Using Natural Lipids to Accelerate Ripening and Uniform Color Development and Promote Shelf Life of Cranberries

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Introduction

Cranberry fruit ripens in late fall when the crop is subjected to frost daily. Wisconsin growers are forced to harvest less than ripe fruits. Some seasons such as in 1995 and 1997 we do not get good color development due to less than optimal environmental conditions. Unripe fruit means less natural color and flavor and thus less economic yield. We have also found that more ripened fruit means better shelf life. Thus the goal of our study is find natural (environmentally safe) means to accelerate ripening and promote shelf life of cranberry fruit. No such product is currently available to our growers. The following were the **specific objectives of our 1997 studies:**

1) To investigate the effect of **pre-harvest spray application of natural lipid (LPE) on color** production (ripening) of cranberry fruit intended for both fresh and juice markets.

2) To investigate the effect of **pre-harvest LPE spray application on the shelf life** of cranberry fruits intended for fresh markets.

3) To investigate the effect of **post-harvest LPE dip treatment on the shelf life** of cranberry fruits intended for fresh markets.

What is LPE?

LPE is a natural fat molecule which is part of the membranes in all plants and animals. The molecule contains two parts, a polar head group that sticks out of membrane

and a fatty acid tail which is buried into the membrane. We have recently found that both the length of the fatty acid tail and degree of unsaturation (it is more saturated when extracted from animal source and more unsaturated when extracted from plant source) determines the bioactivity of LPE molecule.

Desirable Attributes of LPE

1. LPE is a natural fat present in all plants and animals. It can be extracted from cheap raw products such as egg yolk, bovine brain and soybeans. For our experiments we are using LPE extracted from egg yolks.
2. LPE can accelerate fruit ripening (color development) while at the same time improving shelf life. No such product is currently available.
3. Both pre and post harvest application of LPE have been found to enhance shelf life. This has been demonstrated for several fruits including apples, tomatoes, peaches and grapes.
4. LPE treatment to cut flowers can enhance the shelf life.
5. LPE has been found to retard the process senescence or aging in plants. It has been shown that LPE treatment can inhibit enzymes that are activated during senescence (that lead to breakdown of cell membranes e.g. phosholipase D)

General Methodology

A commercial cranberry bed (cultivar Stevens) established near Yellow River, Wisconsin, was used to conduct the field work. LPE applications were made both pre- and post-harvest:

1. Pre-harvest LPE spray applications:

LPE (200 ppm) spray applications were made in two different bogs two weeks before the harvest. Plot size was 2x2 meter (about 40 square feet). For fruit color, samples were harvested one and two weeks after spray application. Anthocyanin content of fruits

were measured by using standard commercial techniques (by extracting in 85: 15 v/v HCl and ethanol mixture). For determination of shelf life wet harvested fruits were stored in commercial cold storage. After five weeks of storage the percent marketable fruits were determined.

2. Post-harvest LPE treatments:

Commercially wet harvested cranberry fruits were dipped into various solutions at room temperature for 15 and 30 minutes. The dip solution contained 0, 50 or 100 ppm LPE. After dip treatments berries were drained and kept in cold storage. Ethylene and CO_2 (respiration) production by the fruit was measured using a gas chromatography after two to three weeks of storage. The percent marketable berry was determined after two months of cold storage.

Results

Both pre- and post-harvest LPE treatments improved the quality and shelf life of cranberry fruits (Figure 1 and 2). Pre-harvest LPE sprays resulted in better color (at harvest). Our results show that an application of 200 ppm LPE sprays can increase 33% anthocyanin accumulation over the control. Also, these berries had improved shelf life. We found a 18% increase in marketable fruits after five weeks of cold storage (Figure 1).

Post-harvest LPE treatments also increased the percent marketable berries after two months of storage (Figure 2). Berries that were dipped for 15 minutes in 50 ppm LPE solution had 21% increase in the marketable fruits over the control. Ethylene production and respiration by the fruit was found lower in 50 ppm LPE treated fruits as compared to control (Figure 3).

Conclusion

Pre- and post-harvest LPE treatments have the potential to improve cranberry fruit color and improve its storability.

Acknowledgments

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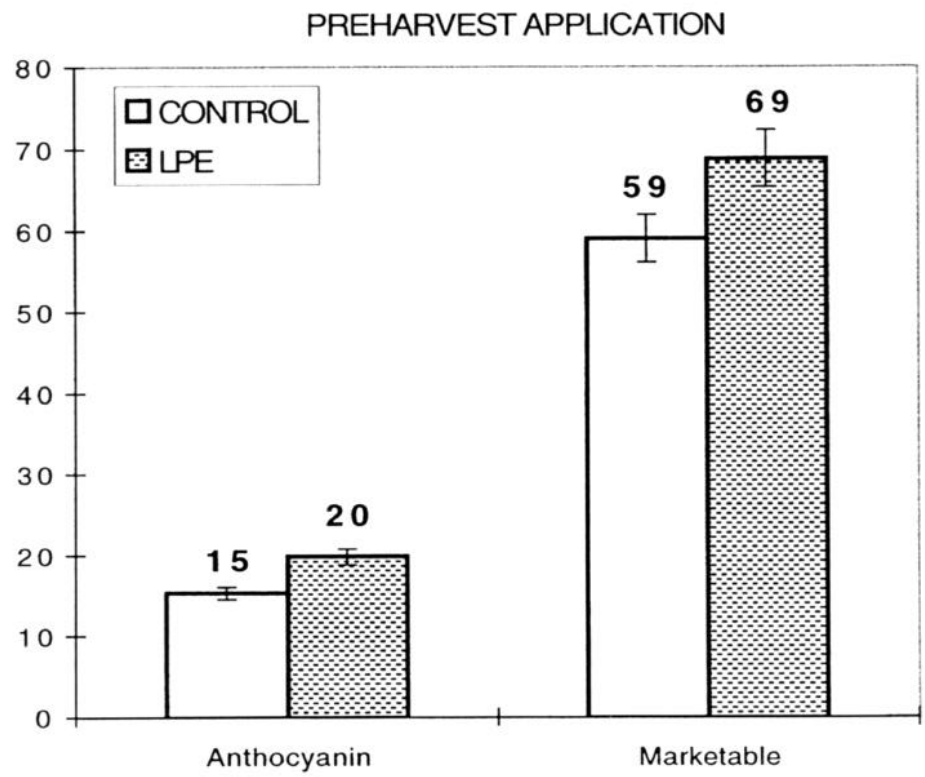

Figure 1: Effect of pre-harvest application of LPE on fruit ripening (color) at harvest and shelf life during storage. Spray application of LPE (200 ppm) were made on a commercial field. For fruit color, samples were harvested one week after spray application. For shelf life, wet harvested fruits were stored in commercial cold storage facility for five weeks. Treatments were applied to four separate plots with in a field. From each plots duplicated samples were evaluated for marketable quality.

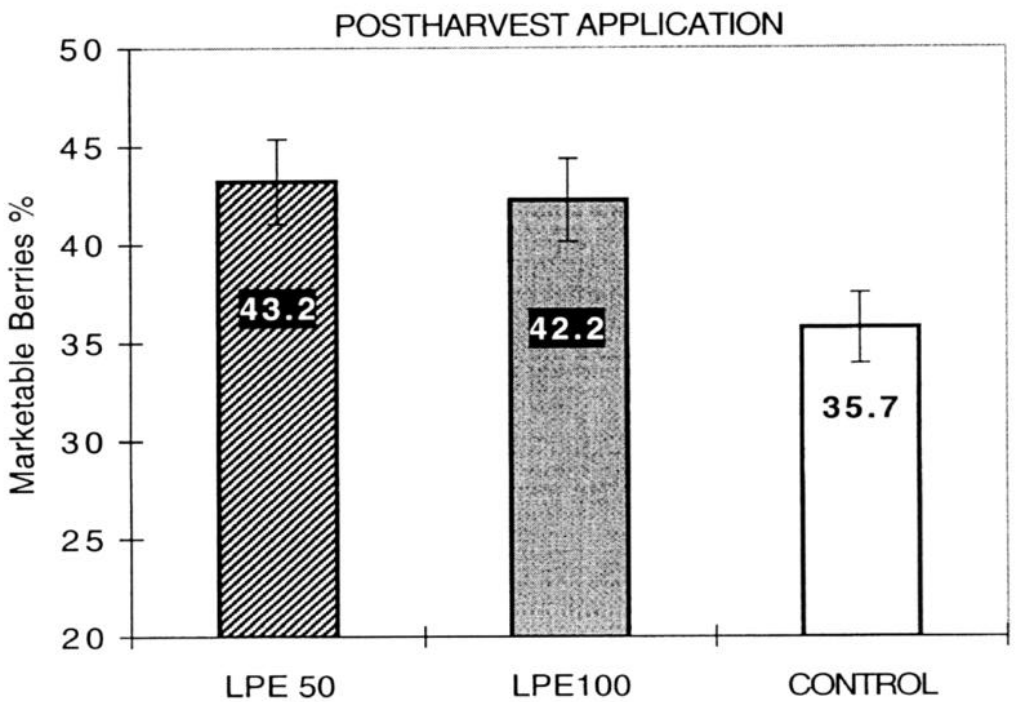

Figure 2: Effect of post-harvest dip treatments with LPE on shelf life of cranberry fruits. Berries were dipped for 15 minute in various solutions at room temperature: Marketable berries were counted after two month cold storage. Each sample consisted of 500 grams of sample. Values are mean ±SE of four separate samples.

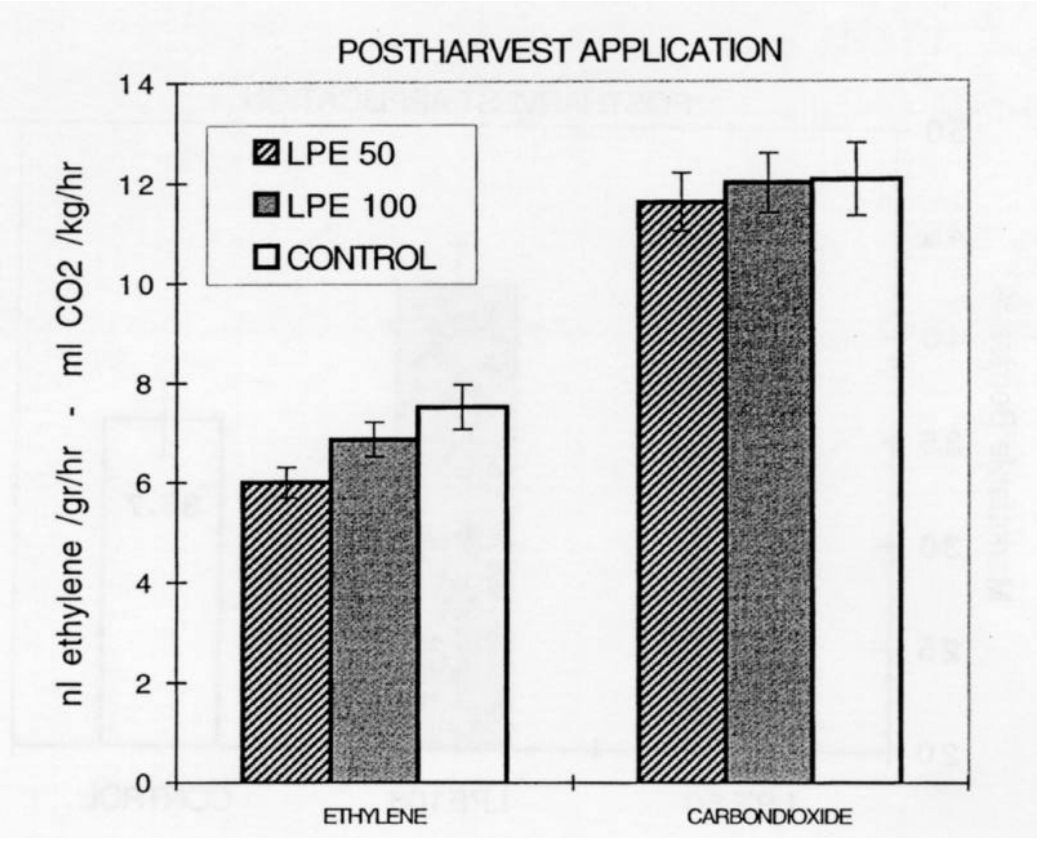

Figure 3: Effect of post-harvest dip treatments on fruit respiration and fruit ethylene production. Cranberries were dipped for 15 minutes in various solutions of LPE at room temperature. Then, fruits were stored in cold room. Two to three weeks later ethylene and carbondioxide measurement were made. For this purpose 50 gram of berries were incubated at room temperature in sealed (air tight) jars for 24 hours for ethylene and 30 minutes for carbondioxide. Ethylene and CO_2 given off by the fruit was quantified by injecting 1 ml. of gas into gas chromatograph (Shimadzu GC-9AM). Data are mean ±SE of four separate measurements.