Fig. 1. Photo of flowering uprights taken on June 29th at Beaton Piney Wood bog in Middleboro, MA. (Credit: Olivia Capriotti)

Understanding Microclimatic Factors of Cranberry Bogs to Improve Fruit Quality

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Introduction

Fruit quality has been identified as one of the most critical agricultural challenges facing cranberry growers. One of the major difficulties with fruit quality in cranberry production is the presence of fruit rot, a disease complex comprised of a diverse set of pathogens that infect the plant. Weather-related factors such as climate change, relative humidity, and water retention can amplify the problem of fruit rot. There are also cultural factors, such as pesticide use, water input, and existing cultural practices.

Most importantly, however, microclimatic factors that exist at the plant level are also known to influence how fruit rot shows up in cranberry systems. These factors include canopy density, air circulation, light penetration, bloom progression, and upright density. **However, the role of these microclimatic factors on fruit rot and quality have not been well established yet.**

Massachusetts Cranberry Industry Overview

→ Massachusetts is the second largest producer, behind Wisconsin.
→ 90% of production is used for sweetened dried cranberries (SDC).
→ Cranberry is an important aspect of the southeastern MA economy. Cultivation started roughly around, where indigenous people

Project Background- CIG (Conservation Innovation Grant)

Prioritizing cranberry fruit quality has led to researchers at the UMass Cranberry Station looking into how growers can implement better strategies for cultivation, so that there are noticeable improvements in yield during harvest.

This research is part of a three-year CIG (Conservation Innovation Grant) project. 2021 was the initial start of the project, and in 2023 data collection will be completed and a large analysis will be conducted.

Objective

→ Obtain microclimatic data from several bogs throughout southeastern Massachusetts to assess variability and how these factors correlate with fruit rot and quality, ultimately developing best practices for cultural management that can reduce fruit rot and improve quality through smaller inputs, enhancing economic and environmental sustainability.

Goals

→ Reduce traditional pesticide use and water use through more sustainable cultural practices to protect against climate change. Warmer, more humid weather can increase cases of fruit rot.
→ Increase economic viability within the cranberry industry by providing updated evidence-based knowledge to stakeholders and community growers.

Hypothesis

There are multiple plant-level microclimatic factors that can possibly correlate with fruit quality; bloom count, canopy density, and upright density. We anticipate that there will be variability among these factors between designated cranberry bogs.

Field Methods

→Upright density (vegetative vs. reproductive upright ratio)

Tissue sampling was conducted after upright density was calculated, where only new growth from uprights were taken for testing to analyze nutrient intake. This helps decide how to proceed with fertilizer use.

→ Bloom count procedure to measure progression

At each bog, I selected 10 random uprights at four spots in the bog, and counted the number of flower buds, flowers, pinheads and fruits.

Measuring Canopy Growth and Light Penetration

→ Canopy density (height measurements with ruler)

→Plant canopy analysis using a device called a ceptometer, which calculates LAI- **leaf area index.** This utilizes the measurement of fractional PAR, **photosynthetically active radiation.**

→ Would measure between 10 a.m. and 3 p.m. when PAR is the strongest.

→ We measure canopy growth to see how much light is passing through, and for each bog how this density impacts quality of light. When there is a denser canopy, less light can enter.

Figure 2. Postdoctoral student Salisu Sulley demonstrating how to use a ceptometer to measure leaf area index. (Credit: Olivia Capriotti)

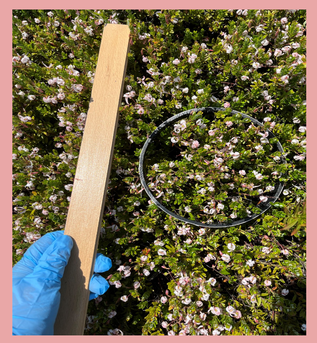

Figure 3. Ruler and 6-inch ring used for measuring canopy and upright density. (Credit: Olivia Capriotti)

Results and Observations

→ I found that near the edge of several bogs, the fruit were visually the healthiest due to the proximity of drainage.

→While I conducted mostly field work, tissue testing will be conducted when lab at the research station is complete.

→There was visual variability among bogs, from canopy density to how far each bog was progressing in relation to bloom counts of the fruit.

Figures 4 & 5. June 22nd – August 5th bloom progression in Carver. (Credit: Olivia Capriotti)

Implications for future research and practice

Once data is collected in the summer of 2023, it will be provided for the grower community to improve cranberry production, so that on an economic level, the cranberry industry is maintained, along with ensuring that environmental sustainability can take place to enhance the local climate. Further data will include an in-depth analysis of tissue samples to assess more nutrient availability. The growing season and part of the plant is crucial for nutrient analysis. Lastly, using this data after next year can help assess how climate change continues to impact these factors of fruit quality.

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