American Cranberry Growers Association
2014 Summer Field Day
Friday August 22, 2014
Rutgers University

P.E. Marucci Center for Blueberry & Cranberry Research & Extension,
Chatsworth, NJ

Parking will be available at the Center’s shop (across from 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

8:30–8:45 Opening Remarks
   Shawn Cutts, President, American Cranberry Growers Association

8:45–9:00 Breeding Fruit Rot Resistant Varieties (Bog 4)
   Jennifer Johnson-Cicalese, P.E. Marucci Center for Blueberry & Cranberry Research
   & Extension, Rutgers University, Chatsworth, NJ

9:00–9:20 Pre-inoculation with Mycorrhizae to Enhance Early Bed Establishment
   (Bog 8)
   James Polashock, Research Plant Pathologist, USDA-ARS

9:20–9:40 Bed Establishment from a Pathology Perspective (Bog 13)
   Peter Oudemans, Department of Plant Biology and Pathology, Rutgers University

9:40–9:55 New Cultivars for Release (Bog 17)
   Nicholi Vorsa, P.E. Marucci Center for Blueberry & Cranberry Research &
   Extension, Rutgers University, Chatsworth, NJ

9:55–10:10 Insecticide Trials in Cranberries (Bog 19)
   Cesar Rodriguez-Saona, Department of Entomology, Rutgers University; Vera
   Kyryczenko-Roth, P.E. Marucci Center; and Robert Holdcraft, P.E. Marucci Center
10:10–10:25 **Assessing Insect Resistance in Cranberries (Bog 20)**  
*Elvira de Lange*, Department of Entomology, Rutgers University

10:25-10:45 **Show and Tell**  
Cranberry growers

**CONFERENCE ROOM:**

11:00–11:10 **ACGA Website**  
*Stephanie Haines*, American Cranberry Growers Association

11:10-11:40 **Precision Water Management for Optimum Quality and Yields**  
*Jean Caron*, *S. J. Gumiere*, *S. Pepin*, *V. Pelletier*, *Y. Périard*, *M.E. Samson*, *C. Vanderleest* and *W.A. Bland*, Université Laval, Québec, Canada

11:40–12:00 **A Phenology Model for Sparganothis Fruitworm in Cranberries**  

12:00–1:00 **LUNCH** (Pole Barn)

**CONFERENCE ROOM:**

1:00-1:30 **Harvest Kick-off**  
*Brenda Conner & Joe Darlington*

1:30-2:00 **Farm Safety**  
*Ray Samulis*, Cooperative Extension Agent, Burlington County Extension, Rutgers University

**LABS:**

1:00-3:00 **Laboratory Tours for CI/CMC Guests**

Nicholi Vorsa – Breeding  
Peter Oudemans – Pathology  
James Polashock – Pathology, Molecular Biology  
Amy Howell – Health  
Cesar Rodriguez-Saona – Entomology
Progress continues to be made in our program to enhance fruit rot-resistance (FRR) in cranberry varieties. Over the past decade, resistant accessions have been used in nearly 200 crosses, both amongst the four resistance types we have identified, and with elite high yielding selections and cultivars. Over 1600 progeny from 50 crosses were evaluated under severe field fruit rot pressure in 2011 through 2013. Families segregated for resistance, and resistance was heritable. Most encouraging, progeny were identified with both good FRR and high yields.

The best progeny from these crosses were planted in a replicated trial in Bog 4 in 2012 and 2013, and fungicides withheld in 2014. Initial evaluations were made August 8, 2014. Fruit rot ratings (1 - 5 scale, 1 = no rot) indicated severe rot pressure, with susceptible cvs. Stevens and Demoranville, having average ratings of 4 and 4.7, respectively. The highly resistant selections had average ratings of 1, 1.3 and 1.5. The best performing selections from this trial will be established in large plots in 2015, for trialing under reduced fungicidal regimes, and to determine their potential for release. Bog 4 also contains progeny from six FRR crosses, and progeny having fruit rot resistance were identified.

Progeny of the most advanced FRR breeding cycle crosses were established in field plots in May of this year, represented by 1759 individuals from 27 crosses. The main goal of these crosses is to determine if we can further enhance FRR by combining the genes of the four different fruit rot resistance sources. Additional crosses to enhance resistance were made in 2014. Laboratory work is underway to identify genomic regions (QTLs) associated with resistance, and to determine the potential effects of fruit organic acids on resistance.
Pre-inoculation with Mycorrhizae to Enhance Bed Establishment and Cranberry Health
James Polashock

Introduction
Many plant species harbor fungi in their roots called mycorrhizae. These fungi are generally host-benefical and can allow improved nitrogen utilization, increased stress tolerance, and increased disease tolerance. American cranberry (Vaccinium macrocarpon) is naturally colonized by ericoid mycorrhizae. There are at least two major species of ericoid mycorrhizae that colonize cranberry in New Jersey (Rhizoscyphus ericae and Oidiodendron maius). The inoculums for colonization come from the wild and are ubiquitous in this part of New Jersey. Virtually all of the samples of cranberry we have collected are colonized by mycorrhizae. However, natural colonization could take years especially in new beds are first covered in a layer of sand. Furthermore, not all mycorrhizae species and isolates within a species will benefit the host plant to the same extent. Some isolates may be neutral (no host benefit) and some may be detrimental.

Considering all of these issues, we sought to first isolate several strains of each species from the wild and evaluate them for colonization ability (40 isolates), effect on nitrogen uptake in rooted cranberries (3 isolates selected from the group of 40), overall effect on cranberry vegetative growth in the field, and the fruit load (five isolates). The field trial was set up in spring 2012 and included one cranberry variety (MQ), three isolates of R. ericae and two isolates of O. maius, and an uninoculated control. There were four reps of each treatment in a complete randomized block design.

Results
In 2014, plots were rated for overall vegetative growth as judged by plot coverage and fruit load. Ratings ranged from 1-4. With 1 having poor coverage and little to no fruit and 4 having good coverage and high fruit load. Average ratings suggested that both CBH3 (an O. maius isolate, Figure 1- left panel) and M27 (an R. ericae isolate, Figure 1- right panel) were more beneficial than the other isolates and the control. However, when analyzed statistically, treatments were not significantly different.

Figure 1. Representative micrographs of cranberry roots colonized by O. maius isolate CBH3 (A) and R. ericae isolate M27 (B).
Conclusions

Significant results have been difficult to verify. We plan on repeating the experiment with increased plot sizes and rating parameters to increase statistical power. We also begin testing stress resistance such as drought.
### Disease control in bed establishment (Year 4)

Peter Oudemans, Chris Constantelos, Tim Waller, Jessica Torres, Jesse Lynch, John Jensen and Josh Gager

**Objective:** To examine establishment of 10 cultivars using different fungicide regimes

**Rationale:** Distinct differences in growth rate using the new generation of fungicides has been noticed. There is no data on resistance to *Phyllosticta* leaf drop.

**Approach:** Beds were planted using rooted cuttings in the fall of 2010. All plots were fertilized equally. Fungicide treatments were applied on June 15-25 and July 15-25 in 2011-2013. Conventional treatment (yellow) only received Bravo whereas the new treatment (Orange and Red) only received Indar/Abound.

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<td>New (2)</td>
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### 2014 Treatment regime.

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2014 Treatment regime.
Estimated yield (bbl/acre) for 10 varieties across three treatments. This yield represents the fourth growing season. In general, the results demonstrate that the percent fruit rot is greatest in the untreated controls (blue) whereas fruit rot is less in the fungicide treated plots. Also, yield is generally greater in the New (orange) than in either the traditional (yellow) or UTC (blue). However, the cultivar response varies. For example, in MQ no yield response was seen as a result of New treatments.
Mid-season Rutgers Cranberry Varieties Slated for Release

Nicholi Vorsa, Jennifer Johnson-Cicalese, Karen Destefano and Susan Vancho  
P.E. Marucci Center for Blueberry & Cranberry Research & Extension, Rutgers University, Chatsworth, NJ

Two Rutgers’ selections CNJ99-52-15 and CNJ99-9-96 (patents pending) are slated for formal release. For over the past half century, the most widely grown cranberry cultivars have been largely utilized in juices, drinks, and sauces. Over the past two decades, however, a large volume of the cranberry crop is being utilized for ‘sweetened-dried cranberry’ (SDC) products. Desired characteristics of a variety now encompass both grower needs relating largely to horticultural traits (e.g., reliable high yields, disease and insect resistance, season of maturity), as well as processing industry needs related to fruit quality traits. For example, some processors have indicated that for SDCs, a larger round fruit having good firmness, and a medium color range (TAcy 25-40 mg/100g FW) is most desirable. Native cultivars, e.g. ‘Early Black’, ‘Howes’ and ‘Searles’, have small fruit sizes, and may not be as suitable for some SDC processes. Rutgers has released during the past decade four varieties, including two early season cultivars, Crimson Queen® and Demoranville®, a later season cultivar Mullica Queen® and a very early maturing cultivar, Scarlet Knight®, recommended for the fresh fruit market.

Two mid-season varieties are now in the process of being released from crosses made in 1999 for commercial fruit production: CNJ99-52-15 (#35 x NJS98-34) and CNJ99-9-96 (Crimson Queen x #35). These two varieties were initially selected in 2006 from field breeding populations planted in Bog #8 at the Rutgers NJAES Marucci Center based on yield performance (> 600g/ft²) over two years (2005 and 2006) and fruit color development. These two varieties along with a number of other half-sib progeny selections were selected from over 240 progeny for further trials. These varieties and half-sib selections were set out in variety trials with other advanced selections in Warrens, Wisconsin (2008, 2011), Wisconsin Rapids, WI (2010), Langlois, Oregon (2009), Long Beach, Washington (2010) and British Columbia (2013, 2014). Both varieties have established and performed well in trials in Oregon and Wisconsin, with yield potential estimates of over 600 g/ft². In more recent trials, indications are these two varieties establish well and have precocious cropping tendencies. Berry size (wt.) is similar to Stevens typically over 2.0 g in New Jersey, and greater than 1.5 and 1.2 g/berry, in Wisconsin and Oregon, respectively. Berry size in high cropping years may be reduced. TAcy (mg/100g FW) is typically lower than that of Ben Lear, Crimson Queen, and Demoranville, but greater than Stevens and Mullica Queen. CNJ99-52-15 blooms ahead of Stevens but behind Crimson Queen. CNJ99-9-96 bloom progression appears similar to Stevens. It should be noted that CNJ99-52-15 appears to be more predisposed to fruit rot pressure in hotter more humid environments, and therefore is recommended for regions having an ‘oceanic climate’, such as that found in the Pacific northwest.

Based on fruit characteristics, e.g. large round fruit, moderate TAcy, desired by SDC processors, these two varieties appear to be well suited for SDCs. Rutgers patented cranberry varieties are available to commercial cranberry growers in the U.S. and Canada, under license from Rutgers University. Plants are available through Integrity Propagation LLC, Chatsworth, NJ.
Insecticide Trials in Cranberries

Cesar Rodriguez-Saona, Department of Entomology, Rutgers University; Vera Kyryczenko-Roth, P.E. Marucci Center; and Robert Holdcraft, P.E. Marucci Center

Insecticide Trial against Blunt-nosed Leafhoppers

We tested the efficacy of Lorsban, Imidan, Closer, Voliam Flexi, and Bifenthrin against blunt-nosed leafhoppers. The experiment was conducted in an ‘Early Black’ bog located at the Rutgers P.E. Marucci Center. Treatments were applied to 60 x 60 cm plots. Control plots received no insecticide. Insecticide applications were made with R&D CO2 backpack sprayer, using a 1-liter plastic bottle. Four hours after treatment, 4–5 insecticide-treated uprights were inserted in florists’ water picks, enclosed in a ventilated 40-dram plastic vial, and secured on Styrofoam trays. Each treatment was replicated ten times (i.e., total of 10 vials per treatment). Five blunt-nosed leafhopper nymphs were placed inside each vial. Plants and insects were placed on a light bench in the laboratory at approx. 25°C, on a 15:9 L:D cycle. Number of leafhoppers (alive or dead) was recorded 24 hours after transfer. Results from this experiment will be presented in upcoming meetings.

Insecticide Trial against Sparganothis Fruitworm and Spotted Fireworm

We conducted experiments to compare the efficacy of various insecticides (Delegate, Altacor, Intrepid, Lorsban, Bifenthrin, Voliam Flexi, Exirel, and a new insecticide) against Sparganothis fruitworm and spotted fireworm 3rd instar larvae in cranberries. The experiment was conducted in a cranberry bog cv. ‘Early Black’ located at the Rutgers PE Marucci Center for Blueberry and Cranberry Research and Extension in Chatsworth, New Jersey. Plots were 60 x 60 cm (2 x 2 feet) each, replicated 4 times (see picture). Each plot was separated by a 15 cm (0.5 foot) buffer zone. Treatment applications were made on Tuesday July 24 with a R&D CO2 backpack sprayer, using a 1-liter plastic bottle. The sprayer was calibrated to deliver 50 gal of vol per acre at 30 psi, using a single T-jet VS 110015 nozzle, yielding 17.4 ml (0.6 oz) per plot. One, 3, and 7 days after treatment, 3-4 insecticide-treated uprights were inserted in florists’ water picks, enclosed in
a ventilated 40-dram plastic vial, and secured on Styrofoam trays (as shown in picture). Seven or ten 3rd instar larvae were placed in each of 8–10 vials for each treatment. Each vial was considered a replicate. Sparganothis fruitworm and spotted fireworm larvae used in assays were from a colony kept at the Rutgers PE Marucci Center. Plants and insects were then placed in the laboratory at ~25°C, on a 15:9 L:D cycle. Larval mortality and weights were assessed at 7 days after setup. Results from these experiments will be presented in upcoming meetings.

Two Insects that are Threatening Our Industry

The Cranberry Toad Bug

Last year we observed damage in cranberry bogs by the cranberry toad bug, *Phylloscelis atra*, in New Jersey. Although we had seen toad bugs in cranberry bogs in the past we had never seen them causing damage to the vines and fruit. Toad bugs are hemipteran insects (similar to bluntnosed leafhoppers) but belong to the Family Fulgoridae (planthoppers) (as opposed to leafhoppers, which belong to the family Cicadellidae).

As far as we know this species of toad bug feeds only on cranberries. It has a single generation per year and overwinters as eggs. The nymphs appear by the end of June through August, and the adults from August through October. Eggs are laid from September through October.

Feeding damage can be noticed in two stages. First stage feeding damage on vines causes closing in (towards the branch) of the leaves on the new growth. Second stage feeding causes changed in color (reddish to brown) of new growth. The damage can be seen from July until harvest. This damage will cause dying of the branch and the berries to shrivel up. Heavy infestation will result in dwarfed berries.

To determine infestation, lightly sweep problematic beds (bugs should be easy to catch in sweep nets as they are very active). Because this is a new pest there is no threshold established yet. Thus, insecticide applications should be based on the relative number of bugs per sweep compared with other sites and previous history of infestation. So far, we know that Diazinon works (you may also use Sevin).


Unknown “Mirid”

This year we observed damage that appears to be caused by an unknown “mirid” (Hemiptera: Miridae). These insects are known as true bugs and have piercing-sucking
mouthparts to suck juices out the plants. The species found in cranberries remains unknown we have sent specimens to the USDA-ARS-Systematic Entomology Laboratory in Beltsville, MD, for identification. The insect seems to damage young leaf and flower buds. We observed deformed leaves and flowers in June. This damage appears to cause serious reduction in yield. The damage was likely caused by the nymphs in April and May, as adults were seen in June-July. We know nothing about the biology and management of this insect at this point. There have not been any previous reports of a mirid causing damage to cranberries. However, mirids can be serious pests of other agricultural crops. For example, the tarnished plant bug, Lygus spp., is an important pest of cotton causing injury to the flowering buds.

At this point, we recommend growers to watch for this insect in early spring after removing the water from bogs. Carefully look for the nymphs in sweep net samples. If needed, use a broad-spectrum insecticide like Lorsban for its control. We will be updating growers on any progress we make towards learning more about this new pest.
Insects are considered a major problem in cranberry production. They are estimated to reduce yield by 1-2% and without spraying, cranberry false blossom, a phytoplasma vectored by blunt-nosed leafhopper, would eliminate commercial cranberry production completely. Spraying of chemical insecticides is the most common practice to combat pathogenic microbes and herbivorous insects, but beneficial insects such as honeybees, important pollinators of cranberry, and natural enemies of herbivores, such as predators and parasitoids, could be affected as well. We therefore study the defensive mechanisms that cranberry plants themselves use to combat against insect feeding. We focus on the most problematic insects on cranberry in New Jersey: gypsy moth, Sparganothis fruitworm, spotted fireworm and the above-mentioned blunt-nosed leafhopper.

In the greenhouse, we have assessed resistance of seven cranberry varieties to gypsy moth larvae. Among the varieties were the widely-used Stevens, as well as newer varieties, such as Crimson Queen and Demoranville. We weighted larvae before and after feeding on the different cranberry plants, to evaluate their performance. Also, we collected leaves from gypsy moth-infested plants for analysis of toxins that may contribute to plant resistance. In addition, we collected the volatiles or aromas that gypsy moth-infested plants emit. These aromas may be detrimental for the plants, as they may guide other herbivorous insects to the plants, but they may also be beneficial, by repelling herbivores and attracting their natural enemies. We aim to identify specific compounds in the cranberry aroma that are correlated with plant resistance. This information is not only useful in the light of cranberry resistance against gypsy moth, an occasionally devastating pest, but may also help battling other caterpillar pests.

In the field, we have studied resistance of cranberry uprights and fruits to Sparganothis fruitworm and spotted fireworm. In an experimental bog with ten cranberry varieties, we put out a large number of cages, in which we introduced the two caterpillar species. Larvae were weighted before and after feeding on the plants, enabling us to identify on which varieties they grow best, more susceptible varieties, and on which varieties they grow poorly, more resistant varieties.

The blunt-nosed leafhopper has been studied in the greenhouse. We let small nymphs feed on healthy and false blossom-diseased plants in small cages, and evaluated their weight and developmental stage 30 days later. We are interested in knowing whether the leafhopper, as a disease vector, benefits from the disease, then we’d expect it to grow better on diseased plants, or is hurt by the disease, then we’d expect it to grow poorly on diseased plants. Also, we evaluated the aromas that healthy and false blossom-infected plants emit. As mentioned above, these aromas may guide herbivorous insects to a suitable host plant, but they may also repel the herbivores or attract their natural enemies.

Elucidating mechanisms of resistance against insect pests in cranberries will help improve insect resistance in existing high yielding varieties, as well as development of novel varieties with improved resistance qualities.
Precision Water management for Optimum Quality and Yields


Water Management does impact cranberry yield. This paper will outline the different cause of poor drainage, how drainage impacts on moisture distribution of cranberry beds and how it may affect yield. It will also outline recent research results related to precision irrigation of cranberry (by overhead and water table management) obtained in Québec and Wisconsin.

Short bio Jean Caron

Jean Caron is an agronomist and a Professor of soil physics at the Soil Science and Agrifood Engineering Department of Laval University, in Québec, Canada, since 1992, and Chair of precision irrigation on Cranberry and Strawberry since 2010. He has published more than 96 scientific papers and book chapters on various aspects of irrigation, water, solute and gas transport in soils and growing media. He is an inventor on 22 patents.
A phenology model for Sparganothis fruitworm

Shawn Steffan, Research Entomologist, USDA-ARS, University of Wisconsin-Madison; Annie Deutsch, University of Wisconsin-Madison; Cesar Rodriguez-Saona, Rutgers University; Vera Roth-Kyryczenko, Rutgers University; Juan Zalapa, Research Geneticist, USDA-ARS

Sparganothis fruitworm, *Sparganothis sulfureana* (SFW), is a major, perennial pest of cranberries. Controlling SFW has proved to be difficult, partly due to the fact that some of the basics of its biology and phenology remain unknown. Knowing the life history of a pest allows growers to refine their control strategies to target the life stages most vulnerable. Phenology models that depict an insect’s development provide the means to track an insect’s growth throughout the year. An insect’s developmental rate is highly temperature-dependent, and degree-days are commonly used to measure this development. In order to quantify degree-days, the upper and lower temperature thresholds for growth must be determined. To these ends, we measured SFW larval growth rates over a wide range of controlled temperatures (44-101°F). Growth rates were then plotted against temperature, and a model was fit to the dynamic. From this model, we were able to determine the lower (50°F) and upper (86°F) development thresholds of SFW larvae. The thresholds were used to generate degree-day (DD) accumulations that were linked to developmental events, such as flight initiation and length, adult lifespan, pre-ovipositional period, ovipositional period, and egg gestation period. These DD accumulations represent key developmental benchmarks, helping to optimize pest management in the cranberry system.
Pesticide Storage Facilities
Ray Samulis, Burlington County Agricultural Agent

Although trends in recent years have shown that many farmers store less pesticides than they did 30 years ago on the farm, the reality is that most farms will have the need to store some pesticides at some time. In an ideal world we would only order exactly what we needed and never have leftovers but that is not reality of life on the farm. Convenience, bulk pricing, and availability all bolster the need for proper pesticide storages.

Building sites:
Sometimes the obvious needs repeating on occasion. Pesticide storages should not be built where there is a propensity for flooding. For most types of agriculture in New Jersey this is not really a problem because most productive farms are based on well drained soils and sites that are essential to growing successful crops. However with cranberries the situation can become more challenging due to the nature of the environment we work in. Cranberry farms have abundant ditches, reservoirs, ponds and other water structures so it may be more challenging to find a spot which is high and dry and not near potential “sensitive” sites as defined by the New Jersey pesticide regulations.

Recommended Construction:
The majority of experts in the field will suggest a pesticide storage building made of metal with concrete floors. For liquid pesticide formulations such as EC’s, F’s, and others it is also advisable to have some type of coating on the floors of the storages to prevent adsorption in the event of an accidental leak or spill. Regulations mandate that the storages are fire-proof, theft-proof, and child-proof. Be sure that there are sign to clearly identify the buildings as pesticide storages. Sign’s should say “Danger Pesticides- Keep Out”. In New Jersey it is mandated that storages be in a separate room from living and/or work areas. The situation becomes complicated when an area is used predominately as a storage and but might be used to work on equipment during certain weather conditions or special needs situations. Although we do not use many “restricted use” pesticides in the cranberry industry, the law states that all restricted use pesticides be kept in totally separate buildings. Some farmers have successfully used shipping containers as pesticide storage. They have the advantage in that they are normally very solidly built, waterproof, lockable, and can be kept very secure in all types of weather.

Heating:
Generally, pesticide storages should be heated as cold temperatures can cause crystallization of many types of both EC and F formulations. Temperature below 40 and above 95 degrees can cause problems and be an economic issue when you consider that settled out materials can reduce effectiveness of the pesticide and with today’s pesticide prices cost you money. Many times you do not have to have an expensive, sophisticated heating system if the storage is small in volume. In some cases, all you need is an electric light bulb to do the job.

Ventilation:
Fans should be installed, fire extinguishers, and some smoke detectors should be functional.
Labels:
Large pesticide containers should be kept on the floor to prevent from falling. Pallets can be used to insulate pesticide containers from the floor but once used in the storage they should not be repurposed to other uses. It is a good idea to mark the date on each new container you put into the storage. Be sure to keep a full inventory of the pesticides and the list should be kept in a separate location from the storage itself. It should also be sent to your local fire company annually. As an added safety precaution you can keep the names and phone numbers of your physician, poison control center, and Hospital Emergency room number for when it’s needed.

Contamination:
Herbicides should be stored separate from other pesticides to prevent cross contamination through volatilization. Likewise, all other pesticide safety equipment including gloves, respirators, and spray suits should be kept apart from the pesticides themselves.

Locks:
NJ DEP mandates that all storages be kept locked at all times when not in use, even if you are leaving the storage for only a short time.
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<tr>
<th>Time Block</th>
<th>Nicholi Vorsa</th>
<th>Peter Oudemans</th>
<th>Cesar Rodriguez-Saona</th>
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Lab Tours