	0	0	3,6	6,3	0	0,9	6,9	0
	Average	13,8	13,8	16,7	10,4	13,0	1,8	9,3	7,3	6,3	13,2	21,6	13,6			
Grey pulp	Control	0	7,7	32,5	25,0	28,6	35,7	0	45,5	54,5	0	3,8	26,1	6,3	21,4	37,2
	Wax	48,2	85,0	44,0	35,0	44,4	30,0	45,0	0	60,0	30,0	63,8	57,6	39,6	48,3	47,9
	W & F	19,6	28,2	44,5	28,6	25,0	30,8	23,2	83,3	56,2	29,2	57,7	58,3	25,2	48,6	47,5
	F	3,6	40,0	53,5	12,5	42,9	53,8	3,8	50,0	66,7	7,1	26,0	43,9	6,8	39,7	54,5
	Average	17,9	40,2	43,6	25,3	35,2	37,6	18,0	44,7	59,4	16,6	37,8	46,5			
Pulp spot	Control	10,7	19,6	25,3	0	7,1	28,6	0	9,1	27,3	10,7	15,4	44,3	5,4	12,8	31,4
	Wax	0	10,0	7,7	0	0	0	10,0	20,0	0	5,0	12,5	8,6	3,8	10,6	4,1
	W & F	16,1	0	18,7	3,6	41,7	15,4	19,6	25,0	25,0	3,1	11,9	25,0	10,6	19,7	21,0
	F	18,1	6,7	20,9	4,2	7,1	0	21,7	0	8 3	21,4	14,9	40,1	16,4	7,2	17,3
	Average	11,2	9,1	18,2	2,0	14,0	11,0	12,8	13,5	15,2	10,1	13,7	29,5			
Vascular Bundle Browning	Control	34,1	35,1	37,4	42,9	42,9	21,4	16,3	63,6	9,1	39,3	23,1	39,0	33,2	41,2	26,7
	Wax	33,2	60,0	63,2	60,0	33,3	30,0	60,0	30,0	50,0	50,0	28,8	55,2	50,8	76,1	49,6
	W & F	47,0	40,7	44,7	17,9	75,0	38,5	38,7	50,0	68,7	13,5	46,4	37,5	29,3	53,0	47,4
	F	22,5	46,7	56,6	36,3	57,1	53,8	0	42,9	66,7	17,9	18,8	51,6	19,2	41,4	57,2
	Average	34,2	45,6	50,5	39,3	52,1	35,9	28,5	46,6	48,6	30,2	29,3	45,8			

W = Wax F = Fungicide

RESULTS

No differences could be found between ripening fruit with wrappers on or removing them immediately after removal from cold storage. The results in Table 1 have therefore combined the effects. Reference to Table 1 shows the following:

Ripening time after removal from cold storage

PY85 and PY30 wrappers had very little or no effect on extending ripening time after removal from cold storage. However, MY wrappers extended shelf-life on average from 3,9 to 5,5 days after four weeks cold storage, from 4,0 to 6,3 days after six weeks and from 4,0 to 5,4 days after six weeks. It is also clear that waxing only extended shelf-life when there was a prior application of fungicide to the fruit. From these results, only the MY wrapper should be considered a worthwhile proposition.

Cold damage

Waxing resulted in more cold damage than on unwaxed fruit. While cold damage was relatively low after four weeks cold storage, it increased markedly after six and eight weeks storage. Wrappers had no effect in reducing levels.

Anthracnose

Anthracnose was severely antagonised when the fruit was waxed. The application of the fungicide Prochloraz considerably reduced the level of anthracnose on waxed fruit. There was a tendency for external anthracnose to increase, the longer the unwaxed fruit was stored in the MY wrapping, but internal anthracnose remained at a low level,

Grey pulp

After four weeks, storage grey pulp was relatively low on unwaxed fruit, irrespective of wrapping treatment. With waxing, however, grey pulp increased to high levels. After six and eight weeks of cold storage the grey pulp level was high on all treatments.

Pulp spot

Occurrence was erratic with treatment having little effect.

Vascular bundle browning

Generally at a high level with no consistent trends as regards treatment.

DISCUSSION

PY85 and PY30 shrink-wrap materials had no effect in the extention of the ripening time

and therefore serve no purpose in avocados. The MY multi-layered material extended shelf-life of avocados by 35 to 57 per cent after being stored at 5,5°C for periods of four to eight weeks. Further work should concentrate on testing MY materials of various porosities, to get the best combination of shelf-life extension with the minimum of disorders.

Cold damage rose to very high levels after six and eight weeks of cold storage. To reduce this to more acceptable levels, storage at temperatures of 7,5°C and higher should be investigated.

Internal and external disorders of anthracnose and grey pulp were severely antagonised with waxing. Results show that while the fungicide dip was very effective in reducing the level of anthracnose, a better result when not waxing them, was obtained by using a shrinkwrap material. Compared to the control, external anthracnose levels increased the longer the storage period with unwaxed MY material and this was reduced slightly with fungicide.

The high incidence of grey pulp after long storage periods, is one of the main problems in attempting to extend shelflife. The high levels obtained in this experiment are probably due largely to the use of very late season Fuerte fruit. Early season fruit should give a lower grey pulp incidence and should therefore be more suitable for use with shrink-wrap materials.

The economics of wrapping the fruit also needs to be evaluated. The 1987 price for a single head unit capable of doing 40 packs per minute, is quoted at R85 000, with packing material costs quoted at 1,8 2,2c/pack,

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