Plum Pollination and Fruit Set  
Jerome L. Frecon, Agricultural Agent

There is a market for high quality fresh plums in the Eastern United States. The limiting factor on plum production is fruitfulness related to: 1) Short tree life due to winter injury and possible latent incompatibility with rootstocks; 2) Low temperature injury to buds and flowers in winter and spring; 3) Diseases and physiological disorders of leaves and fruit; and 4) Problems with pollination and fruit set.

European or prune type plums of the species *Prunus domestica* generally experience fewer of these problems in the Eastern United States. Many of what are called Japanese, Asian or Oriental plums are either the species *Prunus salicina* or interspecific hybrids of *P. salicina* and other species. This genetic variability may be a factor in the difficulty of growing the trees and fruit. Fruitfulness related to pollination and fruit set will be discussed.

Most Oriental plum varieties are self-unfruitful and must be at least cross-pollinated. Most varieties produce pollen in the anther. Some varieties do not produce good quantities of viable pollen. This pollen must be transferred to the stigma of the flower during the pollination process. If the transfer occurs in the same variety, it is considered self-pollination. If the transfer occurs in or with two or more different varieties it is considered cross pollination. However simply the transfer of pollen does not insure fruitfulness or fruit set. In the eastern United States this cross-pollination can be done by wind or insects. Unfortunately because plums are one of the earliest blooming fruit types it may be too cool for good bee activity to help with cross pollination. Also many of the plum plantings are small and because growers generally do not rent hives for cross pollination, good pollination is dependent on natural pollinating agents or wind.

European plums generally bloom earlier than Oriental types. There are self-fruitful types but most European varieties benefit from cross-pollination by consistently producing heavier crops of plums. As new varieties are introduced there appears to be less information available on pollination requirements.

Fruitfulness is more challenging in oriental types. Again this may be due to the interspecific diversity. According to literature from California, most Oriental plum varieties and types are either totally or partially self-unfruitful and require cross pollination. There are charts available in western publications that define the best pollenizer for each variety.
variety and rate them as poor, fair and good. Unfortunately, in my experience in field trials, some that are rated good, I find poor under Pennsylvania and New Jersey conditions. There is definitely a lack good research on fruitfulness in oriental types under eastern conditions. This is probably due to differences in the weather.

Differences in weather can affect the number of flower buds and the time those flowers bloom. Since cross-pollination requires the transfer of pollen from the anther of the flower in one variety to the stigma of a flower of another variety, the release of pollen has to overlap from the pollinator with the receptivity of the stigma on the variety to be pollinated. With plantings of Ruby Queen, a self-incompatible type from the USDA-Byron breeding program, the variety Black Ruby has been suggested as a pollenizer. Ruby Queen has consistently set up good crops in my test block in Richwood and the only variety planted near it has been Black Ruby. Usually Black Ruby bloom overlaps with Ruby Queen although some years if the bloom period is short there is very little overlap. Black Ruby does not always bloom heavily so in new plantings other varieties are being evaluated as pollenizers. Methley, a small red plum, is suggested as a pollenizer for Ruby Queen in Georgia. Vanier overlaps with Ruby Queen as does Shiro. Both bloom later than Black Ruby. Literature in Ontario where Vanier originated, states that it is self incompatible; a good pollen producer; and compatible with Shiro. Both Shiro and Vanier are cross compatible and pollinate each other, so in newer plantings these varieties may serve to help pollinate Ruby Queen. Shiro is an old favorite and Vanier a promising newer cultivar. Bees and other pollinating agents would help set heavier crops of fruit.

Fruitfulness involves more than just bloom overlap so additional information will be presented in future newsletters.

Blueberry Pollination

Gary C. Pavlis, Ph.D., Agricultural Agent

Pollination is an important factor in production of the highbush blueberry. Lack of adequate pollination causes reduced yield, small berry size, and a delay in berry maturity. It is chiefly the honeybee which performs this task. While bumblebees are efficient and diligent pollinators (even under more adverse weather condition), their numbers are steadily decreasing.

According to MSU Entomologist, Dr. Roger Hooper, “Historically, feral (wild) honey bee colonies have provided more than half of the pollination in Michigan.” Wild bee populations are declining. This is due to changes in our own blueberry production practices which remove bee forage and suitable habitat, and there is the problem with mites.

Varroa and trachael mites are killing wild and managed colonies in the U.S. The varroa mite has completely wiped out all of the wild colonies in Europe. It is certain that our dependence upon this population of bees will be reduced in the next few years in Michigan as well.

What does this mean for blueberry producers? What happens when we lose the free pollination service provided by wild bees? You probably already know - more honey bees.

Blueberries have a tremendous number of blossoms per acre. A single bush may have 2,000 to 3,000 blossoms. At a planting density of 870 bushes per acre, that’s 1.75 to 2.6 million flowers! Large-block single-variety plantings make it essential that high numbers of pollinators be available at one time.

The number of colonies needed per acre is determined by weather during the bloom period, colony size, variety, and blossom density per acre.

Weather during blossom time affects the honeybee’s foraging efficiency. Honeybee activity increases as the temperature increases from 50 to 95°F. Sunshine also increases foraging, especially at lower temperatures.

Cold, wet, windy weather decreases foraging activity. Temperatures above 95°F will also reduce foraging as the bees spend their time cooling the hive.

As a general rule, over-wintered colonies are stronger than package bees. A three-pound package may have 12,000 bees, while an over-wintered colony may contain two to three times as many. Honeybee colonies will be smaller in an early bloom year. In essence, the crop has developed faster than the development rate of the forager bees. Are honeybees the answer? Many of you have seen your bees fly out of the hive, past your ‘Jersey’ bushes, and over to your neighbor’s ‘Rubel’ field. This preference for one variety over another is not fully understood. It may be related to the quantity of nectar, pollen, sugar concentration, or flower color. At this time, honeybees

See Blueberry Pollination on page 3
are the best bet. For the long term, we need to learn to cultivate the wild pollinators.

The recommended concentration of hives per acre to use are tabulated below: Remember that the number of hives needed per acre depends on the variety you have.

<table>
<thead>
<tr>
<th>VERY ATTRACTIVE TO BEES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hive/2 Acres:</td>
</tr>
<tr>
<td>Rancocas</td>
</tr>
<tr>
<td>June</td>
</tr>
<tr>
<td>Rubel</td>
</tr>
<tr>
<td>GN-87</td>
</tr>
<tr>
<td>MODERATELY ATTRACTIVE:</td>
</tr>
<tr>
<td>1 Hive/Acre:</td>
</tr>
<tr>
<td>Weymouth</td>
</tr>
<tr>
<td>Bluetta</td>
</tr>
<tr>
<td>Blueay</td>
</tr>
<tr>
<td>Pemberton</td>
</tr>
<tr>
<td>Darrow</td>
</tr>
<tr>
<td>Bluecrop</td>
</tr>
<tr>
<td>Duke</td>
</tr>
</tbody>
</table>

| POOR ATTRACTIVE:                      |
| 2 Hives/Acre:                         |
| Stanley                                |
| Concord                                |
| Berkeley                               |
| Coville                                |
| 1316-A                                 |
| Elliott                                |
| Jersey*                                |
| Earliblue*                             |

Efficiency of pollination poor, add 1/2 hive more per acre.

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**Blueberry Pollination from page 2**

**Peach Bacterial Spot Control:**

**Replacements for Tenn-Cop**

Norman Lalancette, Ph.D., Specialist in Tree Fruit Pathology

As revealed at tree fruit meetings earlier this season, Tenn-Cop 5E, a copper bactericide/fungicide, will no longer be manufactured and therefore available for disease control. For stone fruit growers in New Jersey, this was a critical loss since Tenn-Cop was often the “back-bone” of the peach and nectarine bacterial spot control program. Of particular importance were applications of Tenn-Cop during the post-bloom cover spray period for control of infections by the bacterial spot pathogen, Xanthomonas arboricola pv. pruni, on both fruit and foliage.

**Organometallic vs. Inorganic Copper.** One reason Tenn-Cop was so popular was the belief that it had a lower degree of phytotoxicity to peach, thereby resulting in less foliar injury and defoliation. Since Tenn-Cop was an organometallic copper compound (copper salts of several fatty acids), it was thought to be “softer” than the inorganic copper compounds. After all, many of these inorganic compounds, such as copper hydroxide (Kocide, Champ, Nu-Cop), basic copper sulfate (Cuprofix), copper oxychloride (C.O.C), Bordeaux mix (copper sulfate + lime), etc … were primarily applied/labeled for use during the dormant season. However, the rates of these materials in dormant applications resulted in copper concentrations of 60 to 120 times that applied post-bloom with Tenn-Cop!

Results of a two-year study conducted on 7-year-old ‘Encore’ peach and ‘Redgold’ nectarine demonstrated that Tenn-Cop was not less phytotoxic to these crops than inorganic copper compounds (see Plant Disease 91:1122–1130). Specifically, copper hydroxide caused similar levels or less injury and defoliation than Tenn-Cop when both types of products were applied at the same metallic copper concentration (the copper ion is the active ingredient). Furthermore, no injury was observed to the fruit surface, nor was the fruit size or soluble solids influenced by copper. Finally, estimates of foliar density and tree volume indicated that sufficient photosynthetic capacity existed to allow acceptable leaf damage and loss from copper applications.

**Copper Replacements.** When Tenn-Cop was removed from the market, its manufacturer (DuPont) simultaneously updated the Kocide 3000 label to allow up to six post-bloom cover spray applications (the same number as on the Tenn-Cop label). So, Kocide 3000, which is a copper hydroxide product, can be deployed as a direct replacement for Tenn-Cop in the peach and nectarine bacterial spot program. The recommended rate, however, is 0.75 - 1.5 oz/A, and not the 4.0-8.0
Fireblight Alert for New Jersey-Apples and Pears


Bloom has moved along more rapidly than we anticipated. I now have reports of open apple and pear blossoms in many parts of the region. (Apples are approaching full bloom today at the Rutgers Snyder Farm and near petal fall in South Jersey, Gloucester County, according to one grower.) With the severe heat yesterday (92°F in Hunterdon County) and more heat predicted for today, there may be a risk of fire blight infections in apple and pear blocks that now have open flowers. Temperatures will reach the mid 80’s today and then drop, reaching highs of only the 60’s on Thursday and Friday. There appears to be a chance of rain Tuesday evening through Wednesday. Showers are predicted for Hunterdon County beginning at 11pm tonight.

The rapid onset of bloom, the extreme heat followed by predicted cooling, and the iffy timing of possible rainfall complicates fire blight control. The Maryblyt program indicates that blossom infections could occur today and tomorrow if rain occurs, even if the rain falls on the same day the flowers open. On the other hand, Dr. Rosenberger (Cornell) and others have observed that fire blight infections seem less likely at the very beginning of bloom, or when wetting holds off until after temperatures drop for an extended period. Remember also that open flowers are required for infections to occur. Given all these considerations, here is our best guidance regarding the need for strep applications over the next 2-3 days:

Blocks of apples and pears that had open flowers Monday 4/27 or Tuesday 4/28 may be at risk for fire blight infections if rain takes place during those days. High risk blocks (all pears, apples that had fire blight in the last 2 years, and susceptible apple cultivars particularly those on M9 rootstocks) should receive a strep spray within 24 hours of any rain that takes place on Monday or Tuesday. The risk of infections will decline as air temperatures drop and remain cool into Wednesday and Thursday. So, if rain holds off until Wednesday when temperatures have already dropped into the 60’s, you might gamble and not spray high-risk varieties in blocks if they have no recent history of fire blight infections.

Growers may want to treat highly susceptible blocks that have reached full bloom even before the rain if they have lots of acreage to cover. However, most blocks are not near full bloom and flowers that open after treatment will not be protected. Growers may want to “wait and see” in these blocks since a spray will not be needed if rains do not materialize, and because a spray after the rain will treat all the flowers that might have been exposed to infections. Remember, you have 24 hours from the start of the wetting to apply strep, and the sooner the better. Be sure you have material on hand tomorrow just in case.

The recommended rate for the first strep (Agrimycin 17 WP, Firewall or other generic formulation) applications is one-half lb, per 100 gal. plus either 2 qt. glycerin or 1 pt. Regulaid. Do not concentrate the strep.

See Fire Blight on page 7
Peach

✔ **Oriental Fruit Moth (OFM):** The first of two full insecticide covers for OFM control should be applied this week. A second full insecticide cover should be applied between 350-375 DD. This is predicted to be on or about 5/08-5/10 in southern and central counties and 5/10-12 in northern counties. If using Imidan for OFM control do not use less than 3#/ac. The first and second spray dates for the southern, central, and northern counties are as follows:

<table>
<thead>
<tr>
<th>County / Region</th>
<th>1st Spray Date</th>
<th>2nd Spray Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monmouth – Central</td>
<td>4/27-28</td>
<td>5/09-5/11</td>
</tr>
<tr>
<td>Hunterdon – Northern</td>
<td>4/28-30</td>
<td>5/10-12</td>
</tr>
</tbody>
</table>

✔ **Green Peach Aphids (GPA):** The first aphid colonies of the season were observed in a peach block on 4/27. No blocks with populations above threshold have been seen. At this time of year, growers should not tolerate more than 2 colonies per tree on peach or 1 colony per tree on nectarines. While this is a very conservative estimate for peaches, aphid populations should definitely not be tolerated on nectarines, since they will directly damage and deform the fruit. The neonicotinoids (Provado, Assail, Actara), Beleaf, Lannate, and Thiodan are labeled for control. The best control will be obtained with any neonicotinoid and Beleaf. Only low rates are needed for the neonicotinoids. Actara will control plum curculio, tarnished plant bug, and stink bugs (at a higher rate of 4.5 to 5.5 oz/A as opposed to 3-4 oz/A for aphids). Neither of these two products will control OFM. In order to minimize costs, growers may wish to delay aphid treatments if possible, use a pyrethroid or OP only, or if needed, use a pyrethroid plus a low rate of a neonicotinoid compound. Actara/pyrethroid combinations may offer better PC control than pyrethroids alone. Beleaf (flonicamid) is a different chemistry than the other materials. It is a group 9C feeding blocker, and is very effective on aphids and catfacing insects (tarnished plant bug and stink bugs), but controls those classes of insects only. Leverage and Voliam Flexi are newly registered materials will control most petal fall pests including aphids.

✔ **Tarnished Plant Bugs and Stink Bugs (TPB and SB):** This is the time of the season when treatments are also targeted for these two pests. Growers who have experienced past problems have either had weedy ground covers and/or had plantings with considerable wooded borders. Catfacing insects were present in orchards and active in the heat of last weekend. Where hedgerows, weeds, and woods are near peach trees, growers should be particularly mindful of catfacing insect control. See note on Beleaf above.

✔ **Flower Thrips:** Although early thrips injury is sometimes seen on both peaches and nectarines at harvest, they are generally considered more damaging to nectarines. No thrips have been observed in southern counties as of this date.

✔ **Blossom Blight:** No blossom blight infections have been observed in southern counties despite the wet weather during bloom. Once shuck off begins growers can begin a sulfur based program. This does not apply to blocks known to have peach scab inoculum. In these blocks growers should continue a Captan based program until at least third cover. Some blossom cankers are appearing in varieties considered very susceptible to constriction canker. Constriction cankers look very similar to blossom blight at this time.

✔ **Peach Scab:** If a minimal or incomplete spray program was used during 2008, or if scab was a problem, large amounts of overwintering scab inoculum may be present on last year’s wood. Fruit is infected from conidia on overwintering twig lesions. Spores are splashed onto the fruit during rainy periods from shuck split through the following six weeks. Scab sprays should start to go on now. Combinations that include Gem, Bravo, or Captan are suggested. A strong scab control program that also manages for resistance would be a complete cover at petal fall with Gem, followed by a complete cover at shuck split with Bravo. Keep in mind that Bravo is not labeled past shuck split.

✔ **Bacterial Spot:** Treatments using copper formulations or terramycin (oxytetracyclene) should be included in cover sprays starting at petal fall. Terramycin formulations have limited residual activity, and are thought to have as much as 24 hours “back-action”. Terramycin works best when applied as dilute as possible and under slow drying conditions up to 4 days prior to a rain event. A scouting done Tuesday morning showed the start of foliar bacterial spot infections. These are only a few days old and likely from the heavy rains we experienced Mon.-Wed. last week.

✔ **Rusty Spot:** Rally (formerly Nova) should be included in cover sprays starting at petal fall on rusty spot sensitive varieties. Apply at 2.5 – 5 ozs./acre.

*See Fruit IPM on page 6*
Apple

**✔ Apple Scab:** Continue solid applications with very effective materials. We are now at peak spore discharge in all growing regions. See spore release graph below. Cedar apple rust is also a concern. The strobilurin fungicides, Flint and Sovran and the combined strobilurin/boscalid, Pristine are considered weak rust materials and if these are used, they should be combined with a half rate of an EBDC where rust is known to be a problem.

**✔ Fire Blight:** Blossom sprays using antibiotics should be applied on a 3-7 day schedule or anytime temperatures are 65°F or above and the relative humidity is 60% or above. Growers should rotate streptomycin with oxytetracycline to manage resistance. Refer to the production guide and last newsletter for recommended materials and rates.

**✔ Plum Curculio (PC):** PC adults are now active, and were seen in blueberries earlier this week. This is a key insect target from now through early June. Any petal fall applications made on apples or pears should include control for PC.

**Pear**

**✔ Pear Psylla:** Psylla nymphs are emerging in central and northern orchards. If controls were not applied earlier, then now is a good time, since softshell nymphs are much easier to control than the later instar hardshells. Nymphs are slightly older in southern orchards

**Scouting Calendar**

The following table is intended as an aid for orchard scouting. It should **not** be used to time pesticide applications. Median dates for pest events and crop phenology are displayed. These dates are compiled from observations made since 1995 in Gloucester County. Events in northern New Jersey should occur 7-10 days later.

<table>
<thead>
<tr>
<th>Pest Event or Growth Stage</th>
<th>Approximate Date</th>
<th>2009 Observed Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot; Green Tip Red Delicious</td>
<td>March 27 +/- 10 Days</td>
<td>April 1</td>
</tr>
<tr>
<td>First Apple Scab Infection Period</td>
<td>April 5 +/- 18 Days</td>
<td>Not yet observed</td>
</tr>
<tr>
<td>Tight Cluster Red Delicious</td>
<td>April 8 +/- 10 Days</td>
<td>April 12</td>
</tr>
<tr>
<td>Oriental Fruit Moth Biofix</td>
<td>April 8 +/- 10 Days</td>
<td>April 17</td>
</tr>
<tr>
<td>Pink Peach (Redhaven)</td>
<td>April 10 +/- 9 Days</td>
<td>April 5</td>
</tr>
<tr>
<td>First Blossom Blight Infection</td>
<td>April 10 +/- 5 Days</td>
<td>Not yet observed</td>
</tr>
<tr>
<td>Pink Apple (Red Delicious)</td>
<td>April 13 +/- 11 Days</td>
<td>April 20</td>
</tr>
<tr>
<td>Full Bloom Peach (Redhaven)</td>
<td>April 16 +/- 7 Days</td>
<td>April 17</td>
</tr>
<tr>
<td>Green Peach Aphid Observed</td>
<td>April 16 +/- 16 Days</td>
<td>April 27</td>
</tr>
<tr>
<td>Oriental Fruit Moth – 175 DD target</td>
<td>April 19 +/- 12 Days</td>
<td>April 27</td>
</tr>
<tr>
<td>Full Bloom Apple (Red Delicious)</td>
<td>April 20 +/- 9 Days</td>
<td>April 27</td>
</tr>
<tr>
<td>Petal Fall (Redhaven)</td>
<td>April 21 +/- 9 Days</td>
<td>April 24</td>
</tr>
<tr>
<td>Petal Fall (Red Delicious)</td>
<td>April 27 +/- 13 Days</td>
<td>Not yet observed</td>
</tr>
<tr>
<td>Shuck Split (Redhaven)</td>
<td>April 29 +/- 7 Days</td>
<td>Not yet observed</td>
</tr>
<tr>
<td>Tufted Apple Bud Moth Biofix</td>
<td>May 4 +/- 10 Days</td>
<td>Not yet observed</td>
</tr>
<tr>
<td>Plum Curculio Oviposition Begins</td>
<td>May 5 +/- 16 Days</td>
<td>Not yet observed</td>
</tr>
<tr>
<td>Oriental Fruit Moth – 375 DD target</td>
<td>May 10 +/- 10 Days</td>
<td>Current Forecast – May 10</td>
</tr>
<tr>
<td>Codling Moth Biofix</td>
<td>May 14 +/- 16 Days</td>
<td>Not yet observed</td>
</tr>
</tbody>
</table>

**Blueberry**

**✔ Cranberry Weevil (CBW):** About 61% of tray samples have been positive for weevils, and about 13% of samples have been over our treatment threshold. We expect activity to decrease now that flowers are in or approaching bloom. Most of our monitored fields have bees already placed in them.

**✔ Plum Curculio (PC):** The first adults were seen in Burlington County on 4/24 and in Atlantic County on 4/27. Populations are common at one site in Atlantic County.

**✔ Gypsy Moth (GM):** Eggs are starting to hatch, with the first (1st instar) larvae seen on 4/27.

**✔ Mummy Berry:** Primary strikes are present in unsprayed fields. However, no strikes have been seen in commercial fields.

*See Trap Counts on page 7*
Fireblight from page 4

glycerin or Regualaid. We don't know but suspect phyto
might be possible if you tank mix Regualaid with captan.
If you are going to spray strep, consider one of the fol-
lowing: leave out the Regualaid, leave out the captan, or
substitute another fungicide such as Sovran or Flint for
the captan. There should not be a problem tank-mixing
Regualaid with mancozeb. □

Calendar of Events

April 30, 2009 - 5:30 p.m. - Twilight Blueberry Meeting
at Variety Farms, 548 Pleasant Mills Rd, Hammonton,
NJ. Tel: 609-561-0612. Contact Jerry Frecon at 856-307-
6450, ext 1.

May 27, 2009 – Twilight Sustainable Wine Grape Meet-
ing. 6:00 p.m. Sharrott Winery 370 S. Egg Harbor Rd.
(Rt. 561) Winslow, NJ 08037 (609) 567-WINE
www.sharrottwinery.com. Contact Jerry Frecon at 856-
307-6450, ext 1.

May 28, 2009 - 5:30 p.m - Twilight Blueberry Meet-
ing at Atlantic Blueberry Co. 7201 Weymouth Road,
Hammonton, NJ 08037 (609) 561-8600
at 856-307-6450, ext 1.

June 24, 2009 5:15 p.m -. Tree Fruit and Wine Grape
Research Tour and Meeting. Rutgers Agricultural
Research and Extension Center, 121 Northville Road,
Upper Deerfield Township, NJ. Contact Jerry Frecon at
856-307-6450, ext.1.
PLANT & PEST ADVISORY
FRUIT EDITION - CONTRIBUTORS

Rutgers NJAES Cooperative Extension Specialists
George Hamilton, Ph.D., Pest Management
Norman Lalancette, Ph.D., Tree Fruit Pathology
Bradley A. Majek, Ph.D., Weed Science
Peter Oudemans, Ph.D., Small Fruit Plant Pathology
Cesar Rodriguez-Saona, Ph.D., Cranberry/Blueberry Entomology
Daniel Ward, Ph.D., Pomology
Kristen Tollerup, Ph.D., Post Doctoral Associate, Entomology

Rutgers NJAES
Joseph Goffreda, Ph.D., Breeding

Rutgers NJAES - CE Agricultural Agents and Program Associates
Atlantic County, Gary C. Pavlis, Ph.D. (609-625-0056)
Gloucester County, Jerome L. Frecon (856-307-6450)
Hunterdon County, Winfred P. Cowgill, Jr. (908-788-1338)
Morris County, Peter J. Nitzsche (973-285-8300)
Passaic, Elaine F. Barbour, Agric. Assistant (973-305-5740)
Warren County, William H. Tietjen (908-475-6505)
Fruit IPM, Dean Polk (609-758-7311)
Atanas Atanassov, Ph.D., Program Associate (908-788-1338)
Gene Rizio, Program Associate (856-566-2900)
David Schmitt, Program Associate (856-307-6450)

Newsletter Production
Jack Rabin, Associate Director for Farm Services, NJAES
Cindy Rovins, Agricultural Communications Editor

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