

2014 Annual Winter Meeting of the American Cranberry Growers Association



Rutgers University
EcoComplex
Bordentown, NJ

Thursday
January 23, 2014

RUTGERS

New Jersey Agricultural
Experiment Station



Presentation Summaries

ACGA Winter Meeting Program

Thursday, January 23, 2014

8:00-8:30 Registration and Coffee

8:30-8:40 Welcoming Remarks— **Shawn Cutts, President, ACGA**
Treasurer's Report – **Shawn Cutts**

8:40-8:55 **Cranberry Statistics**
Bruce Eklund, National Agricultural Statistics Service

8:55-9:20 **Promising New Selections being evaluated for Release**
Nicholi Vorsa and Jennifer Johnson-Cicalese, Department of Plant Biology and Pathology, Rutgers University

9:20-9:40 **Possible Mechanisms of Fruit Rot Resistance**
Mariusz Tadych and James White, Department of Plant Biology and Pathology, Rutgers University

9:40-10:05 **Strategies for Increasing Pre-harvest Intervals in a Fruit Rot Management Program**
Peter Oudemans, Department of Plant Biology and Pathology, Rutgers University

10:05-10:25 **Progress towards Understanding the Window for Fruit Rot Control**
Timothy Waller, Department of Plant Biology and Pathology, Rutgers University

10:25-10:40 Break

10:40-11:00 **New Viruses that Threaten Cranberry Production**
James Polashock, Research Plant Pathologist, USDA-ARS

11:00-11:25 **Cranberry Weed Control Progress in the Past Twenty Years**
Brad Majek, Rutgers Agricultural Research and Extension Center, Bridgeton

11:25-11:45 **Effects of Mid-day Misting on Canopy Temperature and Cranberry Production**
Patrick Burgess, Nick Vorsa, and Bingru Huang, Department of Plant Biology and Pathology, Rutgers University

11:45-12:15 **Potential Water and Energy Savings from Frost Cycling**
Peter Jeranyama, Assistant Professor /Plant Physiology, University of Massachusetts

12:15-1:15 Lunch

1:15-2:00 **US Cranberry Marketing Committee; Updates and Programs Overview**
Scott Soares, Executive Director, US Cranberry Marketing Committee

2:00-2:20 Regrowth of Cranberry Uprights after Tipworm Feeding Injury

Sunil Tewari, Department of Entomology, Rutgers University

2:20-2:45 New Tools to Control Insect Pests of Cranberries

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

2:45-3:05 Status of the Southern Pine Beetle in 2013

James Lashomb, Department of Entomology, Rutgers University

3:05-3:30 Fuel Tank Safety Plans

Ray Samulis, Burlington County Agricultural Agent, Rutgers University

3:30 Adjournment- ACGA Board of Directors Meeting

New Jersey Agricultural Statistics
Bruce Eklund, State Statistician
NJ Field Office
National Agricultural Statistics Service

USDA's National Agricultural Statistics Service will not conduct a number of statistical surveys in Fiscal Year 2014 (October 1, 2013-September 30, 2014). Because we are starting the new Fiscal Year with the FY2013 sequestration-level funding under a continuing resolution, we are not able to reinstate the programs that were suspended in March 2013. NASS modified its fruit and vegetable report estimates rather than suspend them entirely as it did for some commodities:

- NASS will publish the Non-Citrus Fruit and Nut Annual Summary; however, there will be no forecasts, no preliminary summary and no monthly prices in FY2014.
- NASS will publish the Vegetable Annual Summary; however, there will be no forecasts or monthly prices in FY2014.

NASS will release preliminary results of the 2012 Census of Agriculture on February 20, 2014. The release, which will provide an initial look at national and state findings, will take place at the [Ag Outlook Forum](#). NASS will release the full Census results at a later date and is working to set a revised schedule that ensures the highest-quality data. The release date was delayed by the work stoppage caused by the lapse in federal funding in October 2013.

Promising New Cranberry Selections Being Evaluated for Release

Nicholi Vorsa and Jennifer Johnson-Cicalese

Department of Plant Biology and Pathology

P.E. Marucci Center for Blueberry & Cranberry Research & Extension

Rutgers University, Chatsworth, NJ

Potential New Releases

Two advanced selections (**Rutgers-W** and **Rutgers-H**) are being considered for release in the near future. Performance data indicate they have greater yield potential than Stevens and Ben Lear and better color than Stevens and Mullica Queen®. They would be considered mid-season ripening varieties being significantly earlier than Stevens and Mullica Queen in New Jersey, but later than Ben Lear, Crimson Queen® and Demoranville®. These selections were selected from the breeding plots at the Marucci Center during 2006 and 2007 and are being tested in variety trials in Wisconsin, Oregon, Washington and British Columbia. **Rutgers-W** performed extremely well in Oregon and Washington trials, and preliminary indications suggest it may be well suited for British Columbia. Although **Rutgers-W** has yielded well in Wisconsin, it appears to be more prone to fruit rot disease, so at this time does not appear suitable in sites prone to fruit rot disease such as New Jersey or Massachusetts. **Rutgers-H** has also performed well on the west coast and as well as in Wisconsin. Preliminary observation suggests **Rutgers-H** is not as susceptible to fruit rot as is Stevens. However, further testing is required to determine whether this is the case. It is hopeful that **Rutgers-H** will be a variety that will prove to be well suited for New Jersey. Both of these selections, along with a few of their sibs, have been established in large plots at the Marruci Center to obtain a better understanding of their susceptibility to fruit rot in future studies in collaboration with P. Oudemans.

Background- These two progeny were selected from over 250 progeny that were derived from two crosses that were made in 1999 and planted in Bed 8 in 2003. Six progeny were selected for further testing in 2007 based on their 2006 and 2007 performance in Bed 8 at the PE Marucci Center. The principal parameters for selection were yield, fruit rot, and Tacy. Six progeny, three from each cross were propagated and planted in replicated trials in Washington, Oregon, and Wisconsin to obtain better estimates of their yield performance, susceptibility to disease, and color development. Two progeny have performed well relative to Stevens and Ben Lear that are used as standards in the trials.

Fruit Rot Resistance Breeding

A major objective of the Rutgers/NJAES cranberry breeding program is to enhance fruit rot resistance. New Jersey cranberry growers face the highest fruit rot disease pressure of all the growing regions, and fruit rot in NJ appears to be increasing in severity and scope. Moreover, fruit rot is also a significant issue in Massachusetts, and has become increasingly a problem in other growing regions, e.g., Wisconsin. Climatic factors in recent years, including record heat during summer and bed flooding, have exacerbated fruit rot pressure. Moreover, fungicides may face more restricted use due to 'minimum residue level' (MRLs) issues, and are subject to potential loss of label. Moreover, some currently used fungicides may loss their effectiveness due to fungicide resistance increasing in the pathogen.

With three years of cranberry fruit rot evaluations, 10 highly resistant, high yielding progeny have been selected (see **Table 1**). Fifty crosses were made in 2005 and 2006 using two highly fruit rot-resistant germplasm accessions, Budds Blues and US89-3, and 2 moderately resistant

accessions, Holliston and Cumberland. The resistant accessions were crossed with one another other, and with elite high yielding selections, in an effort to combine resistance with high yield. Over 1600 progeny were evaluated under severe fruit rot pressure; rot and yield rating were made on all progeny for 3 years, and % rot and yield (g/ft^2) were determined from a subset. Overall, 3% of the progeny were highly resistant, while 50% were highly susceptible. When the top ten progeny were sorted out, nine had Budds Blues as a parent, five were from resistant x resistant crosses, and five were from resistant x susceptible crosses (Mullica Queen and Crimson Queen were susceptible parents). Two resistant progeny from a 1997 cross (Stevens x US89-3) were also used in crosses which yielded three progeny in the top ten. Seven of the top ten had 3-yr mean yields over $250\text{g}/\text{ft}^2$. In the first year of evaluation, when fruit rot pressure was less severe and progeny could more fully express their yield potential, three of the most resistant had yields over $400\text{g}/\text{ft}^2$. All top 10 progeny had mean percent rotten fruit less than 35%, compared

Table 1. Selections with best fruit rot resistance and yield, mean of 2011, 2012 & 2013 evaluations of 1600 progeny, in comparison with Stevens.

Selection	Cross*	Rot rating 1-5, 5=100% rotted fruit	Yield rating 1-9, 9=best	%rotted fruit	Yield g/ft^2
1	BB X 86-45	1.2	6.7	16.3	254.9
2	BB X 86-45	1.2	6.7	23.2	181.8
3	BB X CQ	1.3	6.5	33.6	300.4
4	BB X CQ	1.0	6.5	32.6	294.7
5	BB X CQ	1.3	6.7	29.2	257.6
6	BB X MQ	1.2	6.3	29.8	190.2
7	BB X CU	1.5	6.3	20.6	296.7
8	CU X BB	1.3	6.7	34.9	286.4
9	CU X BB	1.0	6.0	21.1	213.1
10	MQ X 86-46	1.3	7.7	35.0	327.8
Stevens		4.1	4.2	87.1	151.6

*Resistant parents are Budds Blues (BB), Cumberland (CU), and CNJ97-86-45 & 86-46 (St x US89-3 progeny), susceptible parents are Mullica Queen (MQ) & Crimson Queen (CQ).

to Stevens with 87% rot; the most resistant progeny had a 3-yr mean percent rot of only 16%. These highly fruit rot-resistant progeny will now be evaluated in larger, replicated plots to further access their performance. In addition, they will be evaluated under reduced fungicide regimes. It is our hope to release one of these resistant selections soon and have this new variety managed with minimal fungicide input.

USDA-NIFA-AFRI Award - \$500,000

We submitted a grant proposal to the USDA-NIFA-AFRI 2013 competitive grants program last spring, in collaboration with J. Polashock, USDA-ARS, Marucci Center and Juan Zalapa, USDA-ARS, Univ. Wisconsin-Madison, WI. We were one of 14 proposals awarded funding of the 126 submitted. **DURATION:** From 09/01/2013 to 08/31/2017

The title is: '**Genomic Regions and Genetic Constellations Associated with Agronomic Traits, Fruit Quality and Disease Resistance in the American Cranberry'**

Project Director: Dr. Nicholi Vorsa, Rutgers University; **Co-Principal Investigators:** Dr. James Polashock, PE Marucci Center; Dr. Juan Zalapa, USDA-ARS, Univ. Wisconsin-Madison, WI; **Key Personnel:** Dr. Jennifer Johnson-Cicalese, Marucci Center

Possible Mechanisms of Fruit Rot Resistance

Mariusz Tadych and James White

Department of Plant Biology and Pathology, Rutgers University, New Brunswick, NJ

Cranberry fruit rot disease, caused by a complex of pathogenic fungi, is a major threat to the cranberry industry in the Northeastern United States and its importance is increasing in other cranberry growing regions. Chemical methods currently used to control this disease may result in development of fungicide resistance in fungal rot pathogens. Therefore, developing cranberry cultivars with improved resistance to fruit rot should decrease dependence on fungicides and reduce fungicide residues on fruits. Fruit rot resistant cultivars of cranberry are under development, however, the resistance mechanisms are unknown. Our experimental study using cultures of cranberry rot fungi showed that benzoic acid, malic acid and quinic acid, all natural components of cranberry fruit, inhibited growth of cranberry fruit rot pathogens and reduced their ability to produce rot-inducing oxidants (e.g. hydrogen peroxide) that are involved in induction of fruit rot. Selections of cranberries that have fruit that are high in antioxidants, particularly in organic acids, e.g. benzoic, malic and quinic acids, may be used in breeding programs to produce fruit rot resistant varieties. In addition, we are exploring the potential to control cranberry fruit rot disease using organic acids or close derivatives that naturally occur within cranberry plants. If we have positive results, in the future organic acids may be used instead of fungicides to control some diseases.

Strategies for Increasing Pre-harvest Intervals in a Fruit Rot Management Program

Peter Oudemans, Rutgers University

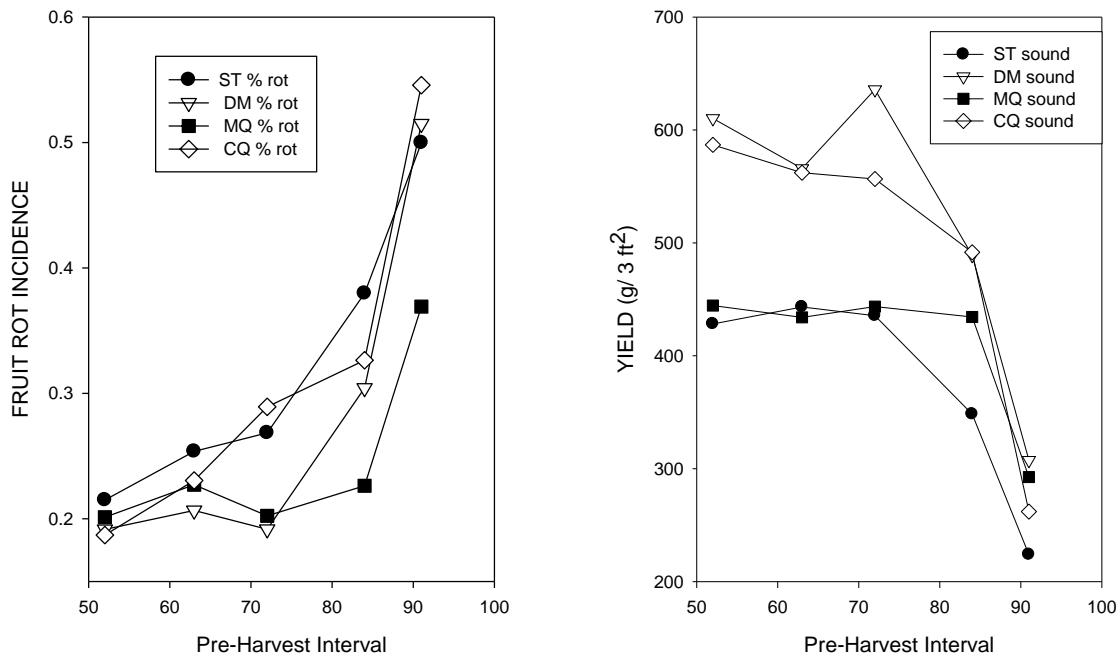
Philip E. Marucci Center for Blueberry and Cranberry Research and Extension.

Acknowledgements. Chris Constatelos, Tim Waller, Dyshay Smagacz, and Jessica Torres

Cranberry fruit rot control has been optimized for timing and efficacy in order to get maximum disease control with the minimum number of fungicide treatments. Our current objectives in developing disease control strategies for cranberry includes:

1. The establishment of improved guidelines on optimal or reasonable PHI values
2. Understanding the response of different cultivars to disease management programs
3. Identification of new chemistries for disease control
4. Optimization of establishment methods targeting leaf drop

In today's talk I will discuss results from three research projects. The first is aimed at objectives 1,2. I will report on results from the first year of a project investigating increasing PHI using four different cultivars (See figures below). In the second project I will report on an exciting new fungicide chemistry that I hope will provide alternatives to late season fungicide applications. Finally, I will provide an update on year 3 of our establishment trial.



Results of increasing PHI on four different cultivars.

Progress towards Understanding the Window for Fruit Rot Control

Timothy James Waller, Department of Plant Biology and Pathology, Rutgers University
Major Advisor: Peter Oudemans

In the control of cranberry fruit rot the critical time for application of protectant fungicides is during and shortly following the bloom period, with applications between 30%-60% open bloom having the greatest effect. This has also been shown for diseases of many of the most economically important fruit crops. These optimal fungicide timings have been identified through fungicide trials but the biological underpinning is still somewhat unclear. Dr. Peter Oudemans' laboratory has previously demonstrated that the majority of spore release from overwintering structures begins during bloom in both highbush blueberry and cranberry. Since the highest level of disease control for many cranberry fruit rotting pathogens is accomplished via fungicide applications during the bloom, it is reasonable to hypothesize that plant signals produced during bloom play a critical role in the sporulation and infection processes. The objective of this preliminary study was to investigate the effects of cranberry cv. Stevens water-soluble floral-extracts on the cranberry fruit rot fungi; *Coleophoma empetri*, *Colletotrichum acutatum* and *Colletotrichum gloeosporioides*.

Three types of tests were conducted for this experiment. A 16-field glass coverslip assay was utilized to determine the effects of the addition of Stevens flower extracts to conidial suspensions of the causal agents. Morphological data were collected at 24-hours for each pathogen and a time course assay was conducted over a 24-hour period for *C. empetri*, collecting data every 6-hours. A second test was designed to investigate the effects of flower extract on the infection of ripe Stevens fruit. A third assay was conducted to investigate the microscopic stages of pathogen infection on the skin of Stevens fruit at 0, 12 and 24 hours post inoculation with either the flower extract or water-only treatments. Cranberry peels, consisting of cuticle and epidermis were mounted on glass slides for microscopic observations and photography.

The experiment demonstrated that cranberry floral-extracts increased the virulence of fruit rot fungi by means of reduced wetness periods needed to form infection structures, increased germination rates, increase in hyphal thickness and occurrence of melanized hyphae and increased spore numbers as compared to water-only controls. It was also demonstrated that addition of floral-extracts to spore suspensions increased fruit rot development on Stevens fruit.

Least is known about the cranberry fruit rot pathogen *Coleophoma empetri* which causes the disease known as 'ripe rot'. This study has uncovered new aspects of the lifecycle of this fungus and revealed unique morphological structures such as melanized hyphae that appear to promote infection by *C. empetri*. This research will have a number of implications including developing inoculation and screening procedures that do not involve the wounding of fruit. I will also discuss the potential use of biological control agents that could effectively outcompete and neutralize the bioactive components of the flower extracts and ultimately provide efficient controls for cranberry fruit rot.

Emerging viruses that threaten cranberry production

James Polashock, USDA-ARS
Nicholi Vorsa, Rutgers University

BACKGROUND

In 2012 in Wisconsin, some fruit of newer cranberry varieties (e.g. Crimson Queen (CQ), Mullica Queen (MQ), Demoranville (DM), and HyRed), were found to have scarring on the surface. The scarring did not appear to be associated with chemical application. Virus testing showed Tobacco streak virus (TSV) to be associated with some uprights bearing scarred fruit. TSV is an Ilarvirus with an extensive host range. We sought to examine a potential source of TSV as well as the mode of transmission.

OBJECTIVES

1. Determine if all plants with scarred fruit are TSV positive.
2. Determine if 'mother plants' of CQ, MQ and DM and field plantings in NJ are TSV infected.
3. Determine if TSV positive plants bear scarred fruit when grown in a greenhouse.
4. Determine if seedlings derived from TSV positive plants are infected with the virus.
5. Determine if the virus can be transmitted to healthy plants and/or their progeny by pollination (as are other Ilarviruses).

METHODS

In August 2012, 65 uprights with scarred fruit were collected from the field in Wisconsin. Leaves were tested for TSV using ELISA. Both TSV+ and – uprights were rooted in Sept 2012 for further testing. Seeds (>200) from fruit on TSV+ uprights were sown Dec 2012. Follow up testing (2013) using both leaf and fruit tissue was done by ELISA kit or by RT-PCR using TSV-specific primers. All 2012 plants were re-tested in 2013 to verify earlier results. Flowers on TSV+ plants were self pollinated and the developing fruit were monitored for scarring. Pollen was also collected and hand-applied to open flowers on healthy plants for transmission studies.

RESULTS

Objective 1: Not all plants with scarred fruit tested positive for TSV. Of 65 (CQ, MQ, and DM) tested in 2012, 25 were positive (38%) and 6 were 'elevated'. If 'elevated' are assumed to be positive, then about 48% of those tested were positive. The 52% testing negative were retested in April and August 2013 (new shoots) and remained negative.

Objective 2: All NJ samples tested negative for TSV. 76 plants (40 MQ and 36 CQ) were collected from a nursery in New Jersey. 200 samples (80 MQ, 60 CQ and 60 DM) were collected from commercial beds in New Jersey with plants originating the same year as those in WI from the nursery noted above. ALL were negative for TSV.

Objective 3: TSV+ uprights rooted in the greenhouse in the fall 2012 bore fruit without scarring. All uprights set fruit and the plants exhibited no symptoms.

Objective 4: TSV does not appear to be seed transmitted. Seeds were collected from scarred fruit borne on TSV positive uprights. Over 234 seedlings from CQ, DM, and MQ were grown in the greenhouse for about 8 months. All were TSV negative by ELISA.

Objective 5: Pollination of flowers of healthy plants with pollen from TSV+ plants does NOT transmit TSV. Pollen from TSV positive MQ was used to pollinate healthy plants. All fruit

that developed were monitored for scarring and tested for TSV. All fruit lacked scarring and all tested negative for TSV.

CONCLUSIONS

1. New Jersey nursery-grown plants of Crimson Queen, Demoranville and Mullica Queen were TSV negative, as were 4-6 year old plantings of these varieties on commercial farms in New Jersey. TSV in cranberry did NOT originate from New Jersey.
2. More than half of the plants with scarred fruit tested negative for TSV and have remained negative after a year.
3. Some plants negative for TSV may be infected with Blueberry Shock Virus (BlShV).
4. Plants from cuttings from TSV positive plants rooted and maintained in the greenhouse remain positive, and none have produced scarred fruit.
5. No seed transmission of TSV was found in cranberry.
6. Hand pollination does not transmit TSV to healthy plants or progeny from those plants.
7. The scarring may be caused by an initial 'necrotic shock' reaction as occurs in other plants infected with these and other Ilarviruses.
8. Flower thrips may be spreading the virus by rasping the flowers, allowing entry of infected pollen into the 'microwounds'.
9. Early varieties may be more impacted as they tend to flower earlier; coinciding with thrips infestations.

The Bottom Line

- TSV and BlShV are emerging viruses in cranberry, but do not yet in New Jersey
- The link between scarring and TSV infection has not been conclusively demonstrated.
- Even if infected plants recover, they remain infected and can still transmit the virus.
- Plants should not be purchased from out of state unless thoroughly virus tested.
- Please let us know immediately if you see fruit with symptoms.



Scarred fruit collected from the field in Wisconsin. Symptoms range from mild (left) to severe (right). All fruit on a runner tend to be affected.

Photos courtesy of Patricia McManus, University of Wisconsin

ACKNOWLEDGEMENTS

We thank Emily Zammitti and Kristy Adams for technical assistance.

Cranberry Weed Control Progress in the Past Twenty Years

Bradley A. Majek

Obtaining a label for an herbicide to be used in cranberries presents several unique challenges. Cranberries are a high value crop grown on limited acreage, which maximizes liability and minimizes profit for products priced to sell in low value high acreage field crops. In addition, cranberries are grown in bogs that are often flooded for harvest and winter protection, raising surface and groundwater contamination concerns for government agencies. Despite these hurdles, three new and very effective herbicides have been labeled for use in cranberries in the past twenty years.

Stinger 3A/Spur 3A has been labeled for the control of composite and legume weeds in cranberries. Composite weeds include annuals such as ragweed, fireweed (American burn weed), and beggars ticks (pitchforks), and perennials such as asters species, goldenrod species, and Canada thistle. Legume weeds include annuals such as vetch species, and perennials such as wild bean and clover species. Stinger 3A should be applied as a single or split application by a ground driven boom sprayer calibrated to deliver between 20 and 50 gallons per acre.

Apply Stinger 3A at the rate of 2.66 to 8.0 fluid ounces of product per acre (0.0625 to 0.188 lb ai/acre) when a single application is planned. When more than one application is sprayed, do not exceed 1 pint of Stinger per acre (0.375 lb ai/acre) per year. Cranberries are more sensitive to stinger before bloom. Use the lowest rate of 2.66 fluid ounces per acre of Stinger 3A when applications are made in the spring before bloom and the period of rapid shoot growth in late May and June. Use a higher rate, 5.33 fluid ounces per acre of Stinger 3A, for most weed problems when applications are made in the summer after bloom. Apply the highest labeled rate of 8.0 fluid ounces per acre to control heavy aster, goldenrod, or Canada thistle infestations.

Stinger is a residual herbicide. The Stinger rate per acre cannot be controlled when applying spot treatments “sprayed to wet”. This type of application may result in moderate or severe crop injury, therefore spot treatments “sprayed to wet” are NOT recommended.

Callisto 4SC has been labeled for newly planted or bearing cranberries to suppress or control rushes, sedges, and many annual broadleaf weeds. Apply 8 fl. oz. per acre (0.25 lb ai/A) in late spring (May) before bloom. Treat newly planted bogs with unrooted cuttings after cuttings have rooted, but before weeds have become established. Treat new bogs planted with rooted plants as soon as the bog is planted. Repeat the application in early summer (July) after bloom in established cranberries. Add NIS (nonionic surfactant) to be 0.25% of the spray solution or oil concentrate to be 1% of the spray solution. Choose NIS when cranberries are growing rapidly and warm cloud humid weather encourages thin cuticle (wax layer) formation on cranberry leaf surfaces. Use oil concentrate when growth has “hardened off” or when hot dry sunny weather encourages a thick cuticle to form on cranberry leaf surfaces.

Callisto is active through foliage and root absorption in susceptible plants. Optimum performance can be obtained by ensuring an 8 to 12 hour rain-free period after application, followed by a light irrigation to move the herbicide into the root zone. Heavy irrigation, such as

for frost protection, can move the herbicide below the root zone of target weeds and may result in reduced weed control or weed control failure. Time the spring application to precede a period of mild weather when irrigation for frost protection will not be needed. Callisto causes bleaching (whitening) of the stems and foliage of susceptible plants. Affected plants will appear white, red or purple. Occasionally cranberries may “flash” temporary whitening in the growing tips of rapidly growing shoots. “Soft” growing conditions, warm cloudy humid weather, during periods of rapid growth the week before Callisto application and cold weather after application increase the possibility of observing the temporary “flash”. When observed, the cranberries recover with no long term affects on the crop.

Quinstar 4L has been labeled to control many annual grasses and broadleaf weeds, including dodder, and certain perennial weeds, notably yellow loosestrife, in cranberries. Apply one half pint per acre (0.25 lb ai/A) in late April or early May to control annuals and dodder. Quinstar 4L should be applied before annuals germination and dodder attaches to the cranberry vines. Repeat the application in early July after cranberry bloom to control yellow loosestrife and for full season dodder control. Yellow loosestrife treated with Quinstar 4L in July does not show herbicide injury the year of application, but does not emerge the following spring. Always add nonionic surfactant to be 0.25% of the spray solution, or crop oil concentrate at 2 pints per acre. Apply no more than 2 applications per year, with a minimum of 30 days between applications. Ocean Spray growers should consult with the cooperative before applying Quinstar 4L concerning the company’s policy on Quinstar 4L as it relates to European exports.

Effects of Mid-day Misting on Canopy Temperature and Cranberry Production

Patrick Burgess, Nick Vorsa, and Bingru Huang

Department of Plant Biology and Pathology, Rutgers University

High air temperatures during summer months imposes heat stress on cranberry plants and can be a major factor limiting large scale production in New Jersey. Growers have adopted the practice of sprinkler irrigation to cool canopy temperatures during the hottest times of day, though little work has been done investigating specific plant response. A previous study showed that short intervals of mid-day irrigation can significantly lower canopy temperature and maintain higher photosynthetic rates compared to non-irrigated plants. The current study investigated additional physiological and morphological responses of cranberry plants under mid-day irrigation during summer 2012 and 2013. The aim of this study was to determine if midday irrigation causing lower leaf temperatures translates into better growth and enhanced berry production. Microsensors connected to a data-logger were used to monitor leaf temperature during the hottest times of day. Length of new-growth uprights, number of leaves on a new-growth upright, leaf area, leaf chlorophyll content, number of fruits, and total weights of fruits on a new-growth upright were measured. Total nonstructural carbohydrates of leaves and fruits was also measured. The results from 2012 and 2013 show significant changes to plant morphology in response to irrigation when canopy temperature reaches 90 °F or 95 °F and the effects were greater for irrigation at 90 °F. Irrigation cooling at both 90 °F and 95 °F effectively cooled the leaves, but the sprinkler on at 90 °F was more effective for cooling and had more positive effects on cranberry growth. Leaf temperature was 10-15 °F lower compared to non-irrigated plants when irrigation was turned on at 90 °F and 3-5° F lower at 95 °F. The 90° F irrigation treatment increased leaf count and leaf area per new-growth upright, both of which can facilitate better light harvesting for photosynthesis. Less growth inhibition or faster growth rate of up-rights as well as maintenance of leaf chlorophyll due to 90° F irrigation indicates plants were experiencing significantly less heat stress. Fruit count per new-growth upright was also significantly higher for plants with the 90° F irrigation. Thus far, mid-day irrigation has not changed carbohydrate content of leaves or berries. Interesting changes to disease incidence were also noted and will be discussed.

Potential Water and Energy Savings in Cranberry Frost Cycling

Peter Jeranyama, University of Massachusetts Amherst, Cranberry Experiment Station, 1 State Bog Rd., P.O. Box 569, East Wareham, MA 02538

Automated intermittent frost (AI) cycling offers an opportunity to reduce the amount of water usage during spring frost protection and at the same time saving energy because the irrigation pump will not be continuously running during a frost night. The objective of this study was to compare cranberry cultivar's response to conventional (CON) and AI approaches. In spring we collected 50 buds from each of the fourteen cranberry beds monitored from late March to early June following a frost event. Buds were dissected under a microscope for visual assessment of the extent of damage from cranberry cultivars 'Early Black', 'Howes' and 'Steven' from both conventional and cycling methods of spring frost protection. Conventional comprise turning on irrigation sprinklers once a temperature threshold has been reached on a frost night and left to run throughout the night. Automated intermittent sprinkling involves cycling irrigation triggered by temperature 2-4 degrees above the threshold and the cut off is normally 4 degrees above threshold. Water use in a frost night using AI was 67% of CON (300 gallons /night /acre). Assessments showed that buds in 'Early Black' suffered the most damage (12%) under AI compared to 'Howes' (5%) and 'Stevens' (8%). All cultivar's damage under CON was less than 5%. The bud damage under AI was mostly on one or two floral meristems which do not result in fruit yield loss. Fuel costs in CON were \$164/acre/night compared to \$80/acre/night in cycling system. Early Black yield under AI was 240 BBL/acre and was significantly higher than 150 BBL/acre in CON. There were no significant yield differences in other cultivars for frost protection method.

U.S. Cranberry Marketing Committee; Updates and Programs Overview

Scott J. Soares, Executive Director, U.S. Cranberry Marketing Committee

The U.S. Cranberry Marketing Committee or CMC as it is typically referred to, was created per the interest of the U.S. cranberry industry by Federal Legislation in 1962 as a quasi-governmental agency under the USDA's Agricultural Marketing Service (AMS). In order to fulfill its mission the CMC works with the United States Department of Agriculture to execute global marketing and promotional activities, support or undertake related research initiatives and may issue volume control regulations when needed and as authorized.

The CMC is administered by a USDA Secretary appointed Committee of 14 members and 10 alternate members through staff that are located in Wareham, MA. Committee membership is established by the CMO and is intended to provide representation for all cranberry growers within the ten states of Connecticut, Massachusetts, Michigan, Minnesota, New Jersey, New York (long Island), Oregon, Rhode Island, Washington and Wisconsin. Authority for its actions is provided under Chapter IX, Title 7, Code of Federal Regulations, referred to as the [Federal Cranberry Marketing Order \(CMO\)](#), which is part of the Agricultural Marketing Agreement Act of 1937, as amended. This Act specifies cranberries as a commodity that may be covered, regulations that may be issued, guidelines for administering the programs, and privileges and limitations granted by Congress. The CMO has been amended several times since its inception to enhance the CMC's ability to expand market development projects and generic promotion programs in domestic and international markets.

The U.S. Cranberry Marketing Committee; Updates and Programs Overview presentation will provide information about the CMC, its structure and recent programmatic activities undertaken toward the fulfillment of its mission *“to ensure a stable, orderly supply of cranberry products as authorized and provided by the Federal Cranberry Marketing Order (CMO)”*. The presentation will also provide an update on U.S. cranberry production and the most recent market policy established by the CMC.

S.J. Soares biography:

Hired in May of 2012, Mr. Soares is the Executive Director of the Cranberry Marketing Committee (CMC), responsible for the expansion of U.S. cranberry business development projects in domestic and international markets.

Preceding the CMC, Mr. Soares served for 17 years at the Massachusetts Department of Agricultural Resources (MDAR) in a variety of leadership positions until his appointment by Governor Deval Patrick as the 18th Commissioner of MDAR in April 2009.

Mr. Soares has received numerous accolades throughout his career including the Government Leadership Award from the Cape Cod Cranberry Growers' Association in 2011 and the Environmental Leadership Award from the Massachusetts Nursery and Landscape Association in 2009.

Mr. Soares served seven years of active and reserve service to the U.S. Army and obtaining double major degree in Biology and Marine Biology from UMass Dartmouth.

Regrowth of Cranberry Uprights after Tipworm Feeding Injury

Sunil Tewari

Department of Entomology, Rutgers University

Larvae of gall making tipworm feed on and injure the apical meristems of cranberry shoots/uprights, disrupting vegetative growth. The majority of tipworm-injured flowering uprights do not resume vegetative growth via activation of lateral axillary buds (side-shoots) before the onset of dormancy. Furthermore, growth and flowering of uprights that fail to produce side-shoots after injury may be inhibited in the following year. In cranberry, limited availability of total nonstructural carbohydrates during fruit development has been reported. Thus, competition between developing fruit and lateral axillary buds for available resources may suppress vegetative regrowth in tipworm-injured flowering uprights. We carried out deblossoming experiments in the field and greenhouse to determine if presence of developing fruit inhibited the growth of side-shoots in tipworm-injured flowering uprights. We also compared tipworm-injured flowering and vegetative uprights to determine if growth form of an upright influenced regrowth after injury. Removal of flowers from tipworm-injured flowering uprights increased the production of side-shoots in three cultivars of cranberry ('Ben Lear', 'Howes', and 'Stevens'). In addition, more tipworm-injured vegetative uprights resumed growth by producing side-shoots, as compared to flowering uprights (Howes and Stevens). Our results suggest that unequal partitioning of resources between developing fruit and lateral axillary buds inhibits regrowth in tipworm-injured flowering uprights of cranberry.

New Tools to Control Insect Pests of Cranberries

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

On-Farm Research Results in Cranberry: Altacor

Altacor is a new insecticide registered in cranberries. Its active ingredient, Rynaxypyr®, is from a whole new group of chemistry (Group 28) with no cross-resistance to other chemistries. Altacor is effective against lepidopteran pests including gypsy moth, leafrollers, spanworms, fireworms, and fruitworms. It controls hatching insects all the way through to adult stages of development and is easy on bees and beneficial insects. Unlike other insecticides, Altacor controls caterpillars by acting on their muscle fibers. It exhibits rapid cessation of feeding, lethargy, regurgitation and muscle paralysis, ultimately leading to death.

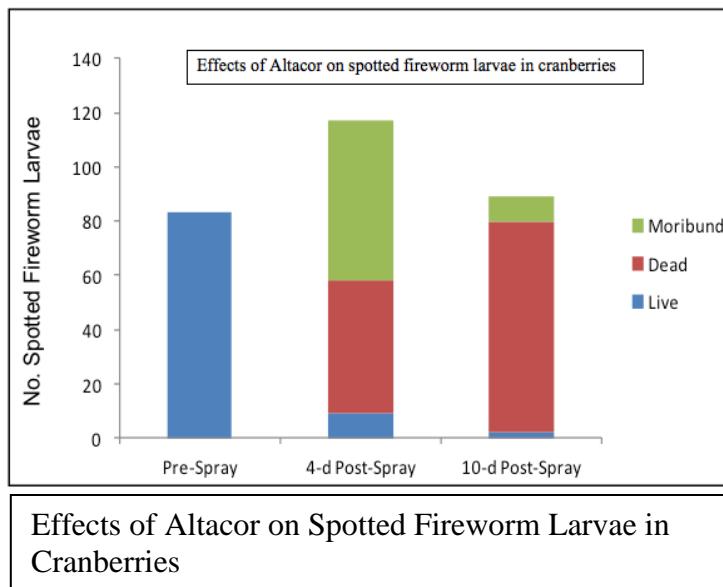
This test evaluated the efficacy of a pre-bloom application of Altacor against spotted fireworm larvae in cranberries. The test was conducted on a 3.72 acre commercial cranberry bog, cv. 'Stevens', located in Chatsworth, New Jersey. Application was made via airplane, using grower standard methods, on 27 May. Treatments were applied in 10 gal of water per acre. Altacor 35WDG was applied at 4.0 oz per acre. Six widely-spaced sweepnet samples

were taken from the bog 4 days before treatment (pre-spray), and 4 and 10 DAT. A sweep set consists of 25 sweeps. Samples were bagged and brought back to the laboratory where the number and identity (species) of larvae were recorded, as well as larval status: live, moribund, or dead. Percent live, percent moribund, and percent dead were calculated, and percent data were arcsine square-root transformed prior to analysis. Data were analyzed using ANOVA, and means separation by Tukey test at $P \leq 0.05$.

Altacor was effective at reducing the survival of spotted fireworm larvae by 4 and 10 DAT (> 90% control). In our study, we saw that 4 DAT most spotted fireworm larvae were not dead but looked lethargic (moribund); however, 10 DAT most of these larvae were dead. These results are in line with Altacor's mode of action.

Current Research on Insecticide Trials against Blunt-nosed Leafhoppers

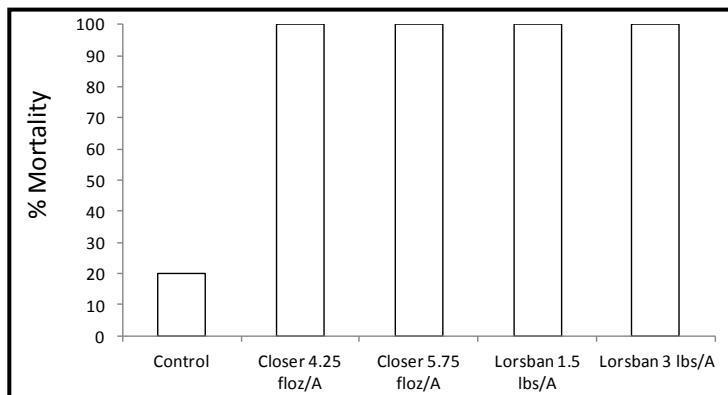
Recently we conducted an experiment to test the efficacy of a newly-registered insecticide (Closer SC) in cranberries against blunt-nosed leafhopper nymphs. Closer (Dow Agrosciences) is an insecticide for the control of sap-feeding insects, including leafhoppers, aphids, and whiteflies. It has both systemic and translaminar activity, belongs to a new class of insecticides (the sulfoximines), and has minimal impact on beneficial organisms. Insecticide control for



leafhoppers is best achieved pre-bloom when targeting the nymphal stage, i.e., immatures. Broad-spectrum insecticides (e.g. Lorsban) are currently recommended for their control. Thus, Closer may provide an alternative to broad-spectrum insecticides and likely be more compatible with biological control because it has less of an impact on natural enemies.

To test the efficacy of Closer against blunt-nosed leafhoppers, an experiment was conducted in an 'Early Black' bog located at the Rutgers P.E. Marucci Center. Closer and Lorsban were applied at 2 rates (full and half label rates) to 60×60 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. Closer and Lorsban were highly effective against blunt-nosed leafhoppers—100% mortality at both rates (see graph).

Further studies will be conducted in 2014 in commercial bogs.



Blunt-nosed leafhopper nymphal mortality after 1 day exposure to treated foliage.

Insecticide Trials against *Sparganothis* Fruitworm and Spotted Fireworm

This experiment tested the efficacy of Altacor, Delegate WG, Exirel, IKI-3106, Intrepid 2F, Imidan 70WP, and Lorsban 4E in controlling *Sparganothis* fruitworm larvae in cranberries. The treatments and rates were: Altacor at 4 oz/ac, Delegate WG at 6 oz/ac, Exirel at 13.5 floz/ac, IKI-3106 at 16.4, 22.0, and 27.4 floz/ac, Intrepid 2F at 16 floz/ac, Imida 70WP at 4 lb/ac, and Lorsban 4E at 3 pts/ac. The experiment was conducted in an 'Early Black' cranberry bog located at the Rutgers PE Marucci Center in Chatsworth, New Jersey. Plots were 1.22×1.22 m each (1.49 sq meters), replicated 4 times in a completely randomized block design. Control plots received no insecticide. Applications were made 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 69.5 ml per plot. Separate plots were treated on 23 July (to assess 1 day after treatment (DAT) and 3 DAT) and on 30 July (7 DAT). On each sample date, treated uprights were randomly clipped from the center of each plot for use in laboratory assays. Samples were taken 30 cm from plot edges. Three insecticide-treated uprights were inserted in florists' water picks, enclosed in a ventilated 40-dram plastic vial, and secured on Styrofoam trays. For both species, eight vials were setup for each treatment on days 1, 3, and 7 days after treatment (1 DAT, 3 DAT, and 7 DAT). On each sample date, three neonates were placed in each vial, with each vial considered a replicate. Neonates used in the assay were obtained from laboratory colonies kept at the Rutgers PE Marucci Center. Vials with plants and insects were placed on a light bench in the laboratory at approx. 25°C, on a 15:9 L:D cycle.

Mortality was assessed after 7 days. Number of larvae (alive, moribund dead, or missing) was recorded. Data on percent live larvae are reported. Data were analyzed using ANOVA and means separation by Tukey test at $P = 0.05$. Percent data were arcsine square-root transformed prior to analysis.

At 1 DAT, all insecticides reduced larval survival of *Sparganothis* frutworm (Table 1) and spotted fireworm (Table 2). All insecticides remained effective 7 DAT except for Imidan.

Table 1. *Sparganothis* fruitworm

Treatment	Rate	% Live Larvae (Mean \pm SE)		
		1 DAT	3 DAT	7 DAT
Altacor	4 oz/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)
Delegate WG	6 oz/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	8.3 \pm 5.5 b (88.2)
Exirel	13.5 floz/ac	0.0 \pm 0.0 b (100)	37.5 \pm 7.6 a (10)	12.5 \pm 8.8 b (82.4)
IKI-3106	16.4 floz/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	20.8 \pm 8.8 b (70.6)
IKI-3106	22 floz/ac	4.2 \pm 4.2 b (93.8)	0.0 \pm 0.0 b (100)	12.5 \pm 6.1 b (82.4)
IKI-3106	27.4 floz/ac	4.2 \pm 4.2 b (93.8)	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)
Intrepid 2F	16 floz/ac	0.0 \pm 0.0 b (100)	4.2 \pm 4.2 b (90)	4.2 \pm 4.2 b (94.1)
Imidan 70 WP	4 lb/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	70.8 \pm 11.7 a 0.0
Lorsban 4E	3 pts/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)
Control	-	66.7 \pm 8.9 a -	41.7 \pm 15.1 a -	70.8 \pm 9.8 a -

Means within a column followed by different letters are significantly different (Tukey test, $P \leq 0.05$)

Numbers in parenthesis are % control = $[1 - (\% \text{ live in treated} / \% \text{ live larvae in control})] * 100$

Table 2. Spotted fireworm

Treatment	Rate	% Live Larvae (Mean \pm SE)		
		1 DAT	3 DAT	7 DAT
Altacor	4 oz/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	8.3 \pm 8.3 b (90.5)
Delegate WG	6 oz/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	20.8 \pm 12.5 b (76.2)
Exirel	13.5 floz/ac	0.0 \pm 0.0 b (100)	4.2 \pm 4.2 b (94.1)	12.5 \pm 6.1 b (85.7)
IKI-3106	16.4 floz/ac	4.2 \pm 4.2 b (91.7)	0.0 \pm 0.0 b (100)	29.2 \pm 9.8 b (66.7)
IKI-3106	22 floz/ac	0.0 \pm 0.0 b (100)	4.2 \pm 4.2 b (94.1)	20.8 \pm 10.8 b (76.2)
IKI-3106	27.4 floz/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	4.2 \pm 4.2 b (95.2)
Intrepid 2F	16 floz/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	12.5 \pm 6.1 b (85.7)
Imidan 70 WP	4 lb/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	79.2 \pm 8.8 a (9.5)
Lorsban 4E	3 pts/ac	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)	0.0 \pm 0.0 b (100)
Control	-	50.0 \pm 12.6 a -	70.8 \pm 13.3 a -	87.5 \pm 6.1 a -

Means within a column followed by different letters are significantly different (Tukey test, $P \leq 0.05$)

Numbers in parenthesis are % control = $[1 - (\% \text{ live in treated} / \% \text{ live larvae in control})] * 100$

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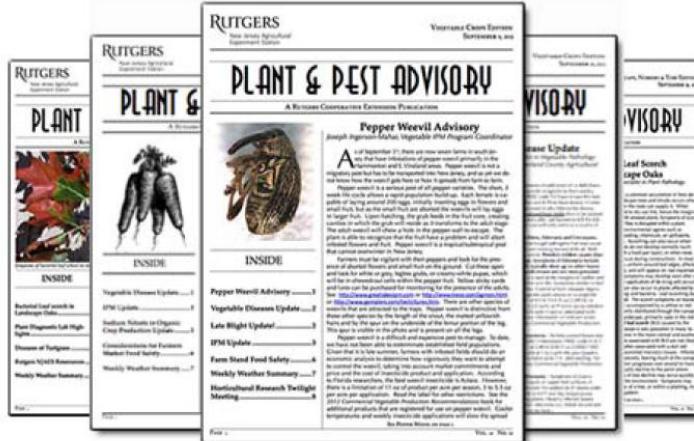
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