

Progress Report for the Project entitled “Pre-harvest Chitosan Application for Postharvest Disease Control and Shelf Life Extension of ‘Camarosa’ Strawberry”

Introduction

Strawberries (*Fragaria x ananassa*) are highly perishable and prone to postharvest decay. Decreased shelf life is often a result of an acceleration in fruit ripeness in storage. Increased public concern for food safety has prompted a need for the use of pesticides that are generally regarded as safe (GRAS). Chitosan (a derivative of chitin from the seafood industry), and oregano essential oil (OEO) have been shown to be environmentally friendly alternatives to chemical fungicides.

Objective

The objective was to determine the effects of pre-harvest chitosan and OEO on preserving strawberry qualities in storage and crop yield characteristics.

Procedure Description

Chitosan was applied to experimental plots at rates of 0%, 0.5%, or 1% with or without 1% OEO. Control treatment consisted of weekly applications of captan with or without 1% OEO. Strawberries were harvested 12 times. On selected harvests, berries from each treatment were placed in clamshells according to treatment and placed at 5 °C for 24 hrs before being placed at 20.9 °C at 33% humidity. Chemical and physical attributes measured were color, texture, soluble solids, pH, total acids, anthocyanin, and total phenolics. These data were measured in berries following harvest and at 0, 2, 4, and 6 days at room temperature.

Results

Interactions. The interaction between chitosan and OEO affected anthocyanin content, while the interaction between chitosan and storage affected total phenolics (Table 1). Treatments that did not receive 1% oil were significantly lower in soluble solids than those that did receive 1% oil at day 0.

pH. At days 4 and 6, OEO treatments had higher pH values than those that received OEO (Fig. 2). total acid content was significantly higher in treatments that did not receive OEO after 6 days in storage (Fig 3).

Anthocyanin content. In treatments that received OEO, 5% chitosan produced significantly more anthocyanin content than the fungicide control (Fig 4). OEO appeared to increase total phenolics.

Total phenolic content. Chitosan applied at 1% concentration increased total phenolic content when compared to the fungicide control, while oil applied alone reduced weight loss in storage compared to the control (Table 2).

Color. Using the L a b color coordinates, chitosan applied at 1% and 0.5% had the highest L values late in the storage period (Day 6) compared to the fungicide control treatment and the 0% chitosan treatment (Table 3). In addition, 1% chitosan and 0.5% chitosan had a-values that were similar to the fungicide control, but significantly higher than the 0% chitosan treatment at 6 days at room temperature storage (Table 3.)

Summary

It was determined that pre-harvest applications of OEO and chitosan appear to be effective alternatives to conventional fungicide spray programs for improving physical and chemical attributes of ‘Camarosa’ strawberry. More work is needed to determine the reliability of these products. Additionally, since storability is at least partially variety dependent, these products should be tested on strawberry cultivars that dominate particular regions of the U.S.

Table 1. Effect of OEO*storage, chitosan*OEO, Chitosan*storage, and chitosan*OEO*storage interactions on soluble solids, pH, total acid, anthocyanin, and total phenolics in ‘Camarosa’ strawberry.

Treatment	Sol. Solids	pH	Total Acid	Anthocyanin	Total Phenolics
+/- OEO*Storage	*	*	*	NS	*
Chitosan*OEO	NS	NS	NS	*	NS
Chitosan*Storage	NS	NS	NS	NS	*
Chitosan*OEO*Storage	NS	NS	NS	NS	NS

Fig 1. Percent soluble solids in ‘Camarosa’ Strawberries at room temperature following 24 hr. cold storage

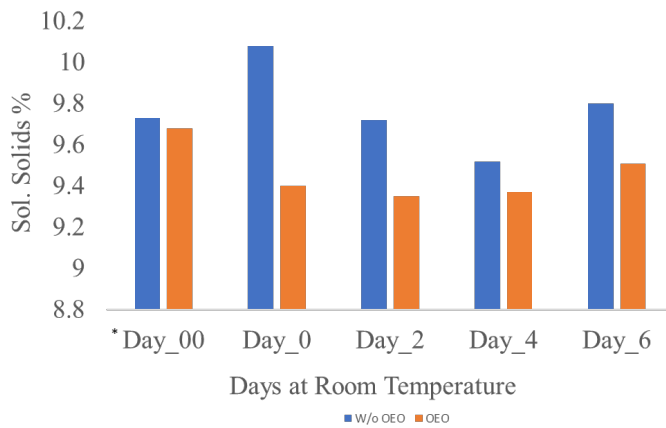
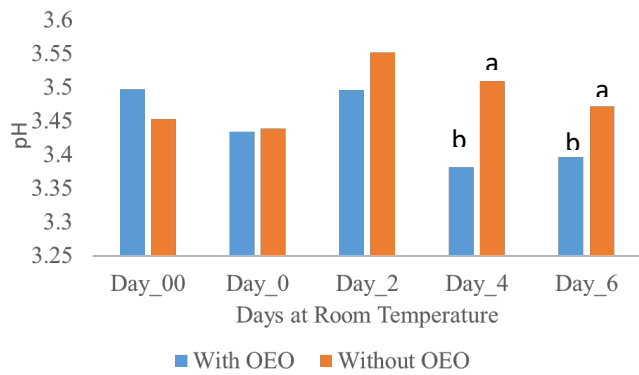
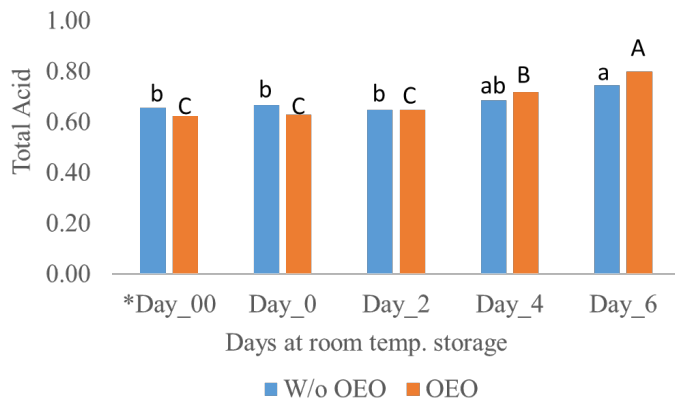


Figure 2. Effect of room temperature storage on pH in ‘Camarosa’ strawberries treated with chitosan and/or chitosan and oregano essential oil*



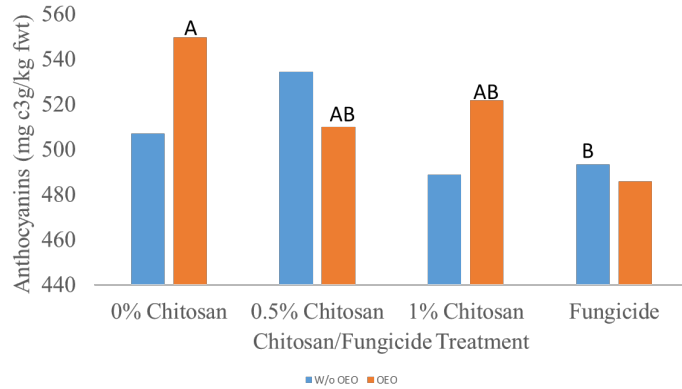
*Day_00 = data collected following harvest prior to cold storage

Figure 3. Effect of room temperature storage on total acid in ‘Camarosa’ Strawberries treated with chitosan and/or chitosan and oregano essential oil



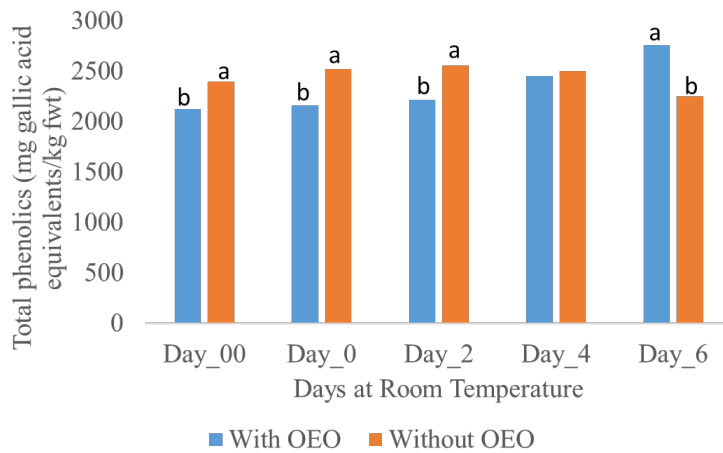
Lower case letters indicate differences between treatments that received no OEO. Upper case letters indicate differences among treatments that received OEO. Columns with letters in common are not significantly different at $\alpha = 0.05$

Figure 4. Anthocyanin content of ‘Camarosa’ Strawberries Receiving Chitosan or Traditional Fungicide treatment



Columns with letters in common are not significantly different at $\alpha = 0.05$

Figure 5. Total phenolics content of ‘Camarosa’ Strawberries Receiving Chitosan or Traditional Fungicide treatment



Columns with letters in common are not significantly different at $\alpha = 0.05$

Table 2. The effects of chitosan/fungicide on Total Phenolic (mg gallic acid equivalents/kg fwt) Content of ‘Camarosa’ Strawberries at each 0, 2, 4, and 6 days at room temperature after 24 hrs. of cold storage at 5 °C

Storage	Chitosan/Fungicide			
	0%	0.50%	1%	Fung.
Day_00	2321.37	2248.52	2189.52	2281.86
Day_0	2266.66	2393.43	2374.29	2330.29
Day_2	2374.25	2269.07	2329.71	2573.6
Day_4	2420.61	2516.7	2596.56	2382.78
Day_6	2538.97 ab	2509.68 ab	2611.7 a	2360.81 b

Rows with letters in common are not significantly different at $\alpha = 0.05$

Table 3. L a b color coordinate values of ‘Camarosa’ strawberries receiving Chitosan and/or OEO or traditional fungicide treatments.

L-Values				
	0	2	4	6
Fungicide	20.4	21.0	17.0	12.3 b
Chitosan 1%	24.4	22.4	18.8	18.3 a
Chitosan 0.5%	23.5	22.8	21.3	19.0 a
Chitosan 0%	22.1	22.4	21.3	12.3 b
a-Values*				
Fungicide	31.0	27.0	23.6	22.1 ab
Chitosan 0.5%	27.2	27.7	25.0	21.3 ab
Chitosan 1%	26.7	27.0	24.4	25.0 a
Chitosan 0%	26.0	26.8	25.4	19.1 b

b-Values**		
Treatment	With OEO	No OEO
Chitosan 0%	10.4	11.2
Chitosan 0.5%	11.0	13.1
Chitosan 1%	12.4	12.4
Fungicide	13.0 a	9.6 b

* Columns with letters in common are not significantly different at $\alpha = 0.05$

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