**NE1336 meeting notes on August 07, 2016** (recorded by Randy Beaudry, MSU and edited by Randy Beaudry and Jun Song, AAFC)

Introductions

No AA report

Multistate Member discussion - Need to make sure that membership reflects efforts. Canadian and USDA members never get anything financially for participating in the meeting. Membership needs to 'do the research and submit a report even if they cannot attend'.

Project rewrite is needed in the coming year - ends 9/20/2018 - rewrite is next year - 2017

A proposal rewrite committee has been formed (Beaudry, Moran, Watkins, Walsh, Song, and Sargent - initial rewrite committee)

Those we have not heard from

AL (Auburn Univ.): Woods

MA (UMAS): Duane Greene

MD-2 (ARS-Beltsville): Jurick - USDA on chopping block

NJ (Rutgers): Frenkel, Oudemans, Yam

NY (Cornell, Ithaca): Rickard - Ag Economist

WA1 (Washington State): Fellman

Suggested membership for new project. Can we get someone from New Hampshire, Connecticut or Vermont (Chris Callahan-extension). Angela Myracle from Maine. Need to add Charles Forney to join - he is attending and is also contributing. The Fellman replacement would be a good addition. Barbara Ulate from UC Davis (new) interested in postharvest, but working on pathogens. University of Georgia - Dan's replacement. Tennessee - Carl Sams. Diane Dowd in Ohio suggested. Eleni Pliakoni from Kansas State.

We need to think about how much basic research we want to include.

Some basic/initial discussions on the proposal rewrite:

TITLES:

Current topic: *Improving Quality and Reducing Losses in Specialty Fruit Crops through Storage Technologies*

Suggested: *Improving Quality and Reducing Losses in Specialty Fruit Crops for Human Well-being (Safety?)*

*Improving Fresh Market Quality and Reducing Losses in Specialty Fruit Crops for Human Well-being (Safety?)*

Thoughts on proposals:

'Honeycrisp' SCRI – Bitter pit, CA injury, Chilling injury

Thoughts and suggestions on rewrite:

Might include an objective for small and mid-sized farms. Could overlap with international efforts.

Might include postharvest vegetables in future rewrite or objective. Might fit well with small farm initiative and local production. Small farms run under the USDA 'sustainability' umbrella.

Planned outputs:

Article on ‘Honeycrisp’ storage.

Article on ozone storage is needed - Workshop?

Moran: Involvement in a book on physiological disorders for apple and pear.

**NE1336 Notes:**

**Objective 1. Optimize storage regimes for existing apple, pear, plum, cherry and berry cultivars, with emphasis on new cultivars arising from breeding programs in NY, BC, ON, MI, MN and WA.**

3 - California (Mitcham).

Walnut storage and poststorage quality. Production has grown due to higher prices. Stored in-shell. Challenges with long-term storage due to 18:3 fatty acids (also decay and aflatoxin). Looked at relationships between water activity, RH, and rancidity and quality loss. Stored at 3 temperature and RH levels. Sampled nuts every 3 mo. Looked at oils, peroxide levels, and free fatty acids. Modest relationships between moisture loss and RH. Difficult to control humidity accurately.

Beaudry suggested use of large tub of glycerol solution with high flow rates

Expecting a relationship between high RH and high rancidity.

7 - Maine (Moran)

1.1 Plum cultivar evaluation. Opportunity for plums because it is a cold hardy plant. Looked at several varieties at two stages of maturity and looked at consumer acceptability. Not a large impact of maturity, but the maturity stages did not differ much to begin with. Chemistry evaluations included phenolics. ‘Obilinaja’ is interesting - high anthocyanins, but very attractive to birds. Also ‘Toka’ - 'bubblebum plum' - ripens in mid August.

1.2 Delta Absorbance (DA) meter evaluation was performed to schedule harvest of ‘Honeycrisp’ apples. Used DA meter to segregate apples into 4 arbitrary stages based on meter readings for two harvests. Some relationship between starch index and DA reading (weak relationship) for both harvests were found. After storage - DA at harvest was highly correlated DA after storage. Poor relationship between bitter pit and DA. Modest relationship between diffuse flesh browning and low DA reading. No relationship for soggy breakdown. Second harvest soggy breakdown and soft scald was much more severe for second harvest, however. Data suggest DA meter is not a good tool for predicting postharvest disorders.

Discussion - Felix F750 NIR meter is an option for evaluating maturity, possibly. Discussion regarding DA meter failings.

Discussion about potential SCRI on postharvest disorders of ‘Honeycrisp’. There was some concern about the 'problem' of significant funding already by Washington State. It was noted that SCRI collaborators can be international.

Plans to repeat the study on ‘Honeycrisp’ and include ‘Cortland’ and ‘McIntosh’. Will be collaborating with Cindy Tong at UM.

1.3 ‘Honeycrisp’ spray with Raynox for sunburn (UV) and disorder protection. In storage - Raynox had no effect on stored fruit quality and disorders (bitter pit, soft scald, diffuse browning and soft scald)

1.4 Ethephon treatment of ‘Honeycrisp’. Strong impact on starch index. Fruit size was slightly reduced and there appeared to be an enhancement of bitter pit for a given fruit size. Yellow background color was advanced. Color was not measured.

7-Maryland (Walsh)

1.1 Apple maturity and harvest date on scald on ‘Cripps Pink’ and ‘Granny Smith’. Interested in finding a visible marker for superficial scald because DPA will likely not be permitted to be used. Anthocyanin development seemed to be related with a loss in scald susceptibility for both cultivars. No hours below 50 F occurred, so not in support of Bramlage's relationship. Several maturity markers were associated with the loss in scald susceptibility. No obvious relationship between DA meter and susceptibility to scald.

1.2 York seedlings - Several crosses look good for storage with better color (lack of muddy brown color sometimes seen in York - may be an anthocyanin color shift- oxidation) and low susceptibility to disorders.

1.3 Did work on internal breakdown in Olympic Pears on the tree. Gets much worse in storage. Seemed to be related to high temperatures.

10-Michigan (Beaudry)

12 - North Carolina (Perkins-Veazie)

Strawberry selections were evaluated for postharvest quality attributes. Pigments were evaluated. P-coumaryl hexose low found very low in one line - may be related to anthracnose resistance - not sure how.

California hire for strawberry breeding may be interested in postharvest attributes.

14 - Nova Scotia (Song and Forney)

1.1 ‘Omics’ of storage disorders. Crossing of ‘Honeycrisp’ and ‘Ambrosia’ and other populations containing 170 (cultivars) with fruit of differing susceptibility to soft scald. Linkage found that seemed to be related to soft scald, but the linkage was not found in another experiment from another year. In a proof of concept experiment, a strong linkage between two chromosome regions and color development were detected in the cultivar populations. In a study on soft scald, differences in volatiles and proteins were determined. Are looking at disorder development as a function of rootstock.

Soft scald development was not easily linked to the development of particular volatile profiles.

Plans to perform proteomic analysis in both targeted and non-targeted experiments. Interested in attempting proteomic genomics.

1.2.1 Breeding project for strawberries. Correlations emerged between postharvest decay and firmness - with firmer fruit being more susceptible. Firmness was also positively correlated with acidity.

1.2.2 Also looked at raspberry storage; ACC Eden has good postharvest quality characteristics. Isoprenoid content and was affected by storage atmosphere.

Comment (Perkins) discussed color reversion in response to high temperatures as well as other factors.

1.2.3 Blueberry DCA. Just beginning to look at the relationship between DCA readings and volatiles. Suggestion was made that fermentation volatiles might be good indicators of CO2 stress for manipulating CA atmospheres.

15 - New York (Watkins)

1.1 New York 1 (‘Snapdragon’, a ‘Honeycrisp’ offspring) and New York 2 (Ruby Frost, a Braeburn offspring) were found to develop numerous postharvest issues including CO2 injury and greasiness.

1.2 ‘Honeycrisp’ storage related to bitter pit and soft scald. Correlations between various metabolites and disorders determined. The dynamics of change have been evaluated over time. Soft Scald late to develop, so a low temperature storage may be an option for a short duration. Ethanol and acetaldehyde concentrations were evaluated as a predictor of soft scald development.

16 - Ontario (DeEll)

1.1 For CO2 injury, a 4-week delay in CA helped to reduce injury. 1-MCP improved prevention in firmness loss.

1.2 Looked at CO2 levels, 1.5 versus 3 and found that there was little impact of CO2 level after 7 months of storage. 1-MCP inhibited senescent browning and blotch was aggravated by 1-MCP.

1.3 Evaluated the influence of temperature conditioning on chilling injury (in terms of mealiness). Is evaluating coating materials and fungicides. Conditioning for one or two days at 10 C completely eliminated the injury. Now evaluating the relationship between time and degree of suppression. Also looking at cooling technique and container effects.

Discussion ensued regarding the interaction between time after harvest and adaptation. Comment was made that the high temperature permits a synchronization of ripening processes.

17 - Oregon (Yan Wang)

1.1 Evaluated regimens for improving ripening capacity of ‘D'Anjou’ pears because it currently takes 2 months for the fruit to develop ripening capacity. Not all pears have the same requirement, but it is related to ripening stage. Elevation affected ripening readiness - perhaps by accumulated chill units (ACU), which reduced chilling requirements markedly. Calcium spray affected chilling requirement. Higher Ca increased chilling requirement.

Influence of factors on dry coarse texture or soft buttery texture. High levels of water soluble polyuronides associated with buttery juicy texture. Low oxygen (0.8 to 1%) CA storage helped to preserve this texture after extended storage. Texture was also affected by Calcium - with high Ca associated with better buttery texture. Once fruit lost the ability to produce ethylene, they also became unable to make buttery texture.

Superficial scald control factors were evaluated. Higher elevation fruits tended to be less susceptible to superficial scald using Ethoxyquin. In addition to higher ACU, higher light seemed to be associated with improved resistance to scald.

1-MCP treatment of 100 ppb is becoming an industry standard. However, this amount not as effective in commercial settings. Very good at reducing superficial scald when combined with low O2.

1.2 - Gem pear storage was evaluated - Gem does not need chilling and is resistant to superficial scald. 150 and 300 ppb 1-MCP helps to preserve crispy texture and completely prevented superficial scald.

Commented on ozone and indicated it was not helpful in reducing decay. Song indicated ozone (and ions) had some potential for benefits for some (e.g., citrus), but not all crops, but also indicated that human safety is an issue. No apparent benefit for apple. Probably best as a sanitizer of walls and other surfaces. Effective at removing spores from air. Negative ions can also clear smoke. Ozone was effective for onions and carrots . Crisosto reported that 0.3 ppm of ozone also inhibited kiwifruit ripening by controlling ethylene. Ozone can reduce the fungicide levels and can increase decay. Song indicated ozone would not reduce DPA or ethylene levels.

1.3 - Long-distance export shipping of ozone by sea. Different orchards had differing arrival quality. Calcium quality seemed to be related to better arrival quality. Higher sugars were linked to better flavor quality.

**Objective 2. Investigate the effects of 1-MCP technology on fruit quality and storage disorders, and its interaction with cold storage and CA storage technology.**

14 - Nova Scotia (Song and Forney)

DPA and 1-MCP treatment effects on proteins were evaluated for 0, 4 and 7 months. They found similar effects of DPA and 1-MCP. 18 proteins identified - 14 related to scald development and 4 that are increased by DPA and MCP. Chlorogenic acid metabolism implicated. Flavonol-3-hydrolysis in another paper implicated - but one in this study on same pathway - 4CL (4-coumarate-CoA ligase ) and a glutathione-S-transferase. Several genes associated with hormones and metabolic processes were implicated.

Discussion of PPO involvement in browning critiqued the level of dependency of browning in superficial scald on PPO and alternative browning pathways were suggested.

15 - New York (Watkins and Nock)

2.1 Use of ‘Harvista’ and DCA on storage of Gala was evaluated. 0.5% O2 level was used in DCA. CA O2 level was 2% O2. DCA was very effective at reducing radial flesh browning.

2.1 DCA control of core browning for different orchard was evaluated for ‘Gala’ and ‘Fuji’. Orchard contributed to differences in maturity and in susceptibility to internal browning. DCA was able to eliminate core browning and delay appearance of stem end browning.

16 - Ontario (DeEll)

2.2 Delay of CA on ‘Gala’ had no effect on flesh browning and core browning. However, slowing the cooling had an impact on reducing browning.

2.3 ‘Harvista’ treatment reduced flesh browning, but ReTain and 1-MCP did not. ‘Harvista’ was found to be better at reducing stem cracking compared to ReTain. ‘Harvista’ was also better at slowing maturation.

2.4 Multiple applications of SmartFresh were evaluated by applying 1-MCP at harvest and at room opening each month for 8 months. Fruit were held at room temperature after room opening. It was found to be very beneficial on firmness at 6 months.

2.5 DCA (RQ) storage was compared to CA storage on Empire apple fruit.

17 - Oregon (Wang)

2.1 1-MCP was evaluated as an alternative to Ethoxyquin for controlling superficial scald in D'Anjou pear. A concentration of 100 ppb of 1-MCP reduced black spot and scald. Post storage treatment with ethylene helped the fruit to recover ripening capacity. Ripening was a little slow, though, and not complete. A slightly higher storage temperature was also tested and yielded no observable increase in decay or other disorders yet helped improve ripening capacity.

2.2 The storage quality of summer pears by 1-MCP and ReTain was evaluated for 'Bartlett' pears. ReTain should be applied 1 week before harvest and at a slightly lower rate to enhance storability. SmartFresh responses were a little unpredictable and seemed to depend on fruit maturity. Less mature fruit were more beneficially affected by 1-MCP. A high ethylene concentration in the storage room reduced effectiveness. ‘Harvista’ applications were also tested and found to have little effect on maturity on tree, but it is too early to report on storage impact.

DISCUSSION - funding opportunities from the Horticulture Innovation Lab - one on tomato in Burkina Faso and the other on postharvest handling of apricots in Tajikistan. A third, but not postharvest, is for integrated animal/plant systems in any Feed The Future countries.

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**DAY 2 (Aug 08th)**

Discussion regarding next year's venue - Discussed Nova Scotia - possible locations for next year would be Kentville or/and Halifax. Late July or early August maybe in conjunction with fruit grower tour, winery tour. Need to miss postharvest conferences in June and October and ASHS in September.

Election - Yan Wang volunteered to take on the role of secretary for the NE1336. His term will begin at the end of this meeting and continue through the meeting in 2018 when he will take on the role of chair.

Rene Moran suggested she would take on the secretary role in 2018.

Payment - ASHS will invoice each of us individually in the next two weeks.

Brecht noted they will be searching for a stone fruit extension/researcher and a blueberry breeder.

Discussion resumes

**OBJECTIVE 3. Investigate the metabolic and physiological processes that underlie the responses of fruit to postharvest technologies.**

3 - California (Mitcham)

3.1 The changes in gene expression for European pear (‘Bartlett’) were evaluated. The influence to chilling, maturity and the relationship to softening was determined. Fruit became responsive to exogenous ethylene at the transition between stages 2 and 3. After stage 3, exogenous ethylene was no longer required. Several important genes were found to be linked to the transitions between maturity stages.

3.2 Low temperature treatments on ‘Bartlet’t can accelerate ripening. 10 °C was found to be most effective in promoting ripening responsiveness. The influence of 1-MCP was also evaluated in the second year of the project. A number genes and transcription factors shifted in response to the treatments. Most ethylene-related genes increase during ripening and those associated with jasmonic acid metabolism decline. A model for transcription factor control of ripening was suggested.

3.3 A model was developed to predict ripening capacity of Bartlett pear. The goal was to develop a commercially useful tool using gene expression to predict the rate of softening. ACO seemed to be the most promising gene. Discussion followed regarding the utility of a protein-based analysis that could support this effort to measure ACO protein. ‘AgriSera’ was mentioned as a possible source suggested by Song.

4 - Florida (Brecht and Sargent - and Huber)

3.1 Programmed cell death (Huber) on banana was evaluated during ripening and over-ripening. Signs of DNA degradation (DNA laddering) were found once brown spots were found on the skin.

3.2 Mango internal discoloration ('corte negro' or 'cutting black') was determined. It appears to be a chilling injury symptom, but it is unclear why the disorder is sometimes found and sometimes not found. Somewhat variety specific. All fruit are treated with hot water at 46 for 60°C to 120 min, which compromises fruit quality.

3.3 The effect of nitrogen rate and application method was evaluated for peach. A melting flesh variety (Tropic Beauty) and a non-melting flesh variety (UFSharp) were used. The highest N rate (240 lb/acre) was not problematic. Fruit were firmer at the time of harvest and after 3 days ripening. Little effect on nutritional components other than carotenoids, which were low in the lowest N treatment. Some differences in sensory were detected, but not a great benefit was found due to the higher N. The peach industry is growing as farmers leave citrus production.

3.4 The use of hot water immersion and coating material was evaluated for orange fruit. The idea was to see if the fruit exiting the hot water treatment had a modified atmosphere and whether that atmosphere could be maintained by applying a coating after removal from the hot water treatment. The project involved work in the US and Bangladesh. An optimal time and temperature were determined and several coatings were evaluated. With carnauba, a 5% O2 and 5% CO2 atmosphere could be maintained. Higher antioxidants were found in addition to reduced moisture loss. Current work is being done in Bangladesh on pomelo and mandarin fruit.

3.5 The impact of prestorage application of oxalic acid to reduce chilling injury in mango was determined. The suggestion is that the oxalic acid improves the metabolic activity of antioxidant systems. A 15-minute drench protected against a 10°C exposure.

3.6 Delay of blueberry cooling on quality loss was determined and a 24-hour delay was not found to negatively impact fruit quality if fruit were cooled to 18°C within 90 min of harvest. The influence of impacts will be evaluated.

3.7 Chilling injury of pitaya (dragon fruit) was investigated using a coating to suppress symptom development. Mild chilling injury was found at 1 °C. A temperature of 4°C was optimal. A carnauba based coating suppressed weight loss.

3.8 Sensory and physicochemical evaluation of mandarin was performed on fruit from a breeding program on differing rootstocks. The rational for work in this area is to see if they could compete with Clementines in terms of consumer acceptability

3.9 A survey of mandarin growers in Tanzania was performed to determine common causes for losses. A picking pole and plastic stackable crates were evaluated and compared to traditional harvesting methods, which involve a harvester and a 'catcher'. The pole did not work well, but other innovations in handling were found to be useful.

10 - Michigan State University (Beaudry)

12 - North Carolina (Perkins-Veazie)

3.1 The pigment profiles of Muscadine grapes were evaluated with an interest in identifying lines with better pigment stability in muscadine wine. Use of Fennel's 3-way as a parent increased malvidin 3,5 diglucoside.

14 - Nova Scotia (Song and Forney)

3.1 Targeted proteomic investigations were developed to look at different pathways including those associated with ethylene, aroma, pigments and antioxidants. In strawberry, antioxidant metabolism was implicated in ripening.

3.2 Changes in the proteome in banana as a model climacteric system was evaluated. Fruit were treated with ethylene and with high temperatures. 91 proteins were found to quantitatively change.

3.3 Proteomic changes in 'Ambrosia' were found in response to chilling (no chilling injury in Honeycrisp found!). The idea was to sort out the mechanism for soft scald development and delayed cooling. Two groups of proteins were found to respond to delayed cooling. Delayed (4 d at 15°C) cooling was helpful in suppressing the disorder. Approximately 80 proteins were found to be linked to preconditioning.

3.4 Impact of delayed cooling on 'Ambrosia' and 'Honeycrisp' aroma volatile profile was determined. The storage temperature was 0.5°C. Differences with storage time were evident, but not with conditioning. Delayed cooling was not particularly effective. Scald versus non-scald sensitive fruit was evident only after conditioning in the first portion of the storage period. Three groups of volatiles were implicated - an acetate ester, and butyl acetate, hexyl butanoate and hexyl hexanoate.

Song indicated there was a new project underway funded by AAFC on apple fruit market attributes - flavor and firmness changes. The hope is to have genetic markers for firmness and flavor. Hoping to get a 2-D GC/MS system to support this effort.

Another project is to look at rootstock effects on soft scald susceptibility and aphid resistance. Amino acid composition of the phloem was being evaluated.

Another project is on proteomic evaluation of antioxidant-related proteins on apple.

Brecht suggested more precise characterization of fruit prior to storage might be valuable since it is so difficult to determine which fruit is going to develop disorders.

Song suggested that we try to learn from the grape researchers and their terroir evaluations.

15 - New York (Watkins)

3.1 The pattern of starch clearing in apple was determined and onset of the degradation at the top was primarily a function of the total accumulation - with more starch content being related to later clearing. Clearing took place soonest at the stem end of the fruit. The attempt is being made to connect ripening related genes with this pattern of starch clearing.

3.2 The linkage with PGRs and IAD values (DA meter) in apple was determined. Harvista and ReTain disassociate ripening and softening behavior from the IAD reading. So IAD readings are of little value for fruit in which ethylene biology is being influenced.

3.3 Jocelyn Rose is working on apple cuticles and is interacting with S. Brown on germplasm available in New York plantings. Work will include metabolomic, proteomic and molecular characterizations.