Comparison of Two Commercial Modified Atmosphere Box-liners for Sweet Cherries.

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EXECUTIVE SUMMARY

The performance of two commercially available box-liners used for sweet cherries was assessed. The first liner is known as Lifespan and is available from Australia. The second is a newly developed micro-perforated film produced in Saint-Jean-sur-Richelieu, Quebec and is known as Ultraperf.

To assess the performance, fruit was obtained from a local packing house and placed into boxes lined with either type of technology. Fruit quality was assessed at 4 and 6 weeks of storage at 1ºC, as was the package atmospheres.

The results from this work clearly show that both the Lifespan and the Ultraperf packages can produce the same results when used in all three major cherry cultivars. The reason for this is that the two technologies generate similar atmospheres. Therefore, it would be appropriate for industry users to determine which of the two liners they select since performance is similar for both.

The closure of the liner does not require the use of a twist-and-tie operation. Folding the liner is a reasonable approach which results in a good atmosphere development within the package.
INTRODUCTION

Selection of proper box liners for cherries is an issue which faces the sweet cherry grower/shipping industry, particularly since there are new options that come on to the market on a regular basis. Some box liners are nothing more than barriers to water loss and may well be acceptable for commercial application if the shelf life expectations are short (e.g. for local markets). However, if longer shelf life is needed, then sweet cherry shelf life can be extended by having packaging which allows an accumulation of high carbon dioxide (~ 8-15 %) in the package, while maintaining oxygen above 5%.

The high carbon dioxide is important in controlling decay in the stored fruit, while high oxygen prevents the induction of off-flavors that can occur in response to low oxygen atmospheres.

In this work, two box liner films were tested. The first is Lifespan, which is a film that has been available from Australia for some time. It is impregnated with clay particles and it is also “stressed” by prescribed post-cast machine stretching. The combination of impregnation and stretching gives this film a unique permeability characteristic that maintains high oxygen and high carbon dioxide atmospheres. The second film is a newly developed micro-perforated film produced by “sparking” ~60 micron diameter pores into any plastic film. It is produced by Ultraperf in Saint-Jean-sur-Richelieu, Quebec. The micro-perforated film also has the characteristic of producing a high oxygen, high carbon dioxide internal atmosphere.

The goal of this work was to evaluate the performance of these two commercially-available sweet cherry box liners with commercially grown and packed sweet cherries. Okanagan Harvest cooperated in allowing us to intercept cherries that had been picked and packed at their facility. The three major cultivars were all tested in this trial (Lapins, Sweetheart and Staccato).

METHODS

Fruit were purchased from Greg and Chris Norton at Okanagan Harvest in Oliver. Three cultivars were sampled at the time when they were in commercial harvest: Lapins; Sweetheart; Staccato. Two box liner types were used, Ultraperf and Lifespan. Before using the box liners, each was fitted with a septum to allow gas sampling with a syringe once they were filled and sealed. At total of five replicate 20 lb boxes were used for each of four and six weeks storage, making a total of 20 boxes (400 lbs) per cultivar. In addition, 40 lbs Lapins at PARC were picked to evaluate whether the box liners needed to be tied to attain a good atmosphere or if folding of the liner was sufficient to effect a good seal.

On day 0, fruit at the Okanagan Harvest facility were picked up. They were already processed through the sorting line, pre-cooled and packed in boxes. The fruit were transferred from the packed boxes into the experimental boxes in the septa-fitted box liners. A sub-sample of five replicates of 25 fruit was placed into polystyrene clamshells for at-harvest quality evaluation. This sub-sampling was accomplished by taking a few fruit from each box, so that no box would contain inordinately few fruit than any other. The box liners were sealed according to supplier’s specifications, in both cases.
the bag was gathered, twisted, folded over and an elastic band applied to hold the folded twist intact.

Fruit were transported back to PARC in 1 °C refrigerated truck. Upon arrival at PARC, the boxes were weighed to record an initial weight. Fruit were then placed into a 1°C storage room for 4 and 6 weeks. At 4 and 6 weeks fruit were removed and handled as described in the “EVALUATION” section below.

For the Lapins picked at PARC, the boxes were held for 6 weeks only. The internal atmosphere and quality were assessed to evaluate whether folding and the recommended sealing procedure produced differing results.

EVALUATION

Package atmosphere measurements. The day before each fruit quality evaluation session, gas samples from three replicates of Lifespan and Ultraperf packages were collected in 1-mL gas-tight syringes and injected into the column of a gas chromatograph set-up to read oxygen, carbon dioxide and nitrogen.

Quality determinations. Samples were weighed immediately after removal from cold storage and the final weight was subtracted from the initial weight to determine weight loss in storage. Then 50 fruit from each box were removed for evaluation (10 from each corner of a box and 10 from middle section). Firmness was measured immediately before fruit warmed up and measured in units of g/mm using a Firmtech2 (Bio-works) firmness tester.

Fruit were then allowed to warm to room temperature (until condensation was gone from fruit) and were then visually assessed for pitting, pebbling, stem quality, stem shrivelling, and decay using the scales described below. Stem shrivel and fruit decay were determined as a percentage of fruit affected by either defect from the 50 fruit sample/ After quality assessment, soluble solids (SS) were determined as °brix using a Mettler Toledo Refracto 30PX refractometer and titratable acidity ((TA) measured as % malic acid using a 719 S Titrino, Metrohm titrator.

Pitting Scale. 4 = severe pitting; 3 = moderate pitting: more of surface area pitted and pits form deeper depressions with clearly defined edges; 2 = superficial pitting: little of surface area pitted, pits are shallow with diffuse edges; 1 = no pitting.

Pebbling Scale. 4 = severe; 3 = moderate; 2 = slight; 1 = none visible

Stem Quality Scale. 1 = 0 - 25% of stem brown, 2 = 25 - 50% of the stem brown; 3 = 50 - 75% of the stem brown; 4 = 75 - 100% of the stem brown.

RESULTS AND DISCUSSION

The quality of the cherries held in either box-liner was similar up to six weeks in 1 °C, indicating that both technologies provided similar benefits to maintaining cherry quality (Figure 1).
Figure 1. Visual appearance of sweet cherries of three cultivars after six weeks storage at 1 °C in two different commercial box-liners in 2007.

The visual results are supported by the quality measures taken on the fruit over time in storage. Stem quality declined similarly for Lapins and Sweetheart but much more for Staccato (Figure 2) – this may have been due to the weather conditions at the time of harvest. However, in all case the browning was similar whether the fruit was
Figure 2. Stem quality (assessed as degree of browning) in three sweet cherry cultivars packed in two different commercial box-liners in 2007.

Figure 3. Presence of visual stem shrivel in three cultivars of sweet cherries packed in two different commercial box-liners in 2007.
packed in Lifespan or Ultraperf box-liners. Shrivelling (water loss) of stems was similar, regardless of the box-liner type or cultivar (Figure 3). The visual quality of the fruit was also unaffected by the box-liner type: pitting (Figure 4) and surface pebbling (Figure 5) varied with cultivar, but not with liner type.

![Figure 4. Pitting on three cultivars of sweet cherry packed in two different commercial box-liners in 2007.](image)

![Figure 5. Pebbling on three cultivars of sweet cherry packed in two different commercial box-liners in 2007.](image)
The weight loss was greatest with Sweetheart compared with Lapins and Staccato, but it was similar in either type of box-liner (Figure 6). There were no differences in decay between the cultivars (data not shown) and the decay levels were identical from the two different box-liners (Figure 7).

Figure 6. Weight loss for three sweet cherry cultivars packed in two different commercial box-liners in 2007.

Figure 7. Average decay for three cultivars of sweet cherries at six weeks, packed in two different commercial box-liners in 2007. Note: values for all three cultivars were similar and therefore they were averaged, rather than shown individually.
Internal quality of the sweet cherries was not affected by box-liner type. Both acidity and soluble solids was low in Lapins as compared with the other two cultivars (Figures 8 & 9). Titratable acidity declined steadily over time in storage, but this decline was similar for both liner types. Soluble solids did not decline until after 4 weeks of storage, but this again was not affected by box-liner type.

**Figure 8.** Titratable acidity for three sweet cherry cultivars packed in two different commercial box-liners in 2007.

**Figure 9.** Soluble solids content for three sweet cherry cultivars packed in two different commercial box-liners in 2007.
These results were initially unexpected, since the two technologies for these films were very diverse. However, atmosphere analysis of the packages clearly show that they performed almost identically (Figure 10). The carbon dioxide and oxygen concentrations were very similar, when any of the three cultivars were packaged. The high carbon dioxide levels would be expected to control decay, which is supported by the low levels of decay at six weeks of storage in Figure 7.

Figure 10. Atmospheres (oxygen and carbon dioxide) in packages of three sweet cherry cultivars packed in two different commercial box-liners in 2007.
The test to compare the performance of folded versus twisted-and-tied liners showed that either method of closure would provide the same benefit and hence the twist-and-tie method would not be required if it was operationally difficult to implement.

CONCLUSIONS

The results from this work clearly show that both the Lifespan and the Ultraprof packages can produce the same results when used in all three major cherry cultivars. The reason for this is that the two technologies generate similar atmospheres. Therefore, it would be appropriate for industry users to determine which of the two liners they select since performance is similar for both.

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