Minutes of the NE1336 Meeting

July 2018

Washington, DC

Submitted by P. Perkins-Veazie

Penelope\_perkins@ncsu.edu

Officers

Jun Song, chair

Renae Moran, secretary

Randy will set up the 2019 meeting with Tracy Shawn at ASHS, July 22 – 25, for Las Vegas. Planning for the Friday and Sat., July 26 and 27, following the ASHS meeting. Randy can handle meeting arrangements, Renae will Chair the meeting. Tianbao Yang, USDA ARS Beltsville was elected secretary and will take office at the meeting in 2019. In 2020, he will be chair.

Send out announcements through NIMSS system and listserv so that all receive them. Requests to join multistate projects are no longer being sent to everyone.

Meeting report from each member need only be a summary, but should include a list of citations for publications, and impacts / outcome statements. Send in the page summary to Renae for report add impacts (see Florida report) -that is all that is needed. Impacts and outcomes: how was knowledge put to use: number of grad students trained, changes in how things done, dollar amounts, outcomes for growers (ie squash growers are now aware that NC grown squash grown in zones 7 or 8 do not need curing).

Objective 1.

**DA meter discussion:**

Difficulty with the meter includes ambient light (have to block), need for excessive measurements, need to calibrate for each cultivar and probably each regional location, and when does work, there are other predictors such as starch (although starch is destructive). Possible that this might be useful for prediction as to when to pull samples out to avoid scald (seems to w

DA meter to measure honeycrisp with maine and cindy: did not condition, stored at 0.5 c to initiate chill injury.

Da meter measures chlorophyll a in fruit, breaks down at 620 vs 720 nm, starts high and gradually decreases but depends on apple cultivar and location (depends on kind of sport also). Starch breakdown happens rapidly from 8 to 4 in days, did see some correlation with starch index with honeycrisp. Heavy crop load have less starting starch. 2017 had green fruit thruout in MN, skin color did not give good indication of ripeness in 2017. Crop load kept at normal in this orchard. HC firmness lost quickly; also rapid starch loss, makes difficult to use as indicators. Chris Walsh may be more a lack of heat tolerance (has abcission rapidly in PA). Ines (WA) the crop load per tree is heavily important-if too high, don’t get good color, won’t mature correctly.

DA meter: did not work for mac, might work for hc. Jennifer: peaches had to be measured for each one, couldn’t just do those that look similar. Can’t use it as a way to train pickers. Delicious was flat line. Also have to keep ambient light out and which side fruit is measured on. Aperture size, can get widely different readings on each side. Peach have different rootstocks that complicates things. F750 for apples also being tried. Have to build the model for F750 on ssc. F750 is temperature sensitive, put toilet paper tubes on top of apple to get fit.

Geneva 41 had young trees, long shoots, giant apples should lead to more bitter pit. See that some are highly different, may also partly be due to the way the apple rootstocks affect shoot growth etc. semi dwarfing rootstock with G202 may also help with calcium uptake. Bud 10 is a dwarfing rootstock.

MD: Starch is a good predictor of internal ethylene behavior which is why works (chris walsh). Da meter shows a lot of outliers even when separate by harvest date. When precondition, storage rots far more of a problem than chilling injury is.

Also getting evercrisp with bitter pit but without expression of symptoms on the exterior. Fireblight x fire blight susceptible. EC stores forever, fb rampant, and don’t know when to pick. MD, PA had bad fblght-4x in this season. York is backbone of Appalachia apples. Cripps pink works well in MD but Maslin strain does not. Grafting cp over the maz on the same tree.

Delta a values for cpink: see linear decline, second week of sept get frost. Can hang on tree until brix goes to 16% in November, don’t drop. If drive red color on granny smith, don’t get scald. Could red color be marker for not getting the scald? Is it correlated with something (is not correlated with the ground color). Moving august 10 to nov 11, planting apple trees on wire. Italians-the precursors for scald pattern are taken away when anthocyanin is increased. Conjugated trienes are reduced with color.

DPA not liked for large packers in MD, want a marker for when red color goes away.

Temp and antioxidant study for granny smith done years back: did see increased aox after 50 F; could be leucoanthocyanins (chris). 4 lines of pink lady (maslin, cripps pink etc) with trademarks.

Fungicides: getting resistance, blue mold is getting to be problem (ie pristine is used as pre and post), also need to look at better bin sanitation. Glomeralla problem with hcrips and red free varieties in md, pa.

Olympic get water soaked flesh, pick 2 weeks earlier in order to avoid this problem in md. If go orange, get internal breakdown issues. Much worse if store a few weeks. Taste better on sunny side. Some want water core in fuji apple because sweeter.

CI can closely resemble co2 injury. If O2 goes to 0 know is not CI. Trying to develop a way to tailor orchardist need for conditioning to avoid damage (MI). Preconditioned some in lab, some in field over time, then treat all with high CO2, leave in storage for 120 days. Also looked at bin stacking vs on ground to see if stacked bins had reduced temperature movement. Can predict very accurately by using degree days to 100 total. If leave longer in field, with more growing degree days, get less co2. But of course will continue to ripen in field. Also increase in greasy-2 is sticky in hands and 3 is very greasy. Oxygen with 3% co2 is ideal for alleviation. Ultralow o2 is ideal.

Wanding of 1mcp over bin across bin in 20 sec. Drench bin; dpa could do so could collect run off in field. Wanding not approved/registered for use for 1 mcp. Harvista keeps separate as production rather than for storage.

Engineering for areas where dry but can do for refrigeration. Water evaporation from surface of room plus solar powering 12 volt for the cool bot. cool 1000 lb water overhead, acts as a battery with solar power to charge, keeps temp down at night. Autoclaved aerated concrete (swells up, floatable concrete, insulated). Use a nylon fabric to do the evaporative cooling-absorbs and spreads evenly. Don’t put solar panels on roof (get too dusty/dirty), have to be washed daily (also get stolen). Concrete blocks are made to weep in US, solid in other countries. Once starts raining, won’t get evaporative cooling. Dripple cheap irrigation (perforated) down the side, have to filter to avoid getting plugged. AAC is used for floor and ceiling (soil temp is 27C).

Also added lightbulbs to simulate heat of respiration in the larger scale building. Keeps water between 8 and 10 C. Will need inverters to go forward with more robust systems.

Minn

Using felix 750 to find blueberry swd detection. Works well-can see entry point, can’t see this for raspberry. Had to adapt the aperture holder for a blueberry fruit (post meeting conversation with Cindy)

DM determination for honeycrisp with preset program. Dm as sample from fruit shoulder, from scan area, and longitudinal, then dried at 65C for 48 h. fit was about 0.40.

Using for apples for da and 750 works for Ontario and mn but not me except for harvests 1&2. F750 wavelengths were 667, 670, 673 closest to the da. So correlating chla and chla essentially. Chl a can do regreening after a dry period followed by rainfall.

Jennifer: harrowcrisp and other releases from this program very sensitive to co2 injury and cavities, now not recommending controlled atmosphere (high co2). Dense tissues in fruit may slow loss of internal co2.

California:

Cherry pit formation with resistant and sensitive. Apoplastic calcium higher in resistant cherries. Dip had little effect on calcium. Also had more pod activity. Cut a piece of tissue, put in isotonic, on shaker, incubate period of time, look at ca levels. Cut the fruit so got access to interior, cut side down to get contact with solution. Dipping had to use a surfactant (no lenticels), a problem also in field to get into the fruit for strawberry. Binding sites full if apoplastic ca is high? Needed for membrane integrity and cross linkages. If freely diffusing, is unbound or bound to membrane. Also sod activity is higher in bing (resistant) than in brooks (suscp). POD did not change with impact though. With impacts. Israel is doing molecular and bioinformatics.

Natural pitting (after pack house)-drops on cleated surface without water, running into tines, caused by impact, develops within a few days for a dead spot below surface. Is this rupture of membrane or reaction, then gradually dead cells sink in. Cold fruit more susceptible. Rainer is showing less-pack line runs slower for this bec yellow. Also has natural resistance. Get bruise color but not sunken. Cherry-sort by size, run raniers on short line, slow with minimal pack line.

Also looking at soluble and ionically bound pod’s in tomato tissue. Activity of both higher with ber. Relative levels are much higher for ionic, if compare healthy to ber. Lignin analysis with staining, but have to see if it is causal or simply residual secondary effect. Disc systems for treatment effects? Could this work out as a bitter pit model for apple? Ace is a more sensitive type to ber. Starts developing at 15 days. Morritz knoche has done many types of pressure measurements (turgor osmotic etc).

Walnut levels were run at 40 to 80% RH. Most of industry does not control temperature or humidity. Temp for shelled than for in shell (for mold/aflatoxin). Temp is strongest factor for rate of deterioration, trying to find best humidity level (possibly around 60%). Temp of around 5 gives more play for humidity range. Stored as both in shell or pieces. Nuts equilibrate quickly to rh in air. Is absorbance slower and less at low temp because have less moisture in air? Industry measures peroxide as primary indicator. PV is around 0.2 to 1.4. Also a small change in L\* shows large difference in browning.

Rancidity actually worse in industry than what sensory saw-were careful to keep out small broken pieces and also held at constant temp. will work on detection of rancidity and also how stiffness is liked; also incorporating a new pastureization system, oxygen scavengers in packages.

Michigan objective 2.

Once reach 40 days, disorder is maximized. 1-MCP and CA. Look at fermentative volatiles: get more rapid fermentation products as co2 increases. Max at 15% CO2. Acetaldehyde is a toxic component at modest levels. Cause damage, get volatile synthesis. CO2 tissue: water soaked then dries out some, goes brown, really wet rather than clear. With and without dpa: prevents disorder at 10% CO2, acetaldehyde is also much lower. No DPA, get spikes for acetal, ethanol, ethyl acetate. Acetaldehyde following damage, not causing the damage. DPA prevents the CO2 injury that stimulates the acetaldehyde. 20% CO2 causes complete browning. Fermentative volatiles may also go up some although most is from damage.

Organic people have to have separate rooms because dpa gets in walls and will attach to apples even when not used.

Objective 3. Looking at the enzymes associated with the volatiles. Whack the ATP with high CO2 (dead tissue), but DPA maintains. See that both CO2 level and DPA affect the metabolism. Go up and down, as fruit adjusts its metabolism. If look at healthy and brown tissues, have more energy charge in healthy tissue (>0.7).

How much fermentation do you get with ADP. As O2 drops, see ADP charge drop. Not making atp-is going into amp which pulls the phosphate from atp-creates acidity as phosphate does not bind (toxic). DPA maintained ascorbic (which declined over time), CO2 compromised. GSH spiked with 7 days with 20% CO2 (most rapid damage phase), tissue tried to make aox and then died.

Succinic acid story: others waited until browning formed, found no difference with undamaged. If catch before see browning, SA is induced, a marker for sdehydrogenase, unpaired electrons (shut down an electron transport system). DPA rescues the ETS. So how does CO2 inhibit SA? CO2 can be fixed into malonic acid, and is inhibitor of SA DH. Could form malonic acid, poisons system? Malonic acid has been around (Hulme did in 1950’s and showed the toxicity).

Heat map/dendogram shows separation of metabolites with the CO2 and no CO2 treatment, also different days etc with the metabolites. Group x less damage and group y more damage. Can also see this on the pca biplots.

1-mcp constantly applied to hc apple, monitored ethylene and aroma production. One treatment effective but multiple was more effective. Second year-after 2nd dose is less effective, 95% of way to total block. Pulled out of storage, let warm up then measure ethylene.

Titratable acids are increased slightly with multiple doses. Aroma (ethyl acetate a nice marker for ripe and overripe) see differences. Recommend a double dose if on green side, but CA storage better than 1MCP. Ethyl acetate and greasiness are correlated bec greasy is related to overripe and EA is highest in OR.

Jennifer Dell:

Empire using labelled rate of harvista. Got increased amount of browning and internal browning, also in gala and seen with retain. If add smartfresh postharvest, get even more. As high as 58% with the three applications.

Harvista application to McIntosh: time trials of 3-2-1. Harvista helped reduce ethylene when applied when harvest started. Ethylene reduced from 929 to 53 ppm. 14 lbs vs 11 or 12 or 8 or 9 on firmness. So even though sprayed late still had strong influence.

Gala: timing of browning with application. Applied harvista on a rolling hill. Block effect was highly significant-40% vs 17 from bottom to top of hill. Soil, trees same; harvista becomes gas when hits water. Temp difference from bottom to top? Stem end cracks few. When hold at room temps, gets worse.

2.4 DCA safepod technology:

Ambient vs ca vs safepod (3%O2), dca pulled down to 1% which shifted rq (resp quotient). Gain a lb of firmness with safepod without the ?

Safepod has own analyzer in box so can monitor within a ca room. 4 bu in one pod to follow real time respiration, flush down to standard ca, valve can open and close. Similar to fluoresecne but using respiration.

July 25-27 or July 26-27 in Los Vegas for NE1836 or July 25-26 if ashs ends in morning.

Core browning as new disorder, see in seed areas.

2.5 Short term ca for hcrisp use 1-2 weeks. Air storage 37% bitter pit. If a week or 2 in ca reduces the bitter pit. But the core browning started showing up with postharvest 1mcp. HC supplemented from chile and new Zealand.

Keep hc out of ca until Christmas (jan-July), about 2/3 of fruit are in ca. First harvest is sold, 2nd pick goes to CA. RD followed by Gala and Fuji are dominant varieties in WA. Over 10,000 a of HC. Cosmic crisp now hurtling up in production. HC premier and HC enterprise. Half of what is planted is cosmic crisp. Dark red, large, lenticels, consistent flavor profile from 0 days to 6 months.

Mac: ca and mcp, no temperature control (Renae).

Florida

Steve Sargent and Jeff Brecht: Fumi Takeda harvesting system uses olive hand harvester to shake branches to remove fruit. Compared hard and padded surfaces on hand-pushed unit. Next, modified the Korvan by removing the tines, added 2 standing positions with handheld harvesters; third year modified a totally mechanized harvester. Southern highbush blueberries more sensitive to bruising than northern highbush types. Meadowlark more resistant to mech harvest (less bruising). Padding placed on fish-scale catchframes on bottom.

Temp management in blueberry (block grant). Commercial practice: forced-air cooling to 55-60C, hold overnight in pack room at 65 F, then pack followed by FA cooling. Assumed that if packed and cooled first would be better. But had similar quality to fruit packed and cooled to 3C day of harvest. Had a similar outcome with strawberry years back.

Hydrocooling could reduce populations of salmonella to 21 days. FA no significant effects. HC reduced 5-6 logs. See a little splitting in a few varieties. Immersion HC, could be shower hc. Pick and cool within 2 h of harvest, seems to be varietal on the splitting. Peach and blueberry being grown as replacement of citrus. Tooled into citrus where rapid cooling was not needed, but actually seems to work. 0 to 50 h chill on blueberries growing from north to homestead, do as pine bark mulch bed with plastic. Prone to being blown over by hurricanes, now trying grafting onto native rootstock or mineral soil adaptation.

Peach-more loss with later ripening fruit. Steve has a portable HC device to cool as a flume orshower unit. GA HC all the peaches. CA uses FA cooling for peaches. Microbial counts indicate mechanical action of water and chlorine. No negative effects on peach from HC as far as splitting. These were done in response to FSMA prior to rules as it sounded like strawberry, blueberry, etc., might need wash when traditionally don’t.

Strawberry/peach

Predict cooling with temp measurement and emulation model. Pull air from wall thru the pallets and release into room. Put 50 sensors thru cooling tunnel to map it. Can pick on and use it to map all others. Can help with management with system, but have to recalculate model if change anything like tunnel size or packaging (6 vs 4 vs 7 boxes on pallet height). As add to data, improves the model. Cooling temp vs room temp: actually see the room air temp rise from the warm air pulled out of the product, and refrigeration is needed to bring down. Don’t pay enough to get full cooling.

Peach (5): melting and non melting flesh. Mercy Olmstead working for CA strawberry commission.

Different N rates applied over the years. 0 trees still alive. Was a cattle pasture where trees are now, plus well water has 5 ppm nitrate. 100 lb acre recommended, growers using far more. Wanted to look at the quality of fruit, found no effect after 4 years. Prune, measure pruning weight to same size. More vegetative growth on the N trees, do keep trees quite small to avoid ladder use. Pruning growth away and wasting N.

USAID project must be applied to home country and 1 year has to be done in home country. Bangladesh has unreliable electric. Pile in shade under trees as postharvest handling. Hot water application to stimulate aox of fruit, ie alleviate ci in mango and tomato. 45C for 30 min to get center temp to 35C, increase respiration, then dry, add coating for internal atmosphere generation. Could get a 3% oxygen level, did with orange, pommelo, mandarin. Trying to get coatings (not available in Bangladesh).

Mango internal discoloration: longer distance are picked earlier and shipped below chill threshold. Brazil shipped at 7C when threshold is at 12 C, 3 weeks on water. Got funding from national mango board for this. Bruce Schaffer and Jonathan Crane-looked at excessive N and insufficient Ca in field for more sensitivity to ci, using commercial groves in Ecuador and peru, could not find correlation. Definitely found was a chill injury and was from the cold storage. Flesh turns brown, patchy and brown , sometimes just under peel. See surface scald and lenticel browning more typically. Ataulfo is more sensitive to ci. Funded for $250,000 for 3 years. Uses 7C because don’t get complaints about hard green, if overripe or decayed then can get rejection of load.

Side project with map on mango with board: could ship tree ripe mangoes, $1200 upcharge for CA containers, and not enough equipped with CA. Ship tests from MX with map bags to florida, simulated storage transit. MAP had no symptoms but control was high in cutting black. Maybe pallet scale system to remove at arrival instead of a box out of a bag. 4% o2 an 12% co2 in bag. Retailers don’t want to resort the load so will reject.

Fresh cut mango (funded by mango board)

Exist to promote consumption of crop. Fruit not really ripe when cut, wanted to document this. Crisosto, plotto, did biweekly store sampling. Ecuador/peru in jan and mexico thru august. Fsma rules on fresh cut must be below 41 or at 41 thru all steps of handling. This means the fruit won’t ripen thru fresh cut process. Processors easier to cut when less ripe, and to peel. A matter of convenience for the processors. Sams wants riper fresh cut than Walmart. Supposed to use stage 3.

Wound induced ethylene (it’s fresh) palladium ethylene scrubber (leon terry engineering)

400-500x more efficient than kpermanganate pellets. Can print labels with scrubber in the ink. Focused on strawberry to see if would extend shelf life. Shipping trials, fla and calif to fla. In a couple of the fla trials got minimized bruise development and sepal were fresher. Calif driscolls had no change. Wound ethylene production can vary 10 fold among cultivars. Bruise with ¾ inch ball and tube drop onto the strawberry. CA produce no ethylene, but overall amounts are tiny for ethylene. Note that strawberries from florida are generally softer (processors only use to fill a gap in supply until CA comes in).

Scrubbing of containers of ripening tomatoes-partial diffusion so more comes out and remove from tomato fruit. C2h4 has 6 binding formations so easier to bind to a scrubber. Ozone scrubs and reacts with everything. Emit ozone, couldn’t get ozone in return air-binds too fast. Still working on ethylene sensors that can be monitored in transit in containers.

Dark red pitaya (high aox)

Decay issues. Fruit grow off ends of climbing stems. Originated in Central America. Studied harvest maturity and chilling and effects of coatings to reduce water loss. Challenge in a wet environment: get anthracnose, latent infections from field. If harvest at ¾ red, get full color, acceptable amounts of SSC (8-11 Brix). Coatings: carnuba wax helped reduce water loss thru scales. Held at 4C but did not see CI. Also need to cool (using room cooling currently). Thailand. Have yellow with white interior.

Maine: European plum flesh is dark gold, less water. Japanese are light green yellow and American have red peel and yellow flesh.

Eggplant (Tianbao) using African type that is high in a hcaa. The hcaa (also cucurmin is an hcaa), links via amide linkages to caffeoyl coa, feruloyl-Coa and p-coumaroyl-CoA. Spermine but not spermidine can fit into substrate binding pockets. Gene exists but is silent in other types of eggplant. Does the amount of compound affect growth (purple with white flesh, round). Sequenced gene from both species, see lot of variation. BAHt is conserved, but the polyamine region is quite different. Model of polyamine shows difference-predicted protein rather than crystal structure. Coordination is also silenced from spermine to spermine. Present in leaves and other parts but missing in fruit. Japanese are working on eggplant genome.

Nova Scotia

GWAS study with Dalhousie and Cheryl Hampson. Used snps for phenolic compounds, found candidate gene for procyanidins (leucoanthocyanind reductase). Soft scald across regions different, also a genetic marker for firmness at harvest, not a pg. pg was used as firmness marker (for firmness loss). Another gene marker is associated with firmness at harvest. Polymorphism of the genes can be got at using snps. Use fluourescence detection and uv for phenolic. Not all cvs have flouresin (1000x difference). Cholorgenic acid is primary phenolic in apple both flesh and peel. Chlorogenic acid is not responsive to 1mcp. Branch point drives what compounds are increased, not beginning substrates. Catechin and epicaticn needed for cider apple flavor. But if increase one several may decrease due to the branch point changes. See spike on chromosome 16. Epic and catechin on chr 16, is the above enzyme reductase. GWAS is more narrow and focused than a qtl. Go from range down to kbytes. Can extract 500 compounds in one run then can do the gwas. Also need to figure out if need more or fewer apple germplasm-88 to 100 for gwas might be enough if have targeted trait. 700 fruit so far. Pod morphisms don’t see yet. Using lc-ms (waters) with qtof machine (emis e to pick up ions as well as fragmentation). Data analysis and

Preharvest effects on postharvest-jeff, chris walsh

Jun song: proteomics to metabolomics to breeder for qualitys in apple and strawberry on flavor, quality

Randy applied and molecular work on pathways with aromatic pathways

Chaim frenkel works on basic physiology of chilling injury in tree fruits especially peach and wooliness development