

SHELF LIFE TESTING OF APPLES

OBJECTIVE: To Analyze the Shelf life extension of apples, during simulated transit periods of up to 3 weeks.

STORAGE PROTOCOL: A chamber was used, with the average temperature inside the chamber maintained at an average of 31°C (87.8 °F)

PACKAGING PROTOCOL: Different Modified Atmosphere Packaging (MAP) based packaging was used for this shelf life extension trial.

Protocol 1: CA FILMS based packaging

Protocol 1 a: CA FILMS based packaging – Yellow – 1 sq in. area

Protocol 1 b: CA FILMS based packaging – Blue – 2.25 sq in. area

Protocol 1 c: CA FILMS based packaging – Green – 4 sq in. area

Protocol 2: Control

Protocol 5: Apples stored in Controlled Atmosphere chambers, were used for base lining quality standards.

QUALITY METRICS: During the duration of the trials, apples will tested for the following quality parameters to determine shelf life:

Skin Firmness: Using a penetrometer, the Skin Firmness of apples will be measured on 7th, 15th and 21st day of the trial period. Figure 1.



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Figure 1: Skin Firmness Testing of Apples

Weight Loss (%): Weight loss will be evaluated at the end of the 21st day for each protocol.

External Defects: Defects such as shrinkage, russet ting, fruits rotting, and insect damage will be documented on 7th, 15th and 21st day of the trial period.

Initial Quality: For the trial, the following quality of the apple was documented:

Skin Firmness: 16.9 pounds.

Starch Index: 2.3-2.5, See Figure 2.

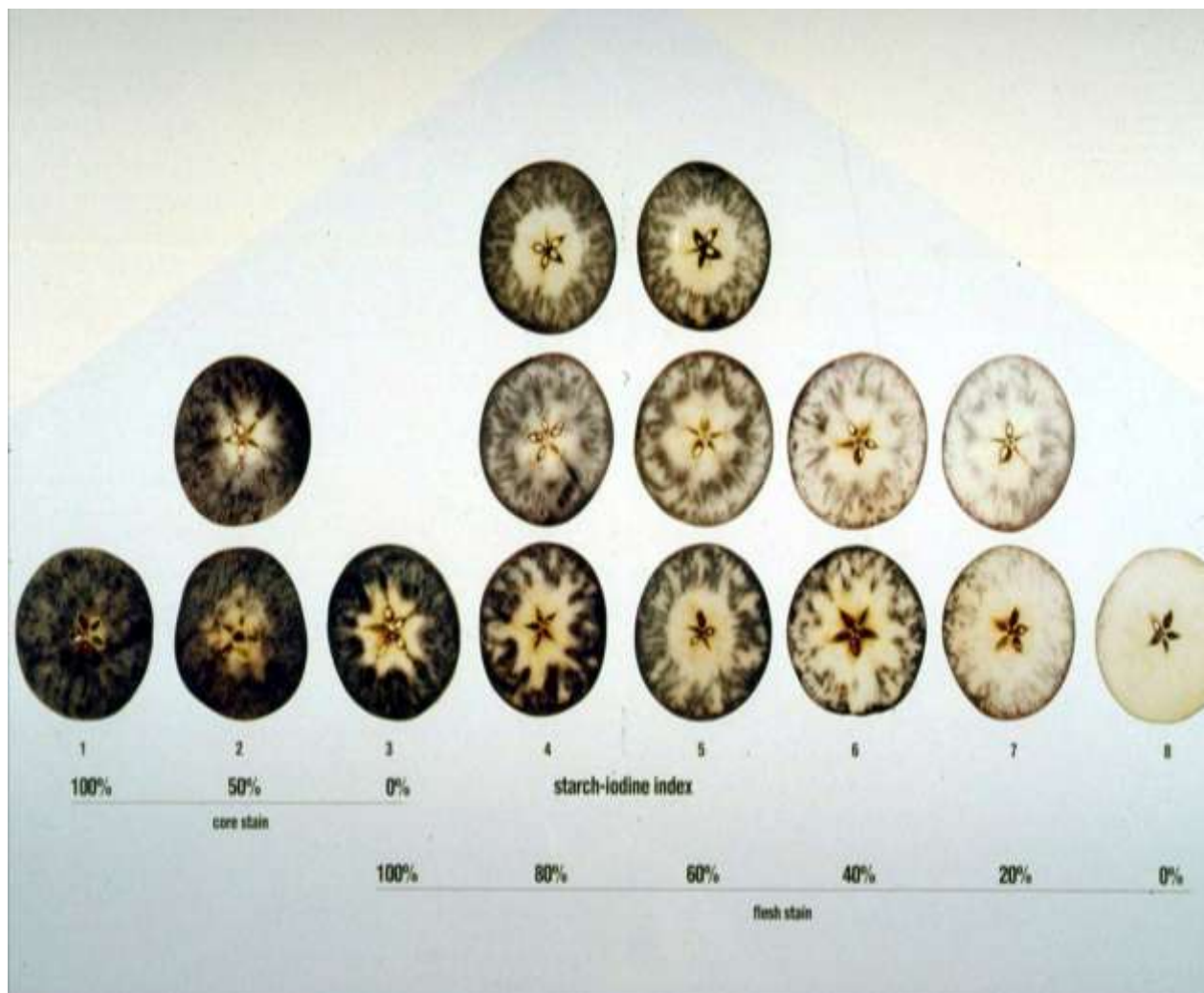


Figure 2: Apple Starch Staining Pattern Chart (Cornell University)

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External Defects: Slight Russetting



Figure 3: Protocol 1 (Day 0): Yellow, Green and Blue (CA FILMS)



Figure 4: Protocol 2 (Day 0): Control

Quality Parameters at the end of Week 1, 2 and 3:

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SKIN FIRMNESS:

Apple Skin Firmness is used worldwide as a measure of ripeness and “condition” of the fruit.

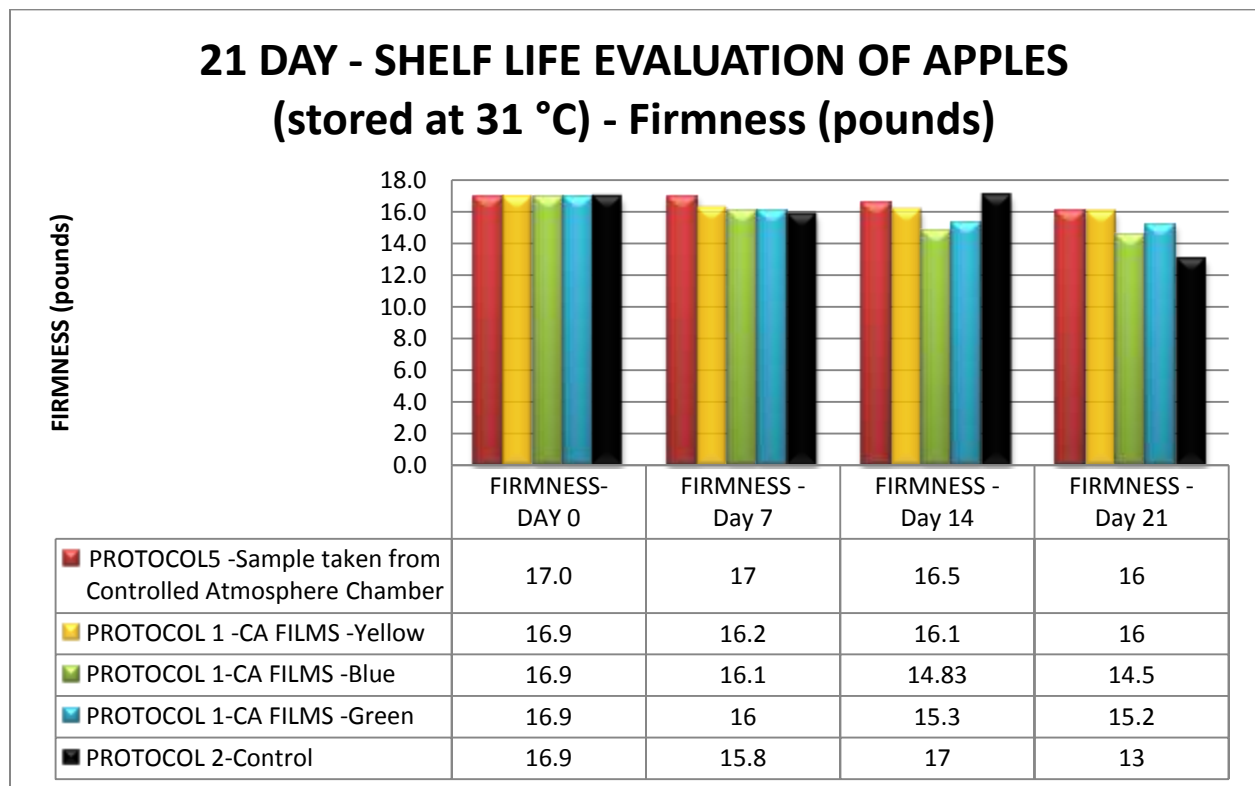


Figure 5: Skin Firmness of the different protocols during the 21-day trial period

Based upon the Figure 5, the skin firmness of apples in Protocol 1-CA FILMS-Yellow is **equivalent** to the maturity of the apples taken from the Control Atmosphere Chamber, even though the apples in Protocols 1 were stored in ambient temperatures in excess of 30 °C for 3 weeks. All the samples from Protocol 1 were better in firmness than the control protocol based apples. When the apple starts shrinking the pressure also goes up for Control, (17 at Day 14) initially and then decreases at a faster pace (13 at Day 21).

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WEIGHT LOSS (%):

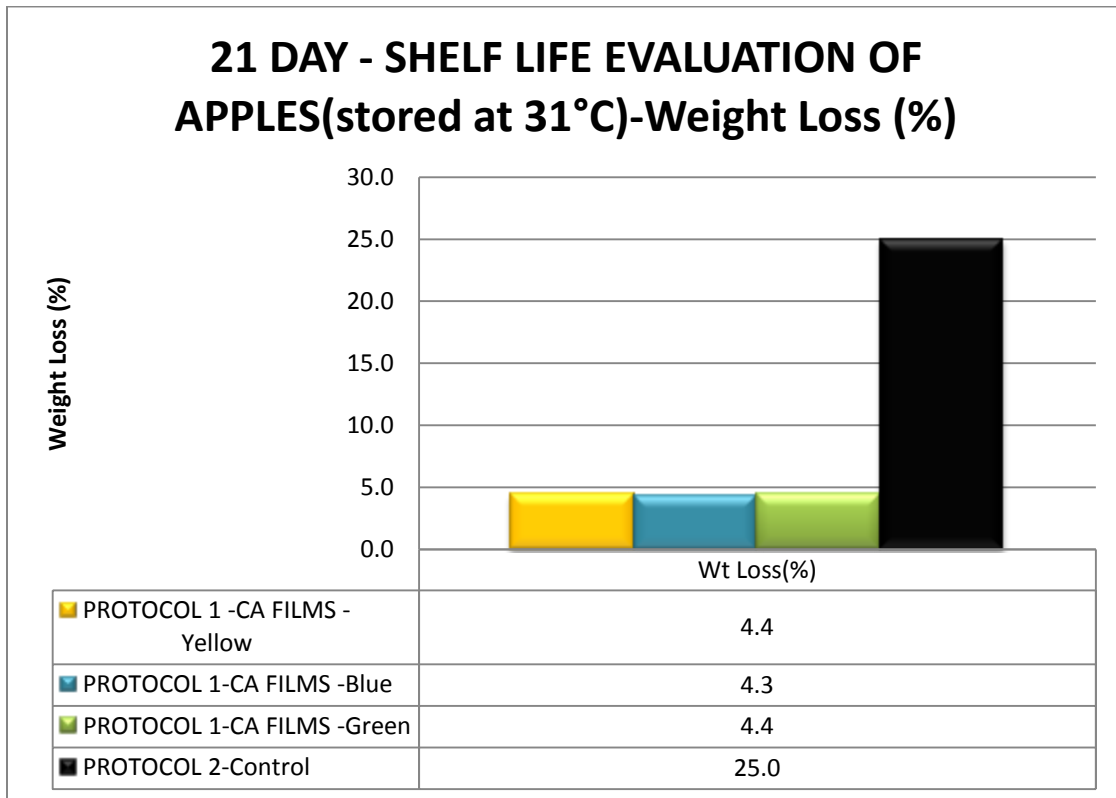


Figure 6: Weight Loss (%) of the different protocols during the 21-day trial period

Based upon data available from Figure 6, there is a substantial weight loss in protocols from Control (25 %). For the CA FILMS based protocols, there is an average loss of 4.3 % for the entire simulated transit based trials for 21 days.

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EXTERNAL DEFECTS:

PROTOCOL	WEEK 1, Day 7	WEEK 2, Day 15	WEEK 3, Day 21
PROTOCOL 1 –CA FILMS –Yellow	Russetting [¥] .	Russetting.	Russetting.
PROTOCOL 1-CA FILMS –Blue	Russetting. Insect damage	Russetting. Insect damage	Russetting. Insect damage
PROTOCOL 1-CA FILMS –Green	Russetting.	Russetting.	Russetting.
PROTOCOL 2 – CONTROL	slight shrinkage	90% shrinkage	100% shrinkage
PROTOCOL 5 – Sample taken from Controlled Atmosphere Chamber	Russetting.	Russetting.	Russetting.

Table 1: Quality Parameters (external defects) for the trial period

¥. Russetting is a brown, corky netlike condition on the skin of apples. It may appear on only a small portion of each fruit, or may cover its surface. Severe russetting may be accompanied by fruit cracking which usually renders the fruit useless. Russetting has been associated with specific environmental conditions, damage from harsh chemicals, excess nitrogen, or infection by certain fungi, bacterial and viral organisms. The fruit of younger or vigorously growing trees seem more prone to russetting than older and slower-growing trees. A little russetting is normal on certain varieties of apples, crabapples, and pears, and is not considered a defect in these varieties.

Apart from the russetting, which was visible on the initial sample used, and on the sample taken from Control Atmosphere chambers, and all the CA FILMS protocol based apples, no shrinkage was recorded for the CA FILMS. Substantial shrinkages were recorded for apples in the Control Protocols.

PHOTOS for apples after weeks 1, 2 and 3 will be provided here as they become available.

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CONCLUSIONS:

Based upon the trial results the following conclusions can be made:

- ❖ CA FILMS based protocols allow the shelf life extension of apples to up to 21 days, in ambient temperatures of 31 °C.
 - The trial results have documented extensive quality loss for the Control protocol based apples (shrinkage is very high, and the firmness is very low).
 - The best protocol to use for optimal shelf life extension is CA FILMS –yellow, which provides quality parameters equivalent to apples stored in Control Atmosphere based chambers at cold chain temperatures.
- ❖ The trial results have documented minimal weight loss for the CA FILMS based protocols apples for the 21 days shelf life extension period.
 - Extensive weight loss has been documented for the apples in the control protocols (25%).
- ❖ **CA FILMS will allow potential apple growers to transit apples to long distances even at high ambient temperatures for 21 days without any loss in quality and weight loss.**