Progress Report for the Project Entitled "Use of 1-Methylcyclopropene (1-MCP) to Prolong Storage Life and Quality of the Blackberry

Introduction

Alabama has seen a 136% increase in the number of strawberry farms from 2012 until 2017. During the same period, there was a 58% increase in the number of operations in the US

There is a small window of marketability for blackberries caused by a short storage life, resulting from thin and fragile skin of the berry, physiological disorders such as white drupelet and red reversion, and microbial growth. Several new preservation techniques have been developed for blackberries, but these options are not available to commercial blackberry growers in Alabama.

An alternative strategy is found in the use of 1-methylcyclopropene (1-MCP). 1-MCP emitted as a gas effectively prolongs shelf life by competing with ethylene for ethylene binding sites on the surfaces of climacteric fruit. Though its use is primarily for climacteric fruit, 1-MCP has been shown to slow color change and softening of non-climacteric fruit. For instance, strawberries are not known to be climacteric, but the tiny amounts of ethylene produced in storage can accelerate metabolism and reduce storage life. More recently, a convenient delivery system for 1-MCP comes in the form of sachets. Sachets contain a matrix which releases 1-MCP gas in the headspace of the fruit storage container. This released 1-MCP in gas form competes with ethylene, prolonging the shelf-life of fruit. If effective, 1-MCP sachets can easily be adopted by growers as a means to prolong the shelf-life of blackberries. More knowledge is needed concerning the use of 1-MCP for prolonging storage life in blackberries.

Objective

The objective of this report is to provide an update on the progress of this project which aims to determine the effects of 1-MCP on some aspects of the storage life of blackberry fruit.

Procedure Description

Fruit from 'Kiowa' and 'Natchez' blackberry cultivarharvested from an established cultivar evaluation at the Chilton Research and Extension Center (CREC) in Clanton, AL (lat. 32° 55'08'' N, long. 86° 40'23'' W). Cultivars in this experiment were arranged in 7 single plant replications and were arranged in a randomized complete block design. Samples from each plot were placed in two 2-quart vented clamshells, which were placed in a cooler equipped with ice packs and transported to a lab on the main campus of Auburn University. Upon arrival at the lab, samples were divided in half and each half was placed in an airtight plastic container (16.63 in. x 10.13 in. x 7.75 in.). Each sample received one of two postharvest cold storage treatments: 1) cold storage with a single 1-MCP sachet (Single Hazel 100™ 1-MCP sachets, Hazel Technologies, Chicago, IL) or 2) cold storage with no 1-MCP sachet. Blackberries in both treatments were stored at 4 °C at 85-90% relative humidity for up to 15 days. Postharvest evaluations began on Day 0 and continue every 5 days during postharvest storage.

During each postharvest evaluation, a 20-berry sub-sample was collected from each sample to measure weight loss using an analytical balance. Additionally, compression texture profile analysis was performed using a TA.XT2i stable Micro Systems texture analyzer with Texture Expert Programs (Stable Microsystems Ltd., Surrey, England).

At each postharvest evaluation, visual ratings for percentage of red reversion, and WDD were assessed. Colorimetric measurements using a ColorFlex EZ Spectrophotometer (Hunter Lab, Reston, VA) were made to measure color and reflectance. In addition, 5-fruit sub-samples from each sample was placed in a Ziplock bag, labeled according to treatment, and held at -80 C for fruit chemistry analyses in the Trandel and Spiers labs. Fruit chemistry assays will include soluble solids content, pH, titratable acidity, and sugar: acid ratio. Total monomeric anthocyanin and total phenolic content will be analyzed by microplate using the methods of Lee et al. (2008) and Singleton et al. (1998).

Results

There were no interactions between cultivar and post-harvest treatment for firmness, percent weight loss, red drupelet reversion or among any of the color coordinates (Table 1). The only interaction noted between cultivar and storage time point was in red drupelet reversion. The treatment main effect of cultivar was significant in firmness, red drupelet reversion, and color coordinate a* and chroma (c*). There was no significant effect of post-harvest treatment (1-MCP or no 1-MCP) on any of the variables.

The incidence of RDR was similar on Day 5, Day 10, and Day 15 in 'Natchez' (Figure 1). The incidence of RDR occurring in these days was significantly higher than in Day 0. RDR was similar on Day 5 and Day 0. In 'Kiowa' incidence of RDR was similar at Day 10 and Day 15. As in 'Natchez', the incidence of RDR at Day 5 and Day 0 were similar to each other, while it was higher at Days 10 and 15 when compared to Day 0.

Some differences were noted in firmness and color. 'Natchez' berries were firmer than was 'Kiowa' berries. Color coordinate a* and c* were higher in 'Kiowa' than in 'Natchez'.

Discussion

1-MCP did not have a noticeable effect on the storage duration of either 'Kiowa' or 'Natchez'. Difference in quality during storage was attributed to cultivar and storage duration.

Firmness was higher in 'Natchez' than in 'Kiowa'. This was expected because there was considerable leakage in 'Kiowa' berries. The incidence of RDR followed similar trends in both cultivars. Similarly, significant increase was delayed until after berries had been in storage for five days and remained unchanged from Day 5 through Day 15. Finally, Kiowa' contained more red pigment than 'Natchez' according to the a* value and had a more vibrant color as was indicated by the c* value. When this study is repeated, we will increase the number of 1-MCP sachets to place in containers while berries are in storage.

Conclusion

‘Kiowa’ is likely the more appealing to the consumer, but it doesn’t hold up as well in storage compared to ‘Natchez’. When this study is repeated, efforts should be made to determine the optimal number of 1-MCP sachets to effect change in the quality of blackberries while in storage.

Table 1. Treatment Interaction and Treatment Effects

	Firmness	% Weight Loss	Red Drupelet Reversion	l*	a*	b*	c*	h*
Cultivar x Post Harv. Trt.	*[z]	*	*	*	*	*	*	*
Cultivar x Time Point	*	*	**[y]	*	*	*	*	*
Cultivar	**	*	**	*	**	*	**	*
Post Harv. Trt.	*	*	*	*	*	*	*	*

[Z]With the exception of color coordinates, a single asterisk indicates no significant at $\alpha \leq 0.05$
[y]Double asterisk indicates significant at $\alpha \leq 0.05$

Figure 1. The Effects of Storage Duration on the Incidence of Red Drupelet in 'Kiowa' and 'Natchez' Blackberry Cultivars

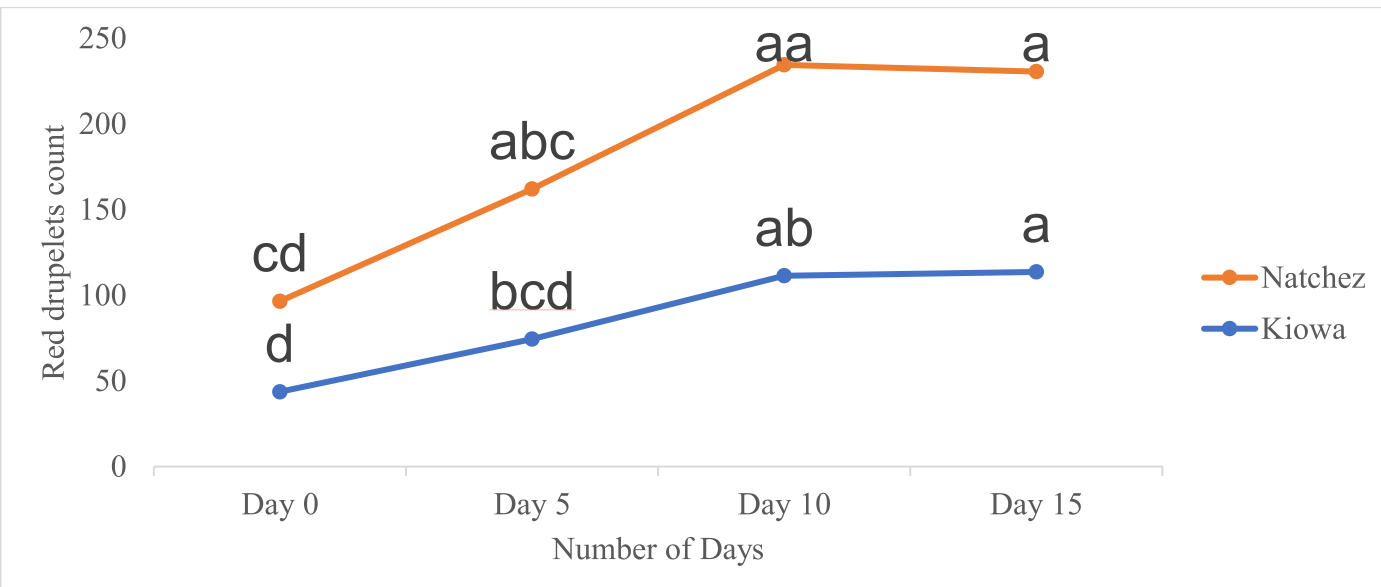

Figure 2. The Effects of Cultivar on Firmness in 'Kiowa' and 'Natchez'

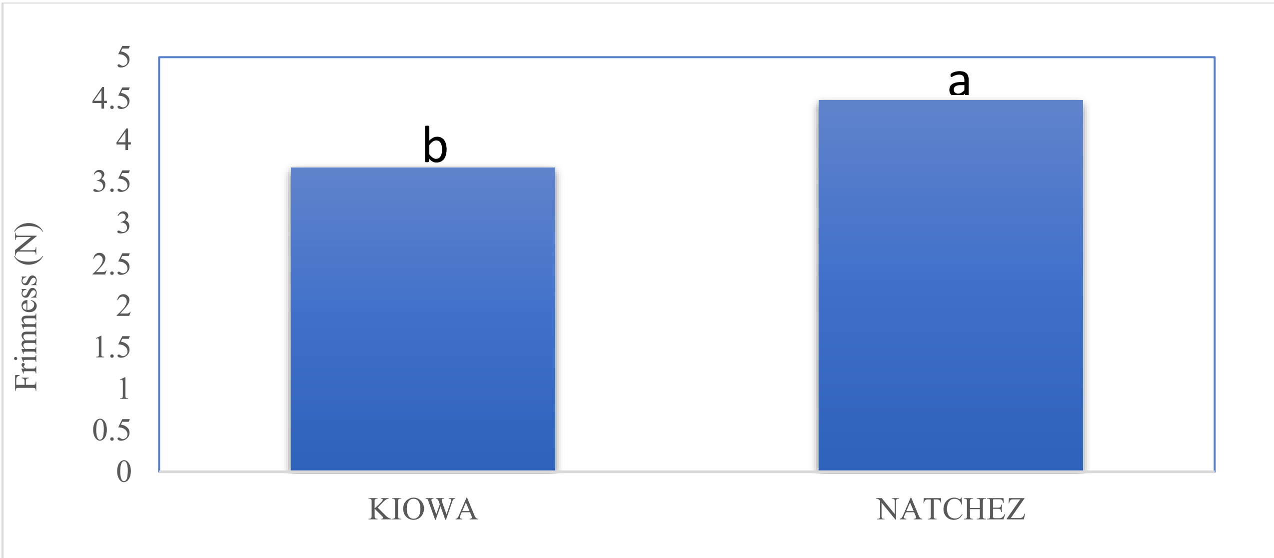

Figure 3. Color Dynamics of 'Kiowa' and 'Natchez' Blackberries while in storage.