American Cranberry Growers Association
2009 Summer Field Day
Thursday August 20, 2009
Rutgers University
P.E. Marucci Center for Blueberry & Cranberry Research & Extension,
Chatsworth, NJ

Parking will be available at the Center’s shop (across cranberry bogs).
Transportation for tours will be provided at the Center.
Restrooms located at the Center, adjacent to Conference Room.

CRANBERRY BOGS:

8:00–8:30 Continental Breakfast (Bog 19)

8:30 Opening Remarks
Stephen V. Lee, IV President, American Cranberry Growers Association

8:30–9:00 2009 Trials with New Insecticides (Bogs 19-20)
Dr. Cesar Rodriguez-Saona, Extension Specialist, Rutgers University

9:00–9:30 Use of New Fungicide Combinations for Fruit Rot Control (Bog 11)
Dr. Peter Oudemans, Extension Specialist, Rutgers University

9:30–10:00 Update on Chemical Control of Flowering to Enhance Bed
Establishment and Reduce Fungal Inoculum (Bog 6)
Dr. James Polashock, Research Plant Pathologist, USDA-ARS, Dr. Peter Oudemans,
Extension Specialist, Rutgers University

10:00-10:30 Cranberry Breeding Update: Breeding for Fruit Rot Resistance and
Maintaining Cultivar Purity (Bog 4)
Dr. Jennifer Johnson-Cicalese, Research Associate, Dr. Nicholi Vorsa, Extension
Specialist, Rutgers University

CONFERENCE ROOM:

10:50-11:20 Honeybees, wild bees, and the mechanics of cranberry pollination
Dr. Daniel Cariveau, Post-doctoral Research Assistant, Department of Entomology,
Rutgers University

11:30–12:00 Pesticide Applicator Safety
Mr. Ray Samulis, Cooperative Extension Agent, Burlington County Extension,
Rutgers University

12:00–12:10 Teaching Students Pineland Agriculture and Preparing for the
Cranberry Harvest Tour
Ms. Barbara Rheault, Teacher, Mullica Middle School, Elwood NJ

12:10–1:30 LUNCH (POLE BARN)

1:30–2:30 LAB TOURS

Dr. Nicholi Vorsa. Nick is Director at the Marucci Blueberry and Cranberry Research and Extension Center. His research interests involve the areas of plant breeding, genetics, germplasm evaluation and reproductive plant biology.

Dr. Amy Howell. Amy is an Associate Research Scientist at the Marucci Blueberry and Cranberry Research and Extension Center. She works on isolating natural products from cranberries and blueberries that benefit health.

Dr. Peter Oudemans. Peter is an Associate Professor in the Department of Plant Biology and Pathology at Rutgers University and is stationed at the Marucci Blueberry and Cranberry Research and Extension Center. Peter's research program tackles problems in the biology and control of fungal diseases of blueberry and cranberry.

Dr. Cesar Rodriguez-Saona. Cesar is an Assistant Professor in the Department of Entomology at Rutgers University and is stationed at the Marucci Blueberry and Cranberry Research and Extension Center. His research program focuses on the development and implementation of cost-effective reduced-risk insect pest management practices for blueberries and cranberries.
TRIALS WITH NEW INSECTICIDES

Cesar Rodriguez-Saona, Robert Holdcraft, and Vera Kyryczenko-Roth
P.E. Marucci Center for Blueberry & Cranberry Research & Extension,
Rutgers University, Chatsworth, NJ

INTRODUCTION

Not all insects are pests in cranberries. Knowing how to recognize and monitor these pests are key components in insect pest management.

**Monitoring for Cranberry Insect Pests**

- **Sparganothis fruitworm**
  - Larvae will feed on the fruit surface, inside berries, and on foliage. One larva may feed on several berries. This insect has 2 generations a year.

In New Jersey, cranberries have historically been attacked by *Sparganothis* fruitworm, spotted fireworm, blackheaded fireworm, and recently by gypsy moth. Changes in pest management practices due to reduction of organophosphate and carbamate use may cause an increase in secondary pest populations. A major concern among New Jersey growers is the blunt-nosed leafhopper that transmits false blossom. Below is a brief overview of these insects:

**Sparganothis fruitworm** - Larvae will feed on the fruit surface, inside berries, and on foliage. One larva may feed on several berries. This insect has 2 generations a year.
Adult flight usually peaks towards the last week in June. A second adult flight starts in mid-August and continues through September, these adults will lay eggs, and the newly hatched first instars will overwinter.

**Spotted fireworm** – High numbers of spotted fireworm larvae are often seen only in cranberry beds where weeds are present in high density. Thus, growers need to monitor for the presence of egg masses on weeds (broadleaf species and grasses). Adult flight typically peaks in the second through third week in June. Larvae from this generation feed on foliage as well as fruit. A second adult flight starts in early August, eggs from the second generation begin to hatch by mid-August, and these larvae will feed on berries and overwinter as second instars. This insect has 2 generations a year.

**Blackheaded fireworm** – This insect is a sporadic pest in New Jersey. It overwinters on cranberry leaves as eggs. The first-generation larvae are foliar feeders, while the second-generation larvae feed on blossoms and fruit. Growers need to be careful when monitoring for this particular pest during the first generation because, if left untreated, the second generation can cause serious damage. First-generation larvae feed on terminal foliage, webbing them together. Feeding can cause vines to appear as if burned. This insect can be detected by looking for webbing in the upright tips.
**Blunt-nosed Leafhopper** – This insect is the principal vector of a phytoplasma that causes cranberry false blossom, which threatened the entire cranberry industry in the early 1900’s. This leafhopper does not move around much, and colonization of bogs occurs slowly. The insect completes one generation a year and overwinters as an egg. Eggs begin to hatch in early May. The nymphs go through five instars in about a month. The adults begin to appear early in July and are most abundant in mid-July. Numbers of this species start to diminish by the first week in August. The adults have a characteristic blunt head and vary from light yellowish-gray to dark brown.

**CURRENT STATUS**

A few new insecticides have been recently registered for control of insect pests in cranberries. These include: Avaunt, Delegate, and Assail. These have been added to the list of reduced-risk insecticides and organophosphate replacements in cranberries; which consisted of Bt products, the insect growth regulators Confirm and Intrepid, and the neonicotinoid Actara, among others.

**Avaunt (Indoxacarb).** Avaunt belongs to a new class of insecticides called the oxadiazines. This insecticide has a novel mode of action: it works by inhibiting sodium ion entry into the nerve cells that results in paralysis and death of the targeted pest. Avaunt has broad-spectrum activity and is designated by the EPA as a “reduced-risk” pesticide. This insecticide is effective against some lepidopteran pests in cranberries, including blackheaded fireworm, gypsy moth, and blossom worm, but has low toxicity against *Sparganothis* fruitworm.

**Delegate (Spinetoram).** This insecticide is similar to SpinTor in that they are both derived from fermentation of a species of bacteria; however, they have different active ingredients. Delegate has both contact and stomach activity, and is highly effective against many lepidopteran larvae: gypsy moth, armyworms, fireworms, *Sparganothis* fruitworm, and spanworms.

**Assail (Acetamiprid).** This is a new neonicotinoid insecticide with broad-spectrum activity. It is effective against leafhoppers and certain lepidopteran pests (gypsy moth and cranberry fruitworm).
## Efficacy of Newly-Registered Insecticides against Major Cranberry Pests in New Jersey

<table>
<thead>
<tr>
<th>Target Pest</th>
<th>New Insecticides: Efficacy Rating¹</th>
<th>Intrepid²</th>
<th>Delegate³</th>
<th>Avaunt³</th>
<th>Assail⁴</th>
<th>Actara⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranberry Fruitworm</td>
<td>++++</td>
<td>++++</td>
<td>++</td>
<td>++++</td>
<td>─</td>
<td></td>
</tr>
<tr>
<td>Sparganothis Fruitworm</td>
<td>++++</td>
<td>++++</td>
<td>+</td>
<td>++</td>
<td>─</td>
<td></td>
</tr>
<tr>
<td>Cranberry Blossom worm</td>
<td>++++</td>
<td>++++</td>
<td>+++</td>
<td>─</td>
<td>─</td>
<td></td>
</tr>
<tr>
<td>Blackheaded Fireworm</td>
<td>++++</td>
<td>++++</td>
<td>+++</td>
<td>─</td>
<td>─</td>
<td></td>
</tr>
<tr>
<td>Spotted Fireworm</td>
<td>++++</td>
<td>++++</td>
<td>+</td>
<td>++</td>
<td>─</td>
<td></td>
</tr>
<tr>
<td>Gypsy Moth</td>
<td>++++</td>
<td>++++</td>
<td>+++</td>
<td>++++</td>
<td>─</td>
<td></td>
</tr>
<tr>
<td>Bluntnosed Leafhopper</td>
<td>─</td>
<td>─</td>
<td>─</td>
<td>++++</td>
<td>++++</td>
<td></td>
</tr>
</tbody>
</table>

¹ ++++ = excellent, +++ = good, ++ = fair, + = poor, ─ = not tested or not recommended
² Can be used during bloom
³ Do not use during bloom
⁴ Not recommended before bloom

### Timing of Control Options

#### INTREPID, DELEGATE, AVAUNT (EXCEPT SPARG)
- **Pre-bloom**
  - Gypsy moth, Spanworms, spotted fireworm, Sparganothis fruitworm, Blackheaded fireworm, Cranberry blossomworm

#### INTREPID
- **Bloom**
  - Gypsy moth, Cranberry fruitworm, Blackheaded fireworm

#### INTREPID, DELEGATE NEW INSECTICIDES
- **Post-bloom**
  - Spotted fireworm, Cranberry fruitworm, Sparganothis fruitworm

- **OP**
  - ASSAIL
  - ACTARA
  - ADMIRE

- **Blunt-nosed Leafhoppers**

- **Rootworm Grubs**
CURRENT RESEARCH

In 2009, the entomology program conducted trials to test newly-registered and unregistered insecticides against leafhoppers and *Sparganothis* fruitworm.

*Laboratory trial for blunt-nosed leafhopper control:* Base-level toxicity of Assail (4 oz/acre), Actara (3 oz/acre), Compound A, and Compound B were evaluated against leafhopper nymphs and adults in the laboratory on cranberry treated foliage and compared to untreated foliage. Insecticide treated and untreated uprights were inserted in florists’ water picks, enclosed in a ventilated 40-dram plastic vial, and secured in Styrofoam trays. Mortality was assessed 3, 6, and 9 days after transfer. Assail, Actara, and Compound B provided good control against nymphs and adults. Compound A provided only 50% control of nymphs after 9 days.
Field trial for blunt-nosed leafhopper control: We evaluated the efficacy of a pre-bloom application of Compound A against blunt-nosed leafhopper nymphs. A cranberry bog located at the Rutgers Blueberry/Cranberry Center was divided into 6 plots. Half of the plots received one treatment (Compound A), while the other half were untreated controls. Application was made on 6 June. Sweepnet samples were taken from each plot on 4 June (pre-treatment) and 29 July (post-treatment). Compound A provided 57% control against blunt-nosed leafhopper after insecticide application.

Field trial for Sparganothis fruitworm control: This trial evaluated the efficacy of a post-bloom application of Delegate and Lorsban against Sparganothis fruitworm. The test was conducted in 4 commercial cranberry bogs. Two bogs were treated with Delegate and two bogs with Lorsban. Both insecticides provided similar control.
Cranberry Fruit Rot Control

Plant Pathology Lab
Peter Oudemans, Chris Constantelos, Donna Larsen, Jennifer Vaiciunas

Cranberry fruit rot is currently one of the most destructive cranberry diseases particularly in warmer growing regions such as New Jersey and Massachusetts. Historically, it has also been one of the most economically important factors affecting cranberry production (Shear et al., 1931). The disease is actually caused by a wide variety of fruit infecting fungi. Shear (1907) and Shear et al. (1931) identified over 15 species of fruit infecting ascomycetes (anamorph and/or teleomorph) of both major and minor importance. Subsequently, mycologists described several new species (Weideman and Boone, 1982, Carris, 1990) and there are currently eleven species considered to be economically important (Table 1).

Cranberry fruit rot can be divided into two general classes (Wilcox, 1940). Field rot typically expresses prior to harvest and storage rot is a post harvest disease important for fresh marketed fruit. There is significant overlap among the species causing field and storage rot and typically one species cannot be classed as exclusively causing either field rot or storage rot. On exception is the end rot pathogen Godronia cassandrae (Fusicoccum putrefaciens) which is primarily a postharvest problem. The causal agent can be determined by culturing rotted fruit on common microbiological media. In many cases more than one fungal species is isolated from a single fruit. Cranberry fruit rot is widespread and occurs at differing levels depending on climatic conditions. It is more of a problem in the Northeast (NJ and MA) than it is in the Northwest (OR, WA, BC). In Wisconsin and Quebec the disease occurs at very low levels and most growers utilize a minimal spray program. Organic production can only occur in areas where fruit rot pressure is low.

Each fruit rotting species has a unique life cycle and mechanism of spread (Oudemans et al. 1998). Composition of the fruit rot community in a single cranberry bed may vary significantly from one year to the next when only rotted fruit are tested. One reason for this may be that the fungi (Table 1) reproduce successfully without infecting fruit and thereby maintain an active population that will cause fruit rot only when the conditions are conducive for that species. McManus et al (2003) compared different growing conditions and harvesting techniques and found that the compliment of fungi isolated from rotted fruit statistically similar. There has been significant research examining overwintering sites for each species and use of molecular diagnostic methods may become very useful in accurately characterizing the fungal fruit rot community in individual cranberry beds (Robideau et al. 2008)
From a practical perspective fruit rot is normally treated as a single disease. Management strategies including choice of fungicide and timing of application target fruit rot without regard for individual species. This approach is appropriate when broad spectrum fungicides are used. However, as new chemistries with more limited spectra of action are introduced the particular compliment of species causing fruit rot becomes very important (Fig. 1). Recently, registration of fenbuconazole and azoxystrobin was completed and combinations of these two modes of action provide a greater spectrum of action and improved disease control than either fungicide alone (Oudemans and Vaiciunas, 2008 attached below). It is likely that as horticultural practices and breeding efforts lead to increased crop yields it will become necessary to better characterize the fruit rot community and target specific fungal species.

Table 1. Important cranberry fruit rot pathogens

<table>
<thead>
<tr>
<th>Latin Name of Fungus</th>
<th>Common name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Allantophomopsis cytosporea</strong></td>
<td>Black Rot</td>
<td>Storage¹</td>
</tr>
<tr>
<td><strong>Allantophomopsis lycopodena</strong></td>
<td>Black Rot</td>
<td>Storage¹</td>
</tr>
<tr>
<td><strong>Phyllosticta elongata</strong></td>
<td>Berry Speckle</td>
<td>Field¹</td>
</tr>
<tr>
<td><strong>Phyllosticta vaccinii</strong></td>
<td>Early Rot</td>
<td>Field¹</td>
</tr>
<tr>
<td><strong>Colletotrichum gloeosporioides</strong></td>
<td>Bitter rot</td>
<td>Field¹</td>
</tr>
<tr>
<td><strong>Colletotrichum acutatum</strong></td>
<td>Bitter rot</td>
<td>Field¹</td>
</tr>
<tr>
<td><strong>Physalospora vaccinii</strong></td>
<td>Blotch Rot</td>
<td>Field¹</td>
</tr>
<tr>
<td><strong>Coleophoma empetri</strong></td>
<td>Ripe Rot</td>
<td>Field¹</td>
</tr>
<tr>
<td><strong>Phomopsis vaccinii</strong></td>
<td>Viscid Rot</td>
<td>Field¹</td>
</tr>
<tr>
<td><strong>Strasseria geniculata</strong></td>
<td>Black Rot</td>
<td>Storage¹</td>
</tr>
<tr>
<td><strong>Fusicoccum putrefaciens</strong></td>
<td>End Rot</td>
<td>Storage</td>
</tr>
</tbody>
</table>

¹Found in both storage and field rot stages but predominates in one

From a practical perspective fruit rot is normally treated as a single disease. Management strategies including choice of fungicide and timing of application target fruit rot without regard for individual species. This approach is appropriate when broad spectrum fungicides are used. However, as new chemistries with more limited spectra of action are introduced the particular compliment of species causing fruit rot becomes very important (Fig. 1). Recently, registration of fenbuconazole and azoxystrobin was completed and combinations of these two modes of action provide a greater spectrum of action and improved disease control than either fungicide alone (Oudemans and Vaiciunas, 2008 attached below). It is likely that as horticultural practices and breeding efforts lead to increased crop yields it will become necessary to better characterize the fruit rot community and target specific fungal species.

Fig. 1. Frequency fruit rotting fungi isolated from 20 commercial beds in New Jersey,
Selected References


Evaluation of selected new fungicides for the control of fruit rot in cranberries, 2007.

Six fungicides were evaluated for their ability to control cranberry fruit rot, a disease complex. Three of the fungicides were being tested for the first time. Proline (prothioconazole) showed activity in 2006 and was being tested again to confirm activity. Indar (fenbuconazole) and Abound (azoxystrobin) are currently labeled for cranberry fruit rot nationwide. Both of these registered materials have limited spectra of action and gaps in activity have been observed. Therefore, a tank mix of these fungicides (at full, labeled rates) was tested to determine if they were complimentary in activity. The study was conducted at the Marucci Center for Blueberry and Cranberry Research and Extension, Chatsworth, NJ in a 0.2ha cranberry bed maintained under commercial conditions, but without fungicide usage. The bed was established in 1972 with the cultivar Early Black. The site was irrigated as needed to prevent frost, heat and drought stress. Insecticide and fertilizer applications were made according to recommended crop management strategies. Plots were 1.2m by 1.2m and arranged in a randomized complete block design with eight replications. Fungicides were applied in water equivalent to 1215 liters/ha with a CO\textsubscript{2} powered sprayer at 207Kpa using a single TeeJet 8002VS flat fan nozzle. Treatments were initiated on 15 Jun 07 when plants were at 50% open bloom and reapplied on 27 Jun and 4 Jul. Cranberry fruit rot was first observed in mid-Jul and disease pressure was high throughout the study. An initial evaluation of fruit rot was conducted 24 Jul by counting fruit on twenty uprights from each plot. Percent fruit rot was expressed as the number of rotted fruit divided by the total number of fruit on twenty uprights. There were no differences among treatments for the total numbers of fruit however; the non-treated control had begun to express fruit rot symptoms. Plots were harvested on 9 Oct. Following harvest, the fruit were separated into two categories (sound and rotted) and the weight of each category was measured. Percent fruit rot was
calculated as the weight of rotted berries divided by the total weight of berries multiplied by 100. Yield was measured by taking the weight of sound berries per sq ft and converted to bbl/A. Data were subjected to analysis of variance and a means separation test (Student-Newman-Kuels, 5%). Distinguish, AEC656948 and Omega did not provide any significant level of control as compared with the non-treated control. Vines treated with Distinguish appeared red and unusually erect on 27 Jun and by 4 Jul symptoms were obvious. By harvest time these effects had disappeared. Abound provided an intermediate level of control. As standalone fungicides Proline and Indar provided the greatest levels of control however, the tank mix of Abound and Indar provided statistically similar control. This tank mix did result in a significantly greater yield.

<table>
<thead>
<tr>
<th>Treatment and rate/A</th>
<th>% Fruit rot</th>
<th>Harvest data (9 Oct.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>24 Jul</td>
<td>9 Oct</td>
</tr>
<tr>
<td>Non-treated control</td>
<td>14.9 a</td>
<td>83.2 a</td>
</tr>
<tr>
<td>XXX 480SC 5.7 fl oz….</td>
<td>5.8 b</td>
<td>29.4 c</td>
</tr>
<tr>
<td>XXX 480SC 18 fl oz</td>
<td>7.2 b</td>
<td>76.6 a</td>
</tr>
<tr>
<td>XXX</td>
<td>8.0 b</td>
<td>73.5 a</td>
</tr>
<tr>
<td>XXX 500SC 1.25 pt</td>
<td>10.6 ab</td>
<td>78.9 a</td>
</tr>
<tr>
<td>Abound 2.08SC 15.2 fl oz</td>
<td>5.5 b</td>
<td>55.8 b</td>
</tr>
<tr>
<td>Indar 75WSP 4.0 oz</td>
<td>6.6 b</td>
<td>27.5 c</td>
</tr>
<tr>
<td>Abound 2.08SC 15.2 fl oz + Indar 75WSP 4.0 oz</td>
<td>3.8 b</td>
<td>14.7 c</td>
</tr>
</tbody>
</table>

\(^3\)Barrels per acre

\(^3\)Weight of 100 berries was taken and the average calculated

\(^3\)Column numbers followed by the same letter are not significantly different at P=0.05 as determined by the Student-Newman-Kuels test

2009 Experiment and Field Demonstration

Experiment 1. Evaluation of combinations of Indar and Abound to test for synergistic activity

Objective: To test Abound and Indar at three concentrations in all combinations to determine if they act in an additive or synergistic manner.

<table>
<thead>
<tr>
<th>Indar 2F fl.oz./acre</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
<td>T4</td>
</tr>
<tr>
<td>3.4</td>
<td>T5</td>
<td>T6</td>
<td>T7</td>
<td>T8</td>
</tr>
<tr>
<td>7.7</td>
<td>T9</td>
<td>T10</td>
<td>T11</td>
<td>T12</td>
</tr>
<tr>
<td>15.4</td>
<td>T13</td>
<td>T14</td>
<td>T15</td>
<td>T16</td>
</tr>
</tbody>
</table>
Update on Chemical Control of Flowering to Enhance Bed Establishment and Reduce Fungal Inoculum

James Polashock and Peter Oudemans

Introduction

New cranberry beds are usually started with rooted cuttings or pressed in vines. Establishment and the time to first production harvest vary depending on such factors as planting density, fertilizer regime and cultivar, but at least 2-3 years is typical. During the first two years, inhibition or elimination of fruiting could be advantageous for several reasons. First, eliminating the fruit load will shift allocation of plant resources to vegetative growth. Second, we have shown that open ground in cranberry beds allows the establishment of undesirable seedlings from dropped and rotted fruit. Thus elimination of fruiting in the early stages of bed establishment will help preserve cultivar purity. Third, many fruit rot pathogens sporulate on infected fruit and then overwinter on vegetative tissue. Thus, eliminating the unharvested fruit could reduce build up of fungal inoculum.

Objective

The objective of this project is to eliminate flowers and/or fruit in establishing cranberry beds. When we first started this project, we tried two approaches 1) ‘burn’ flowers and/or young fruit using chemical treatment such as ammonium thiosulfate and 2) prevent flowering and/or fruiting using plant growth regulators such as ProGibb. Our preliminary data suggested approach 2 to be the most viable and treatment in 2009 was limited to the most promising candidate in this category, ProGibb.

Treatments

We selected two different sources of material. The first source is now a 3-year old bed of rooted cuttings of ‘Crimson Queen’ and ‘Stevens’ (Bog 3). The second source is an established bed of ‘Stevens’ (Bog 6). The treatments used in 2008 were as follows: 1) Ethephon, 2) ProGibb, 3) Induce, 4) Ammonium Thiosulfate (ATS), and 5) Sulforix. In 2009, we used only ProGibb (two applications).

Results

Data collected in the fall 2008 showed that across both beds (3-year old and mature) and both cultivars (Stevens and Crimson Queen), that the ProGibb treatment consistently showed no phytotoxicity, increased vegetative
growth, and the lowest yields (almost no berries) as compared to the control and all other treatments. Thus, treatment this year (2009) was limited to only ProGibb as this was by far the most promising treatment. The extensive vegetative growth in response to ProGibb treatment was monitored for hardening and susceptibility to winter injury. No winter injury was observed suggesting that there is no negative effect on plant health. Some plots sprayed last year with ProGibb were not sprayed this year to determine if the effects (more vegetative growth and severe inhibition of flowering) linger for more than one year. Ideally, flowering and normal growth will resume one year after treatment.

Conclusions
Based on three years of data, only the gibberellic acid (ProGibb) treatment has the potential to safely accomplish the objective. We have shown that we can 1) dramatically reduce the occurrence of unwanted fruit and 2) dramatically increase vegetative growth (a benefit when establishing new beds) with no ill effects (i.e. no phytotoxicity or increased susceptibility to winter injury or disease).

Figure 1. ProGibb Treatment of ‘Crimson Queen’ (boxed area). Note the absence of flowers and increased runner growth.
Honeybees, wild bees, and the mechanics of cranberry pollination.

Dan Cariveau—Postdoctoral Research Associate
Rachael Winfree—Assistant Professor
Department of Entomology
Rutgers University
New Brunswick, NJ 08901

Cranberry fruit production relies on the transfer of pollen grains from the anthers (male structure) to the stigmas (female structure) of the flower. Pollination in cranberry is carried out almost solely by bees with managed honeybees being the most abundant pollinators. While honeybees are critical to ensure high yields of cranberry, native, wild bees also pollinate and may play an important role in fruit production. Recent declines in honeybee colonies due to Varroa mites and Colony Collapse Disorder have highlighted the importance of understanding the role of native bees in cranberry pollination. The goals of this study were to 1) quantify the contribution of honeybees and native bees to cranberry pollination and 2) examine how attributes of cranberry farms and the surrounding landscape influence the abundance and diversity of wild bees.

OBJECTIVE 1: Quantify the contribution of honeybees and native bees to cranberry pollination.

Numerous bee species visit cranberry flowers yet each may differ in their effectiveness as pollinators. Pollinator effectiveness is a product of the frequency at which the pollinator visits flowers (visitation rate) and the average number of pollen grains they transfer on each visit. In the summer of 2009, we recorded the visitation rate of various bee species on 32 cranberry bogs throughout central New Jersey. In addition, we collected bees to determine bee species abundance and variety. We recorded approximately 25 wild bee species visiting cranberry flowers. Honeybees were the most
frequent pollinator and accounted for 73% of the visits. Native bees made up 25% of the visits with wasps and flies comprising roughly 2%. Of the native bees 66% were bumblebees (Genus *Bombus*) and 34% were other bee species. In the summer of 2010, we plan to conduct experiments to determine the number of pollen grains deposited per visit by each bee species, and to calculate the contribution that each type of bee makes to cranberry pollination.

**OBJECTIVE 2:** Determine how landscape factors such as proximity to natural habitat and proportion of surrounding area in cranberry production influence the abundance and diversity of wild bees.

Wild bees that visit cranberry must feed and nest entirely on the landscape within and surrounding bogs. Variation in landscape attributes may influence bee abundance, diversity and subsequently cranberry pollination. To examine landscape factors, we used GIS to locate bogs that 1) ranged in proportion of surrounding landscape in cranberry production and 2) were close or far from woodlands. At these bogs, we conducted visitation rate observations and collected wild bees (as described above). We also collected stigmas to quantify the number of pollen grains deposited per stigma at each of these bogs. This will allow us to directly link landscape attributes to visitation rate, wild bee abundance and diversity, and pollination.
JUST HOW MUCH EXPOSURE DO I HAVE TO PESTICIDES ON THE FARM?

By Raymond J. Samulis, Burlington County Agricultural Agent

Pesticide applicator licensing has been with us for more than 30 years now. Yet we still have many unanswered questions about evaluating our repeated exposure to various pesticides. For acute exposure to pesticides the circumstances are usually obvious. We know when we get spray material in our eyes, see stains on our clothing, get headaches, dizzy, and so on that we have an immediate problem. With organophosphate pesticides, we can get a cholinesterase blood tests at the beginning of the season to see if we are getting in trouble.

I think that the more nagging question regarding pesticide exposure deals with our continual chronic exposure. What happens to us when we are exposed daily, weekly, monthly or yearly to minute amounts of various pesticides?

The amount of our pesticide exposure vulnerability will vary according to the method of application. If we are handgun spraying, weed wiping or tractor spraying our vulnerability to exposure will have a wide range. Likewise, exposure to pesticides from seed treatments generally has a low hazard rate associated with their use. A recent pesticide exposure study of farmers conducted by Iowa and North Carolina has produced interesting results. Overall, 14% of the farmers and farm workers were shown to have high exposure to pesticides on their farms.

This study was able to conclude that the application in this highly exposed category had these things in common:

- Stored pesticides in their homes;
- Repaired their own equipment;
- Delayed changing clothes and washing;
- Applied pesticides within 100 yards of their houses;
- Washed in their houses versus in an outside building;
- Mixed pesticides within 50 yards of a well;
- Mixed work clothing and family laundry together.

It was startling to learn that more than 94% of farmers washed their family laundry in the same machine as their work clothes. This study was also unique in that it studied the change in pesticide use over the years and was less concerned with old, historic pesticide use.

Probably the most useful aspect of the study was that it resulted in production of a simple system to measure your exposure to pesticides over time. This formula ultimately can help you answer the question posed in the title of this presentation.
The formula specifically rates four distinct areas of exposure and comes up with a numerical rating to evaluate problem areas. These areas include mixing and loading, application methods, whether you repair your own equipment, and how extensive is your use of personal protection equipment. In the exposure category, factors range from 9 for handgun spraying down to 1 for granular application. Mixing and loading pesticides are given ratings of 0 through 9 depending upon the frequency of mixing. The repair category is given a 2 X rating to those farmers who repair their own equipment. Finally a range of .1 to 1 is given to personal protection equipment with .1 used for maximum use of equipment to 1 for no use of personal protection equipment.

This information can also be used to calculate a lifelong exposure formula with a few additions.

Let’s face it, whether acute or chronic, pesticide exposure can cause us serious health effects. It’s in all of our best interest to use formulas like these to determine ahead of time just how vulnerable we are to needlessly damaging our health.
Maintaining Cultivar Purity

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Maintaining cultivar purity is a continual challenge for both the cranberry grower and cranberry researcher. In a production bed, cranberry contaminants, or off-types, can reduce yield, quality and vigor of the bed (see “A DNA fingerprinting study of Washington State and Newfoundland ‘Stevens’: is ‘Stevens’ becoming more contaminated with off-types”). These contaminants can come in with vines used to establish a new bed, or as volunteer seedlings, particularly when disease or other problems leave an open area in a bed. Unfortunately, the off-types are often highly vegetative and crowd out more productive vine.

For the cranberry researcher, contaminants can seriously confound results. In 1995, Rutgers cranberry breeding program established two beds containing an extensive germplasm collection, where each plot was propagated from a single stem to ensure 100% genetic homogeneity within each plot. In the past few years, it has become apparent that despite our efforts to maintain purity, these beds now show signs of contamination. The germplasm was collected in 1988 through 1994 from bogs throughout the U.S. (NJ, NY, MA, DE, WV, PA, MI, and WI), and includes both major and minor cultivars, genetic variants that had developed in cultivated beds many decades old, and wild cranberries collected from a diverse range of habitats. Alleys between each 5’ x 5’ plot were maintained with regular herbicide applications. This germplasm collection is a valuable resource for our breeding program. Within it we have identified accessions with fruit rot resistance, high sugars, low acids, and other traits of interest which have been used in crosses and new cultivar development.

To re-establish this collection, we examined each plot in September 2007 and selected one piece of vine with fruit attached that looked typical to the plot. These individual vines were rooted in the greenhouse, propagated into 25 plants, and will be replanted in a new 5’ x 5’ plot in April 2010. Plants were DNA fingerprinted to confirm their identity and assure that they are the same accession originally planted in 1995. Once established, these new plots will serve as a resource to researchers here at Chatsworth and around the country.
Cranberry – Update on Health Benefits
Amy Howell

Cranberry is well established as a “super fruit,” with a wide array of potential health benefits, the most substantiated being prevention of urinary tract infections. Cranberries contain a number of phytochemicals, among them anthocyanin pigments, flavonol glycosides, organic acids, and complex oligomeric flavonoids known as proanthocyanidins (PACs) or condensed tannins. PACs appear to be particularly bioactive and, in recent years, have gained the attention of the medical and pharmaceutical communities for their wide array of potential health benefits. The PACs in cranberry are of interest in that they have unusual molecular structures when compared to PACs from other foods and have been linked to prevention of bacterial adhesion in the urinary tract, stomach, and oral cavity. Bacterial adhesion to cells is the initial step in many bacterial infection processes. If the initial adhesion step is inhibited, the bacteria are not able to multiply and colonize, essentially preventing infection. The role of cranberry in preventing bacterial adhesion in the urinary tract, gastrointestinal tract, and oral cavity will be reviewed, as well as the emerging research into the benefits of cranberry on markers for heart disease and cancer.
Biology and Management of *Rhizoctonia/Thanatophytum*, the Causal Agent of Cranberry Fairy Ring Disease

The Fairy Ring Team includes:

Rutgers University:
  Ms. Jennifer Vaiciunas  
  Dr. Peter V. Oudemans

Cooperators and Institutions:
  Dr. James Polashock, USDA-ARS, Beltsville, MD  
  Dr. Frank Caruso, University of Massachusetts

Fairy Ring is a re-emerging disease on cranberry. We have recently identified the causal agent and now have the opportunity to develop a new management strategy. Fairy Rings cause not only direct crop losses but also provide an entry point for weed species and promote development of cranberry seed banks which lead to development of rogue cranberry genotypes that can shorten bed life. We are developing improved fairy ring management strategies aimed at reducing spread of the disease to new beds and new cranberry growing areas as well as to investigate control procedures to help arrest the development of existing rings. In the short-term we are attempting to identify fungicide control methods to reduce the expansion of Fairy Rings. Ferbam used at a rate of 0.9lb/100ft² will be eliminated and replaced by lower impact fungicides used at lower rates. We have developed methods to diagnose the disease and determine how new rings are being formed. The benefit will be that dispersal to new beds and other growing regions will be prevented or reduced. When successful controls are developed it is likely that the life-span of individual cranberry beds will be increased. Long-term objectives that will be initiated under this proposal include an elucidation of the mechanisms for dispersal and investigation of biological control methods.
A CHEMICAL ECOLOGY LAB FOR BLUEBERRY & CRANBERRY ENTOMOLOGY

Cesar Rodriguez-Saona, Extension Specialist, Rutgers Entomology

Plant volatiles serve as a source of airborne chemicals in insect communication. Insects may use plant volatiles to locate food and mates. Females may also use these chemicals to locate oviposition sites. Because these chemicals play an integral role in the insect’s life, they can be used for insect control. A laboratory for the study of plant volatiles and insect response to these chemicals has been established at the P.E. Marucci Center, Rutgers University in Chatsworth, NJ. The laboratory accommodates equipment for the collection and analyses of plant volatiles, electro-antennographic detection, and insect’s behavioral response to plant volatiles (repellency and attraction). We are currently studying the response of cranberry fruitworm and cranberry weevil to host-plant volatiles to develop better tools for monitoring these insect pests.