Progress Report for the Project Entitled "Use of 1-Methylcyclopropene (1-MCP) to Prolong Storage Life and Improve Quality of Prominent Strawberry Cultivars in South Atlantic Region

Introduction

Consumer awareness of health promoting qualities of strawberries continues to increase along with increasing acreage in the US devoted to strawberry production. Alabama has seen a 64% increase in the number of strawberry farms since 2012. In the South Atlantic Region, grower acreage tends to be small, and markets are generally regional, so strawberries tend to be riper (at or close to full red color) than those from large production areas.

Postharvest decay in strawberries remains a major challenge in the industry despite numerous advances in postharvest technologies during the past decade. The sensory and nutritional attributes are related to traits firmness, color, aroma, sweetness, and Vitamin C and phenolic compounds. Changes in physical properties and chemical composition of the fruit occur in storage and can have an effect on consumer preferences and acceptance.

Decreased shelf life in strawberries is often a result of an acceleration in fruit ripeness in storage. In climacteric fruit such as apple or banana, there is an increase in ethylene production and a corresponding increase in respiration in the fruit. Strawberries are not known as climacteric fruit although the tiny amounts of ethylene produced in storage can accelerate metabolism and reduce storage life. Accelerated ripening leads to reduced shelf life. In addition, ethylene can cause browning and shriveling of strawberry calyxes, which can further reduce consumer perception of freshness and acceptability.

An emerging alternative strategy to improve shelf life in strawberries is use of 1-methylcyclopropene (1-MCP). found that 1-MCP protect the calyx from degradation. While in storage, fruit are exposed to 1-MCP gas. One of these systems uses sachets, which contain a matrix that releases 1-MCP gas into the headspace of the storage container. The 1-MCP gas blocks ethylene activity, prolonging fruit shelf life. As the South Atlantic region tends to produce strawberries for market that are often close to full red, incorporation of sachets will be a simple grower strategy if the sachets help slow softening and potential decay development.

Objective

The objective of this study is to determine the effects of 1-MCP on fruit color and total anthocyanin, soluble solids content (sweetness), titratable acidity (sourness), and total phenolic content in commonly used strawberry cultivars. In addition, we will determine the usefulness of 1-MCP in preventing water loss, gloss loss, and calyx browning of stored strawberry fruit and potential negative effects, such as enhancing decay. The current report focuses on the ability of treatments to reduce weight loss through loss of moisture and the color intensity of the calyxes.

Procedure Description

Strawberry fruit of two of the most cultivars, ‘Camarosa’ and ‘Camino Real’ will be harvested from a local strawberry grower in Chilton County, AL. The ‘Camarosa’ and ‘Camino Real’ varieties were in planting in adjacent fields in the operation. The cultivar evaluation will be established using the annual hill plasticulture system. Rows (beds) were spaced on 6 ft. centers. Strawberry plants were set in double staggered rows. Within-row spacing was 12 in. and between row spacing was 14 in.

Marketable fruit of each variety were divided among six two-quart clamshell containers. Three clamshells per variety were placed in a wax coated box (16.63 in. x 10.13 in. x 7.75 in.) which contained a single 1-MCP sachet, while the remaining three clamshells were placed in a wax coated box with the same dimensions with no 1-MCP sachet. Both boxes were placed in cold storage at 5 °C for 48 hrs. After 48 hrs. samples were removed from cold storage, placed in unsealed plastic bags at room temperature (20.9 °C). At 0, 2, 4 and 6 days after storage the following were measured: Percentage of fruit decay, fruit weight, greenness of calyxes, fruit color, and fruit firmness. Additionally, a five-fruit sample from each clamshell was placed in individual freezer bags and stored at -20 °C for fruit chemistry analyses.

Results

The current results will focus on the effects of 1-MCP on early and late season weight loss as well as chroma values of the calyxes in ‘Camarosa’ and ‘Camino Real’ strawberry varieties.

In the early season, strawberry weight loss trended similarly in ‘Camarosa’ strawberries treated with 1-MCP and untreated strawberries (Figure 1) decreasing steadily at each day after cold storage. Weight loss decreased steadily after storage in ‘Camino Real’ strawberries. ‘Camino Real’ strawberries treated with 1-MCP (Figure 2) were able to maintain slightly higher weights than the non-treated berries.

In the late season harvest, ‘Camarosa’ and ‘Camino Real’ strawberries treated with 1-MCP maintained slightly higher weights at each day after storage with the exception of treated ‘Camino Real’ six days after storage (Figures 3 and 4). Oftentimes strawberry weights of both varieties were slightly higher in the treated berries even at harvest (Day 00).

Lower chroma values indicate a darker color. Chroma values vacillated among treated and untreated ‘Camarosa’ strawberry calyxes in the early season harvest with lower values at 0 and 2 days after storage (Figure 5). Early season ‘Camino Real’ strawberries treated with 1-MCP were lower than non-treated berries at 0 and 2 days after storage (Figure 6). In late season strawberries, chroma values of strawberry calyxes trended similarly (Figures 7 and 8).

Summary

Strawberries of both cultivars that were harvested later in the season seemed to maintain slightly higher weights when treated with 1-MCP sachets while in cold storage. Regardless of the harvest period, 1-MCP sachets appeared to have little effect on calyx color. Factors influencing consumer choice and nutrition are color, firmness, antioxidant content, and vitamin C contend of different strawberry varieties. More data is needed to determine the value of using 1-MCP to protect strawberries in cold storage.

Figure 1. Effect of 1-MCP on Weight Loss of 'Camarosa' Strawberry at Harvest Day 0, 2, 4, and 6 Days at Room Temperature after 48 Hrs. of Cold Storage

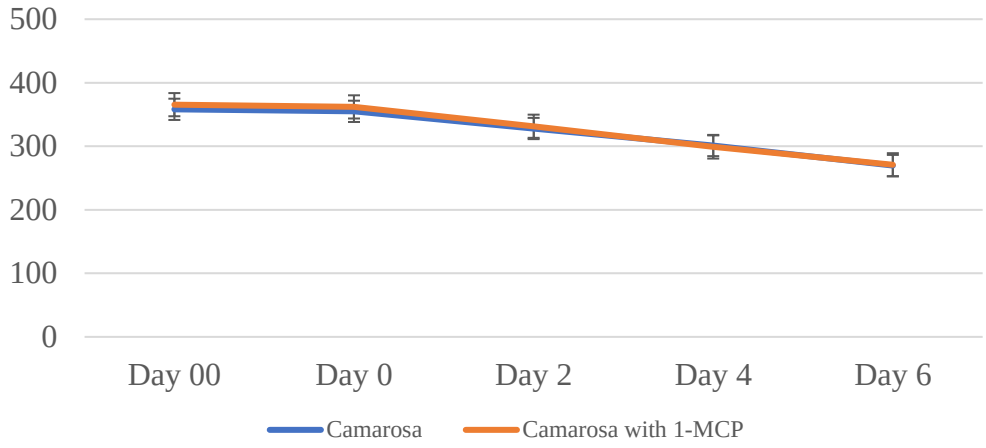

Figure 2. Effect of 1-MCP on Weight Loss of 'Camino Real' Strawberry at Harvest Day 0, 2, 4, and 6 Days at Room Temperature after 48 Hrs. of Cold Storage

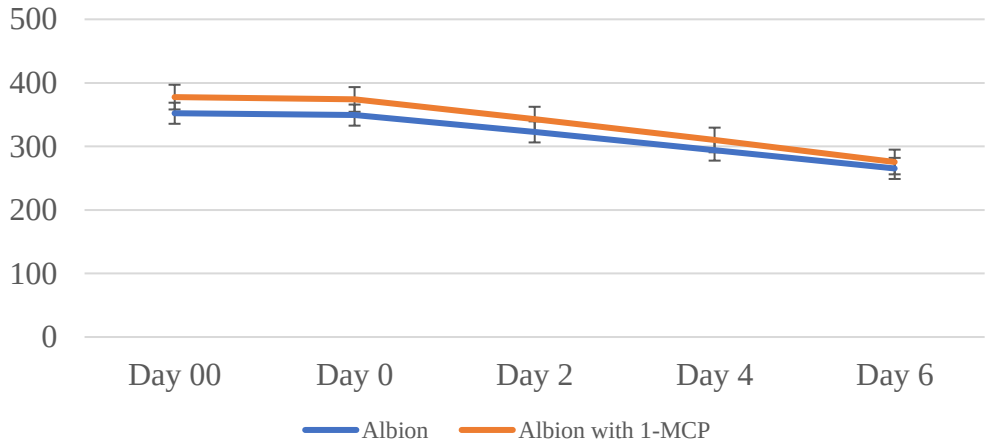

Figure 3. Effect of 1-MCP on Weight Loss of Late Season 'Camarosa' Strawberry at Harvest (Day 00) and at 0, 2, 4, and 6 Days at Room Temperature after 48 Hrs. of Cold Storage

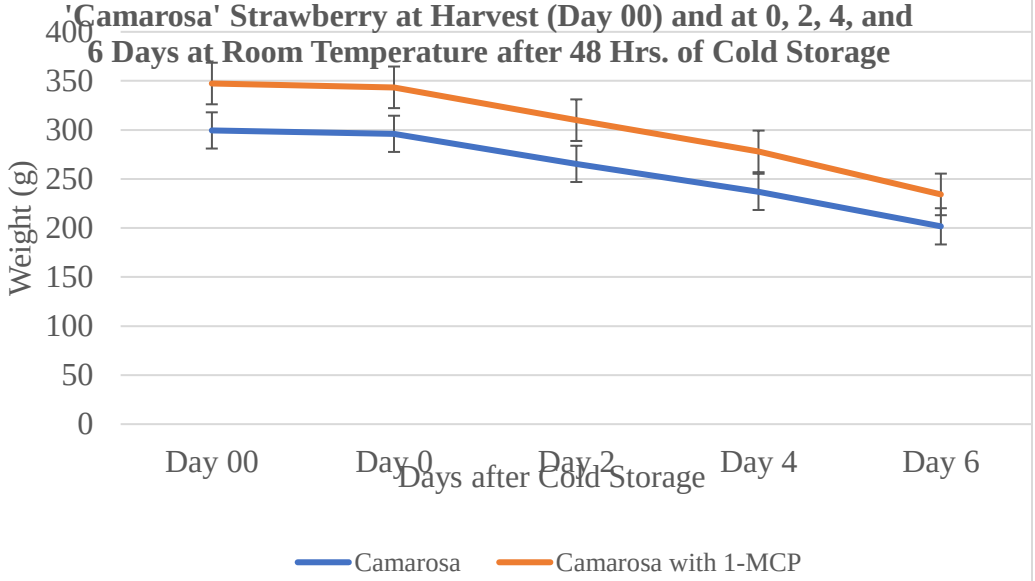

Figure 4. Effect of 1-MCP on Weight Loss of Late Season 'Camino Real' Strawberry at Harvest(Day 00) and at 0, 2, 4, and 6 Days at Room Temperature after 48 Hrs. of Cold Storage

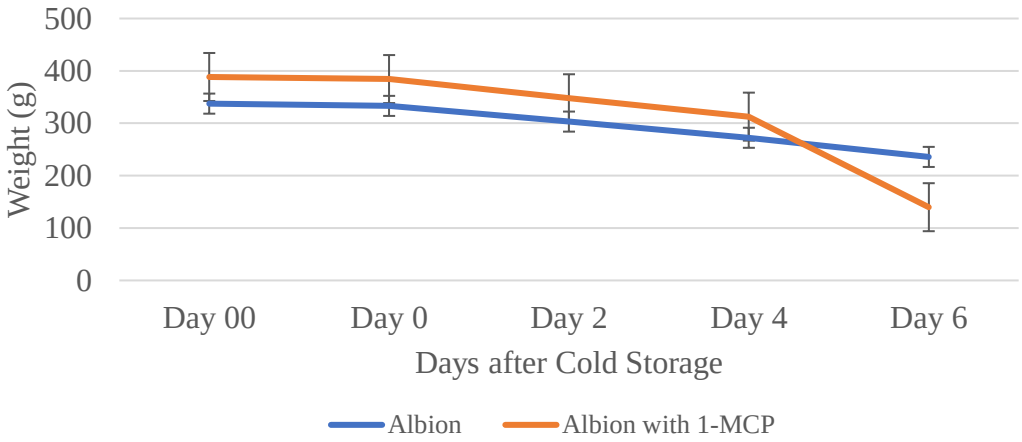

Figure 5. Effect of 1-MCP on Chroma Values on Strawberry Fruit Calyxes in Early Season 'Camarosa' Strawberries

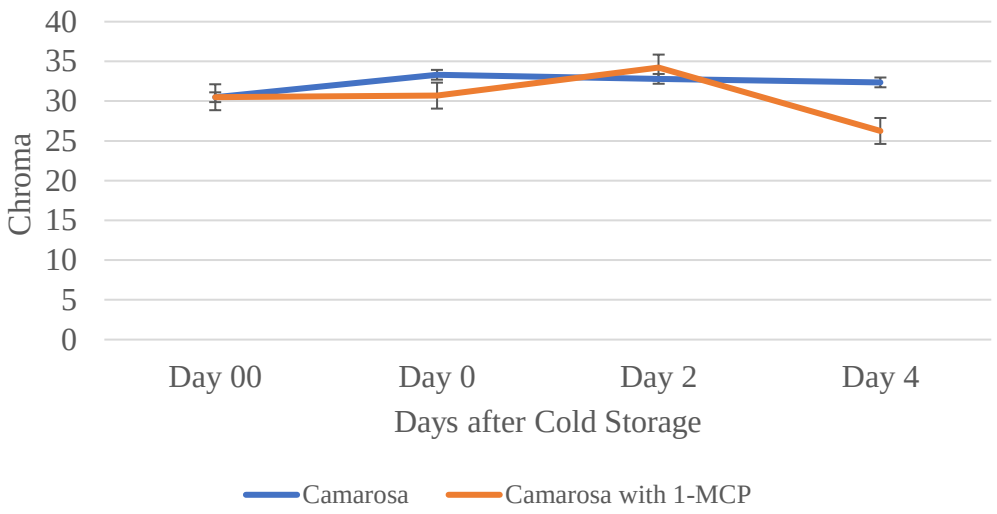

Figure 6. Effect of 1-MCP on Chroma Values on Strawberry Fruit Calyxes in Early Season 'Camino Real' Strawberries

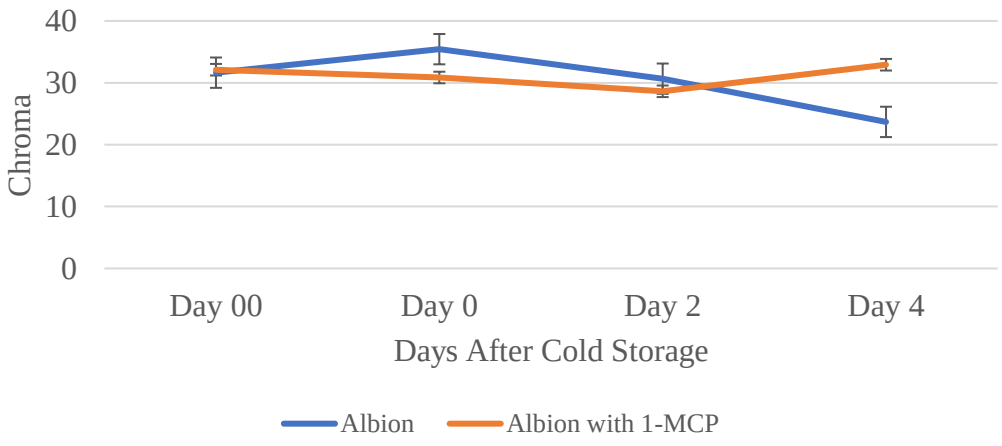

Figure 7. Effect of 1-MCP on Chroma Values on Strawberry Fruit Calyxes in Late Season 'Camarosa' Strawberries

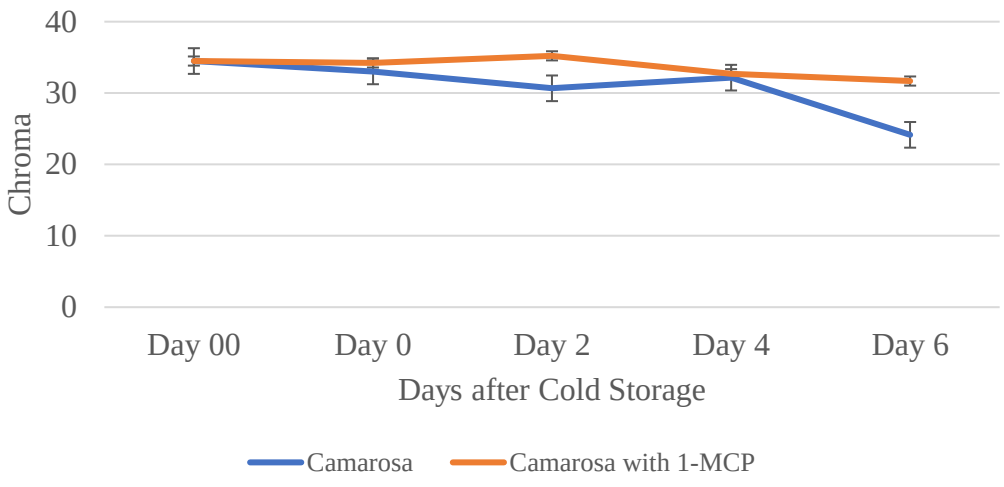

Figure 8. Effect of 1-MCP on Chroma Values on Strawberry Fruit Calyxes in Late Season 'Camino Real' Strawberries