Fruit Maturity

2011 McIntosh Starch index, Highmoor Farm, Monmouth ME
Fruit NOT treated with ReTain or other growth regulators

 COMMENTS:

The maturity report is intended for apples that will be put in short or long-term storage. Fruit that will be sold soon after harvest should be picked at a stage of maturity based on customer approval.

**Spurtype McIntosh** at Highmoor Farm were harvested once. No detectable ethylene, yet. Rough estimate for date of 10% drop of sound **standard McIntosh** (i.e. non-spur, Rogers) at Highmoor Farm is September 24-26.

**Honeycrisp** is at starch index 3.6. A rapid starch breakdown in Honeycrisp is likely to occur this week and indicates they are at the stage when they become highly susceptible to soft scald. Honeycrisp is ready for an early harvest.

**Gala** is nearly ready according to its taste and texture. **Cortland** is at starch index 1.0
Apple Storage Reminders

With this year’s large volume of apples, a long storage duration is likely which can increase the chance for disorders and quality loss. The list below summarizes the most common storage disorders and some practices for prevention. (Photos by Renae Moran)

BITTER PIT

Bitter pit is a form of calcium deficiency that shows up as sunken spots at the blossom end of apples. Honeycrisp is extremely prone to bitter pit. It usually develops while the apples are in storage, but in severe cases will show up in the orchard. Cortland and Jonagold are also known to develop bitter pit, but not as often or as severely as Honeycrisp. Frequent calcium applications to the fruit and foliage during summer are needed when growing Honeycrisp. An early harvest when fruit are not as mature can also lead to more bitter pit.

SOFT SCALD AND SOGGY BREAKDOWN

These two disorders are chilling injuries that occur in Honeycrisp when stored at temperatures below 37 °F. In its early stages, soft scald can resemble bruising, but it eventually turns dark brown. Soggy breakdown causes internal browning in the cortex. Fruit are less prone to soft scald at early stages of maturity, but an early harvest predisposes Honeycrisp to bitter pit development. To prevent chilling injury, a combination of preconditioning and storage at a temperature above 36 °F are recommended. To precondition Honeycrisp, hold fruit at an ambient temperature (50 to 70 °F) for five to seven days before placing in cold storage. Ventilate the room where apples are preconditioned to prevent a dangerous buildup of carbon dioxide or a dangerous depletion of oxygen. Where bitter pit is expected to be severe, I recommend putting fruit promptly into cold storage at a temperature above 36 °F and checking fruit frequently for the development of soft scald. Soggy breakdown is an internal disorder and requires that you cut into apples in order to detect it.

SUPERFICIAL SCALD (also called storage scald)

This type of scald is different from soft scald in how it develops and the varieties likely to get it. Fruit picked at early stages of maturity are more prone, and it takes at least three months of cold storage for its development. Symptoms are well defined patches of brown discoloration in the skin than can be solid or splotchy. Most varieties can develop superficial scald, but Honeycrisp and Gala do not. Susceptible fruit that will be stored longer than three months should be treated with a scald inhibitor prior to cold storage.
Diphenylamine (No-Scald) and ethoxyquine are two materials that prevent scald, but SmartFresh has replaced them for most varieties. Drenching bins with a scald inhibitor is cumbersome, time consuming and requires that a fungicide be added to the drench to prevent decay. Field drenching of bins is replacing the recycling drench, but is still considered experimental. Those of you who are trying the non-recycling field drench this year should remember to add only diphenylamine and fungicide, NOT calcium. For more information on non-recycling drenches, see the attached article by Dave Rosenberger.

SmartFresh is effective in preventing scald in most varieties, so fruit that receive a standard application of SmartFresh do not require drenching. Exceptions to this are Cortland and Empire which benefit from diphenylamine, Cortland because of its high susceptibility to scald and Empire because it will develop carbon dioxide injury in CA storage.

CARBON DIOXIDE INJURY

Injury can occur to the skin and flesh of apples in CA storage if the carbon dioxide concentration is too high. Traditionally, the initial concentration was held at or below 3% in the first month or so of the storage period and then allowed to increase up to 5%. Drenching with DPA protects apples from the high carbon dioxide concentrations that occur in CA storage. Where apples are not drenched with DPA, carbon dioxide should be kept at 1% or lower, especially in the first month. SmartFresh also increases sensitivity, but slows down respiration, so carbon dioxide concentrations should be easier to control. Honeycrisp and Empire are more sensitive than other varieties.

EMPIRE AND MCINTOSH FIRM FLESH BROWNING

The occurrence of firm flesh browning is on the rise because of the longer storage times in fruit treated with SmartFresh. SmartFresh does not directly cause the problem, but instead, by lengthening storage duration, it is probably giving us too much confidence in how long we can actually store some apples. Symptoms are browning in the flesh without a definite margin, and in severe cases, browning in the core. Empire is more prone than McIntosh, and apples harvested at later dates are more prone to this disorder. Apples from a late harvest are at risk of breakdown when they remain in storage longer than four months. ReTain and CA storage cannot always overcome the adverse effects of a late harvest. With this year’s large volume of apples, carefully consider the storage durations and harvest dates. Colder storage temperatures also worsen symptoms of firm flesh browning, so keep temperatures in CA storage around 35 to 36 °F. Warmer temperatures are not recommended for these varieties which can rapidly lose firmness or condition. Keep carbon dioxide below 2% in CA storage and below 1% during the first month. An article on this subject was published in the October 2010 New York Fruit Quarterly, online at [http://www.nyshs.org/fq.php](http://www.nyshs.org/fq.php).
**Non-Recycling Drenches**

Risks and Benefits of Using Non-Recycling Drenches to Apply DPA and Postharvest Fungicides to Apples  
Dave Rosenberger, Plant Pathologist  
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**Background on non-recycling drenches (NRD) for controlling postharvest diseases and disorders:**

- Non-recycling drenches involve spraying 2.5 quarts of treatment solution per bin over tops of filled bins.
- The NRD method was pioneered by storage operators in western NY.
- NRD worked well in initial commercial settings, but the lack of untreated controls left questions that we attempted to address via research reported here:
  - Would NRD treatments provide scald control only under “low scald pressure”?
  - Are fungicides needed if drenches are not recycled?
  - What proportion of fruit surfaces are actually contacted by treatment solutions?

- Non-recycling postharvest treatments are attractive because of:
  - Low cost: less total product is used.
  - Ease of use: Just spray it over the tops of bins.
  - No waste disposal issues for spent drencher solutions.
  - No food safety concerns associated with recycling drenches.
  - No recycling solution to redistribute *Penicillium* spores from bins to fruit wounds.

**Conclusions from two years of replicated trials:**

- **Effectiveness of NRD for controlling storage scald:**
  - NRD controlled scald as well as traditional high-volume recycling drenches (RD).
  - Treatments designed to show proportion of fruit surfaces contacted via NRD indicated that only 20 to 40% of fruit surfaces were contacted.
  - DPA treatment via NRD is effective because DPA volatiles move from treated to non-treated fruit, and the volatiles alone can control scald. (For the same reasons, organic produce cannot be stored in the same cooler as DPA-treated fruit!)
  - Effectiveness of DPA for controlling scald was reduced with both NRD and RD applications when small quantities of treated fruit were placed into a storage room and the treated bins were not enclosed in poly bin bags to retain volatiles.

- **Effectiveness of NRD for controlling decays in wound-inoculated fruit:**
  - Results that were consistent in both 2009 and 2010 trials:
    - Fungicides applied via high-volume drenches were usually more effective than fungicides applied via NRD, especially for fruit at the bottoms of bins.
    - Fungicides applied via NRD provided good decay control for fruit at the tops of the bins, but were ineffective for fruit at the bottoms of bins.
  - NRD control fruit had 65% less decay than RD control fruit in 2009 because the recycling solutions carried spores into more wounds in the RD controls. However, NRD controls had more decay than RD controls in 2010, possibly because DPA was included in controls treatments in 2010 (but not in 2009) and the surfactant in the DPA may have enabled more spores to enter wounds. Also, the Cortland fruit used in 2009 were less susceptible to decay than the Empire fruit used in 2010.
- Adding a surfactant (Tween in 2010) did not improve activity of Scholar applied via NRD.
- Increasing treatment volume from 2.5 qt to 2 gal or 4 gal per bin did not improve activity of Scholar in NRD treatments.
- Fungicides apparently lack the vapor activity found in DPA and therefore fungicides effectiveness is limited by the coverage achieved during application.

**Risks/issues to consider when applying DPA via non-recycling drenches:**

1. Some product labels may prohibit this application method so check your product label.
2. NRD applications are not appropriate for applying postharvest calcium: Calcium applied via NRD may cause burning where water tension leaves large deposits on fruit surfaces.
3. Treatment location issues: DPA applied in the field prior to loading bins on trucks may “air dry” during transport, thereby resulting in less volatiles to suppress scald in fruit not directly contacted by NRD applications. Research in 2011 will address this question.
4. Gray mold caused by *Botrytis cinerea* may become more common:
   - Quiescent infections present in the calyx at harvest have been controlled by high-volume drenches but will not be fully controlled by NRD due to limited fruit surface coverage.
   - Problems are most likely in years with heavy rains during late bloom and first cover sprays because we believe that many *Botrytis* infections are initiated on dying petals, then move into fruit calyces where they remain quiescent until fruit begin senescing in storage.
   - *Botrytis* is unlikely to affect more than 3-4% of fruit even in a severe-disease year.
5. Penicillium spores left in storage rooms can be blown onto fruit, enter wounds, and cause decays if fungicides are not applied with a traditional high volume drench:
   - This risk can be eliminated by sanitizing storage floors with a quaternary ammonium sanitizer during summer. (Chlorinated water is NOT recommended for storage floors!)
   - All storage floors should be sanitized prior to refilling! !!!!

**REMAINING UNCERTAINTY:** Are postharvest fungicides needed if recycling drenches are eliminated?

- It would be desirable to omit postharvest fungicide treatments if DPA is not needed or if DPA is applied via fogging or via non-recycling drenches. However, decay risks will vary depending on the inoculum load coming from the field and/or on densities of *Penicillium* inoculum present on bins and storage room floors. Thus, decay risks in the absence of postharvest fungicide treatment will be highly variable among years, orchards, and storages.
- FACTS concerning decay risks:
  - Penicillium spores can be spread by water or by air.
  - Recycling drenches contribute to *Penicillium* problems by:
    - Collecting *Penicillium* spores from bin surfaces.
    - Transporting *Penicillium* spores into wounds.
  - Airborne spores are less efficient for infecting fruit because concentrations in air are lower than in drenches.
  - In the absence of effective fungicides, losses to *Penicillium* decrease when drenches are eliminated.
Reasons to continue including a fungicide in NRD treatments:

- NRD treatment solutions could still spread spores to as much as 40% of fruit surfaces (i.e., surfaces contacted by treatment solutions), but the number of spores available for dissemination will be lower if bin surfaces are not “washed” with recycling drenches.
- Fungicides included with DPA in NRD treatments will control:
  - \textit{Botrytis} on fruit surfaces that are contacted.
  - \textit{Penicillium} in the upper layer of fruit in bins, which is also the area where airborne spores are mostly likely to be deposited on the fruit as rooms are filled.

Sanitizing storage rooms during summer is critical where no postharvest fungicides are used! ! !

FINAL CONCLUSIONS:
1. DPA applied via NRD will provide excellent control of scald.
2. DPA applied via NRD should also control CO$_2$ injury, but this conclusion is based only on indirect evidence, including observations by those who have used NRD commercially. Also, we suspect that it is easier to control CO$_2$ injury than scald, and DPA applied via NRD controlled scald very well.
3. Fungicides applied via NRD will not control decays on wounded fruit in the bottoms of bins if that fruit is exposed to inoculum.

Add MA & RI to the Spotted Wing Drosophila list

Last week’s report of spotted wing drosophila being found in NH (and probably CT) is supplemented by news this week that SWD is being found in MA and RI. This insect is a threat to peaches and stone fruit, but is not known to damage apples. The most informative factsheet I have found about SWD is at http://www.ipm.msu.edu/SWD/ManagementRecommendations-raspberryBlackberryAug2011.pdf

Closing Words

"It isn’t the mountains ahead to climb that wear you out; it’s the pebble in your shoe."

"The man who views the world at 50 the same as he did at 20 has wasted 30 years of his life."
- Muhammad Ali
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Orchard Radar weather and pest tracking models at http://pronewengland.org/AllModels/DecisionModels.htm

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