Quantifying Consumer Acceptance and New Postharvest Technology Innovations on Reducing "Sensory Damaged" Tree Fruit in the Market

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Abstract

A trained panel was established as a sensory evaluation tool to evaluate orchard factors and postharvest technology on consumer perception. A generic descriptive analysis was used to develop the language and methodology for the evaluation of tree fruits in order to obtain the sensory profiles of peaches and nectarines from different cultivars. A consumer test was conducted to characterize consumers' preferences according to the obtained sensory profiles (degrees of liking for the various segments). This sensory panel is being used to validate new pre and postharvest technology innovations to reduce postharvest losses, and will be used to predict consumer responses (acceptance) and potentially contribute to the economic impact analysis of these new technologies at the market.

Different postharvest technologies are being evaluated such as different FDA chemical treatments (ABA, 1-MCP), and new packaging technology such as a hammock tray. Air flow in a marine container to reduce fruit losses at the retail end is being evaluated carefully on different peach, nectarine and plum cultivars. The influence of rootstocks on the fruit soluble solids concentration, titratable acidity, size and sensory attributes of peaches and nectarines is also being investigated.

Introduction

Despite all of the information on the health benefits of eating fruits and vegetables, consumption of some commodities, such as peaches, nectarines and plums (tree fruit), are low compared with other commodities, and losses at the retail end are high. Thus, prevention of these postharvest quality losses during the cold chain could be an approach to improve tree fruit consumption, since major sensory quality problems (softening and unfavorable taste or lack of taste) occur during postharvest handling.

Our approach to handle these postharvest losses is to establish a sensory evaluation system to understand fruit sensory losses during postharvest handling and propose innovative treatments to reduce these barrier problems. This descriptive analysis sensory evaluation system will consist of a trained panel at KAC-Davis (Tree Fruit) that will be validated by several 'in store' consumer tests. At the same time, this trained panel sensory tool will be used to validate new pre and postharvest technology innovations to reduce postharvest losses, and eventually will be used to measure consumer responses (acceptance) and contribute to the economic impact analysis of these new technologies at the market. Important tree fruit sensory quality attributes such as soft, mealy, "off flavor", and others change during postharvest cold storage handling, thus evaluation of these attributes during tree fruit postharvest life will be carried out using trained and consumer panels. The sensory data will be analyzed using preference mapping (descriptive and consumer panels) to characterize the impact of these sensory attributes on consumer consumption. In addition, to determine the impact of these sensory attributes on consumer perception, the relationship between the tree fruit trained panel and consumer acceptance will be tested. In the future our tree fruit trained panel can be used to screen out preliminary pre-postharvest treatments prior to a full consumer evaluation and/or economic impact at the market place. An intense evaluation including sensory analysis of new postharvest technology on maintaining tree fruit flavor and reducing losses is being carried out.

OBJECTIVES (Current & Future Timetable, if extended duration)

- Establish the relationship between the trained panel and consumer acceptance (descriptors and preference mapping).
- Test performance at the retail level of new postharvest technologies and their impact on consumer acceptance.

Objective 1: Establish a sensory evaluation tool for testing postharvest handling innovations

Trained Panel

A CTFA trained panel was established as a sensory evaluation tool to evaluate orchard factors and postharvest technology on consumer perception. Generic descriptive analysis was used to develop the language and methodology for the evaluation of tree fruit in order to obtain the sensory profiles of peaches and nectarines from different cultivars. The sensory properties were divided into three main groups: aroma, taste and texture. The descriptive panel identified five terms related to the perception of aroma (overall aroma, floral, almond, grassy, pit). Taste was mainly associated with sweetness, sourness, bitterness and overall flavor. Peaches and nectarines differed in their textural attributes; those identified by the panel were: firm, crunchy, juicy, mealy, melting, smooth, and fibrous. A vocabulary has been developed to measure those terms. Training consisted of 6-8 sessions. A consumer test was conducted to characterize consumers' preferences according to the obtained sensory profiles (degrees of liking for the various segments). This sensory panel is being used to validate new pre and postharvest technology innovations to reduce postharvest losses, and eventually will be used to measure consumer responses (acceptance) and contribute to the economic impact analysis of these new technologies at the market.

The benefits of using a trained panel in preharvest and postharvest research programs are being demonstrated. Adding sensory evaluation of new pre-postharvest technology will help our industry to adopt beneficial new technology.

Objective 2: Test performance at the retail level of new postharvest technologies and their impact on consumer preference.

Evaluating the role of 1-MCP in the tree fruit industry

The goal of this work was to use the 1-MCP technology to solve some of the causes of postharvest losses affecting the Californian peach, nectarine and plum market. The general objective of this project was to evaluate the role of 1-MCP, applied at 500 ppb 1-MCP for 24 h on warm fruit immediately after harvest, on the shelf life performance of peaches, nectarines and plums.

- Screen peach, nectarine and plum cultivars for 1-MCP performance
- Test storage and transportation at 50°F
- Compare cold versus warm application
- Develop a forced air cooling application technique

Results

Screening California Cultivars for 1-MCP Performance

Ten different peach and nectarine cultivars were screened for the effect of 1-MCP on controlling softening during this season to continue the work we did last season on more than 40 different cultivars of peaches, nectarines and plums. The results collected during this season showed that the effect of 1-MCP on controlling ripening of tree fruit varies greatly depending on the cultivar used. In plums, the results were more consistent than for peaches or nectarines, offering at least an extension of shelf life of 2-4 days. However, results on peaches and nectarines were more erratic, as seen during last season's trials, depending on the cultivar used.

Test Storage and Transportation at 50°F

In these trials, 1-MCP was used as a tool to substitute for the effect of low temperatures to control softening of the fruit for short storage periods. The main objective of this technique would be to save energy by using higher temperatures (50°F) during the storage of fruit for short periods of time. Our results showed that 1-MCP was able to maintain the firmness of the fruit stored at 50°F for up to 20 d of cold storage (Fig. 1 and 2). However, no significant differences with the control (untreated) fruit were found after 30 d of cold storage. Therefore, 1-MCP treatment could be a potential treatment in order to save energy cooling and storing at low temperatures for short storage periods.

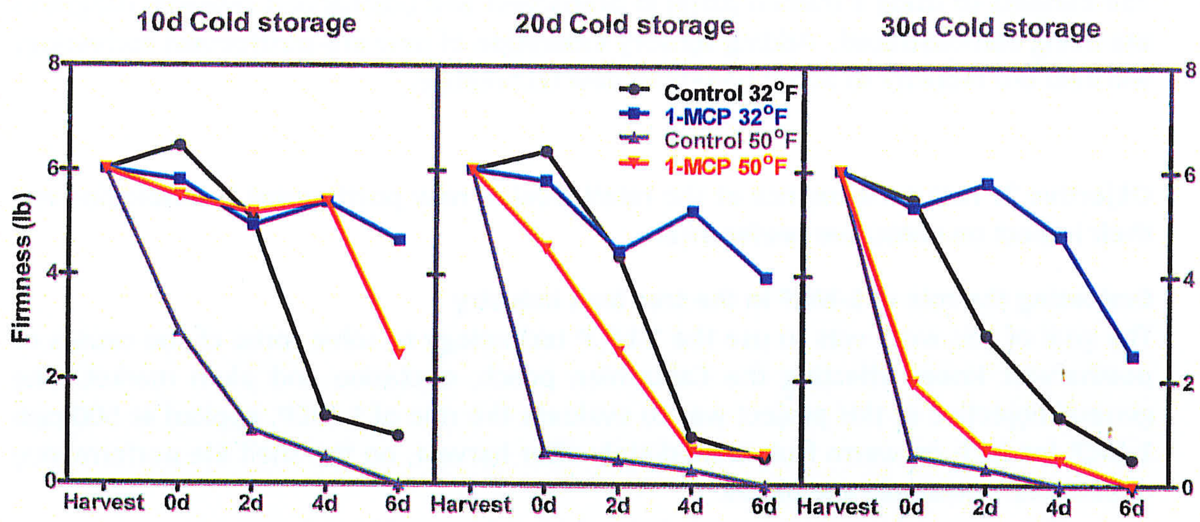

Figure 1. Effect of 1-MCP on the softening of a red plum during the shelf life period. Softening on fruit cheeks is shown after 10, 20 and 30 d of cold storage at both 32°F and 50°F.

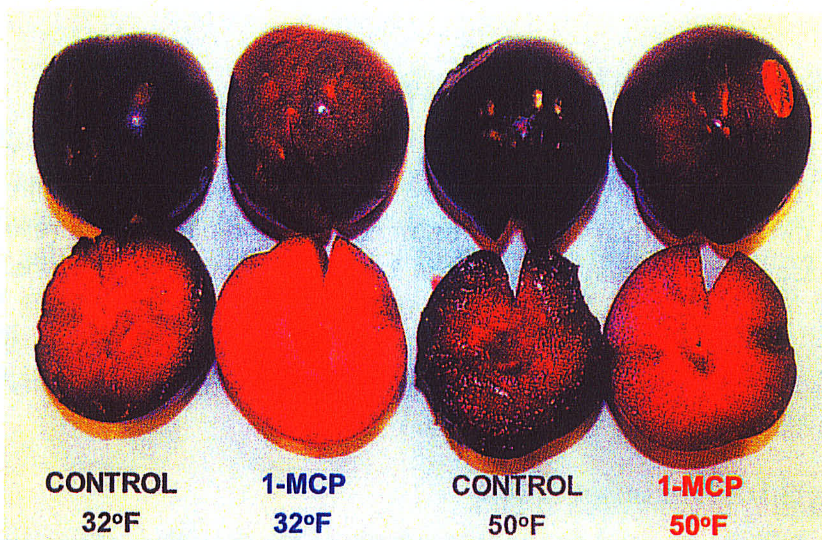

Figure 2. Effect of 1-MCP on a red plum after 10 d of cold storage at both 32°F and 50°F.

Comparing Cold versus Warm Application

No significant differences for any of the evaluated parameters (firmness loss, color, SSC or TA) were found between 1-MCP treatments when the fruit was warm, immediately after harvest, compared to the treatments where 1-MCP was applied to already cold fruit, at any of the evaluation times during shelf life. Therefore, we suggest applying the 1-MCP treatment to warm fruit immediately after harvest, as recommended on the commercial label.

Developing a Forced Air Cooling Application Technique

In these series of trials, we combined the FAC operation with the application of 1-MCP. 1-MCP was applied for 6 h (Fig. 3), reducing the time of application from the 24 h used commercially. These experiments were carried out at both 32°F and 50°F.

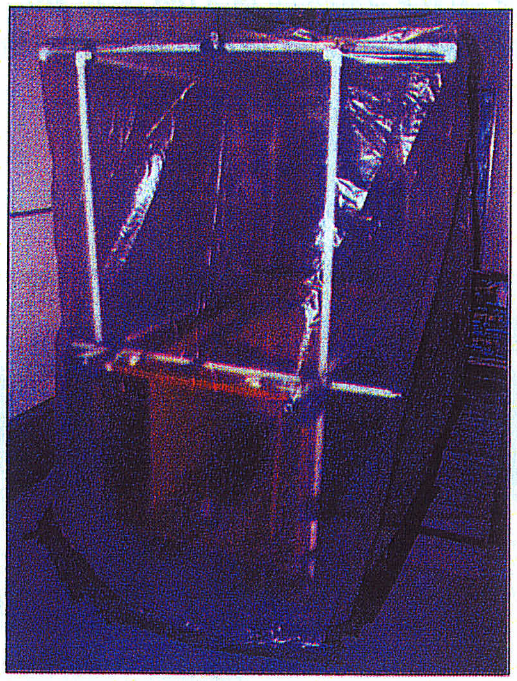

Figure 3. FAC tunnel used for the application of 1-MCP during FAC operation. Duration of application was reduced from 24 h (in the commercial application) to 6 h.

1-MCP applied simultaneously with the FAC operation resulted in similar control of firmness loss to what resulted from the commercial application of 1-MCP for 24 h at 32°F and 50°F (Fig. 4 and 5). These results show the possibility of reducing the application time from 24 h to 6 h when applied during the FAC operation, and at the same time, simplifying the postharvest handling of the fruit by combining both operations. Based on our promising results from this season, further experiments are planned to be carried out next season.

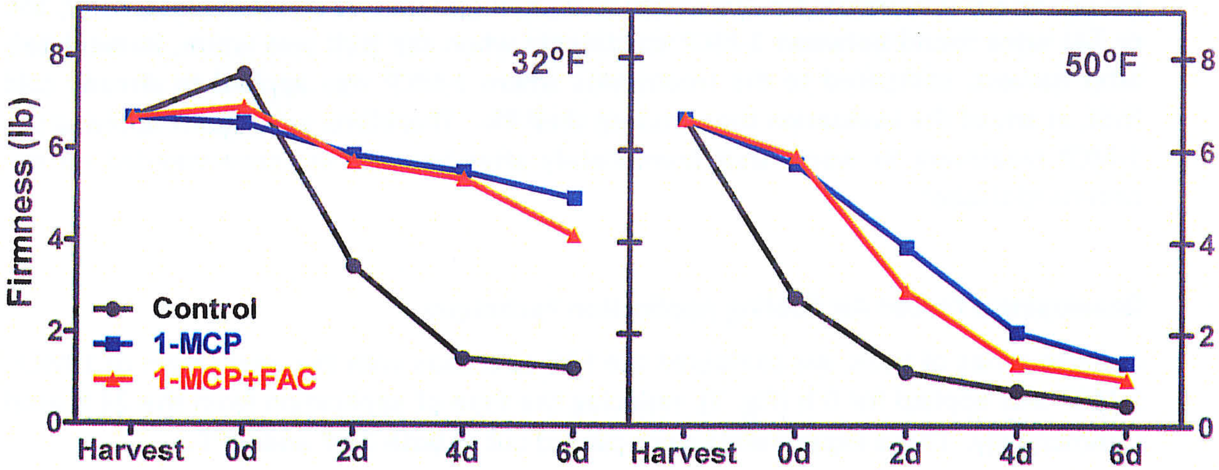

Figure 4. Effect of 1-MCP on the softening of a red plum after 10 d of cold storage at both 32°F and 50°F. 1-MCP was applied for 24 h on warm fruit (blue); and with FAC for 6 h (red).

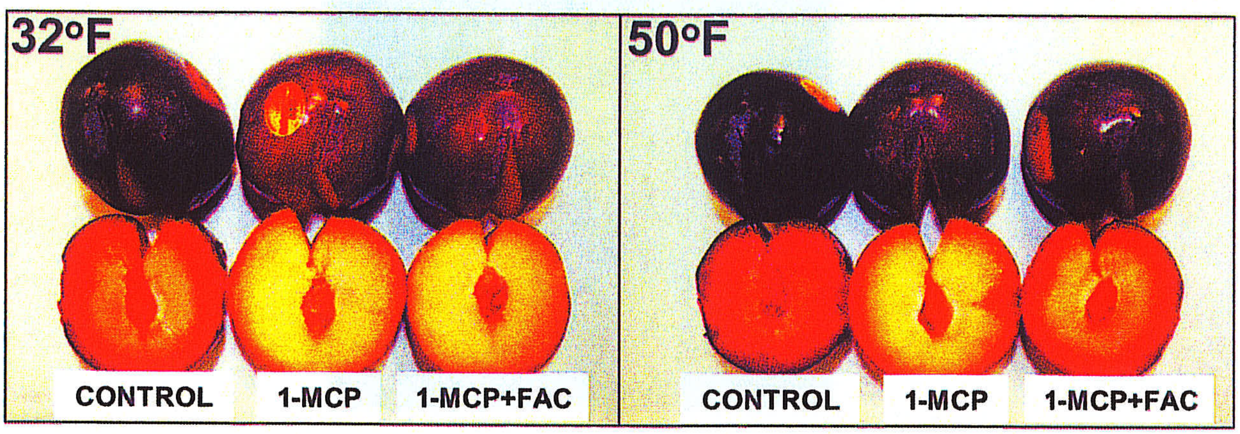

Figure 5. Effect of 1-MCP on a red plum after 10 d of cold storage at 32°F (left) and 50°F (right) plus 6 d of shelf life at 68°F. 1-MCP was applied for 24 h on warm fruit and for 6 h with FAC.

Conclusions

- Our results show that 1-MCP treatment seems to be a potential tool to control softening on some cultivars of plum, peach and nectarine. However, more consistent results have been found on plums than on peaches and nectarines.
- No differences in the effect of 1-MCP on the control of ripening of tree fruit were found when comparing applications on warm or cold fruit.
- The use of 1-MCP could be a promising postharvest technique to control the ripening of tree fruit stored at 50°F instead of 32°F, in order to save energy and avoid chilling injury. The treatment with 1-MCP at 50°F could substitute for the effect of low temperatures by controlling the softening of the fruit for short storage periods.
- Application of 1-MCP during the FAC operation seems to be a promising technique to reduce the duration of the 1-MCP application, and to integrate both postharvest management operations in one simple step. Further investigations will be done on this technique.