Ohio
Fruit ICM News

Editor: Ted W. Gastier, Extension Educator, Agriculture
Ohio State University Extension, Huron County
180 Milan Avenue, Norwalk, OH 44857 419-668-8219
FAX: (419) 663-4233 E-mail: gastier.1@osu.edu

Volume 9, No. 23 June 23, 2005

In This Issue

Calendar

June 28: Ohio Fruit Growers Society Board Meeting, Burnham Orchards, Berlin Heights, OH, 6:30 to 8:00 p.m. Contact Tom Sachs at 614-246-8290 or e-mail Tsachs@ofbf.org or Kathy Lutz at 614-246-8292 or e-mail growohio@ofbf.org.

June 28: Ohio Apple Marketing Program Board Meeting, Burnham Orchards, Berlin Heights, OH, 8:00 to 9:30 p.m. Contact Tom Sachs at 614-246-8290 or e-mail Tsachs@ofbf.org or Kathy Lutz at 614-246-8292 or e-mail growohio@ofbf.org.

June 29: Ohio Fruit Growers Society Summer Tour, Burnham Orchards, Berlin Heights, OH, 8:00 a.m. to 3:00 p.m. Check out <http://www.ohiofruit.org/ofgs/> (click on 2005 Summer Tour). Burnham's website is <http://www.burnhamorchards.com>.

Ohio Fruit Growers Society Summer Tour 2005

Source: Tom Sachs, by Randi Espinoza, Ohio Fruit Growers Society

Pick the Ohio Fruit Growers Society (OFGS) Summer Fruit Tour, Wednesday, June 29, in Berlin Heights, for the latest resources on disease control, increased production, and technological advances that will help you improve crop yield and quality. Sponsored by OFGS, the Ohio Agricultural Research and Development Center (OARDC), and Ohio State University Extension, the annual event runs from 7 a.m. to 2 p.m. at Burnham Orchards, 8019 State Route 113, Berlin Heights.

Cost is $15 for OFGS members, $20 for members' families, $20 for non-OFGS members, and $25 for non-OFGS members' families. Lunch will be provided by Ag Credit. Registration begins at 7 a.m. Orchard tours start at 8 a.m. and run every half hour. Tour presentations include "A Brief History of Burham Orchards" by owner Joe Burnham, who will also talk about the different training systems for apple growth used in his operation.

Other presentations are "Apple Scab Control" by Mike Ellis, plant pathologist with OARDC and OSU Extension; "High-Value Apple Varieties" by Bill Gammie, Quarry Hill Orchards, Berlin Heights; and "Integrated Pest Management (IPM) Scouting" by Ted Gastier, OSU Extension, Huron County office.

"In addition to the orchard tours, we will tour Burham's brand-new, 14,000-square-foot apple-packing facility, which was built to increase the efficiency of the packing operation and to increase work space around the apple packing line," said OFGS Executive Director Tom Sachs.

"Attendees will be able to tour the dry refrigerated storage area, which includes three loading docks that allow the fruit to be cooled immediately after packing and keep it cool until it's loaded onto the shipping trucks."

During the packing facility tour, participants can witness an educational food-safety audit conducted by Shari Plimpton, Center for Innovative Food Technology and food safety educator with the Ohio and Indiana Specialty Crop Food Safety Initiative. The tours will be followed by lunch from 11 a.m. to 1 p.m. and the OFGS business meeting beginning at 1 p.m.

The summer tour will also gather more than 30 suppliers that support the fruit industry. "Interaction with these exhibitors will allow participants the unique opportunity to network with industry professionals and discuss and learn about products and technology essential to growing and marketing better fruit," Sachs said.

A tour of The Berlin Fruit Box Company, a long-standing local basket manufacturer, is scheduled at 2 p.m. For more information, contact Sachs at 614- 246-8290, tsachs@ofbf.org, or Kathy Lutz at 614- 246-8292, klutz@ofbf.org.

On The Fly

Source: Harvey Reissig & Art Agnello, Entomology, Geneva, Scaffolds Fruit Journal, Volume 14, No. 14, June 20, 2005

Once again, it is nearly time to expect the first appearance of apple maggot (AM) flies in volunteer apple stands and abandoned orchards, particularly in eastern N.Y.; western N.Y. could be about a week later, or not, depending on what kind of temperatures we get over the next week or so. Crop scouts and consultants have been using traps to monitor AM populations for a long time, but this tactic, useful as it is, nevertheless is not recommended in all cases. Some orchards have such high or such low AM populations that monitoring for them is a waste of time. That is, sprays are needed predictably every season in some blocks, and on a calendar basis; conversely, they are rarely needed at all in other blocks.

However, most commercial N.Y. orchards have moderate or variable pressure from this pest, so monitoring to determine when damaging numbers of them are present can reduce the number of sprays used in the summer with no decrease in fruit quality.

Sticky yellow panels have been in use for over 30 years, and can be very helpful in determining when AM flies are present. These insects emerge from their hibernation sites in the soil from mid-June to early July in New York, and spend the first 7-10 days of their adult life feeding on substances such as aphid honeydew until they are sexually mature. Because honeydew is most likely to be found on foliage, and because the flies see the yellow panel as a "super leaf," they are naturally attracted to it during this early adult stage. A few of these panels hung in an orchard can serve as an early warning device for growers if there is a likely AM emergence site nearby.

Many flies pass this period outside of the orchard, however, and then begin searching for fruit only when they are ready to mate and lay eggs. That means that this advance warning doesn't always have a chance to take place -- the catch of a single (sexually mature) fly then indicates a spray is necessary immediately to adequately protect the fruit. This can translate into an undesirable risk if the traps are not being checked daily, something that is not always possible during a busy summer.

To regain this time advantage, researchers developed newer traps that have the form of a "super apple" -- large, round, deep red, and sometimes with the smell of a ripe apple -- in an attempt to catch that first AM fly in the orchard. Because this kind of trap is so much more efficient at detecting AM flies when they are still at relatively low levels in the orchard, the traps can usually be checked twice a week to allow a one- or two-day response period (before spraying) after a catch is recorded, without incurring any risk to the fruit. In fact, research done in Geneva over a number of years indicates that some of these traps work so well, it is possible to use a higher threshold than the old "one fly and spray" guidelines recommended for the panel traps. Specifically, it has been found that sphere-type traps baited with a lure that emits apple volatiles attract AM flies so efficiently that an insecticide cover spray is not required until a threshold of 5 flies per trap is reached.

The recommended practice is to hang three volatile-baited sphere traps in a 10- to 15-acre orchard, on the outside row facing the most probable direction of AM migration (towards woods or abandoned apple trees, or else south). Then, periodically check the traps to get a total number of flies caught; divide this by 3 to get the average catch per trap, and spray when the result is 5 or more. Be sure you know how to distinguish AM flies from others that will be collected by the inviting-looking sphere. There are good photos for identifying the adults on the Apple Maggot IPM Fact Sheet (No. 102GFSTF-I8); see p. 226 of the Recommends for details on obtaining any that may still be in print, or else check the web version at: <http://www.nysipm.cornell.edu/factsheets/treefruit/pests/am/applemaggot.html>.

In home apple plantings, these traps can be used to "trap out" local populations of AM flies by attracting any adult female in the tree's vicinity to the sticky surface of the red sphere before it can lay eggs in the fruit. Research done in Massachusetts suggests that this strategy will protect the fruit if one trap is used for every 100-150 apples normally produced by the tree (i.e., a maximum of three to four traps per tree in most cases), a density that makes this strategy fairly impractical on the commercial level.

A variety of traps and lures are currently available from commercial suppliers; among them: permanent sphere traps made of wood or stiff plastic, disposable sphere traps made of flexible plastic, and sphere-plus-panel ("Ladd") traps. The disposable traps are cheaper than the others, of course, but only last one season. Ladd traps are very effective at catching flies, but are harder to keep clean, and performed no better than any other sphere trap in our field tests. Brush-on stickum is available to facilitate trap setup in the orchard. Apple volatile lures are available for use in combination with any of these traps.

These tools are available from a number of orchard pest monitoring suppliers, among them:

- Gempler's Inc., 100 Countryside Dr., PO Box 328, Belleville, WI 53508; 608-424-1544, Fax, 608-424-1555
- Great Lakes IPM, 10220 Church Rd. NE, Vestaburg, MI 48891; 800-235-0285, Fax 989-268-5311
- Harmony Farm Supply, 3244 Gravenstein Hwy, No. B, Sebastopol, CA 95472; 707-823-9125, Fax 707-823-1734
- Ladd Research Industries Inc., 83 Holly Court, Williston, VT 05495; 800-451-3406, Fax 802-660-8859
- Olson Products Inc., PO Box 1043, Medina, OH 44258; 330-723-3210, Fax 330-723-9977
- Scenturion Inc., P.O. Box 585, Clinton, WA 98236; 360-341-3989, Fax 360-341-3242

By preparing now for the apple maggot season, you can simplify the decisions required to get your apples through the summer in good shape for harvest.

Timing Sprays for Flyspeck & Sooty Blotch

Source: David A. Rosenberger, Plant Pathology,Highland

Flyspeck and sooty blotch infect apple fruit during summer and cause blemishes that can make fruit unmarketable. These diseases are caused by unrelated fungi, but both diseases are favored by extended periods of wet weather during mid- to late summer. Sooty blotch is easily suppressed by fungicides, but flyspeck is more difficult to control in northeastern United States. In abandoned or unsprayed trees, sooty blotch may appear on fruit before flyspeck does. However, flyspeck usually appears first in commercial orchards and causes more commercial losses than sooty blotch.

Most of the inoculum for sooty blotch and flyspeck comes from wild hosts in orchard perimeters. Ascospores of the flyspeck fungus mature in wild hosts shortly after apples begin bloom. Release of ascospores peaks about 10 days after petal fall. However, only a few ascospores land on apple fruit, and most of these are killed by fungicides used to control apple scab. Although ascospores do not play much of a role in commercial orchards, they are important because they initiate secondary infections in the border areas.

Brown and Sutton in North Carolina showed that flyspeck becomes visible on apple fruit only after fruit have been wet for a cumulative total of approximately 270 hr following infection.

If we assume that flyspeck has a similar incubation period on wild hosts, then the primary infections initiated by ascospores will begin producing conidia on non-orchard hosts after approximately 270 hr of Accumulated Wetting counting from Petal Fall (hr-awpf).

The conidia produced on non-orchard hosts are continuously blown into apple orchards beginning at 270 hr-awpf, and these conidia cause the majority of infections that appear on apple fruit during late summer. However, another 270 hr of accumulated wetting are required before flyspeck becomes visible on apple fruit. Thus, most infections on fruit will become visible only after 540 hr-awpf.

Because flyspeck spores do not enter orchards in significant numbers until 270 hr-awpf, summer fungicides for controlling flyspeck are not needed during early summer. Furthermore, Topsin M, Flint, and Sovran (and probably Pristine) all provide post-infection activity that will eradicate flyspeck infections that have accumulated less than 100 hr of wetting after infection. Given that conidia begin blowing into orchards at 270 hr-awpf and that fungicides can provide post-infection activity through another 100 hr of wetting, summer fungicides should not be needed between the end of scab season and the time that the orchard reaches 370 hr-awpf. However, summer sprays probably should not be delayed beyond about 320 hr-awpf to allow for errors in measuring wetting periods and to ensure that a lengthy wetting period will not suddenly cause the 370 hr threshold to be exceeded.

In dry years, 320 hr-awpf may not occur until mid-August, but summer sprays should not be delayed beyond July 20-25 in New York State for two reasons. First, summer fungicides may be needed in late July to protect fruit against black rot and white rot, especially on cultivars that mature in late August or early September. Second, complete spray coverage becomes increasingly difficult as apples increase in size, especially on cultivars such as Redcort that tend to produce two short-stemmed fruit on a single cluster. Complete spray coverage also becomes more difficult as limbs bend downward under heavy crop loads.

In dry years, a single fungicide application in late July can sometimes provide adequate control of flyspeck for the whole season. Depending on a single application is risky, however, because effectiveness of a single spray depends on achieving perfect spray coverage. A safer approach in dry years is to use a minimum of two summer fungicide applications with one timed for mid- to late July and the second about three weeks later in early to mid-August. A slightly earlier timing may be advisable in orchards where poor pruning or an exceptionally heavy crop load make effective spray coverage impossible after mid-August. More than two applications will be needed in wet years when 320 hr-awpf is reached by late June.

Commercial losses to flyspeck usually occur when late summer rains remove fungicide protection from the “last spray” and then another 270 hr of accumulated wetting occurs prior to harvest. Under those conditions, flyspeck can suddenly appear on a high proportion of fruit within a few days. This scenario was illustrated in 2004 in a field trial at the Hudson Valley Lab that was conducted in a small orchard surrounded by woodlots. The last fungicide sprays in test plots were applied on August 17. Fungicide residues were removed by 2.15 inches of rain that occurred August 20-22. Development of flyspeck on Golden Delicious fruit was monitored in each of four replicated plots per treatment by observing 25 fruit per plot. On Sept. 22 less than 10% of fruit had any flyspeck, and most of the lesions observed were inconspicuous infections in stem-cups or calyx ends of fruit. Five days later, and after exactly 270 hr of accumulated wetting counting from the fungicide wash-off date of August 22, incidence of flyspeck jumped to 27-64% in all except the Pristine plots. Data from this trial suggests that none of our fungicides (with the possible exception of Pristine) will provide fruit protection through more than 2 inches of rain, and the results verify the accuracy of the 270-hr incubation period for flyspeck.

As was seen in the 2004 trial, the critical decision for controlling flyspeck was deciding when to re-spray orchards after heavy rains in August and September. September of 2003 was one of the wettest Septembers on record at the Hudson Valley Lab, and we accumulated 270 hr wetting in just 25 days. Thus, one might assume that a “worst-case” rule of thumb would be to recover apples following heavy rains in late August or early September if fruit will remain on the tree for another 25 days, especially if the fruit are adjacent to a good inoculum source.

However, fungicides need not be re-applied immediately after a wash-off event in late August or early September because Topsin M, Sovran, and Flint will all provide post-infection activity covering up to 100 hr of accumulated wetting after the wash-off event. Given the scenario in 2004, that means that if trees had been resprayed any time before Sept. 7 (when hours of accumulated wetting reached 100), then flyspeck should have been controlled through September. If another storm had delivered 3 inches of rain on August 30, then a grower who re-applied fungicides on August 25 might have needed yet another application in September to protect fruit through September, whereas an application on Sept. 4 would have sufficed to eradicate infections from both the August 20-22 and August 25 rain events while at the same time providing protection on through September.

Conclusions: Fungicides for flyspeck are not needed between the end of scab season and 320 hr-awpf, so fungicide schedules can often be stretched during June if orchards are scab-free at second cover. Control failures with flyspeck usually occur either because of poor spray coverage during the latter part of the growing season or because trees were left unprotected through more than 270 hr of wetting during the preharvest interval. Fungicide protection on fruit is exhausted after 2 inches of rain, so fungicide sprays may be needed in September if heavy rains occur with more than 25 days remaining before fruit will be harvested.

Strawberry Renovation

Source: Bruce Bordelon, Purdue University Commercial Small Fruit Production Specialist, Facts for Fancy Fruit, 05-05, June 20, 2005

Matted row strawberry plantings must be renovated after harvest to establish new crowns for next year's crop. For best results, renovation should be started immediately after the harvest is completed to promote early runner formation. The earlier a runner gets set, the higher its yield potential. Renovation should be completed by the end of July in normal years. Harvest is winding down across the state so growers should begin renovation as soon as the last marketable berries are harvested. The following steps describe renovation of commercial strawberry fields.1. **Weed control:** Annual broadleaf weeds can be controlled with 2,4-D amine formulations. Check the label, as only a few products are labeled for use on strawberries (e.g. Amine 4 [Dimethylamine salt of 2,4-D (3.74 lb./gal.)] at 2 to 3pts./acre in 25-50 gallons of water.) Apply immediately after final harvest. Be extremely careful to avoid drift when applying 2,4-D. Even though the amine formulation is not highly volatile, it can volatilize under hot, humid conditions and can cause damage to desirable plants a considerable distance from the site of application. Some damage to strawberries is also possible. Read and understand the label completely before applying 2,4-D amine. If grasses are a problem, sethoxydim (Poast 1.5 EC) or clethodim (Select 2 EC) will control annual and some perennial grasses. However, do not tank mix these materials and 2,4-D.

2. **Mow the old leaves off** just above the crowns 3 to 5 days after herbicide application. Do not mow so low as to damage the crowns.

3. **Fertilize the planting.** A soil test will help determine phosphorus and potassium needs, but foliar analysis is a more reliable measure of plant nutrition. For foliar analysis, sample the first fully expanded leaves following renovation. Generally, nitrogen should be applied at 25 to 60 lbs/acre, depending on vigor. It is more efficient to split nitrogen applications into two or three applications at regular intervals, rather than apply it all at once. A good plan is to apply about half at renovation and half again in late August when flower bud development is occurring.

4. **Subsoil:** Where picker traffic has been heavy on wet soils, compaction may be severe. Subsoiling between rows will help break up compacted layers and provide better infiltration of water. Subsoiling may be done later in the sequence if crop residue is a problem or if soils are too wet at this time.

5. **Narrow rows:** Reduce the width of rows to a manageable width based on your row spacing, the aisle width desired, and the earliness of renovation. A desirable final row width to attain at the end of the season is 12-18 inches. Wider rows lead to low productivity and increased disease pressure. This means that rows can be narrowed to as little as 6 inches during renovation. Use a tiller or cultivator to achieve the reduction. Since more berries are produced at row

edges than in the middle, narrow rows are superior to wide rows. Narrow rows will give better sunlight penetration, better disease control, and better fruit quality.6. **Cultivate:** Incorporate the straw and other plant material between rows and throw a small amount of soil over the row by cultivation. Strawberry crowns continue development at the top, and new roots are initiated above old roots on the crown, so 1/2 to 1 inch of soil on the crowns will facilitate rooting. This also helps cover straw in the row and provides a good rooting medium for the new runner plants.7. **Weed control:** Pre-emergence weed control should begin immediately. Dacthal, Sinbar or Devrinol are suggested materials. Devrinol must be incorporated by irrigation, rainfall, or cultivation to be effective. Rate and timing of Sinbar application is critical. If regrowth has started at all, significant damage may result. Some varieties are more sensitive to Sinbar than others. If unsure, make a test application to a small area before treating the entire planting. Use 2 to 6 oz/acre/application and no more than 8 oz/acre/year total. Sinbar should not be used on soils with low organic matter, or on sensitive varieties like Guardian, Darrow, Tribute, Tristar and possibly Honeoye. If Sinbar gets onto strawberry leaves, irrigate to wash it off. (See following article for additional weed management advice).

8. **Irrigate:** Water is needed for both activation of herbicides and for plant growth. Don't let the plants go into stress. Ideally the planting should receive 1 to 1-1/2 inches of water per week from either rain or irrigation.9. **Cultivate to sweep runners into the row** until plant stand is sufficient. Thereafter, or in any case after early September, any runner plant not yet rooted is not likely to produce fruit next year and can be removed. Coulter wheels and/or cultivators will help remove these excess plants in the aisles.

10. **Adequate moisture and fertility** during August and September will increase fruit bud formation and improve fruit yield for the coming year. Continue irrigation through this time period and fertilize if necessary. An additional 20-30 pounds of N per acre is suggested, depending on the vigor.

Weed Control at Strawberry Renovation

Source: Doug Doohan, OSU Horticulture & Crop Science Weed Specialist

Seasoned growers know that weed control at renovation is critical to maintain a productive and long-lasting planting. While the main purpose of renovation is stimulate new growth and daughter plant production – the basis for next year's crop, unless weeds are consistently controlled that future crop may never come to fruition. Narrowing the rows, cultivation and mowing all help to reduce weed growth in the renovated berries but the key to a clean field is judicious use of herbicides.

Good growing conditions during summer are required to stimulate strawberry renewal and for herbicides to work – therefore, don't turn off the irrigation system! If perennial grasses such as quackgrass or johnsongrass were present during harvest apply either Poast or Select immediately after harvest. Crop oil concentrate must be used with these herbicides but not with any others that are recommended on strawberry. Nearly all growers should apply either Stinger (Ohio Section 24C No. OH-030004) or 2,4-D amine (Formula 40) before starting renovation. Use 2,4-D if the predominate broadleaf weeds are plantains, dandelions, and mustards. Use Stinger if Canada thistle, clover, vetch, docks and sorrel predominate. Stinger controls dandelions very well but is more costly to use than 2,4-D and does not control mustards or plantain. On the other hand it is much more effective than 2,4-D on thistles, clovers, and docks and is worth the extra money. Both herbicides require a rain-free period of 6 hours after application. Wait 4-6 days after the Stinger or 2,4-D application before mowing old leaves off the beds. Narrowing the rows and cultivating will not impair herbicide activity if delayed to this point. Remember to put the irrigation pipe back in the field and turn it on!

Narrowing the beds and cultivating between rows will stimulate weed seed in the soil to

germinate. Not more than one week after cultivation (and not sooner than two weeks after applying Poast or Select – if used) apply Sinbar or a tank mix of Sinbar and Devrinol. Sinbar can be applied at 4–8 oz/A. Use the low rate on sandy soils, low in organic matter and the high rate on heavy soils with high organic matter. Sinbar is not recommended on soils with less than _ % organic matter. Devrinol can be used at 4-8 lbs/A. At 4 lb Devrionol will improve control of annual grasses. For those needing to control common groundsel 8 lbs are needed, and even then control may be inadequate. Both Sinbar and Devrinol require moisture to activate them; however, with Devrinol it is important to supply 1 inch of water within 24 hours of application or sunlight will degrade the herbicide. Watch closely for strawberry (cyclamen) mite and other pests following renovation. Mites not only damage the crop on their own but predispose the crop to damage from the renovation herbicide.

Post harvest Sinbar will often provide control well into the fall; however, you have to keep an eye on your fields. All growers will benefit tremendously by applying Sinbar again, in early fall – this is known as the Labor Day treatment. Stay tuned to this station for more on late summer weed control.

.

Grape Shoot Positioning and Canopy Management

Source: Bruce Bordelon, Purdue University Commercial Small Fruit Production Specialist, Facts for Fancy Fruit, 05-05, June 20, 2005

Now that we are past fruit set and shoots have toughened-up, it's time to get serious about shoot positioning in grapes. Varieties differ in their need for shoot position due to their growth habit and vigor. Some varieties such Vignoles and Chancellor tend to have relatively short shoots that stand up well on their own, so shoot positioning is seldom needed.

Other varieties such as Traminette, Foch, and all the American varieties produce horizontally growing shoots that tend to run along the top of the trellis and cause significant shading of the fruit and renewal zone. Shoot positioning is very important with these varieties. The need for shoot positioning on other varieties will vary depending on vigor of the particular site.

In high cordon-trained vines, shoot positioning involves pulling lateral-growing shoots off the top of the trellis to hang vertically downward. In mid-wire cordon-trained vines, shoot positioning is done by tucking shoots between sets of catch wires, or pulling catch wires up into position so that the shoots grow vertically upward.

Shoot positioning is critical for improving sunlight exposure of fruit and increasing fruit quality. Additionally, it improves fruitfulness of the basal nodes on the shoots for full fruiting potential next year. Shoot positioning may need to be repeated two or three times during the summer.

Retailing Requires TQBM: Total Quality Berry Management

Source: Kevin Iungerman, NE New York Area Fruit Program, Cornell Cooperative Extension, Ballston Spa, NY, New York Berry News, Vol. 4, No. 1 5, (Reprinted from: Northeast Fruitlet, Vol. 9, No. 5, June 2005)

Editor's note: Save the strawberry information for next season, utilize the blueberry and raspberry info this season.

Total Quality Berry Management (TQBM) involves aspects of proper site selection and preparation, the choice of suitable cultivars, maintaining optimum nutrition and pest management, and educating pickers regarding point of harvest criteria, especially careful handling. TQBM places emphasis upon the rapid movement of the crop from the farm to a pre-arranged market destination via a continuously maintained cold-temperature handling chain. TQBM addresses the need for storage-life plus shelf-life, where "shelf-life" refers to the extent to which sufficient berry eating quality (i.e. marketing quality) is maintained without cold storage.

In contrast, "storage-life" refers to the extent to which eating quality is maintained in berries with cold storage. The goals of TQBM are to expand berry marketing options by using rapid refrigeration to extend both the window of quality fruit availability and the shipment range of this excellent, eating-quality fruit than was previously thought possible.

TQBM changes the 1-2 day shelf life of picked berries at ambient temperatures (68°F.) to a specific crop's maximum attainable post-harvest quality range. Using proper harvesting and storage techniques, it is possible to maintain quality raspberries for 7 days after harvest, strawberries for 2 weeks, and blueberries for 3 weeks.

Perhaps the three most important keys to achieving TQBM are the following:

- Appreciating the dynamics of post-harvest physiology
- Using rapid, two-stage cooling
- Maintaining a refrigerated transport and handling chain

First and foremost, remember that following harvest, fruit remains alive! And while harvest is a radical event in a fruitlet's existence, it is not the end of the berry's life - not yet. Life encompasses senescence and deterioration as well as growth and maturity. Respiration and transpiration are processes governing this cycle of life and post-harvest decline. Post-harvest life span is directly related to the inherent respiration rates of fruit.

Respiration rates of various fruits stored at different temperatures in °F (in mg CO_2 / kg^{-1} / hr^{-1})

	@ 32°	@ 41°	@ 50°	@ 59°	@ 68°
Raspberry	24 mg	55 mg	92 mg	135 mg	200 mg
Blackberry	22 mg	33 mg	62 mg	75 mg	155 mg
Strawberry	15 mg	28 mg	52 mg	83 mg	127 mg
Blueberry	10 mg	12 mg	35 mg	62 mg	87 mg

Respiration is the oxidation (O_2) of food reserves in the fruit to produce energy. Our second concern, transpiration, involves water loss. It is prompted by differences of water vapor concentration (which means pressure differences). Like all gases, water vapor disperses from regions of greater concentration to regions of lesser concentration. Harvested fruits, and indeed all plants, constantly lose water to the environment.

Vapor pressure decreases over a gradient between the fruit cell, the intercellular spaces surrounding those cells, and the atmosphere surrounding the fruit. This means a concentration gradient moving from about a 99% relative humidity to one of 50% to 80%, depending upon the outside environment.

Putting these two forces together, unmanaged respiration and transpiration cause many undesirable outcomes:

- Sugars are oxidized, and cells lose turgor pressure.
- Energy deficit and membrane disarray open fruit to pathogen invasion.
- Symptoms of deterioration and senescence as follows:
    1. Loss of berry crispness, texture, flavor, sweetness, and nutritive value.
    2. Loss of berry weight due to shrinkage, shriveling.
    3. Wilting, softening, and berry rot (death).

What, then, must be done with harvested fruit to put the brakes on respiration and transpiration to ensure TQBM?

- Harvest in the cool of the day. Have a runner or individual pickers take filled flats to a shaded, central pickup point.
- Cover flats with a moist, light-colored tarp and provide shelter from the wind in order to retain water vapor.
- Rapidly cool fruit to remove field heat. An 18° drop in fruit temperature equals a 2x - 4x drop in respiration rate.
  (e.g. With raspberries held at 32°F and 90% RH, rather than 77°F and 30% RH, water loss rate will be 35 times slower.)
  (e.g. Strawberry shelf life at 30°F is 50% greater than at 40°F.)

Refrigeration is an absolute to TQBM. Passive refrigeration has the advantage of being relatively inexpensive, but involves a long cool-down period, which severely compromises storage-life potential. Controlled atmosphere (CA) cold storages (which combine refrigeration, higher CO_2 levels, and reduced O_2 levels to reduce respiration rates) have a similar cool-down phase, but due to the modified gas environment, it is conducive to long-term produce storage. However, it is not rapid enough for highly respiring fruits (such as our small fruits) and is cost-prohibitive to smaller growers.

A third general cooling approach is pre-cooling, which utilizes two-stage refrigeration. It has the advantage of being relatively easy to construct and adapt, and it is the least expensive approach after passive. Liquid ice, hydro-cooling, or vacuum cooling as pre-cooling methods have differing problems of practicality for small fruit processing, higher pathogen transmittal risk, and relative expense.

Rapid, forced-air pre-cooling is the most practical choice for most small fruit operations. Several operating principles are involved for rapid forced-air cooling:

- Refrigerated air (35°F) is ducted so that it is pulled to and through covered vented flats. Warm air then returns to flow over the coils of the cooling unit to repeat the cycle. Air leakage is controlled in the loop and the larger cooler.

- Heat is removed by convection, not conduction. A monitoring unit tracks fruit flesh temperature drop and trips fans (i.e. turns them off) within 5° of 32°F. (Excess air movement causes dehydration).

- Ideal design: a separate cooling chamber sized to harvest flow. Can be adapted to a portion of a cooler.

TQBM requires both rapid pre-cooling and high relative humidity (RH). Theoretically, if the cold storage could be at 100% RH, so long as there is a vapor pressure differential between the warmer fruit and the cold air of the storage, fruit would continue to rapidly lose moisture until temperatures were equated.

Cool-down in a passive system is too slow. Even if fruit and cooler have similar relative humidities, the differences of temperatures represent very different drying powers, for vapor pressure deficit. (VD)

Location & Temp. °F	Humidity Relative%	Pressure (mm Hg)	
		Vapor	Deficit
Fruit & Air	Fruit, Air	Fruit, Air	
@37	100, 90	5.69, 5.12	.57
@32	100, 90	4.58, 4.12	.46

(Information from USDA Agricultural Handbook 68, p 20)
(Note: Storage RH & VD never = 0)

Recommended storage regimens:

Raspberries and Strawberries at 32°F and 90-95% RH
Blueberries at 32°F and 85% RH

Rapid pre-cooling puts the brakes on pathogens, too. *Rhizopus* rot is unable to grow below 40°F, and *Botrytis* spread to healthy fruit is arrested at 32°F. In general, rapid cooling to 32°F complements fungicide control to counter the incidence of various food spoilage fungi, including: *Cladosporium, Penicillium, Mucor, Aureobasidium, Alternaria, Epicoccum, Didymella Species.*

TQBM also requires that you maintain the 'Cool Quality Chain'. Consider this: farmgate to consumer fruit loss, due to deterioration and rot, is estimated at about 40%, and it is largely due to poor handling. Some 14% of the loss occurs in the chain from farmer to wholesaler, 6% from wholesaler to retailer, and 22% from the retailer to the consumer. (Gives new meaning to loss leaders in the produce section.)

In the cool quality handling chain, there are plenty of opportunities or places for things to go wrong. You need to focus on your percentage piece of the problem and you need to educate your customer on his, so that together you may enhance everyone's profit and satisfaction.

TQBM seeks to avoid the losses associated with handling and transport breaks in the cool quality chain. This can be achieved by observing the following:

- After pre-cooling, cover berry containers with rubber-banded cellophane (reduces water loss, excludes contaminates, and aids overall appearance).
- Cover flats with plastic before removal from cold storage. Maintain covers over cellophaned fruit through each phase of refrigerated movement.
- When placed in ambient air, allow berries to warm above the dew point before removing the outer plastic. (Deters sweating or condensation on either berries or cello. Reduces pathogen development risk and appearance problems.)
- Pre-cool fruit first, and move by refrigerated transport. (Refrigerated trucks are incapable of removing field heat.)
- Avoid non-refrigerated breaks in cool fruit movement.
- Properly position flats on pallets in truck. Do not overload the vehicle, as free air movement is critical. Air should flow from the front elevated cooling unit to the rear of the truck, to be deflected down and under flats.
- Avoid flat contact with the truck body (this can raise flat temperatures as much as 20°F). Use trucks with good air suspension. Avoid stacking over wheels. Make sure to stabilize the load**.**

Organic Methods for Blueberry Nutrition

Source: Elsa Sanchez, Assistant Professor, Horticulture Systems Management, Penn State University

This article examines organic options for blueberry nutrition. Because soil pH and nutrient availability are closely linked, methods for adjusting soil pH are also included.

Before Planting

Blueberries grow optimally in soils with a pH between 4.5 and 5.0. Generally, the soil pH will need to be lowered prior to planting to meet this requirement. Some materials for lowering soil pH include sulfur, peat moss, and organic cottonseed meal. Options for sulfur include elemental sulfur and iron sulfate. Both of these products are labeled as 'restricted' according to the Organic Materials Review Institute (OMRI). That means that they are allowed in organic production but are subject to restrictions.

Peat moss, which has a pH between 3.0 and 5.0, can also be used to lower the pH of the soil. It is allowable in organic crop production; however, the type used cannot contain a synthetic wetting agent. Organic cottonseed meal is a fertilizer (see table below) that also has a low pH and can be used to decrease the soil pH. It is approved for organic production as long as it is not from GMO cotton and is free from prohibited substances. Peat moss and cottonseed meal can be expensive. With all of these materials, it is best to work closely with your certifying agency before applying them to ensure organic certification is not compromised by their use.

Berry crops grow best in soils with organic matter contents between 2% and 5%. Organic matter acts as a slow release nutrient source. Methods to increase the soil organic matter content include the use of green manures, composts, and raw manures.

Green manures are crops that are turned into the soil while they are young and succulent, rather than harvested, to improve the organic matter content. When planting a green manure crop before blueberries, select one that will grow well in soils with a low pH, compatible with blueberry plant requirements. Some options include: crimson clover, buckwheat, cereal rye, and spring oats. All of these will grow in soils with a pH of 5.0.

Finished compost typically contains 0.5 to 2.5% total nitrogen. Most of the nitrogen is in an organic or slow release form. As a general rule, about 10% of the organic nitrogen in the compost will be available to the plant per year. When using composts, it is best to apply it based on crop needs rather than on a volumetric basis for long-term soil health.

When raw manures are used for blueberry production, they must be soil incorporated a minimum of 90 days before harvest. The Fact Sheet, *Estimating Manure Application Rates*, Penn State Publication CAT UC151, is available through cooperative extension with detailed calculations for determining application rates for manures.

After Planting

If soil pH needs to be adjusted after planting, sulfur products used prior to planting can be used. Blueberries generally have a relatively high nitrogen requirement, followed by potassium. Phosphorus is needed in lesser amounts. Compost and many 'meals' can be used to meet the nutrient requirements of blueberries. The table below contains the percent nitrogen, phosphate, and potash as well as relative availability of nutrients in some of these products. Many blended fertilizers and liquid fish products are also available and allowed for organic production. Many of these products can be costly. Also, as with materials applied prior to planting, verify that the formulations you plan on using are allowable with your certifying agency to avoid compromising your organic certification.

Fertilizer Sources and Nutrient Levels

Fertilizer Source	% Nitrogen	% Phosphate	% Potash	Relative Availability of Nutrients
Alfalfa Meal	3.0	1.0	2.0	Medium - Slow
Blood Meal	10.0 - 14.0	1.0 - 1.5	0.6 - 0.8	Medium - Fast
Cottonseed Meal	7.0	2.5	1.5	Slow - Medium
Feather Meal	11.0 - 15.0	0	0	Slow
Fish Meal	10.0	4.0	0	Slow
Soybean Meal	7.0	1.6	2.3	Slow
Compost	Variable*	Variable	Variable	About 10% of nitrogen per year

* Nutrient levels in compost vary depending on source materials and composting protocols used; therefore, it is recommended that compost be tested to determine the amount of nutrients it contains (kits are available through local county extension offices.)

A Key to Successful Marketing Strategies

Source: Judith A. Barry, Extension Associate, Department of Applied Economics and Management, Cornell University; reprinted from Smart Marketing, April 2005

Here is a riddle. Within it contains one of the secrets to successful marketing strategies. When you are born, you have lots of it. As you get older, it seems that you use it at a more rapid rate. Some people are good at keeping it; others are definitely not. Whether you are a good marketer or a bad marketer, you are likely to claim you never have enough of it. What is it that I am talking about? The answer, of course, is ***time***. Successful marketing strategies require wise use of time.

Every commercial farmer is both a producer and marketer. Whether you are selling your vegetables at a farmers' market or your milk to a dairy cooperative, your product must be marketed off the farm. How important it is to have detailed, planned marketing strategies will vary from farm to farm, but as every farmer knows, to produce and successfully market a product requires smart use of time.

Here are some points to help you question your use of time and assess whether you are getting as much as you can out of your marketing strategy:

- **Time costs money.** As one of the most costly inputs into any business, the value of time is often underestimated and incorrectly predicted in a business plan. Whether the owner is paying him/herself or an employee, the business should be delivering adequate returns on time invested. If it is not, is the use of time being distributed in the correct areas of your business?

- **Assess your skills.** Successful marketers do not have more time than unsuccessful marketers, but the use of their time may be managed in a more effective and efficient way. Every person on this earth has his or her unique set of skills and personalities. Some extrovert personalities are great at facing people all day long and actually feel that by doing so, it charges their batteries. Introvert personalities, in contrast, are sapped of energy when they are with people all day, but are energized when they are working on more solitary jobs. We all have skills and different personalities. Identifying those skills and the skills of others in the business can utilize people more efficiently and help give the highest return on time investment. Brainstorming and sharing ideas with family and co-workers will probably confirm what is already known, but may also help to recognize how the skill sets within the business can be better applied to operations.

- **Come in the middleman.** Recognizing the use of external people and their individual skills in your business may save money and time in the long run. Delegating tasks and concentrating on areas of competency may achieve a higher return on business time invested.

- **"Time costs money, but my time is free."** Families in farm businesses frequently misconstrue this concept as it shies away from the real costs of doing business. It becomes a problem when the person with the "free" time is incapable of working (illness, injury) causing costs to be incurred to pay someone else to do the job and bringing in some very real costs to the bottom line. People's time is the essence of successful marketing and should not be undervalued when calculating profitability. It is important to remember, of course, some return on time invested might not have a $ value. Lifestyle factors do not have a price tag, but can certainly provide a positive return on time invested.

- **Where can I get more time?** It is probably safe to say that everyone needs more time. Food and product quality is increasingly in demand. However, quality production typically commands more time and energy. Many producers find that after producing the finest quality, they have insufficient time to actually get the product from farm to the consumer. Successfully marketing a quality product to the consumer is, no doubt, an extremely time consuming task. Strategic planning is a useful tool that can help allocate time and people to implement a marketing plan. Doing this establishes the feasibility of the marketing task with the skills and resources available. Producing and marketing a product to meet the demands of the consumer need to go hand in hand, but if there is not the time or resources to achieve both, the strategy may not be profitable.

All of this said, we all have 24 hours in a day. Some sleep less, some eat for less, but to be a producer **AND** a marketer, it is necessary to make ***smart*** use of your time to succeed in managing your smart marketing strategies.

Pest Phenology

Coming Events	**Degree Day Accum.** Base 50°F
Spotted tentiform leafminer 2nd flight begins	449 - 880
Oriental fruit moth 1st flight subsides	493 - 823
Pear psylla 2nd brood hatches	584 - 750
San Jose scale 1st generation crawlers present	619 - 757
Apple maggot 1st catch	749 - 1033
Redbanded leafroller 2nd flight begins	772 - 1080
Oriental fruit moth 2nd flight begins	784 - 1022

Revised thanks to *Scaffolds Fruit Journal* (Art Agnello)

Fruit Observations and Trap Reports

Site: Waterman Lab, Columbus
Dr. Celeste Welty, OSU Extension Entomologist and Gretchen Sutton

Apple: 6/16 to 6/22/05	
Redbanded leafroller	38 up from 21
Spotted tentiform leafminer	203 down from 556
San José scale	0 same as last wk.
Codling moth (3 trap mean)	5.3 down from 18.3
Lesser appleworm	7 down from 17
Tufted apple budmoth	2 down from 10
Variegated leafroller	5 down from 6
Obliquebanded leafroller	7 down from 11
Apple maggot (sum of 3 traps)	0 first report

Site: East District; Erie and Lorain Counties
Jim Mutchler, IPM Scout/Technician

Apple: 6/14 to 6/21/05	
Codling moth (3 trap mean)	1.4 down from 4.8
Oriental fruit moth	1.3 down from 4.7
Redbanded leafroller	1.8 up from 0.0
San Jose scale	0.0 same as last wk.
Spotted tentiform leafminer	62.5 up from 23.3
Lesser appleworm	1.0 down from 23.3

Beneficials found: lacewings, native lady beetles, orange maggots, brown lacewings

Peach: 6/14 to 6/21/05	
Redbanded leafroller	1.7 up from 0.0
Oriental fruit moth	0.1 down from 1.0
Lesser peachtree borer	14.3 down from 21.0
Peachtree borer	0.4 down from 0.7

Beneficials found: lacewings, native lady beetles

Site: West District: Huron, Ottawa, Richland, and Sandusky Counties
Lowell Kreager, IPM Scout/Technician

Apple: 6/13 to 6/20/05	
Codling moth	0.9 up from 0.3
Oriental fruit moth	13.8 up from 2.7
Redbanded leafroller	4.9 up from 0.2
San Jose scale	0.0 same as last week
Spotted tentiform leafminer	471.1 up from 0.0
Lesser appleworm	7.2 down from 15.8

Beneficials found: syrphid flies

Peach: 6/13 to 6/20/05	
Redbanded leafroller	12.0 up from 0.0
Oriental fruit moth	0.1 up from 0.0
Lesser peachtree borer	11.4 up from 2.5
Peachtree borer	0.1 up from 0.0

Beneficials found: brown lacewings, lacewings