2022 Annual Summer Meeting of the American Cranberry Growers Association

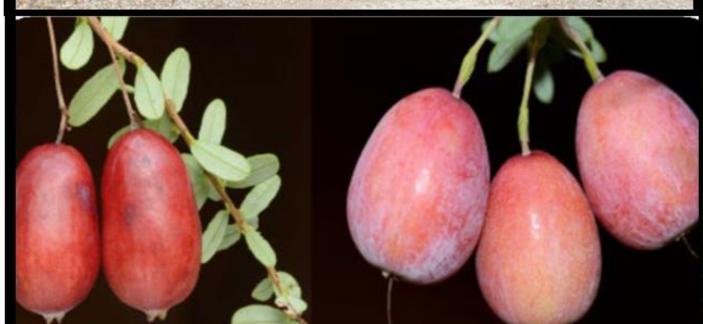
AMERICAN CRANBERRY GROWERS association

Rutgers University
Marucci Center

Chatsworth, NJ

Thursday
August 18, 2022

RUTGERS
New Jersey Agricultural Experiment Station



Presentation Summaries

American Cranberry Growers Association
2022 Summer Field Day

Thursday August 18, 2022
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 **Refreshments**

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

8:45–9:05 **Cranberry Wax Content, Assessment, and Benefits (Bog 1)**
James Polashock, Research Plant Pathologist, *Lindsay Erndwein*, and *Joseph Kawash*, USDA-ARS, P.E. Marucci Center, Chatsworth, NJ

9:05–9:25 **Strategies for Improving Cranberry Fruit Quality (Bog 2)**
Peter Oudemans, Professor & Extension Specialist, Department of Plant Biology, Rutgers University

9:25–9:45 **New Options for Residual Weed Control in Cranberry (Bog 3)**
Thierry Besancon, Associate Professor & Extension Specialist, Department of Plant Biology, Rutgers University, and *Wesley Bouchelles*, P.E. Marucci Center, Chatsworth, NJ

9:45–10:05 **Phenotyping and Genotyping CNJ14-31: A Unique Population Segregating for Fruit Rot Resistance, Fruit Chemistry, and Other Traits (Bog 18)**
Sara Knowles, Joseph Kawash, Jennifer Johnson-Cicalese, James Polashock, Nicholi Vorsa, P.E. Marucci Center, Chatsworth, NJ

10:05–10:25 **Overview of the 2022 Season So Far (Bog 19)**
Lindsay Wells-Hansen, Senior Agricultural Scientist, Ocean Spray, Chatsworth, NJ

10:25–10:45 **Entomological Research Updates (Bog 20)**
Cesar Rodriguez-Saona, Professor & Extension Specialist, *Yahel Ben-Zvi*, Department of Entomology, Rutgers University; *Vera Kyryczenko-Roth*, and *Robert Holdcraft*, P.E. Marucci Center, Chatsworth, NJ

POLE BARN

11:00–11:05 **Cranberry Statistics**
Bruce Eklund, National Agricultural Statistics Service, Trenton, NJ

11:05–11:30 **Improving Cranberry Fruit Quality by Understanding the Microclimate of the Bog**
Michael Nelson, Department of Environmental Conservation, University of Massachusetts, Amherst, MA

11:30–12:00 **Be On Target: Tips to Avoid Drift**
Kate Brown, Program Associate—Commercial Agriculture, and *William Bamka*, Rutgers Cooperative Extension of Burlington County

12:00–12:05 **Plant Nutrition Possibilities from OMEX USA**
Heather Huffman, Research Agronomist, and *Mike Williams*, CEO, OMEX USA

12:05–1:00 **LUNCH**

CRANBERRY WAX CONTENT, ASSESSMENT, AND BENEFITS

James Polashock, Research Plant Pathologist, *Lindsay Erndwein*, and *Joseph Kawash*
USDA-ARS, P.E. Marucci Center, Chatsworth, NJ

The cranberry industry in the U.S. is experiencing challenges exacerbated by climate extremes and increasing restrictions on fungicide use. Some cranberry fruit develop a thick epicuticular waxy coating that may protect against pathogen invasion, sun scald and dehydration. We examined a cranberry population that segregates for different relative amounts of fruit epicuticular wax (ECW). Fruit with high ECW tend to have lower levels of fruit rot. Fruit from clones with high ECW deposition vs. clones with low wax were subjected to high intensity light treatment and heating was measured with a FLIR thermal camera. Fruit with high ECW heated to a lesser degree and more slowly than those with little wax, suggesting fruit wax offers some protection against scald. Representative detached fruit were also subjected to dehydration under heated (30 ºC) conditions. Fruit coated with higher amounts of wax lost less weight than those with low coverage of wax, indicating water loss is reduced in high ECW fruit. The segregating population was genotyped using GBS, and QTL analyses were used to identify genomic regions associated with variation in fruit ECW. A single peak was found identifying a chromosomal location associated with ECW. Molecular markers were designed, based on the QTL peak location, and are being tested for use in our breeding program. Markers will allow selection of seedlings that are likely to exhibit high ECW fruit.

Strategies for Improving Cranberry Fruit Quality (Bog 2)

Peter Oudemans, Matt Hamilton and Luke Mackara (Plant Pathology)
Jennifer Johnson Cicalese and Nicholi Vorsa (Breeding)
Rutgers, The State University PE Marucci Center

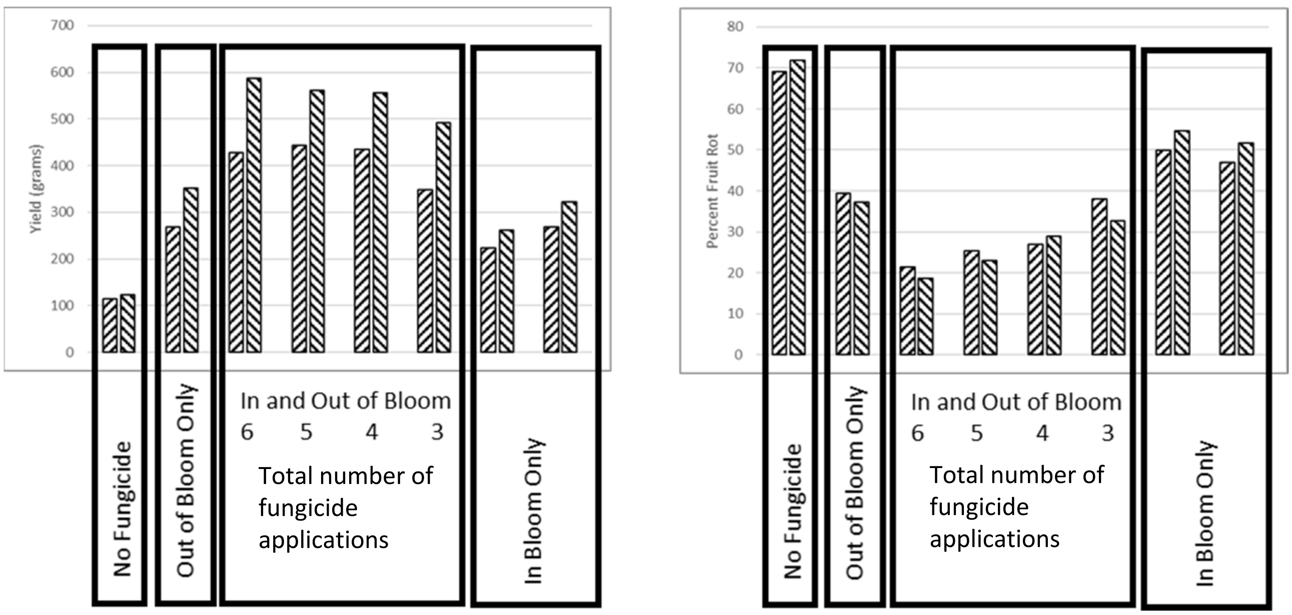
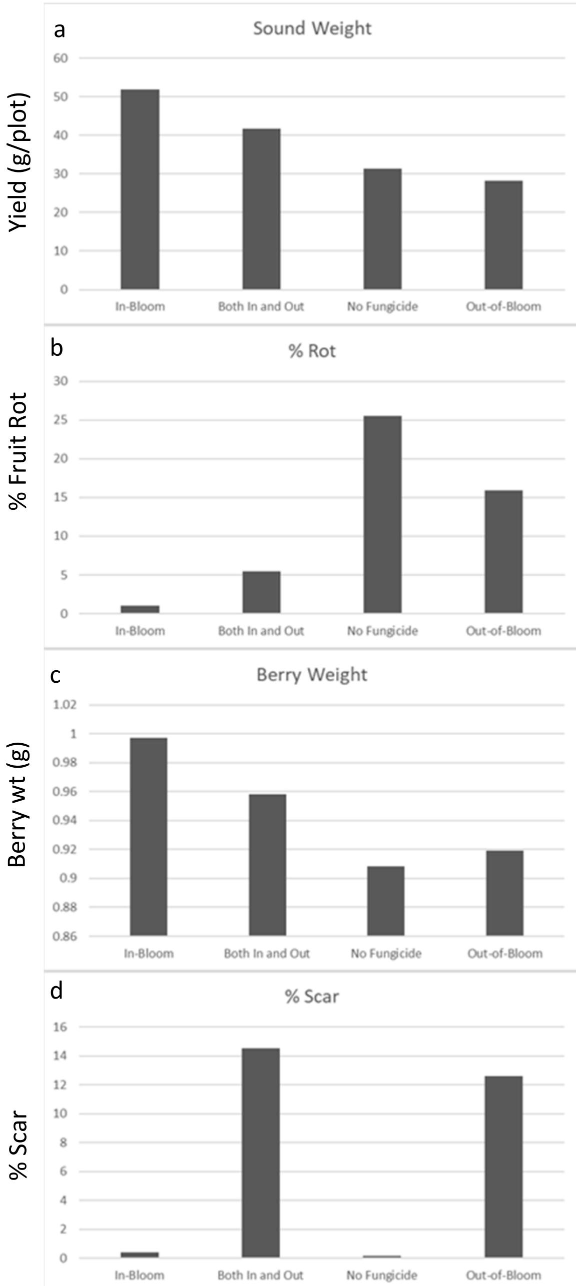


Figure 1. Characteristics of susceptible varieties: Cranberries susceptible to fruit rot disease require fungicide applications both in- and out-of-bloom to achieve satisfactory economic control. The cultivars Stevens and Crimson Queen (shown above) represent high yielding, susceptible varieties that benefit from fungicide application. Fungicide efficacy depends on timing, spectrum of activity and coverage of the fungicide applications and are critical factors in an effective control program

Figure 2. Results from a replicated trial on a 0.5 acre experimental bed at the PE Marucci Center. Nine selections from the Rutgers Cranberry Breeding Program were evaluated in this trial under three fungicide regimes. Results shown above represent 3-yrs of trials aimed at testing the effect of reduced fungicide inputs. Results show the selection CNJ05-80-2 performed significantly (<0.001) better than the susceptible with only 2 fungicide applications.



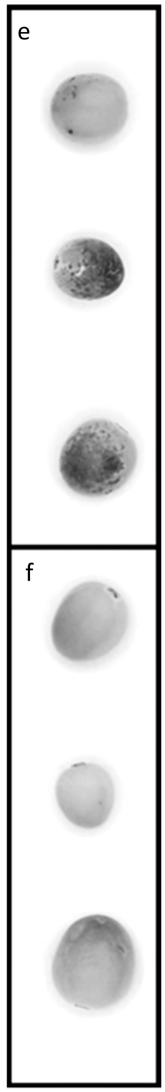


Figure 3. Bog 2 results. Seven advanced selections and the cultivar Haines all developed by the Rutgers Cranberry Breeding Program are being tested under the same fungicide regimes as in Bog 11. Overall the results indicate In-Bloom sprays are necessary and overall provide improved yield, better fruit rot control and improved berry quality compared with the other treatments. **a-d** show the overall performance of the treatments across the entire trial. Note that sound weight and % rot both appear to be better in the In-Bloom (2-spray) treatment than in the 4-spray treatment. This is likely due to the impact of scarring (e and f) on berry weight and predisposition effects resulting in increased rot. **e-f** show the symptoms of scarring (e) in chlorothalonil treated fruit versus no scarring (f) in the 2-spray treatments.

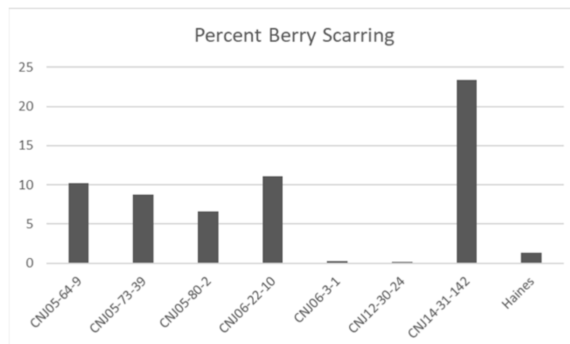
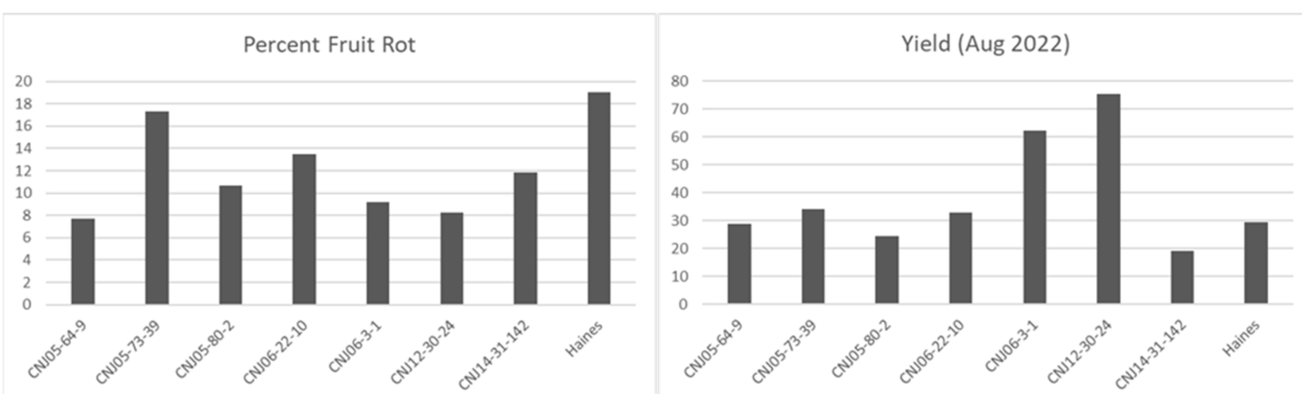


Figure 4. Comparison of scarring among the eight selections averaged over all treatments in Bog 2. Note that the high variability of scarring among selections may indicate compatibility with chlorothalonil in a spray program.

Figure 5 (below) shows variation among the selections for fruit rot and yield in the second year after planting. (Results collected Aug 12 2022)



The development of fruit rot resistant cultivars through the Rutgers Cranberry Breeding Program has yielded selections that perform well under a 2-spray in-bloom fungicide program under the high fruit rot pressure of New Jersey. Improved fruit quality with reduced fungicide applications will have significant implications for adapting to changing conditions and regulations.

EXPLORING THE INFLUENCE OF WEEDS ON CRANBERRY YIELD AND QUALITY

Jed Colquhoun, Thierry Besançon, Katherine Ghantous and Hilary Sandler

The influence of weeds on cranberry yield and quality is not well known and cannot be extrapolated from other cropping systems given the unique nature of both cranberry production and the weed species spectrum. The work presented here addresses this need with four common weed species across multiple production seasons and systems in Wisconsin, Massachusetts and New Jersey, USA: Carolina redroot, earth loosestrife, bristly dewberry and polytrichum moss. The objectives were to use these representative species to quantify the impact of weed density, groundcover and biomass on several cranberry yield components and related interactions with other cranberry pests, and to determine whether these relationships were consistent enough across seasons to be reliably used in weed management decision-making. The relationships between Carolina redroot and bristly dewberry growth measures and marketable cranberry yield were highly significant ($p < 0.001$ in 12 of 13 regressions) and consistent across growing seasons, but not significant for similar regressions with earth loosestrife. In particular, the strong relationship between Carolina redroot and bristly dewberry visual groundcover observations and cranberry yield suggests a simple way for growers and crop scouts to reliably estimate yield loss. The relationship between polytrichum moss biomass and cranberry yield was also significant in both years, but not consistent between years. Weed competition also affected cranberry quality, where Carolina redroot density was strongly related to the percentage of insect-damaged fruit and bristly dewberry growth reduced cranberry color development. Practically, this information can be used to educate growers, consultants, agrichemical registrants and regulators about the impacts of weeds on cranberry yield and quality, and to economically prioritize management efforts based on the weed species and extent of infestation.

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DOI: https://doi.org/10.1017/wet.2022.28

Nomenclature: Bristly dewberry, *Rubus hispidus* L.; Carolina redroot, *Lachnanthes caroliana* (Lam.) Dandy; polytrichum moss,
Polytrichum commune Hedw.; earth loosestrife, *Lysimachia terrestris* (L.) Britton, Sterns & Poggenb.; cranberry, *Vaccinium macrocarpon* Ait.

Key Words: weed interference; weed competition; crop quality; thresholds

INVESTIGATING WEED CONTROL AND CROP SAFETY WITH SYNERGISTIC TANK-MIX COMBINATIONS OF SIMAZINE AND MESOTRIONE APPLIED PREEMERGENCE

Thierry Besançon, Wesley Bouchelles

Several corn studies have demonstrated that tank-mixing photosystem II (PS II)-inhibiting with 4-hydroxyphenylpyruvate dioxygenase (HPPD)-inhibitingr herbicides provided a synergistic effect for postemergence (POST) control of giant ragweed (*Ambrosia trifida*), common lambsquarters (*Chenopodium album*), velvetleaf (*Abutilon theophrasti*), and pigweed species (*Amaranthus* ssp.) (Chahal and Jhala, 2018). However, when the PS II- and HPPD-inhibitor tank-mixture is applied preemergence, the synergistic interaction varies among weed species (Bollman et al., 2006). No information is available regarding the synergistic or additive interactions of PS II- and HPPD-inhibitor applied preemergence in tank-mixture for weed control in cranberry. Since simazine (PS II) and mesotrione (HPPD) are both labeled for use on cranberry, this study investigates weed control and crop responses to different rates of these preemergence herbicides applied alone or combined.

Location and Design: The trial was conducted in 2022 at the Marucci Center in a 3-yr old cranberry bed planted with 'Haines' (bed 3). This bed is heavily infested with flatsedge (*Cyperus retrorsus*), broomsedge bluestem (*Andropogon virginicus*), poorjoe (*Diodia teres*) and orangegrass (*Hypericum gentianoides*). Each herbicide treatment was replicated four times and treatments were arranged in a randomized complete block design. Individual plot size was 36 ft2. Treatments were applied at white bud (May 3rd) or cabbagehead stage (May 12th), and included the following herbicides:

1. Untreated weedy check
2. Devrinol (napropamide) 18 qt/A.
3. Callisto (mesotrione) 8 oz/A.
4. Simazine 4L (simazine) 0.75 qt/A
5. Simazine 4L (simazine) 1.5 qt/A
6. Simazine 4L (simazine) 0.75 qt/A + Callisto (8 oz/A)
7. Simazine 4L (simazine) 1.5 qt/A + Callisto (8 oz/A)

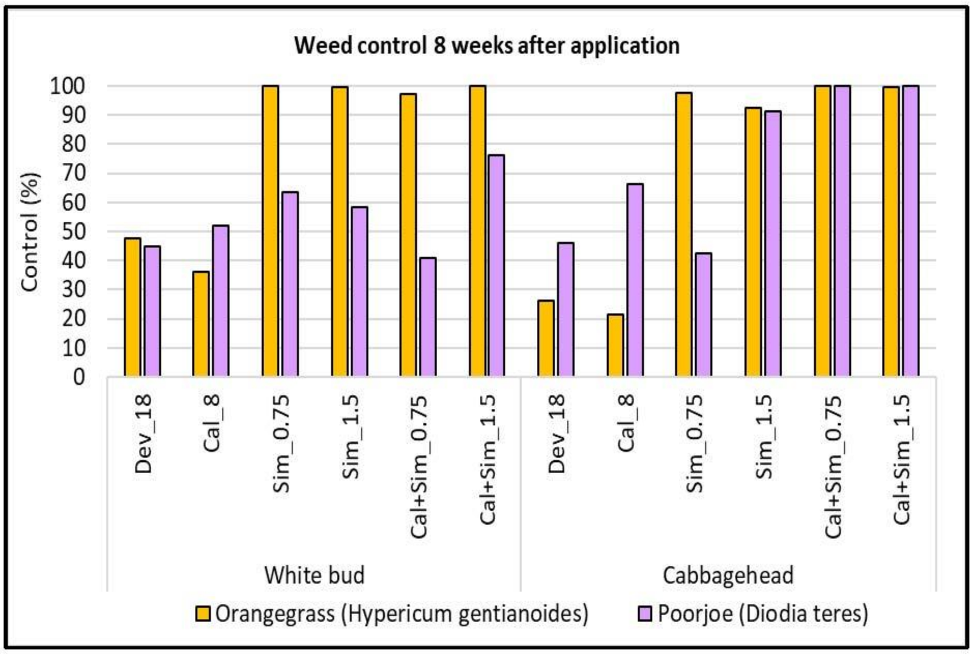
Treatments were broadcasted at 30 GPA using a 54-inch spray boom fitted with four Teejet XR8004VS flat spray tips at a pressure of 30 PSI. Irrigation and fertilization of the field studies was provided as needed during the growing season.

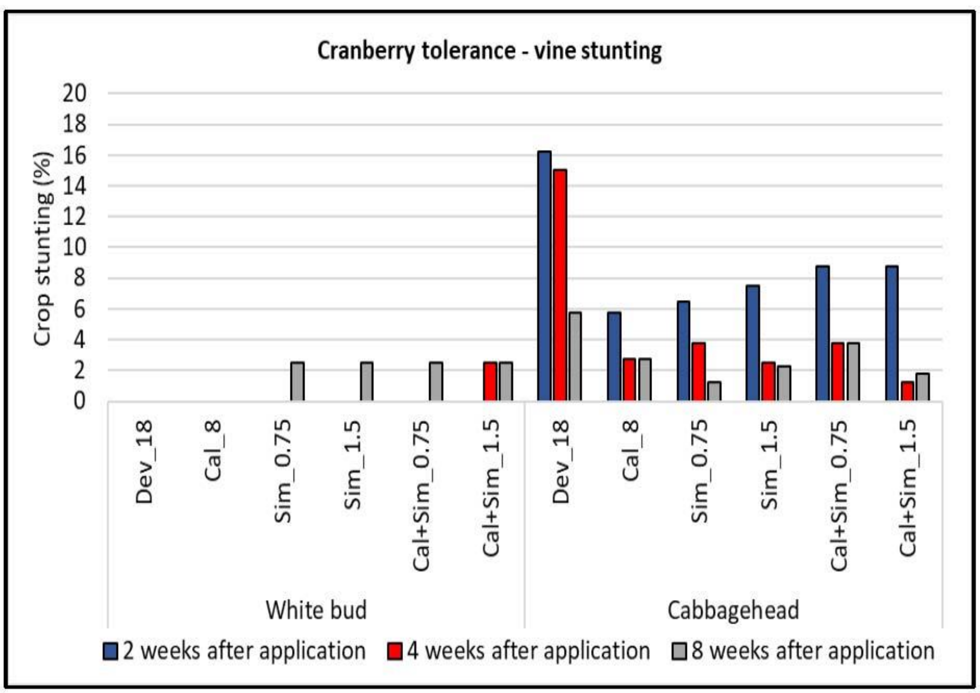
Preliminary results

Cranberry tolerance: No necrosis or chlorosis of the leaves was observed following application of the herbicide treatments. Stunting or delayed emergence of new cranberry shoots was noted following applications made at the cabbagehead stage, including the Devrinol standard application for which a 16% reduction of shoot elongation was observed 1 week after application (WAT). All treatments combining simazine and Callisto showed over 8% stunting of the new shoots 1 WAT. However, stunting was no more than 4% for all simazine treatments 8 WAT.

Weed control: Excellent control (≥ 93%) of orange grass 8 weeks after application was observed with all treatments that included simazine alone or mixed with Callisto. Devrinol or Callisto did not provide more than 48% control of orange grass 8 weeks after treatment. Poorjoe was control less than 70% will all applications made at the white bud stage. Only applications at the cabbagehead stage of simazine at 0.75 qt/A plus Callisto or simazine at 1.5 qt/A alone or combined with Callisto provided greater than 90% poorjoe control.

Use of simazine at 0.75 qt/A combined with Callisto at 8 oz/A in young beds (1-yr or older) can provide efficient control of troublesome annual broadleaf weeds such as orange grass with minor and temporary phytotoxicity response. However, this combination remains inefficient for control of emerging or established perennial monocotyledonous weed species, such as bluestem (*Andropogon* ssp.) or Carolina redroot (*Lachnanthes caroliniana*). Further studies in 2023 will be conducted to confirm results observed this year.





Phenotyping and genotyping CNJ14-31: A unique population segregating for fruit rot resistance, fruit chemistry and other traits

Sara Knowles, Joseph Kawash, Jennifer Johnson-Cicalese, James Polashock, and *Nicholi Vorsa,*
P.E. Marucci Center, Chatsworth, NJ

Due to climate change and increased fungicide restrictions, developing a more fruit rot resistant cranberry variety has become essential. In response to this need, a large, advanced population, CNJ14-31 (Fig. 1), with high yielding parentage and three diverse sources of fruit rot resistance (FRR) was planted in 2016, in 5' x 5' field plots, with 219 progeny replicated four times. Because of the large size of the population, and the fact that each progeny is replicated, it offers an exceptional opportunity to identify genetic markers for FRR and a host of other important traits in cranberry.

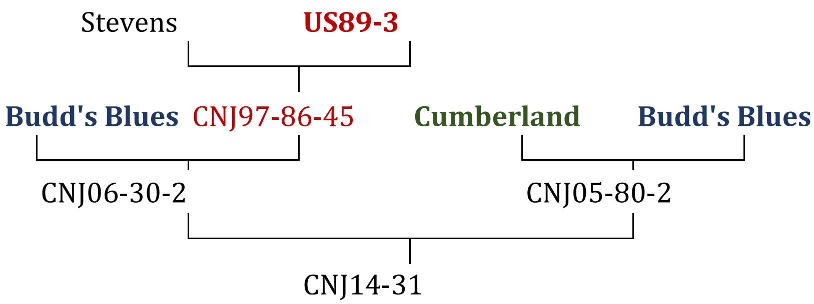


Figure 1. Pedigree of CNJ14-31 population includes 3 sources of FRR, highly resistant Budd's Blues and US89-3, and moderately resistant, but high yielding Cumberland.

Phenotyping: In 2019-2021, plots were evaluated under severe fruit rot pressure for percent fruit rot, yield, berry size, titratable acidity (TA), soluble solids (°Brix), and total anthocyanin (Tacy) content. Significant genetic variation was observed for all traits evaluated; for example, fruit rot ranged 8 - 90% (Fig. 2), yield ranged 18 – 251 g/ft^2 (Fig. 2), and TA ranged 1.6 - 2.6 %. Though major loci for organic acids contributing to TA have been identified in other *V. macrocarpon* accessions, the variability exhibited by this population suggest additional quantitative loci influence acidity.

We are seeing variability in ranges of organic acids in CNJ14-31. For example, benzoic acid makes up the least percentage of organic acid composition in the progeny, ranging 0.007 – 0.202 mg/g fruit, while malic acid is found at the highest levels, ranging 1.403 – 8.660 mg/g fruit (Fig. 3). With completion of all replications of the population in 2022, we can search for significant organic acid QTL, as well as their correlations with other traits. Other traits being evaluated include flowering period, flowers/upright, fruit set, epicuticular wax, fruit firmness and shape.

Genotyping: Genotyping-by-sequencing (GBS) was used to genotype the population. SNPs called against a cranberry reference genome were used as markers. R/qtl was used to calculate genetic distance between markers and to identify quantitative trait loci (QTL), where significance of LOD scores were calculated at $p < 0.05$. QTL were found for Tacy (Fig. 3), Brix, TA, and percent fruit rot. Further development of these markers will facilitate more efficient breeding for FRR and fruit quality.

High yielding, low fruit rot individuals were identified, which have potential for commercialization and FRR parental material. For example, progeny #142, had a mean yield of 251g/ft^2 and 12% rotted fruit (versus a susceptible control with 151g/ft^2 and 86% rot). Correlations between FRR versus horticultural and fruit chemistry traits were < |0.15|% suggesting low to no linkage, indicating traits are largely independent.

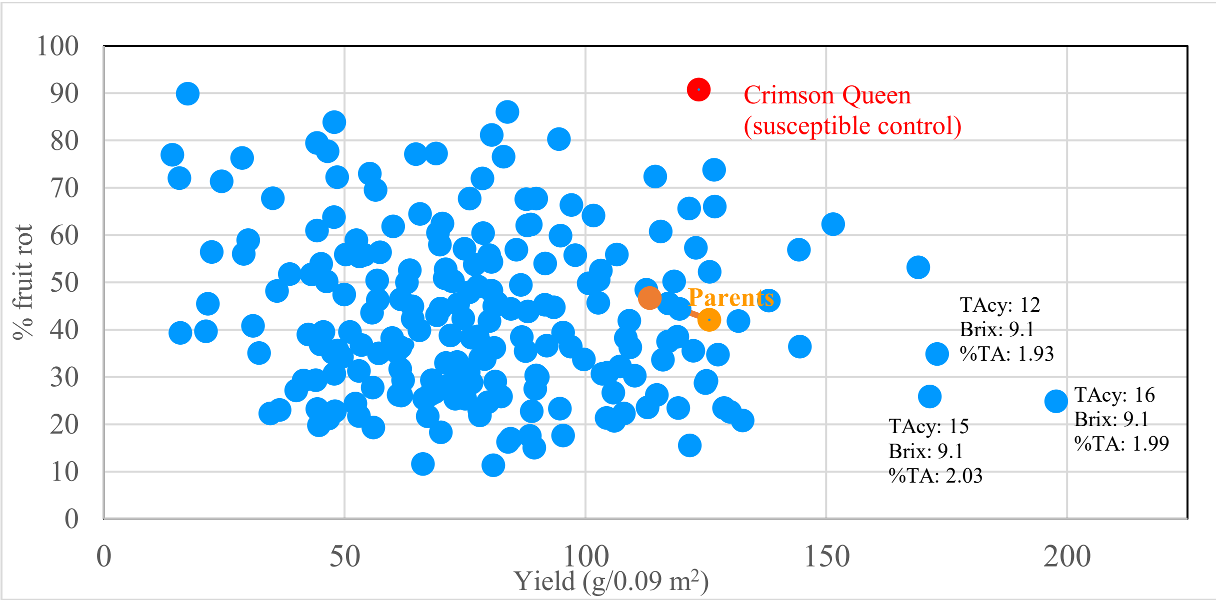


Figure 2. Plot of CNJ14-31 progeny yield and %fruit rot (mean of 2019-20). Some progeny performed better than their parents, and almost all progeny had less fruit rot than susceptible control, Crimson Queen. Fruit chemistry of the best progeny were within acceptable levels.

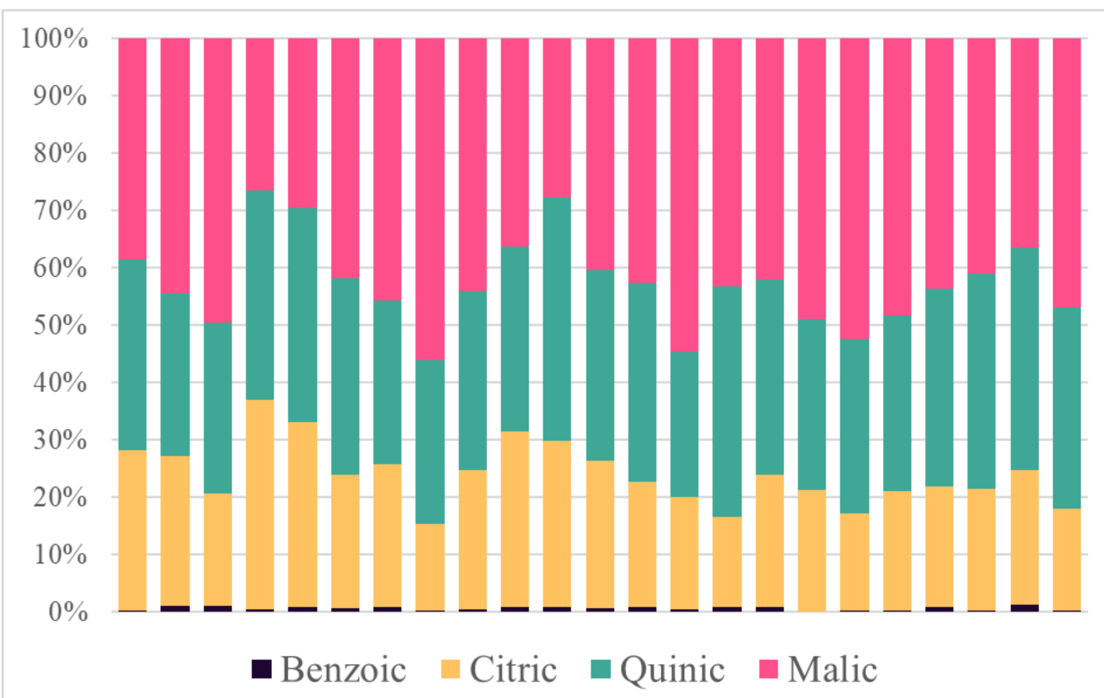


Figure 3. Snapshot view of organic acid composition of some CNJ14-31 progeny.

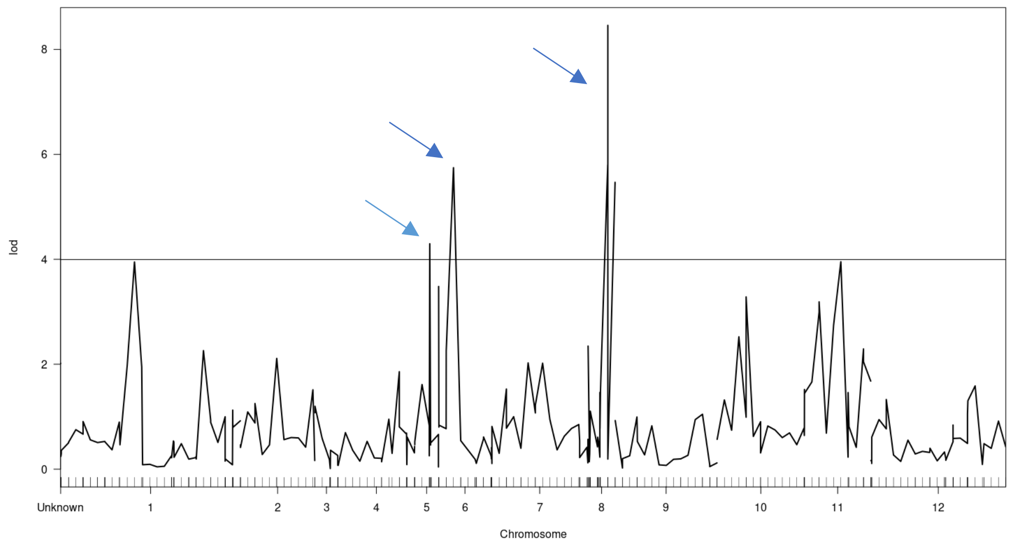


Figure 4. QTL plot for Tacy, potential markers on chr5, chr6 and chr8; LOD threshold = 4.00

Acknowledgements – Dr. Neyhart and Dr. McLaughlin for statistical support, and Thomas Spain for technical support. Research supported by USDA-NIFA-SCRI-2019-51181-30015 grant, NJAES, and the New Jersey Blueberry and Cranberry Research Council.

OVERVIEW OF THE NEW JERSEY 2022 SEASON SO FAR

Lindsay Wells-Hansen, Ph.D., Sr. Agricultural Scientist, Ocean Spray Cranberries, Chatsworth, NJ

WEATHER & PLANT DEVELOPMENT

The 2022 season started off with a week of unusually cold temperatures in late-April which delayed water draw for many growers this year. Temperatures then turned warmer, and many growers got away with only a few nights of frost watch, depending on the farm & temperature threshold being used, which was quite different than the 2021 season that was chock-full of cold night temperatures. We experienced some bizarre weather patterns throughout the growing season, with substantial temperature swings in the spring that resulted in worrying about frost one night followed by cooling irrigation runs to protect new growth soon after. Spurts of warm temperatures (>95°F) in late-May and June pushed plant growth along quickly, and many current season leaves were large in size prior to bloom as a result of early rapid growth. Drought symptoms (e.g., flagging, bronzing) were observed at the tips of uprights on some beds just prior to bloom, likely resulting from overheating of rapidly expanding, sensitive leaves during those days in which we experienced unseasonably warm temperatures.

Although we had a somewhat slow start to bloom this season (similar to 2021), warm temperatures, combined with *very* little rainfall during bloom, led to ideal pollination conditions, and fruit set looks good across the state. Fluctuating temperatures have led to somewhat variable plant growth across farms and varieties this year, and while development in most varieties has evened out, fruit size in 'Stevens' remains noticeably smaller, especially the uppermost berries that set later in the season.

Overall, the story this season is that it's been incredibly hot and humid, and until recently, we hadn't gotten any measurable rain in weeks. Growers have had to work tirelessly to manage soil & canopy moisture while keeping berry temperatures in check, with the added stressor of trying to conserve water in reservoirs for the duration of the season. This hot, dry weather has elucidated areas with drainage issues and suboptimal plant health; areas of vines with weak/shallow root systems have died despite frequent irrigation runs. Because areas of dying or dead vines look similar regardless of the cause of the browning/bronzing of vines, growers have been focusing on identifying the source of injury (e.g., moisture management, fairy ring, *Phytophthora* root rot, rootworm, girdler, etc.) of any affected vines to ensure proper management tactics are deployed. Despite these challenges, berries continue to size nicely and have started to turn red as we move toward harvest, and the crop potential looks quite promising across the state.

INSECTS

Spongy (formerly Gypsy) **Moths** once again made their debut in early May, primarily in beds in which populations were high last year. These pests were again present in high enough numbers to warrant treatment on some farms; insecticide applications were well-timed and effective, and we escaped without substantial damage. After the Spongy Moth (SM) outbreak, the insect populations were much more predictable, and in general, **Spotted Fireworm**, **Sparganothis Fruitworm** and **Blackheaded Fireworm** larval numbers were low across the board, but populations were high enough to warrant a pre-bloom insecticide application on several farms this year. Sparganothis moth trap counts were variable across farms this year; most farms averaged less than 40 moths across all traps during peak flight, while moth counts on other farms exceeded the action threshold (typically 75-100 moths per trap during peak flight), and a treatment was warranted. Peak flight was reached during the week of June 27th on some beds on some farms, but not until the week of July 4th or later on other farms. This pattern was similar to that observed in the 2021 season.

Blossomworms were swept in high enough numbers to warrant treatment on a couple farms during our pre-bloom sweep sets this year, but insecticide applications were well-timed, and we did not see the crop damage that we did last year.

Without chlorpyrifos products in our arsenal this year, growers deployed new/different insecticides (e.g., acephate, bifenthrin, sulfoxaflor) for management of **blunt-nosed leafhopper (BNLH)** nymphs in beds in which action thresholds were met, and/or in false blossom-infested bogs to which a broad-spectrum insecticide had not been applied pre-bloom in several years. All products seemed to work well to manage BNLH populations.

Damage from root-feeding insects, especially **cranberry rootworm,** was observed on several farms again this year, especially in younger (e.g., 4- to 5-year-old) plantings. Damage was visible earlier than usual in some beds (early May) and continued to become more noticeable through June, especially during bloom and early fruit set. Similar to what we observed in 2021, feeding suspected to be from adult beetles of cranberry rootworm was observed on berries and to a lesser extent, foliage, especially in beds exhibiting substantial vine damage from this pest. Growers who observed dead patches and confirmed that rootworm and/or other root-feeding insects were the cause of the damage applied a post-bloom imidacloprid (e.g., Admire Pro®) treatment for management.

Although typically not a substantial problem in NJ, **cranberry girdler** reared its head on a few farms during the 2021 season and again this year, especially on bogs/farms that have not been sanded in several years.

Cranberry toad bugs are active now, numbers are generally low (<3 per sweep set on average) across the state to date, and no plant damage associated with toad bug feeding has yet been observed.

In general, **cranberry flea beetle** numbers are currently low (<10 per sweep set on average) on most farms, and only minimal feeding has been observed on lush vegetative growth; most growers will likely not have to treat for this pest. Interestingly, flea beetle feeding on fruit has been observed in a rare (for NJ) instance this year, serving as a good reminder that although flea beetles do not typically cause damage of economic importance in NJ cranberry beds, it's a good idea to monitor their populations closely to ensure treatments are not needed.

CRANBERRY FRUIT ROT

The extremely high humidity and constant irrigation and cooling runs that have dominated much of the 2022 season make the development of **cranberry fruit rot (CFR)** a concern. That being said, conditions were generally favorable for pesticide applications during bloom and early fruit set, meaning fungicide applications targeting CFR were deployed in a timely manner on most farms this year. Unfortunately, unexpected pop-up rain showers did occur on a couple of farms immediately following a fungicide application, but the duration was short, and the rain seemed to pass without rendering the fungicide applications useless. Harvest is just a few short weeks away in early maturing beds; hopefully conditions remain favorable for a successful crop this year!

ENTOMOLOGICAL RESEARCH UPDATES

Cesar Rodriguez-Saona, Professor & Extension Specialist, *Yahel Ben-Zvi*, Department of Entomology, Rutgers University

Vera Kyryczenko-Roth and *Robert Holdcraft*, P.E. Marucci Center, Chatsworth, NJ

The continued availability of broad-spectrum insecticides, such as organophosphates and carbamates, for use in cranberries is under threat from the FQPA of 1996. In the last decade, the pesticide industry has experienced a mini-revolution in terms of registration of novel classes of insecticides, such as insect growth regulators, spinosyns, and diamides. Although these insecticides are selective, effective at low rates, and safe to the environment and human health, they have no control over piercing-sucking insects (order Hemiptera) such as blunt-nosed leafhoppers. As such, we have seen recent increases in population size and damage caused by this insect pest. Thus, it is imperative that new classes of insecticides are evaluated to ensure the availability of commercially acceptable controls to manage blunt-nosed leafhoppers in cranberries. This is particularly critical since chlorpyrifos (Lorsban), a key insecticide used for blunt-nosed leafhopper control, has been banned for use in cranberries.

Research is being conducted at the P.E. Marucci Center to: 1) Evaluate the efficacy of entomopathogenic fungi and a new insecticide against blunt-nosed leafhoppers; 2) Investigate the abundance of insect pests and their natural enemies in five varieties across cranberry farms; 3) Determine the levels of resistance among old and new varieties against multiple insect pests of cranberries.

NEW INSECTICIDES

Currently, cranberry growers in New Jersey rely on three classes of insecticides: organophosphates (Diazinon), carbamates (Sevin), and pyrethroids (Fanfare and Danitol) applied pre-bloom to manage blunt-nosed leafhopper nymphs. Some of these insecticides are under threat from the EPA Food Quality Protection Act. In addition, heavy reliance on insecticides with the same mode of action raises serious concerns on the development of insecticide-resistant pest populations. In 2022, we tested different classes of insecticides against blunt-nosed leafhoppers, which included a new (unregistered) insecticide that belongs to a new class and NoFly, a product containing the entomopathogenic fungi *Isaria fumosoroseus*.

Figure 1. Semi-field insecticide trial for blunt-nosed leafhoppers.

In 2022, studies were conducted in semi-field (P.E. Marucci Center) to evaluate the efficacy of a new (unregistered) insecticide against blunt-nosed leafhoppers nymphs.

The following treatments were evaluated: new insecticide, Danitol, and control (no insecticide). Foliar applications of these insecticides were applied to small (4-by-4 feet) cranberry plots (Figure 1). Toxicity of these insecticides was evaluated by placing leafhopper nymphs on insecticide-treated foliage. For this, five insecticide-treated uprights were inserted in florists' water picks, enclosed in a ventilated 40-dram plastic vial, and secured in Styrofoam trays. Leafhopper nymphs were then placed in the vial and the number of insects alive, dead, or missing after 7 days was recorded.

HOST-PLANT RESISTANCE

Recently, cranberry growers have been presented with new opportunities to increase production through improved high-yielding cultivars, many of which were developed by Rutgers University. These new cultivars are being grown in all cranberry-growing regions (Northeast, Midwest, and West Coast). There is, however, little information available to growers on the susceptibility of these cultivars to insect pests. A better understanding of pest-host dynamics and resistance mechanisms will help develop better management recommendations for the newer cultivars. Thus, our main goal here was to better understand insect resistance among cranberry cultivars and integrate this information into IPM recommendations if feasible.

Figure 2. Greenhouse setup for cultivar resistance trials against cranberry insect pests.

Cultivars

We tested resistance of twelve cranberry cultivars (Early Black, Howes, Ben Lear, McFarlin, Potter, Stevens, Franklin, #35, Crimson Queen, Mullica Queen, Demoranville, and Haines) to blunt-nosed leafhoppers, spongy moth, Sparganothis fruitworm, and spotted fireworm in greenhouse assays (Figure 2). Experiments were conducted at the Rutgers PE Marucci Blueberry/Cranberry Center (Chatsworth, NJ). Crimson Queen, Mullica Queen, Haines, #35, and Demoranville are five new high-yielding cultivars. We also included seven "old" varieties (Early Black, Howes, Ben Lear, McFarlin, Potter, Stevens, and Franklin) for comparison in their resistance against cranberry insect pests.

Insects

In the greenhouse, early instar nymphs and 1st instars of spongy moth, Sparganothis fruitworm, and spotted fireworm were enclosed in an upright of one of the cultivars in individual pots. Mortality and final weights were assessed after 21 days (leafhoppers), 7 days (spongy moth), and 14 days (Sparganothis fruitworm and spotted fireworm).

Mechanisms of resistance

For each variety, we measured plant growth, levels of flavonols and proanthocyanidin, as a proxy of plant defenses, and the levels of carbon and nitrogen, as a proxy of plant nutrients.

ABUNDANCE OF INSECT PESTS AND THEIR NATURAL ENEMIES IN CRANBERRY VARIETIES

The abundance of insect pests and natural enemies (predators and parasitoids) was assessed in 50 beds across three commercial cranberry farms in New Jersey. Each bed was geo-referenced to assess the landscape composition surrounding them and to characterize the type of landscape (forest, crop, other) surrounding each bed. Of the 50 beds, 10 beds are Stevens, 10 Early Black, 10 Ben Lear, 10 Mullica Queen, and 10 Crimson Queen. In each bed, we placed two yellow sticky traps, one of the traps was baited with a commercial natural enemy attractant called PredaLure (AgBio Inc.), while the other trap was unbaited. Traps were placed once a month in May, June, July, and August, and left in the field for 1 week. Trapped insects, including blunt-nosed leafhoppers and natural enemies, were counted. To assess the natural enemy function, we measured predation of sentinel eggs (using fall armyworm egg masses) in each of the beds. Sentinel eggs (N = 6 egg masses per bed) were placed in the field for 2 days (Figure 3), and the number of eggs was counted before and after field exposure to assess the level of predation. In addition, we will collect insecticide and yield records for each bed and assess levels of weeds (abundance and diversity). These data will be used to study, for the first time, the relative importance of landscape composition and local management practices on insect communities in cranberries.

Figure 3. PhD student Yahel Ben-Zvi placing sentinel egg masses in cranberry beds.

NEW JERSEY AGRICULTURAL STATISTICS

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New Jersey 2022 Cranberry Crop Forecast at 590 thousand Barrels

New Jersey cranberry producers expect to harvest 590 thousand barrels in 2021, comparable to 589 thousand barrels in 2021, according to Bruce Eklund, New Jersey State Statistician.

United States cranberry total production for the 2022 season is forecast at 7.44 million barrels, up 5 percent from the 2021 crop year. In Wisconsin production is forecast at 4.30 million barrels, up 3 percent from last year. Production in Massachusetts, forecast at 2.00 million barrels, is up 11 percent from last year. Early in the growing season, Wisconsin and Massachusetts growers reported the crop experienced cold, wet weather, and hail. The planting season started the first of week of June but was delayed due to rainy days. Warmer temperatures and better weather conditions helped cranberry plants and berries to develop. Cranberries continue to increase in size, as growers monitor fruit quality. Oregon producers expect to harvest 550 thousand barrels, up from 520,000 barrels in 2021.

NASS released this production forecast within the August 12, 2022, crop report. The NASS Northeastern Regional Office now organizes cranberry data collection and editing for all four States.

USDA's National Agricultural Statistics releases more detail in the 2022 Non-citrus Fruit and Nut Final Summary at a date to be determined in 2023. NASS released the detailed 2021 crop data in the Fruit and Nut Final Summary May 5, 2021.

Please respond to the 2022 census, to be mailed in November.

The 'Crop Production' report and all other NASS reports are available online at *www.nass.usda.gov*

Or https://www.nass.usda.gov/Publications/Reports_By_Date/index.php

IMPROVING CRANBERRY FRUIT QUALITY BY UNDERSTANDING THE MICROCLIMATE OF THE BOG

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Overview

Cranberry fruit rot is a major challenge for Northeast cranberry cultivation each year. Cranberry fruit rot is a disease complex (associated with more than a dozen fungi species). In heavy rot years, upwards of 50% of the crop may be lost. Factors such as canopy density, air circulation, light penetration, shading, irrigation, and vine health are likely to affect cranberry fruit rot, however the nature of the relationships are not yet well known. As new challenges arise, such as chemical resistance and climate change, growers are looking to reduce chemical inputs for controlling fruit rot. The goals of our project are to understand the relationships between various environmental variables and fruit quality characteristics to help growers optimize their bog-level microclimates.

On a day-to-day basis, most Massachusetts cranberry bogs are exposed to broadly similar regional weather conditions. However, they also experience unique bog-to-bog variations in conditions (the microclimate) for numerous environmental parameters such as temperature, relative humidity, and soil tension. To quantify the bogs' microclimate, we partnered with Hortau to install environmental sensors in 25 bogs in Eastern Massachusetts. The sensors record several environmental parameters including temperature, soil tension, and relative humidity at 15-minute resolution.

This is a multi-year study, however, have data for the 2021 growing season which will form the basis for the results presented here. Preliminary analyses reveal high levels of variation in microclimate throughout each day, over the entire growing season, and among individual bogs. For example, among bogs, the median soil tension over the entire growing season varied from 1 to 5 kPa. Individual bogs experienced broadly similar temperatures, however the daily low values for relative humidity varied widely among bogs. Fruit quality measures also varied greatly among bogs, ranging from 0% rot in some plots to around 60% in others.

Preliminary modeling suggests relationships among environmental variables and fruit quality measures. For example, increases in median soil tension were associated with decreases in fruit firmness. There also appear to be differences in the magnitude and significance of these associations throughout the growing season. For example, the negative relationship between fruit quality and soil tension is strongest in August and September, suggesting that there may be critical periods during which certain environmental parameters are most important during the growing season.