

Customized Modified Atmosphere (MA) / Modified Humidity (MH) Packaging for Storage and Ripening of Hass & Ettinger Avocado



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Abstract

The effect of Xtend® modified atmosphere (MAP) and modified humidity (MHP) on prolonged storage and ripening of Avocado fruits (Hass and Ettinger) was studied in two types of bags.

Laboratory experiments as well as semi-commercial and commercial trials have shown that the storage life (+5°C) of Ettinger and Hass fruits can be extended to 45 and 60 days respectively in the AV-16 MAP, without significant chilling injury (CI) or other internal and/or external disorders. Normal fruit ripening occurred after removal from the bag at ambient temperature (20°C).

In AV-15 MAP, the storage life (at 5°C) of Hass Avocado was extended to 50 days. Shelf life at 20°C for 3-5 days allowed the fruit to ripen inside a sealed bag. Fruit ripening inside the bags was uniform, and with a significantly low incidence of internal and external disorders.

It appears that the Xtend® MAP AV-16 and AV-15 can be considered a reliable technology for successful, prolonged commercial storage of Avocado fruit (Ettinger and Hass), and for fruit ripening inside the bags in the case of the Hass variety.

Introduction

It was previously shown that modified atmosphere packaging can significantly extend the cold storage life of some Avocado fruits, maintaining their internal and external quality (Kader, A.A. et al, 1989; Meir et al., 1996). However, to achieve a normal ripening process, the modified atmosphere packaging had to be removed. Thus, commercialization of MAP was limited to non-ripened fruit only. Ripening fruit outside the bag is non-uniform and results in considerable weight loss.

The added value of Xtend® MA/MH packaging manufactured by StePac. L.A. Ltd, in comparison to other MA packaging, is the low rate of decay facilitated by the high % of CO₂ inside the bag combined with avoiding condensation within the bag.

Results

Fig. 1: AV-16 MAP succeeded to maintain good quality Hass for 60 days at +5°C with a low incidence of chilling injuries and decay. In the control non-bagged fruit, a high incidence of pulp discoloration and Anthracnose decay was detected already after 30 days of storage (see picture no. 2). After opening the bags and transferring the fruits to an ambient temperature of 20°C (fig. 2), a normal ripening process occurred in the previously bagged fruit, with little chilling damage and decay in comparison with the non-bagged control.

Results of static trial :Mehadrin Tnuport Export (Ashkelon April 2002)
 Avocado Stored in Xtend AV16 MAP for 60 days at +5°C.

Treatment	External color		Internal color			Internal decay			Firmness		
	Green	Black	Normal	Grey pulp	anthracnose	Black Vascular	HARD	FLEX	SOFT		
CONTROL	59	41	74	26	22	18	55	34	11		
Xtend	94.2	5.4	97.5	2.5	0	0	100	0	0		

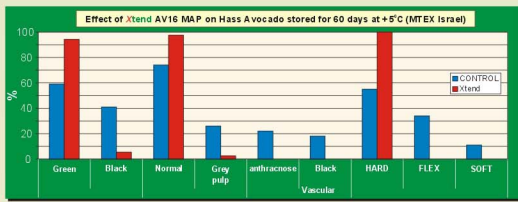


Fig No. 1

Results of static trial: Mehadrin Tnuport Export (Ashkelon April 2002)
 Hass Avocado Stored in Xtend AV16 MAP for 60 days at +5°C. + 8days at Amb. (opened bag)

Treatment	External color		Internal color			Internal decay			Firmness		
	Green	Black	Normal	Grey pulp	anthracnose	Black Vascular	HARD	FLEX	SOFT	WATERY	
Control	0	0	0	100	78	24	0	0	65	35	
Xtend	0.0	0.0	92.0	8	6	0	15	85	0		

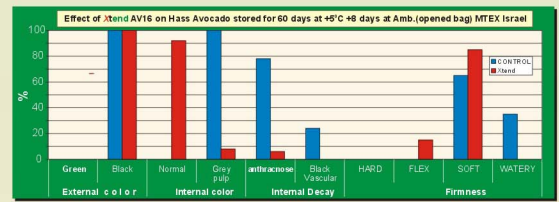


Fig No. 2

The ripening process in the AV-16 and AV-15 bags (represented by firmness), and differences in O₂/CO₂ levels is clearly shown in figures 3 and 4. The consistent levels of MA gases created by the AV-16 at 5°C (fig. 3) maintained the stored Ettinger fruits in a 'stone hard' condition (28 lbs) for 45 days (picture 3), while the control fruits already started to soften after 2 weeks in the cold storage.

Transferring the sealed AV-16 bags to ambient temperature caused a significant change in MA by reducing the O₂ and doubling the CO₂ levels. Keeping the fruit in this environment for longer than 60 hours (previous data) caused oxygen deficiency damage and prevented the normal softening/ripening process. Opening the bag within the first 24 hours in ambient conditions allowed a normal ripening process within 6-8 days (fig 1).



Picture No 1. Hass in AV-16 & AV-15 after 65 days at +5°C



Picture No. 2. Hass in AV-15 MAP



Picture No. 3. Ettinger in AV-16 MAP

Keeping Hass fruits in the AV-15 MAP for 45 days at 5°C (fig. 4) created higher O₂ and lower CO₂ levels at 5°C, followed by an increase in the CO₂ level and a decrease in the O₂ level when transferred to 20°C (ambient temperature) in a closed bag. This enabled the fruit inside the bag to ripen normally within 6 days (see fig. 2, pictures 1&2).

Dynamics of Ripening of Ettinger Avocado in relationship with O₂/CO₂ levels in Xtend AV-16
 Stored for 35 days at +5°C. Removed for 1 day to Ambient Temp. in closed bags

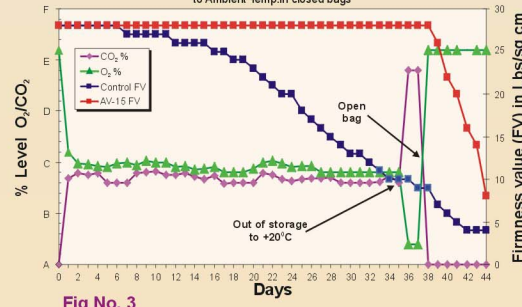


Fig No. 3

Dynamics of ripening of Hass Avocado in relationship with O₂/CO₂ levels in Xtend AV-15 Ripening Bag
 Stored for 45 days at +5°C. Removed for 7 days to Ambient Temp. in closed bags then opened

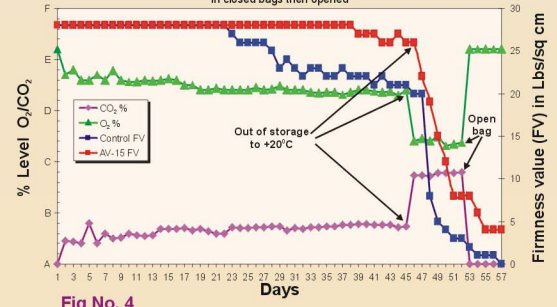


Fig No. 4

Conclusions

- Xtend® MAP AV-16 extends the life of Ettinger and Hass fruit in cold storage conditions to 45 and 60 days respectively, and enables its normal ripening at 20°C only after removal from the bag.
- Xtend® MAP AV-15 extends the storage life of Hass avocado fruits to 50 days and allows a normal ripening process inside the bag after exposure to ambient temperature of 20°C.
- Both AV-16 and AV-15 MAP have been tested commercially with considerable success and offer a solution for extended cold storage with the ability to achieve high quality ripening with minimized produce handling.