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Extending Sweet Cherry Markets

Craig Kahlke
Area Extension Specialist, Fruit Quality
Management
Lake Ontario Fruit Program
Cornell Cooperative Extension

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The use of Modified Atmosphere Packaging (MAP) technology to extend shelf life and increase market window

- Sweet Cherries
 - Liners holding 10-20 pounds of fruit



- MAP's in studies made by Amcor (Australia)
- Decreases respiration rates by maintaining a low oxygen concentration within the internal atmosphere of the package
- Decreases decay incidence by allowing CO₂ levels to climb
- The liners are made of micro-perforated polymers which encourage selective permeability
- Misuse of MAP can cause produce to spoil due to anaerobic conditions (Rai et al., 2002)





MAP Use in Sweet Cherries Elsewhere

- Major use is in transportation
 - Via ship instead of airfreight
 - WA to overseas countries
- used in Europe and Australia for the same purpose as well



- By Padilla-Zakour et al. NYSAES 2005—7
- Study on best preharvest practices, cooling methods in sweet cherries
- MAP and edible coating study for 4 sweet cherry varieties
- Analysis of taste, stems, TA, etc.

A photograph showing a large industrial component, possibly a turbine or generator part, being hydro-cooled. The component is partially submerged in a tank of water. The top portion is yellow and has a grid of small holes. The bottom portion is red. The water is splashing and bubbling around the component, indicating active cooling. The tank is made of metal and has a corrugated metal grate at the bottom. The background is dark, suggesting an industrial setting.

Hydro-cooling



- **A disinfectant needed**
 - **Easiest is Sodium hypochlorite**
 - **pH needs to be adjusted and closely monitored for antimicrobial action to occur**
 - **Adding of sodium hypochlorite raises pH**
 - **pH must be lowered to 6.5-7.0 for maximum effectiveness**
- **Scholar (fludioxonil):**
 - **Post harvest fungicide for stone & pome fruits**
 - **8 oz/100 gal water**
 - **Very expensive - ~ \$250 for 8 ounces**
 - **Excellent decay control**



Forced-air Cooling





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2008-2009 Studies

- 2008 – taste tests with students at Geneva, plus analysis of color, brix, acid, stem hold/loss
- 2009- minimal lab evaluations, trials based on grower impressions
- Craig trained growers in how to use bags and set up mini-trials
- Growers were encouraged to try different varieties with just a few liners/variety
- Surveys developed by Herb Cooley, NYSAES Geneva, were completed by growers after opening of MAPs and mailed to Herb



- 10 growers participated
- 30 tests on 20 varieties
- Per trial, 1-2 reps of controls plus 2-3 reps of MAPs
- In most cases, fruit cooled statically overnight before putting in liners
- only 1 grower used hydro-cooling, with sodium hypochlorite disinfectant



■ Challenges

- Extremely wet weather
 - widespread rain cracking
 - Many growers losing 1/3 to 1/2 of total crop
 - Some more crack-susceptible varieties not picked at all
 - Increased labor costs through more sorting & brown rot sprays
- WA bumper crop, made prices very low
 - Many NY supermarkets previously pushing local produce turned their backs on local sweet cherries



■ More Challenges

- some growers backed up on picking, did not put cherries in MAP liners until several days to a week after harvest
 - These fruit did not fare well
- A grower admitted the cherries were not cooled fully before putting in liners
- Another grower admitted containers that the liners went into were dirty – some puncture holes in the bags



- **Excess moisture in cherries did not help their storage life**
 - Some more rots than usual, with and without MAPs
 - Some varieties that showed promise in past did not perform well this year
 - All 3 growers who tried Regina had problems
 - Sour flavor/off flavor in only 10-20 days with MAP
 - 1 grower did not cool fruit properly
 - It was later surmised that this variety is sensitive to high CO₂, and MAP use is not recommended



- Many varieties reported satisfactory to excellent results
 - MAPs had very good flavor and texture in Hudson & Sams at 4-6 weeks after harvest
 - Liner cherries had rots also, but usually less than controls
 - Hardy Giants, Vic, Oxhearts, Black Gold, White Gold , Rainer, Van, Columbian



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2010 - SARE Grant

- Continue trials in similar to 2009
- Had 6 growers participate, to try 1-3 varieties in MAPs vs. unbagged controls
- 3 growers/varieties compared MAP hydro-cooled + disinfectant with MAP static
- Could choose cultivars that showed promise in the past or ones not tested before



2010 varieties

- Sam (3 growers), showed previous promise
- Hudson (4 growers), " " "
- Emp Fran (2 growers), " " "
- Hardy Giant (1 grower) " " "
- 19's (1 grower), 1st time tested in MAPs
- Honey (1 grower), " " " " "
- Summit (1 grower), " " " " "



- 3 reps of MAPs per variety plus 2 reps controls
- For hydro-cooled comparisons, there were the above reps for static and H-C treatments
- Atmospheres (O₂ & CO₂) taken in MAPs at 10-14 days after packing
- 1 MAP/treatment evaluated at 4 weeks after packing (+/- 3 days)



- **MAPs evaluated by grower(s) and PI when available – for flavor, texture, taste, stem color/hold, appearance – final grower ratings: fresh, acceptable, fair, and unacceptable**
- **Most samples taken to Geneva and evaluated for TA/brix**



- If the 1st rep opened of the MAPs were acceptable or better after 4 weeks, the remaining 2 reps were left sealed for another week
- If 5 week MAPs were acceptable or better, the remaining rep was left sealed for a final week



- **Excellent growing season for most**
- **2 growers could not participate because of rain cracking**
- **Sams and Hudsons performed well nearly across the board**
 - **Cherries of acceptable quality even after 5-6 weeks**
 - **Exception – “pocking” pits in 1 set of MAP SAMs that could not be explained – occurred in both H-C and static treatments**
 - **Some cooler failures increased rots in MAPs for 1 SAM and 1 Hudson**



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SAM



6 weeks control



6 weeks MAP



- **Hardy Giants performed not as well as in 2008, this makes 2 years in a row where 4 weeks was about the maximum, there were more rots and pitting**
- **Honeys had lots bruising and stem problems**
 - in future leaving some air in bags may help (works for Rainier)
 - Stem hold was very weak after 4 weeks, and loss was over 80% by 5 weeks



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Honey (Gold)



5 weeks MAP



- 19s performed very well in first year – both H-C and Static were still of acceptable quality at 5 weeks, but H-C cherries were firmer than Static, however- tips of stems were brown (chlorine burns?) compared to static
- Summits had too many rots, even after 4 weeks
 - 1 lot was packed with a pulp temp of 50F (too warm)
 - However the 40F lots also had too many rots
 - Too long to cool?



■ Emperor Francis

- MAPs are yellower and lighter than controls
- Fruit still are acceptable at 6 weeks
- Texture and stem color/hold are very good, but fruit tends to have a blander flavor than controls
 - But a mild flavor is also characteristic of the cultivar
- However, controls are much to dehydrated with brown stems and many rots



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Emperor Francis



5 weeks MAP



■ Varietal Responses/tendencies

- Dark, firm cherries such as Sam, Hudson, and Schmidt tend to do best in MAPs
 - They retain their crunchy texture and stem color/hold very well in the MAPs
 - Most tend to get a bit darker in the MAPs
 - A downside is flavor is not as sweet as fresh (all MAPs lose brix and acid somewhat over time in storage)
 - One set of Hudsons compared H-C and static with no difference in flavor/texture, but less rots in H-C treatment (used Scholar)



Overall Impressions

- large, soft varieties such as Hedelfigen tend to have too many rots in MAPs
- Large firmer cherries picked too late (turning soft) such as Hardy Giants need to be evaluated closely
- Some white/yellow varieties like Honey (Gold) or Rainier may bruise too easily
- Some varieties have a sensitivity (Regina) to high CO₂ and develop a tin-like flavor or break down in the MAPs



- Stem loss/hold can be a problem in some varieties (Lapins)
- Year to year differences –
 - Sweetheart performed well most years, but was terrible in 2009
 - Royaltons were good with grower, but bad with another



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Varieties in MAPs

- Hudson, Sam, Schmidt, 19, look the best overall
- Emperor Francis, Hardy Giant are good with a few concerns
- Honey (Gold), Rainier, and other white/yellow cherries need to be tested with extra air in bag to see if bruising is reduced



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Varieties in MAPs

- Regina and Lapins are not recommended, as are any cherries that are large and soft
- Caution on Hedelfigen, Sweetheart
- More testing needed for Vic, Oxhearts, Black Gold, Van, Columbian, Royalton



A Quality System

- **Garbage In = Garbage Out**
- **Harvest at correct maturity (better slightly under-mature than over-mature)**
- **Use GA if possible**
- **Control Brown Rot**
- **The need for caution when trying**
 - Test small numbers per variety or monitor closely if using large numbers
- **The push for hydro-cooling/rapid cooling**
 - Can be inexpensive to set up
 - Large 100-300 gallon stainless steel tub with sodium hypochlorite as a disinfectant



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Amcor

Sweet cherry growers: Andy Nesbitt Fruit Farm, Dan Tower Farm, Fowler Brothers, Fruit Valley Orchards, G&S Orchards, Kalir Enterprises, Ledge Rock Farms, NewRoyal Orchards, Philip Wager Fruit Farm, Roger Lamont Fruit Farm, Schwab Farm, Singer Farms



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Questions?

Contact Info:

cjk37@cornell.edu

Cell phone (585) 735-5448