Title: Assessing the effect of different Nitrogen fertilization rates on the postharvest quality of 'Ouachita' grown in South Georgia

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Abstract:

This research was conducted in a 4-year-old 'Ouachita' blackberry field located in Omega, GA. Three different N treatments were applied: T1: 80 lb/acre, T2:40 lb\acre, and T3: No N fertilization. Each treatment was replicated three times. This experiment began in March 2022 and ended in July 2023**.** Blackberries were hand harvested and total yield, berry size, firmness, marketable yield, total soluble solids (TSS), berry weight, titratable acidity, and anthocyanin content were analyzed. The yield per plant was significantly higher when no N was applied, but the marketable yield was not affected. No significant differences were found among N treatments in any of the fruit quality parameters measured.

Introduction

The blackberry industry in Georgia has grown from 300 acres in 2009 to 800 acres in 2017 (U.S Department of Agriculture (USDA, 2021). However, the guidelines for blackberry fertilization in Georgia were revised in 2001 (Krewer et al, 2001). Furthermore, the Southeast Regional Caneberry Production Guide was reviewed and updated in 2016 on the basis of research published around 1999 and 2001(Fernandez et al.,2016). Thus, it is important to assess the current fertilization practices used by the blackberry industry in Georgia to help them achieve higher yields, produce healthier crops, and provide consumers with superior fruit quality.

Georgia soils have a loamy sandy texture and are acidic (4.5-5.5 pH); thus, growers use lime to increase soil pH for blackberry cultivation (Pederson and Lathem, 2021). Constant Nitrogen fertilization reduces soil pH, which could affect plant nutrient availability and cause nutrient deficiencies (Hart et al, 2006). In addition, soil mineral nutrients constantly change because of erosion, leaching, chemical fertilization, and plant uptake. Deficient or excessive nutrient fertilization affects plant developmental stages, reduces productivity, makes plants susceptible to pests and diseases, and decreases the postharvest quality of berry crops (Prange and DeEll, 1997). Indeed, deficiencies or excessive nutrient fertilization lead to nutrient imbalances. An example of this is the decrease in leaf calcium content with increasing N fertilization (Naraguma and Clark, 1998). In addition, excessive fertilization leads to fertilizer loss, excessive nutrient concentration in the soil (which could lead to increased salinity), and unsustainable management practices (Bryla, 2011). The objectives of this research were 1.) Determine the effect of different Nitrogen fertilization rates on the postharvest quality of 'Ouachita,'2.) Determine the effect of different Nitrogen fertilization rates on the marketable yield of 'Ouachita'.

Materials and Methods

Blackberry plants of the cultivar 'Ouachita' located in Omega Georgia at S&P Berry farm (31°19'43.1"N 83°34'44.5"W) were used in this study. The plants were about four years old. The treatments were 80 lb. N/acre, 40 lb. N/acre, and Zero N. Leaf tissue samples were collected to determine the concentration of N. After harvest, the berries were separated into marketable and unmarketable berries, and culls were weighted to quantify the percentage of unmarketable yields. Data on firmness, size, and berry weight were collected. Fruit juice was extracted to analyze for titratable acidity (TA) using an 810 Metrohm titrator, total soluble solids using a digital Atago refractometer, and anthocyanins using a Biotek microplate reader.

Results

Leaf N concentration was not affected by N treatment (Figure 1). Leave N levels were the same among treatments during the growing season. Leaf N increased by the end of April following a normal growing season. Marketable yield did not show any significant difference among treatments, but total yield per plant in the zero N treatment was significantly higher ($p < 0.05$) than when the plants received 80 lbs. of N per acre (Figure 2a and b). Firmness, size, berry weight, fruit acidity, pH, and TSS did not show any significant difference among treatments. However, rain reduced fruit firmness ($p < 0.05$), and firmness was lower when it rained the day before harvest (Figure 3). The anthocyanin content was not affected by N treatment (Figure 4).

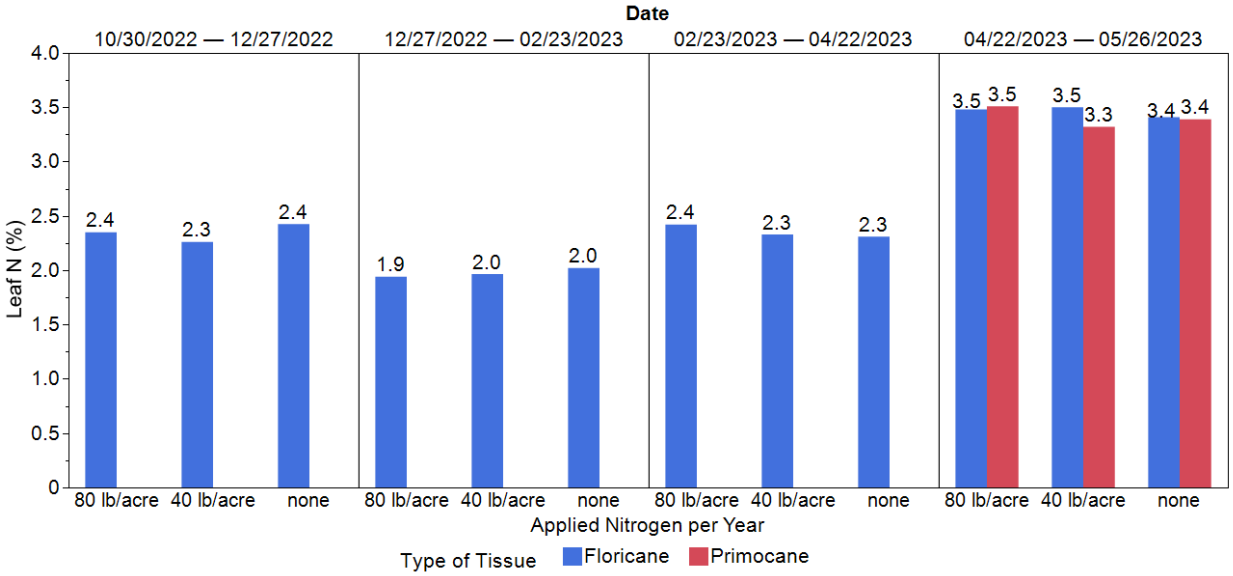

Figure 1. Leaf N concentration from October 2022 to the end of May 2023 under three different N rates: 80, 40, and 0 lbs. N per acre per year. Blue bars represent levels from the floricane and red bars represent leaf N levels for primocane.

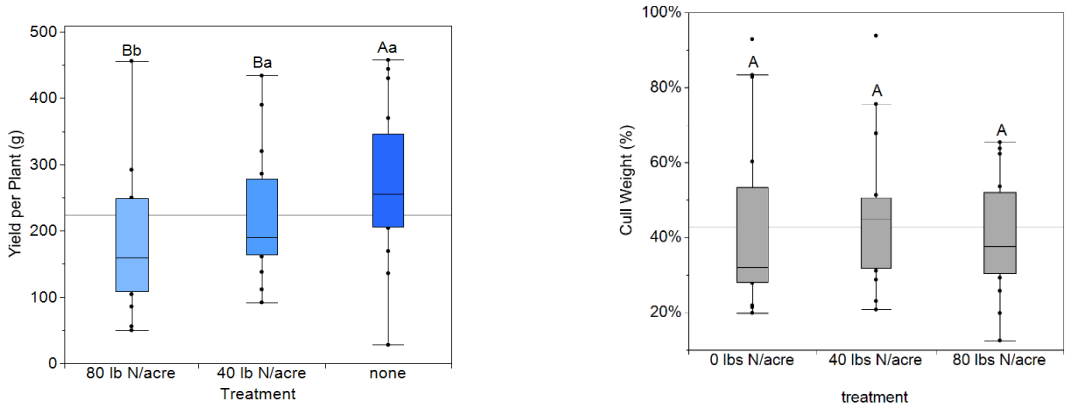

Figure 2. a. Yield per plant in grams under three fertilization doses: 80, 40, and 0 lb. N per acre per year. Different letters represent significant differences ($p < 0.05$). **b.** Percentage of culls per treatment.

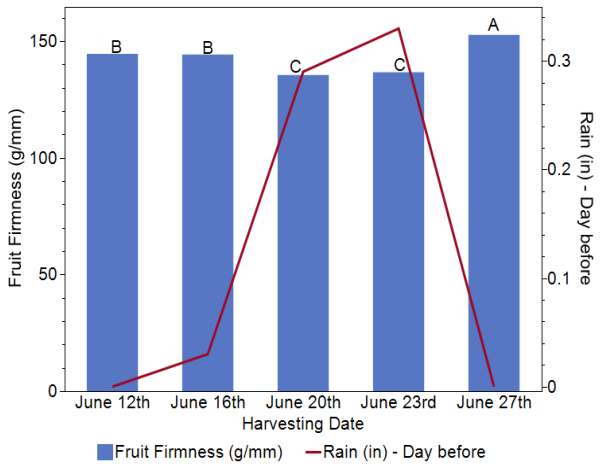

Figure 3. Fruit firmness gram per millimeter (Left Y axis) and Rain (in) the day before harvest (Right Y axis) on different harvesting dates. Different letters represent significant differences ($p < 0.05$).

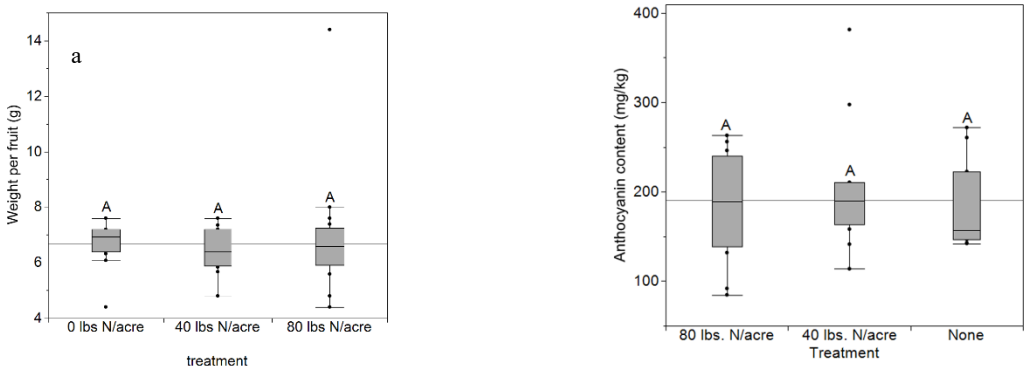

Figure 4. a Weight per fruit (berry weight) in grams under three fertilization doses: 80, 40, and 0 lb. N per acre per year. **b**. Anthocyanin content in milligrams per kilogram. The same letters represent no significant differences ($p > 0.05$).

Conclusion

The results obtained in this study demonstrated that different rates of N fertilizer did not affect yield and fruit quality in 'Ouachita' blackberries. However, more years' worth of data is needed to better understand the effects of different N rates on yield and quality, as this study has only one year of data.

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