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Research report

Influences of packaging attributes on consumer purchase decisions for fresh produce ☆

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ABSTRACT

Packaging attributes are considered to have an influence on consumer purchase decisions for food and, as a consequence, also on its consumption. To improve the current minimal understanding of these influences for fresh produce, a survey instrument in the form of an online questionnaire has been developed and launched in the US. The first part of the questionnaire covers consumers' preferences for packaging convenience features, characteristics, materials, disposal method, and others for fresh produces in general, and the second focuses on attributes like price, container size, produce shelf life for a specific fresh produce, sweet cherries, to allow us to supply specific values for these factors to the participants. Cluster and conjoint analyses of responses from 292 participants reveal that specific packaging and produce attributes affect consumer purchase decisions of fresh produce in general and of sweet cherries in particular ($P \leqslant 0.05$) and that some are population segment dependent ($P \leqslant 0.05$). For produce packaging in general, 'extend the "best by" date' was ranked as the top convenience feature, the type of packaging material was considered to affect the food product quality (92.7%) and containers made from bio-based materials were highly appealing (3.52 out of 5.00). The most important attributes that affect the purchasing decisions of consumers regarding a specific fresh produce like sweet cherries are price (25%), shelf life (19%) and container size (17.2%).

Introduction

Fresh fruits and vegetables are essential ingredients of a healthy and balanced diet since they are sources of key nutrients such as vitamins, antioxidants and minerals (Nishida, Uauy, Kumanyika, & Shetty, 2004). Nowadays, various packaging materials and packaging technologies are available for applications in the fresh produce industry. Wood, corrugated fiberboard, paper pulp, and plastics are the most common materials. Among these, plastics are the most versatile. They can be used in rigid (e.g. clamshells, trays) and flexible (e.g. bags, pouches) form and are the only ones that allow the implementation of a modified atmosphere to maximize the projected shelf life of fresh fruits and vegetables. The combined use of modified atmosphere packaging (MAP) and refrigeration can decrease the respiration rate and suppress microbial growth (Alique, Martinez, & Alonso, 2003). Common petroleum-based plastics used for fresh produce packaging include polyethylene terephthalate (PET), low density polyethylene (LDPE), polypropylene (PP), and polystyrene (PS) (Mahalik & Nambiar, 2010). A new category of plastics made from renewable resources like corn, sugar cane, wheat and fruit scrap is also available for food packaging applications (Siracusa, Rocculi, Romani, & Rosa, 2008). Packaging made from plastic materials from renewable resources has been shown to extend the shelf life of fresh produce (Almenar, Samsudin, Auras, Harte, & Rubino, 2008; Conte, Scrocco, Lecee, Mastromatteo, & Del Nobile, 2009; Joo, Lewandowski, Auras, Harte, & Almenar, 2011).

While the appearance of the fresh produce is a critical selling point, consumers make purchasing decisions based on multiple factors. Produce selection mainly depends on consumer demographics, marketing strategies, environmental awareness, convenience of use, package design and esthetics, amount of product in the container, and price (Kamphuis et al., 2006; Pollard, Kirk, & Cade, 2002; Rokka & Uusitalo, 2008; Thogersen, 2004; USDA, 2010). Packaging is one of the extrinsic attributes that consumers tend to apply when relevant intrinsic attributes cannot be evaluated before the purchase of the food product (Zeithaml, 1988). Thus, packaging is constantly being developed and updated to meet changing consumer demands.

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Currently, information on the influences of packaging attributes on consumer purchase decisions for fresh produce is scarce. Ampuero and Vila (2006) discussed the need to understand consumer perceptions in order to correctly design product packaging. However, this research was focused only on design elements like color, typography, graphic shapes and images. Ragaert, Verbeke, Devlieghere, and Devevere (2004) investigated the consumer perception and choice of the Belgian population for processed vegetables and packaged fruit based on the importance given to different packaged produce attributes provided in the form of a list at the purchase and consumption stages. Among all evaluated attributes, the study only included four packaging attributes and these were 'transparency packaging', 'feeling packaging', 'information on packaging' and 'shape packaging'. It was concluded that 'transparency packaging' was significantly ($P \leqslant 0.05$) more important at the purchasing stage while 'shape packaging' and feeling packaging' were significantly ($P \leqslant 0.05$) more important at the purchasing stage. Peters-Texeira and Badrie (2005) investigated consumers' perception of food packaging in Trinidad, West Indies, and its related impact on food choices but the study was general and not specific to any type of food product. Bottani, Montanari, Vignali, and Guerra (2011) studied relationships between food product characteristics, packaging technologies, packaging materials and storage temperature in the Italian food market, but no specific results were given for fresh produce. Siegrist, Cousin, Kastenholz, and Wick (2007) examined the factors that influence the willingness to buy a food product in nanotechnology food packaging. However, this study was limited to one type of packaging which was geared towards meat, not fresh produce.

Of the previous studies only the one by Ragaert et al. (2004) focuses on fresh produce packaging and this study is limited to a few packaging parameters. There is not information in the literature about preferences for packaging materials, ratings of packaging convenience features, preferences for container characteristics, desired produce shelf life, and others. Therefore, our study's goal was to identify factors that drive the consumers' choice when it comes to making a fresh produce buying decision. In particular, we investigated the preferences for packaging materials and disposal methods for produce packaging, consumer knowledge and appeal for packaging made from renewable resources, consumer rating of packaging convenience features and attributes for produce packaging, and the effect of non-packaging factors but related to these like price, produce shelf life and absence of stem. A specific fresh produce was selected to allow us to supply specific values for these factors to the participants. Fresh, sweet cherries were chosen because of the substantial growth of the consumption of this fruit in the European Union, the US, and other important markets in the last years. Between 2007 and 2011, the consumption of cherries (in metric tons) increased from 361 to 425 for the European Union (increased by 17.7%), from 173 to 194 for the US (12.1%), from 150 to 228 for China (52.0%), from 30 to 40 for Canada (33.3%) and from 23 to 28 for Japan (21.7%) (FAS, USDA, Stone fruits: World Markets, & Peach/Nectarine:, 2011). In addition, cherries can be considered a representative example of a pool of different produces in terms of size, shelf life period, and others, and the packaging used for cherries is the same as for several other types of fresh produce in the US (grapes, chestnuts, etc.).

Materials and methods

Survey instrument development

In order to gain insight into the influences of packaging attributes on the consumer purchase decisions for, and as a consequence on the consumption of, fresh produce in general and sweet cherries in particular, data were collected through a consumer survey. A three-part questionnaire (demographics, packaging system and package/product interface) was developed for use as a survey instrument. The demographics section collected information on gender, age, number of adults and children per household, level of education, ethnicity and area of residence of the participants. These attributes were selected based on insights from the literature. In the second part of the questionnaire, participants were asked about their preferences for produce packaging in terms of convenience features (easy to carry, easy to open, extend the 'best by' date, package size, and reclosability), container characteristics (labeled nutritional value, absence of foreign particles, pesticide free, brand name, traceability and environmental footprint), materials (corrugated paperboard, paper pulp, plastic-flexible, plastic-rigid, other, and no preference), and disposal method (recyclable, compostable, and trash bin). In addition, participants were asked about sources of bio-based plastics, general and product-associated appeal to purchase of containers made from renewable resources and awareness of its purchase. Lastly, the importance of specific produce and packaging attributes to consumer's choice was evaluated. While the previous part of the questionnaire was general and included all fresh produce, this final part of the questionnaire was narrowed to a specific fresh produce: fresh sweet cherries. This choice was made to allow us to supply specific values for the researched factors to the participants. Fresh, sweet cherries were chosen due to their importance worldwide and as a representative fresh produce as explained in the Introduction Section.

In this part of the questionnaire, participants were asked to rate containers on the basis of how likely they would be to purchase fresh sweet cherries if packaged in these containers. Participants were shown a text describing the characteristics of a container. The attributes assessed were price, disposal method, material, container size, shelf life, stem, and integrity of the container.

Participants responded to a total of 18 questions, with the question for the conjoint analysis adding another 16 questions. Response choices were several. For the demographics, response choices included choice responses (with single response option) and fill-in-the-blank answers. For the part of the questionnaire dealing with packaging systems for fresh produce in general, response choices included choice responses (with single or multiple response options), 5-point-importance-rating scale responses (0 = 'extremely unimportant' to 5 = 'extremely important'), 5-point-appeal-rating scale responses (0 = 'extremely unappealing' to 5 = 'extremely appealing') and 5-point-inclined to purchase-rating scale responses (0 = 'extremely unlikely to buy' to 5 = 'extremely likely to buy'). For the part of the questionnaire dealing with packaging systems for cherries, the response scale was ordinal in nature with 0 = 'extremely unlikely to purchase' and 5 = 'extremely likely to purchase'. After three separate pilot tests of 10 participants each, the questionnaire was revised each time to improve question clarity, user-friendliness, and enhance the quality of collected data.

Data collection

In this study, an online survey was used. Internet access is increasing among consumers across the world. Consumers of all ages are becoming familiar with the use of this computer network. According to Internet World Stats. United States of America & Broadband Usage Report (2010), 77.3% of the population in US has Internet access. Advantages of online surveys include convenience of use, minimum time needed for collection of responses, ability to collect responses from individuals in remote locations, instant access to participants' responses, elimination of data entry mistakes when translating the paper results to software platforms for data analysis and reduced cost compared to paper based surveys. However, there are also disadvantages linked to online

surveys like uncertainty over the validity of the data, sampling issues, and concerns surrounding the design and implementation (Wright, 2005).

The online survey was developed by using the Qualtrics online software platform (www.Qualtrics.com) and was authorized to collect consumer responses by the university committees designated to control research with human subjects (Michigan State University Human Research Protection Program, 2010). The data were collected by using the online survey software suite by Qualtrics Inc. Participants were recruited by employing MarketTools Inc. database. The survey instrument was distributed among adult (>age 18 years) consumers residing in the US, who agreed to participate in the study. Participation was stimulated by the rewards program of MarketTools Inc., according to the company's terms. Participants were screened at the beginning of the survey to allow participation only to those who had purchased and consumed fresh fruits and vegetables within the last 30 days. The online questionnaire was launched in the US, in July 2010 and 292 consumer responses were recorded across the country.

Conjoint analysis

Conjoint analysis is a powerful research technique used to evaluate factors that influence consumers' produce preferences and trade-offs, and therefore purchasing decisions. Specifically, conjoint analysis studies the affinity of consumers towards specific configurations of produce attributes. The relative importance of each attribute can be identified compared to other attributes among the same or different products. The results of conjoint analysis allow the identification of market segments between consumers with similar affinity to one or multiple product attributes (Hair, Anderson, Tatham, & Black, 1998). Previous studies have used conjoint analysis to investigate the acceptance of many attributes in various products of agricultural origin, including asparagus (Behe, 2006), bell peppers (Frank, Nelson, Simonne, Behe, & Simonne, 2001) and tomatoes (Simonne, Behe, & Marshall, 2006), however, none of these studies have focused on the characteristics of the container besides those of the produce.

In this study, conjoint analysis was used to evaluate the affinity of consumers towards specific produce and packaging attributes with the goal to rate them by importance. Price, shelf life, stem, disposal method, material, size, and integrity of the container were evaluated. These specific attributes were chosen because of their significant importance in consumers' choice and they being key elements for a new fresh produce packaging system design. The research was limited to only seven attributes to reduce the number of possible combinations.

Price

Price is a crucial factor affecting the purchasing decisions of consumers. Prices per pound (1 lb = 453.59 g) of 3, 4 and 5 dollars were chosen to simulate equi-distant points around an anticipated average price of domestic, fresh, sweet cherries during season across the US.

Shelf life

Modern lifestyle has limited the time expended on grocery shopping. In addition, perishable produce needs to last from the field to retail so purchasers can consume them before spoilage. Shelf life estimations of 3, 6 and 9 days were used simulating the shelf life of cherries when stored in different environments (low, medium and room temperature). The lower the temperature the more extended the cherry life.

Size of container

Packaging size has been stressed as one important variable of packaging convenience (Draskovic, 2010). According to fresh produce industry experts, containers of 8, 16 and 32 oz (1 oz = 28.35 g) are the most commonly used retail package sizes for fresh, sweet cherries in the US.

Disposal method

Packaging disposal is a growing concern of municipal authorities, governmental agencies, environmental organizations as well as consumers. Recycling or composting used containers could yield multiple advantages, including a more efficient usage of petroleum and fossil fuels, reduction in environmental footprint of each produced container, generation of new employment opportunities, decrease of the energy needed in the manufacturing process, lower the production cost and decreased methane emissions from landfills (Environmental Protection Agency. Methodology for estimating municipal solid waste recycling benefits, 2007; Tsiliyannis, 2005). The disposal methods preferred by consumers are extremely important because these inform about the most likely end of life scenario for the container, independently from the recyclability or compostability capacity of the material. The disposal methods (recycling, composting and throwing in trash bin) were selected based on possible different end of life scenarios for the package of a fresh produce.

Material

Both petroleum- and bio-based materials are currently available for food packaging applications. However, the perception, acceptance, appeal and preference of the consumer for containers made of petroleum- and/or bio- based materials for fresh produce is unknown.

Integrity

Both flexible and rigid packaging is currently available in the market at the retail level for fresh produce. Flexible packaging can be found as bags and pouches, while rigid containers include clamshells, tubs and trays.

Stem

Produces either have stems or not. Cherries can be found with or without these. Cherries maintain their stems during harvesting or not depending on the variety. In addition, the mechanical harvesting currently available and employed by the US cherry industry allows both stem-on and stem-free cherries for varieties which maintain the stem after harvesting.

The initial number of possible container configurations when including all attributes was 648. However, these configurations were limited to only 16 using an orthogonal fractional-factorial design (NIST/SEMATECH e-Handbook of Statistical Methods, 2006) to improve participant response rates for all attributes and to decrease participant fatigue due to lengthy exposure to extensive amounts of information. All of the 16 proposed container configurations were presented to the participants in random order among the rest of the questions in the survey. Table 1 shows the 16 container configurations presented to the participants.

Statistical analysis

Analysis of variance (ANOVA) and K-means, non-hierarchical, cluster analysis were performed in order to analyze the recorded responses and to allow participant segmentation (SPSS Inc., 1997; SPSS Inc., 1998). ANOVA was performed over the 292 participants' responses and allowed for the cluster analysis to group these participants into different clusters or market segments with similar part-worth utility coefficient estimates (Green & Helsen,

Table 1
Container configurations presented to the participants for the conjoint analysis.

Location among questions presented to participants	Container configuration
12a	32 oz of fresh cherries with the stem on, bio-based, recyclable, rigid container which can keep cherries fresh for 6 days priced at $3.00 per pound
12b	8 oz of fresh cherries with the stem off, petroleum-based, recyclable, rigid container which can keep cherries fresh for 3 days priced at $3.00 per pound
12c	16 oz of fresh cherries with the stem on, petroleum-based, recyclable, flexible container which can keep cherries fresh for 3 days priced at $4.00 per pound
12d	8 oz of fresh cherries with the stem on, petroleum-based, compostable, flexible container which can keep cherries fresh for 3 days priced at $3.00 per pound
12e	8 oz of fresh cherries with the stem on, bio-based, recyclable, rigid container which can keep cherries fresh for 3 days priced at $3.00 per pound
12f	32 oz of fresh cherries with the stem off, bio-based, recyclable, flexible container which can keep cherries fresh for 3 days priced at $4.00 per pound
12g	8 oz of fresh cherries with the stem on, petroleum-based, recyclable, flexible container which can keep cherries fresh for 6 days priced at $5.00 per pound
12h	8 oz of fresh cherries with the stem off, bio-based, recyclable, flexible container which can keep cherries fresh for 9 days priced at $5.00 per pound
12i	8 oz of fresh cherries with the stem off, bio-based, throw away, flexible container which can keep cherries fresh for 3 days priced at $3.00 per pound
12j	16 oz of fresh cherries with the stem off, bio-based, compostable, flexible container which can keep cherries fresh for 6 days priced at $3.00 per pound
12k	32 oz of fresh cherries with the stem on, petroleum-based, throw away, flexible container which can keep cherries fresh for 9 days priced at $3.00 per pound
12l	8 oz of fresh cherries with the stem off, petroleum-based, throw away, rigid container which can keep cherries fresh for 6 days priced at $4.00 per pound
12m	32 oz of fresh cherries with the stem off, petroleum-based, compostable, rigid container which can keep cherries fresh for3 days priced at $5.00 per pound
12n	8 oz of fresh cherries with the stem on, bio-based, compostable, rigid container which can keep cherries fresh for 9 days priced at $4.00 per pound
12o	16 oz of fresh cherries with the stem on, bio-based, throw away, rigid container which can keep cherries fresh for 3 days priced at $5.00 per pound
12p	16 oz of fresh cherries with the stem off, petroleum-based, recyclable, rigid container which can keep cherries fresh for 9 days priced at $3.00 per pound

1989). For the conjoint analysis, only 286 responses were taken into consideration. The remaining six were discarded due to their incomplete answers in the conjoint analysis section of the questionnaire. The calculations of relative importance means and part-worth utilities means of the conjoint analysis for the cluster members were performed using SAS (SAS Institute Inc., 1987) and the separation of both types of means using Tukey's honestly significant difference ($P \leqslant 0.05$) test utilizing SAS (SAS Institute Inc., 1987). Relative importance means represent in percentile the amount of importance in which an attribute contributes to the consumers' overall purchasing decisions (Hair et al., 1998). The part-worth utilities means represent in percentile the amount of each utility among all utilities for the same attribute. Uppercase letters (A,B,C,D,E etc.) were used to show the differences across the importance means (e.g. price, shelf life etc.) while lowercase letters (a and b) were used show the differences across the part-worth utilities (e.g. high school, college degree, graduate school) for the same importance mean (e.g. price).

Results and discussion

Population demographics

Responses were collected from a total of 292 participants. Data in Table 2, presents the gender distribution of our respondents that was 137 males (46.92%) and 155 females (53.08%). These percentages match the gender distribution of 49% males and 51% females in the US in 2010, respectively (US Census Bureau. Current Population Survey. Age, 2010a). Almost half of our respondents (45.11%) were less than 40 years old, 36.71% were between 40 and 60 years old, and 18.18% were older than 60 years old. This age distribution could be considered quite similar to the one reported for the US population in this same year (US, 2010a) (48.02%, 34.70%, and 17.24% for people less than 44 years old, between 45 and 64 years old and over 65 years old, respectively (values obtained excluding the population under 18 years of age since this age group did not participate in our survey). The slight difference between our values and the 2010 US. Census values could be attributed to the different choices of age groups, with the age groups in the 2010 US. Census being 4 years older. The lower limit for the oldest age group in the Census is 64 years instead of 60 years in our study, hence, one would expect the percentage of this age group in the total to be smaller in the Census data. The average age of our responder was 43.63 years. Nearly one quarter (23.42%) of the respondents were living in a single person household. The number of participants living in a two adult household was 34.96%, while 28.32% were living in a three adult household and 13.28% in a household with four or more adults. Most respondents (64.68%) had no children younger than 18 years old in the household, while 15.41% had one child and 11.99% had two children and 7.53% had three or more children living in their household. Nearly half (48.95%) of the participants had a high school education, 39.16% had college degrees and 15.38% had graduate school degrees. The majority of the participants (81.16%) were White-Caucasians, non-Hispanic. The rest of participants were 5.48% African-Americans; 5.14% Asian-Americans or Pacific Islanders; 5.48% Hispanic/Latinos; 1.71% Native Americans; and 1.03% Other ethnical groups. The results presented in this study, although biased toward a higher White-Caucasians, non-Hispanic population (81.2% vs. 72.4%), can be considered representative of the current ethnic composition of the US population (US Census Bureau. Current Population Survey, 2010b). Based on the similarity in the demographics (gender, age and ethnicity) between our responders and the US population in 2010, the results presented in this study can be considered representative of the 2010 US population.

Table 2
Relative importance means and corresponding standard errors (between parentheses) of the different attributes studied for different population segments. Upper case letters represent mean separation for attribute (rows) and lower case letters represent mean separation for population segment (column), by Tukey's honestly significant difference ($P \leqslant 0.05$) test. *Note:* the differences in columns are only for the grouping they are in (i.e. – an 'a' in ethnicity is only comparing against other ethnic groups). Percentages in brackets represent the percentage of participants in a total number of 292.

	N	% of participants	Price	Shelf life	Container size	Disposal	Material	Integrity	Stem
All	286	100	25.03 (0.97)A a	19.05 (0.71)B a	17.20 (0.66)BC ab	15.43 (0.52)C a	8.72 (0.48)D a	7.51 (0.35)D a	7.07 (0.33)D a
Cluster 1	181	63.29	24.49 (1.16)A a	19.57 (0.96)B a	16.04 (0.78)B b	16.04 (0.65)B a	8.6 (0.55)C a	7.76 (0.45)C a	7.49 (0.44)C a
Cluster 2	105	36.71	25.96 (1.73)A a	18.14 (0.99)B a	19.22 (1.19)B a	14.37 (0.88)B a	8.92 (0.89)C a	7.07 (0.56)C a	6.33 (0.49)C a
Gender									
Male	131	45.80 [46.92]	23.38 (1.30)A a	18.44 (1.01)AB a	18.06 (1.08)B a	16.50 (0.81)B a	8.60 (0.75)C a	7.52 (0.56)C a	7.50 (0.46)C a
Female	155	54.20 [53.08]	26.43 (1.41)A a	19.56 (0.99)B a	16.48 (0.82)BC a	14.52 (0.68)C a	8.82 (0.61)D a	7.49 (0.45)D a	6.70 (0.48)D a
Age									
<40	129	45.10	24.53 (1.39)A a	19.77 (1.12)AB a	16.38 (0.98)B a	15.34 (0.71)B a	8.61 (0.64)C a	8.15 (0.55)C a	7.23 (0.48)C a
40–60	105	36.71	23.86 (1.54)A a	19.05 (1.22)AB a	17.79 (1.16)AB a	16.15 (0.98)B a	8.94 (0.73)C a	6.81 (0.57)C a	7.41 (0.59)C a
>60	52	18.18	28.65 (2.61)A a	17.26 (1.21)B a	18.08 (1.38)B a	14.18 (1.17)B a	8.55 (1.51)C a	7.30 (0.75)C a	5.98 (0.74)C a
Number of adults									
1	67	23.43	27.03 (2.29)A a	18.07 (1.43)B a	17.42 (1.79)B a	14.98 (1.19)B a	8.31 (1.10)C a	6.83 (0.64)C ab	7.36 (0.69)C a
2	100	34.97	24.93 (1.57)A a	19.73 (1.25)AB a	16.27 (0.83)B a	16.08 (0.89)B a	8.39 (0.72)C a	7.48 (0.61)C ab	7.12 (0.59)C a
3	81	28.32	23.20 (1.49)A a	18.31 (1.15)AB a	18.72 (1.28)AB a	15.39 (0.94)B a	9.41 (1.00)C a	8.77 (0.73)CD a	6.21 (0.57)D a
4 or more	38	13.29	25.68 (3.17) A a	20.53 (2.37)AB a	16.05 (1.70)BC a	14.57 (1.33)BC a	8.86 (1.04)CD a	6.06 (0.81)D b	8.25 (1.02)D a
Number of children									
0	185	64.69	26.18 (1.31) A a	18.69 (0.80)B a	17.44 (0.87)BC a	14.45 (0.64)C b	8.81 (0.66)D a	7.25 (0.44)D a	7.18 (0.43)D a
1	44	15.38	22.60 (2.13)A a	20.90 (2.24)A a	15.94 (1.60)A a	18.22 (1.35)A a	7.82 (0.83)B a	8.27 (1.04)B a	6.24 (0.63)B a
2	35	12.24	23.06 (1.91)A a	19.03 (2.41)A a	16.76 (1.74)A a	17.12 (1.60)A ab	8.93 (0.98)B a	7.15 (0.86)B a	7.95 (1.09)B a
3 or more	22	7.69	23.34 (3.09)A a	18.34 (2.42)A a	18.46 (1.84) A a	15.41 (1.73)AB ab	9.42 (1.42)BC a	8.65 (0.95)BC a	6.38 (1.20)C a
Education									
High school	140	48.95	26.19 (1.50)A a	19.01 (1.05)B a	15.95 (0.81)B a	15.29 (0.74)B a	9.30 (0.76)C a	7.05 (0.46)C a	7.20 (0.47)C a
College	112	39.16	23.68 (1.45)A a	19.00 (1.13)AB a	18.40 (1.22)B a	15.31 (0.86)B a	8.77 (0.65)C a	7.94 (0.61)C a	6.90 (0.56)C a
Graduate school	34	11.89	24.71 (2.34)A a	19.34 (1.83)A a	18.44 (1.96)A a	16.40 (1.46)A a	6.15 (1.22)B b	7.93 (1.05)B a	7.04 (0.89)B a
Ethnicity									
African-American and Asian-American or Pacific Islander	31	10.84	21.68 (1.98)A a	18.14 (1.76)A ab	16.83 (1.73)A a	18.36 (1.67)A a	9.56 (1.47)B a	8.08 (1.32)B a	7.36 (0.93)B a
Hispanic/Latino Native American and Other	22	7.69	28.97 (5.10)A a	15.20 (2.27)AB b	14.23 (1.92)B a	13.64 (1.50)B b	11.33 (2.02)B a	8.21 (1.32)B a	8.42 (1.10)B a
White-Caucasian	233	81.47	25.10 (1.05)A a	19.53 (0.81)B a	17.54 (0.76)BC a	15.21 (0.58)C ab	8.36 (0.52)D a	7.36 (0.38)D a	6.90 (0.38)D a

Cluster analysis: results for fresh produce in general

ANOVA, performed over the 292 participants' responses, identified eight questions with significance ($P \leqslant 0.05$) among responses which allowed for the cluster analysis to group these participants into two different clusters (cluster 1 and 2) or market segments with similar part-worth utility coefficient estimates. The identified questions are presented in Table 3 and the differences between both clusters are described below.

Members of cluster 1 were much younger than members of cluster 2 (33.4 vs. 61.6 years). Members of cluster 1 had a higher number of children per household compared to cluster 2, which is not surprising given the mean age of the members of cluster 2. Members of cluster 1 were ethnically more diverse than cluster 2 (74.2% vs. 93.4% White-Caucasians, non-Hispanic population). In contrast, no differences were found in either gender or level of education in the main purchaser of fresh fruits of the household. This could be attributed to the increased representation of women in all aspects of modern life in the US as shown in the US Census 2010 (high school education: 29.4% males vs. 28.8% females; bachelors degree: 15.4% males vs. 14.8% females; master degree: 7.1% males vs. 8.1% females; PhD title: 1.8% male vs. 1.0% females (US Census Bureau. Current Population Survey. Annual Social, 2010c)).

More members of cluster 1 consumed fresh fruits and vegetables during the month prior to the survey (June 2010) than members of cluster 2 (98.9% vs. 94.3%). Although 3% of the participants did not consume fresh fruits and vegetables during the previous month, their responses were recorded since they were the main purchasers of fresh produce in their household.

The appeal for purchase of bio-based containers was rated high (3.52 out of 5.00) for the total population, however, when the participants were asked to identify the raw materials used to produce

Table 3
Identified questions with significantly different ($P \leqslant 0.05$) responses between cluster1 and cluster 2 (cluster 1 equals 63.70% and cluster 2 equals 36.30% of the survey population ($N = 292$)). Lower case letters represent mean separation for population segment (column), by Tukey's honestly significant difference ($P \leqslant 0.05$) test.

Attribute		Total	Cluster 1	Cluster 2	Significance
Age		43.63	33.4 ± 0.58a	61.6 ± 0.98b	0.000
Number of people younger than 18 years old per household					0.000
0		65.07%	52.69%	86.79%	
1		15.41%	18.82%	9.43%	
2		11.99%	17.74%	1.89%	
3		5.48%	8.06%	0.94%	
More than 3		2.05%	2.69%	0.94%	
Ethnical composition					0.000
African-American		5.48%	8.06%	0.94%	
Asian-American or Pacific Islander		5.14%	6.45%	2.83%	
Hispanic/Latino		5.48%	8.06%	0.94%	
Native American		1.71%	2.15%	0.94%	
White-Caucasian		81.16%	74.19%	93.40%	
Other, please specify		1.03%	1.08%	0.94%	
Consumption of fresh fruits in the last month					0.021
Yes		97.26%	98.92%	94.33%	
No		2.74%	1.08%	5.66%	
Identification of raw materials used to produce bio-based containers					0.017
Yes		54.45%	59.68%	45.28%	
No		45.54%	40.32%	54.72%	
Purchase of plastic containers for food items made from renewable resources within the last 2 months					0.014
Yes		23.97%	27.42%	17.92%	
No		17.12%	19.35%	13.21%	
Don't know		58.90%	53.23%	68.87%	
Likelihood of purchasing organic foods if packed in plastic containers made from renewable resources 0 extremely non-likely to 5 extremely likely			3.24 ± 0.1a	2.82 ± 0.14b	0.012
Convenience features	Easy to carry		2.86 ± 0.09a	3.17 ± 0.11b	0.037
0 extremely unimportant 5 extremely important	Easy to open		3.16 ± 0.09a	3.5 ± 0.11b	0.021

these containers, only 54.5% of them could correctly identify the materials. Cluster 1 could identify them in more cases compared to cluster 2. Considering the age difference between the participants of cluster 1 and 2, younger consumers appeared to be more informed regarding bio-based materials and were more often able to identify the sources of bio-based containers compared to the other cluster, comprised of older participants. More than half (58.9%) of the participants had no knowledge of purchasing food items packaged in a container made from renewable resources within the last 2 months before the survey with participants in cluster 1 more aware than those of cluster 2 of the purchase. Furthermore, the members of cluster 1 were significantly more inclined ($P \leqslant 0.05$) to buy organic foods if they were packed in bio-based plastic containers made from natural resources compared to the members of cluster 2. However, they were not more inclined to purchase other food products like dairy products, dried fruits, dry nuts and seeds, eggs, fresh produce, muscle foods (meat, fish and poultry) and powder products packaged in bio-based containers. This could indicate a possible linkage between words like organic and bio-based.

From a list of convenience features in a package including 'easy to carry', 'easy to open', 'reclosable', 'extend the best by date' and 'package size', 'extend the best by date' was ranked as the top convenience feature for the total population while 'easy to carry' and 'easy to open' were rated significantly higher ($P \leqslant 0.05$) by consumers in cluster 2 than consumers in cluster 1. This could reflect the higher importance of convenience features like 'easy to carry' and 'easy to open' for older consumers compared to younger ones.

When the participants were asked to rate the importance of 'labeled nutritional value', 'absence of foreign particles', 'pesticide free', 'brand name', 'traceability', and 'environmental footprint' as characteristics of a package containing fresh produce, 'absence of foreign particles' was rated as the most important followed by 'pesticide free'. In contrast, Peters-Texeira and Badrie (2005) reported 'information on label (product description, brand name, and nutritional information)'as the most important specific packaging feature for a packaged food product or new food product.

'No preference' followed by 'plastic-flexible' and 'plastic-rigid' were the preferred type of material to package fresh produces among 'corrugated paperboard', 'paper pulp', 'plastic-flexible', 'plastic-rigid', 'other', and 'no preference'. Similarly, plastic was consumers' preferred choice of packaging material for packaged food products or new food products according to Peters-Texeira and Badrie (2005). In contrast to the given response 'no preference', most responders (92.7%) believed that the type of packaging material could adversely affect the quality or performance of the food product. No significant differences ($P \leqslant 0.05$) were found between clusters either regarding importance of package characteristics or preferred material. The same trend was observed for the evaluated attribute 'disposal method (recyclable, compostable, trash bin)'.

Participants resided in 45 states across the US (Fig. 1). Members of cluster 1 had the majority in 33 States, while members of cluster 2 had the majority in 12 States. Cluster 1 had more participants on both the East and West coasts of the US as well as in Hawaii. The same numbers of participants for each cluster were recorded in New Mexico and West Virginia. No participants were recorded for the States of Alaska, Wyoming, North Dakota, Rhode Island and Maine.

Conjoint analysis: results for fresh, sweet cherries

The relative importance means, values representing the importance of each attribute when compared to the other tested attributes, along with the separation of means are reported in Table 2. The part-worth utilities, values representing utility value among the same attribute, along with the separation of means, are reported in Table 4.

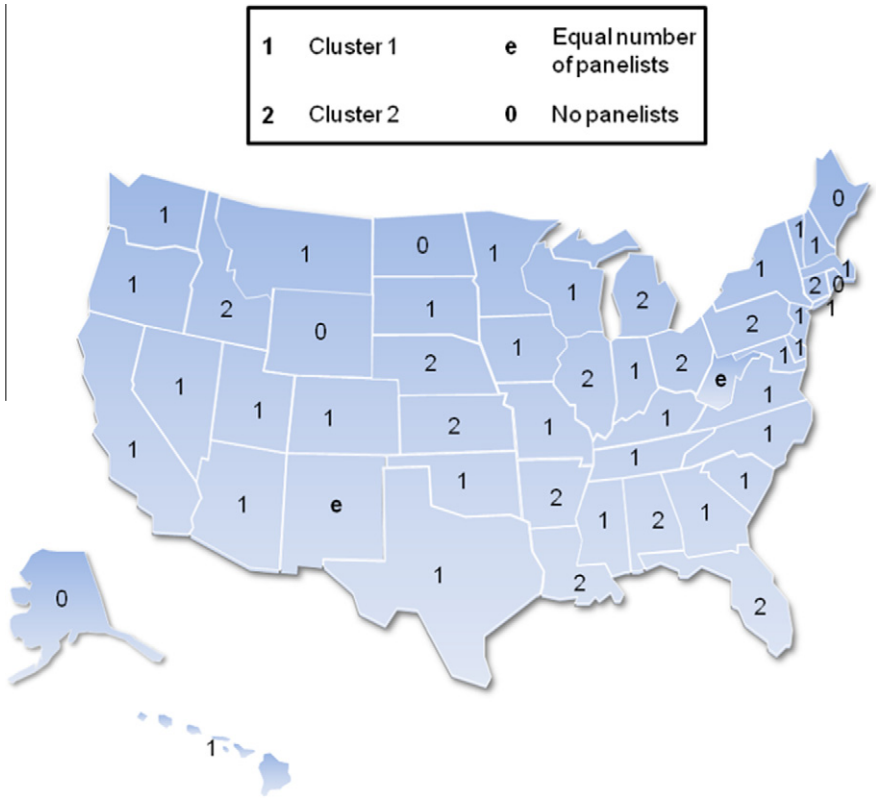

Fig. 1. Geographical mapping of participants across US.

Results for total population

The most important attributes that affect the purchasing decisions of consumers regarding a fresh produce like fresh, sweet cherries are price (25%), shelf life (19%), container size (17.2%) and disposal method (15.4%), followed by material (8.7%), package integrity (7.5%) and stem on/stem off (7.1%) (Table 2). This is in agreement with Peters-Texeira and Badrie (2005) who found that price also was the factor that most influenced respondents in the purchase of a packaged food product or new food product. The lowest proposed price of $3/pound was significantly more desired than the higher proposed values of $4 and $5/pound ($P \leqslant 0.05$; Table 4). Price is one of the most important factors when it comes to deciding what food products to buy (Fuller, 1994; Underwood, Klein, & Burke, 2001). However, other factors can be the driving force when a choice has to be made for fresh produce. According to Lin, Smith, and Huang (2008) and Yiridoe, Bonti-Ankomah, and Martin (2005), while consumers prefer lower prices for fresh produce of conventional agriculture, they are inclined to pay more for special categories of fresh products like organic produce, as well as produce with special health benefit claims like high amount of vitamins, antioxidants, fiber, etc.

The longest shelf life of 9 days is also significantly preferred ($P \leqslant 0.05$) over 3 or 6 days for the total population (Table 2). Ragaert et al. (2004) related a desired prolonged shelf life for produce with consumers working outside the home as well as those buying produce during the weekend for storage. Participants also showed a predilection for larger containers (16 and 32 oz) over the smallest one (8 oz). No preferences were found for the disposal method (recycling, composting, and regular disposal in trash bin) of the containers after consumption of the produce, which seems to contradict the high importance scores of disposal method. This may be evidence of a lack of consumers' knowledge regarding principles and details of each disposal method. Further education on the subject could improve the current situation. In contrast, consumers were significantly ($P \leqslant 0.05$) more inclined towards bio-based materials over petroleum-based ones for packaging of fresh, sweet cherries. Participants valued more rigid containers over flexible ones and stem-free cherries were preferred over stem-on cherries ($P \leqslant 0.05$).

Results for clusters

Both clusters considered price as the most important attribute affecting the purchasing decisions regarding a fresh produce like sweet cherries (24.5% for cluster 1 and 26% for cluster 2) (Table 2). The lowest proposed price of $3/pound was significantly the most preferable ($P \leqslant 0.05$). Additionally, cluster 2 valued the lowest price significantly higher ($P \leqslant 0.05$) compared to cluster 1 (Table 4). This may be a consequence of cluster 2 having a higher percentage of older consumers. For the three attributes following the price in terms of importance (shelf life, container size and disposal method, Table 2), no differences were found between cluster 1 and 2 for shelf life and disposal method, but members of cluster 2 rated container size more important ($P \leqslant 0.05$) than those of to cluster 1. The longest shelf life (9 days) was preferred by both, cluster 1 and 2 (Table 4). This is in agreement with earlier results regarding convenience features in this survey instrument, where 'extend the best by date' was ranked as the top convenience feature. Regarding container size, cluster 1 showed a strong affinity for 16 and 32 oz containers; while at the same time they disliked the smaller proposed container (8 oz) significantly more ($P \leqslant 0.05$) than cluster 2. This may be due to the younger age and the higher number of children per household, leading to the consumption of higher amounts of fresh produce and consequently to a demand for larger container sizes, in cluster 1 compared to cluster 2. Cluster 2 did not have any preferences in container size (Table 4). However, the smaller proposed container was the only size that had positive part-worth utility value for this cluster. The demand for smaller portions has increased, based on

Table 4
Part-worth utilities means and corresponding standard errors (between parentheses) of the different attributes studied for different population segments. Upper case letters represent mean separation for attribute (rows) and lower case letters represent mean separation for population segment (columns), by Tukey's honestly significant difference ($P \leqslant 0.05$) test. *Note:* the differences in columns are only for the grouping they are in (i.e. – an 'a' in ethnicity is only comparing against other ethnic groups).

	Price			Shelf life			Container size			Disposal method			Material		Integrity		Stem	
	$3	$4	$5	3 days	6 days	9 days	8 oz	16 oz	32 oz	Compost	Recycle	Throw away	Bio-based	Petroleum-based	Flexible	Rigid	On	Off
All	0.41 (0.03)A ab	−0.08 (0.02)F a	−0.33 (0.03)G ab	−0.23 (0.03)G a	0.04 (0.02)CD a	0.19 (0.02)B a	−0.06 (0.03)EF ab	0.02 (0.02)CDE a	0.04 (0.03)CD a	0.03 (0.02)CDE a	−0.04 (0.02)DEF a	0.00 (0.02)CDE a	0.11 (0.02)BC a	−0.11 (0.02)F a	−0.03 (0.01)DEF a	0.03 (0.01)CD a	−0.03 (0.01)DEF a	0.03 (0.01)CD a
Cluster 1	0.33 (0.04) A b	−0.07 (0.02)EF a	−0.26 (0.04)H a	−0.24 (0.03)GH a	0.03 (0.02)CDE a	0.21 (0.03)AB a	−0.12 (0.03)FG b	0.04 (0.02)CDE a	0.08 (0.03)CD a	0.03 (0.02)CDE a	−0.05 (0.02)EF a	0.02 (0.03)CDE a	0.09 (0.02)BC a	−0.09 (0.02)F a	−0.04 (0.02)EF a	0.04 (0.02)CDE a	−0.02 (0.02)DEF a	0.02 (0.02)CDE a
Cluster 2	0.56 (0.06)A a	−0.11 (0.03)DEF a	−0.44 (0.05)G b	−0.2 (0.04)F a	0.05 (0.03)BCD a	0.16 (0.04)B a	0.03 (0.05)BCDE a	−0.01 (0.03)CDE a	−0.02 (0.05)BCDE a	0.04 (0.03)BCDE a	−0.02 (0.03)CDE a	−0.03 (0.05)BCDE a	0.13 (0.03)BC a	−0.13 (0.03)EF a	−0.03 (0.02)CDEF a	0.03 (0.02)BCDE a	−0.04 (0.02)DEF a	0.04 (0.02)BCD a
Gender																		
Male	0.32 (0.04)A b	−0.06 (0.03)DEF a	−0.26 (0.04)G a	−0.13 (0.03)FG a	−0.04 (0.02)CDEF b	0.17 (0.03)AB a	−0.04 (0.04)CDEF a	−0.01 (0.02)CDEF a	0.05 (0.04)BCDE a	0.04 (0.03)BCDE a	−0.05 (0.03)DEF a	0.01 (0.04)CDE a	0.10 (0.02)BC a	−0.10 (0.02)EF a	−0.04 (0.02)DEF a	0.04 (0.02)BCD a	−0.02 (0.02)CDEF a	0.02 (0.02)CDE a
Female	0.49 (0.05)A a	−0.10 (0.02)FG a	−0.39 (0.04)H b	−0.30 (0.04)H a	0.10 (0.02)BCD a	0.21 (0.03)B a	−0.08 (0.03)FG a	0.05 (0.02)CDE a	0.04 (0.04)CDE a	0.02 (0.02)CDEF a	−0.02 (0.02)EFG a	0.00 (0.03)CDEF a	0.12 (0.02)BC a	−0.12 (0.02)G a	−0.03 (0.02)DEFG a	0.03 (0.02)CDEF a	−0.04 (0.02)EFG a	0.04 (0.02)CDE a
Age																		
<40	0.29 (0.04)A b	−0.06 (0.03)DE a	−0.24 (0.05)F a	−0.24 (0.04)F a	0.02 (0.03)CD a	0.22 (0.04)AB a	−0.12 (0.03)EF a	0.03 (0.02)CD a	0.09 (0.03)BC a	0.02 (0.02)CD a	−0.05 (0.02)DE a	0.03 (0.03)CD a	0.08 (0.02)BC a	−0.08 (0.02)BC a	−0.04 (0.02)CDE a	0.04 (0.02)CD a	−0.02 (0.02)CDE a	0.02 (0.02)CD a
40–60	0.45 (0.06)A ab	−0.10 (0.03)EFG a	−0.35 (0.05)H ab	−0.26 (0.04)GH a	0.08 (0.03)BCD a	0.18 (0.04)B a	−0.01 (0.04)CDEF a	0.02 (0.03)CDEF a	0.00 (0.05)CDEF a	0.05 (0.03)BCDE a	−0.03 (0.03)DEF a	−0.02 (0.05)CDEF a	0.12 (0.02)BC a	−0.12 (0.02)FG a	−0.02 (0.02) DEF a	0.02 (0.02)BCDEF a	−0.05 (0.02)DEF a	0.05 (0.02)BCD a
>60	0.63 (0.09)A a	−0.11 (0.06)CD a	−0.52 (0.07)E b	−0.11 (0.06)CD a	−0.02 (0.04)BCD a	0.14 (0.06)B a	−0.01 (0.08)BCD a	0.01 (0.04)BCD a	0.00 (0.07)BCD a	0.02 (0.03)BCD a	−0.02 (0.05)BCD a	0.00 (0.06)BCD a	0.14 (0.05)BC a	−0.14 (0.05) D a	−0.05 (0.03) BCD a	0.05 (0.03) BCD a	−0.01 (0.03) BCD a	0.01 (0.03) BCD a
Number of adults per household																		
1	0.44 (0.07)A a	−0.12 (0.04)DEF a	−0.32 (0.06)F a	−0.20 (0.06)EF a	0.03 (0.03)BCD a	0.17 (0.05)B a	0.01 (0.07)BCDE a	−0.02 (0.04)BCDE a	0.01 (0.06)BCDE a	0.04 (0.04)BCD a	−0.05 (0.04)CDE a	0.01 (0.05)BCD a	0.12 (0.04)BC a	−0.12 (0.04)DEF a	−0.01 (0.02)BCDE a	0.01 (0.02)BCDE a	−0.06 (0.02)CDE a	0.06 (0.02)BCD a
2	0.44 (0.05)A a	−0.12 (0.03)EF a	−0.32 (0.05)G a	−0.21 (0.04)FG a	0.01 (0.03)CDE a	0.19 (0.04)B a	−0.08 (0.03)DEF a	0.04 (0.03)BCD a	0.04 (0.04)BCD a	0.05 (0.03)BCD a	0.01 (0.03)CDE a	−0.06 (0.05)CDE a	0.09 (0.02)BC a	−0.09 (0.02)BC a	−0.01 (0.02)CDE a	0.01 (0.02)CDE a	−0.01 (0.02)CDE a	0.01 (0.02)CDE a
3	0.37 (0.06) A a	−0.03 (0.04) BCDE a	−0.35 (0.07) G a	−0.22 (0.05) FG a	0.08 (0.03)BCD a	0.14 (0.04) AB a	−0.08 (0.05)DEF a	0.04 (0.03)BCDE a	0.04 (0.03)BCDE a	0.00 (0.03)BCDE a	−0.06 (0.03)CDEF a	0.07 (0.04)BCD a	0.11 (0.03)BC a	−0.11 (0.03) EF a	−0.07 (0.03) DEF a	0.07 (0.03) BCD a	−0.03 (0.02) BCDE a	0.03 (0.02) BCDE a
4 or more	0.38 (0.11)A a	−0.04 (0.05)BC a	−0.34 (0.10)C a	−0.34 (0.09)C a	0.02 (0.06)B a	0.33 (0.07)A a	−0.10 (0.05)BC a	0.00 (0.04)B a	0.10 (0.05)AB a	0.04 (0.04)B a	−0.07 (0.04)BC a	0.03 (0.05)B a	0.11 (0.03)AB a	−0.11 (0.03)BC a	−0.06 (0.03)BC a	0.06 (0.03)AB a	−0.03 (0.03)B a	0.03 (0.03)B a
Number of children per household																		
0	0.45 (0.04)A a	−0.10 (0.02)EFG a	−0.35 (0.04)H a	−0.23 (0.03) H a	0.02 (0.02)CDE a	0.22 (0.03)B a	−0.02 (0.04)DEF a	0.03 (0.02)CD a	−0.01 (0.03)CDE a	0.04 (0.02)CD a	−0.04 (0.02)DEF a	−0.01 (0.03)CDE a	0.13 (0.02)BC a	−0.13 (0.02)FG a	−0.03 (0.02)DEF a	0.03 (0.02)CD a	−0.03 (0.02)DEF a	0.03 (0.02)CD a
1	0.34 (0.08)A a	−0.03 (0.05)BCDE a	−0.31 (0.07)F a	−0.25 (0.08)EF a	0.11 (0.05)ABC a	0.14 (0.07)ABC a	−0.11 (0.05)DEF a	−0.04 (0.04)BCDE a	0.15 (0.06)AB a	0.00 (0.05)BCDE a	−0.05 (0.05)BCDE a	0.06 (0.05)BCD a	0.07 (0.03)ABCD a	−0.07 (0.03)CDEF a	−0.07 (0.04)CDEF a	0.07 (0.04)ABCD a	−0.01 (0.02)BCDE a	0.01 (0.02)BCDE a
2	0.35 (0.09)A a	−0.08 (0.04)BCD a	−0.27 (0.08)D a	−0.14 (0.05)CD a	0.00 (0.04)BC a	0.14 (0.06)AB a	−0.11 (0.05)CD a	0.03 (0.06)BC a	0.08 (0.07)ABC a	0.05 (0.05)BC a	−0.02 (0.05)BCD a	−0.03 (0.05)BCD a	0.06 (0.03)BC a	−0.06 (0.03) BCD a	−0.01 (0.03) BCD a	0.01 (0.03) BC a	−0.02 (0.04) BCD a	0.02 (0.04) BC a
3 or more	0.32 (0.14)A a	−0.06 (0.05)ABCD a	−0.27 (0.13)CD a	−0.27 (0.09)D a	0.11 (0.06)AB a	0.16 (0.06)AB a	−0.20 (0.07)CD a	0.04 (0.04)ABCD a	0.15 (0.07)AB a	−0.01 (0.05)ABCD a	−0.04 (0.04)ABCD a	0.05 (0.06)ABCD a	0.10 (0.05)ABC a	−0.10 (0.05)BCD a	−0.03 (0.04)ABCD a	0.03 (0.04)ABCD a	−0.06 (0.03)ABCD a	0.06 (0.03)ABCD a
Education																		
High school	0.46 (0.06)A a	−0.08 (0.02)DEF a	−0.38 (0.05)G a	−0.20 (0.04)F a	0.03 (0.03)BCD a	0.17 (0.03)B a	−0.01 (0.03)DE a	0.01 (0.02)CDE a	0.01 (0.04)CDE a	0.03 (0.02)BCD a	−0.03 (0.03)DE a	0.00 (0.03)CDE a	0.12 (0.02)BC a	−0.12 (0.02)EF a	−0.02 (0.02)DE a	0.02 (0.02)CD a	−0.05 (0.02)DEF a	0.05 (0.02)BCD a
College	0.35 (0.05)A a	−0.08 (0.03)EFG a	−0.27 (0.04)H a	−0.25 (0.04) Ha	0.05 (0.03)CDE a	0.21 (0.04)AB a	−0.12 (0.05)GH a	0.04 (0.03)CDE a	0.08 (0.04)BCD a	0.04 (0.03)CDEF a	−0.06 (0.03)EFG a	0.02 (0.04)CDE a	0.11 (0.02)BC a	−0.11 (0.02)FGH a	−0.06 (0.02)DEFG a	0.06 (0.02)BCDE a	−0.01 (0.02)CDEFG a	0.01 (0.02)CDEFG a
Graduate school	0.43 (0.09) A a	−0.12 (0.05) CDE a	−0.31 (0.09) E a	−0.25 (0.08) DE a	0.03 (0.05)BC a	0.22 (0.06)AB a	−0.06 (0.07)CDE a	0.01 (0.04)BCD a	0.04 (0.07)BC a	0.02 (0.05)BCD a	0.01 (0.06)BCD a	−0.03 (0.06)BCD a	0.05 (0.03)BC a	−0.05 (0.03)CDE a	−0.02 (0.03)BCD a	0.02 (0.03)BCD a	−0.01 (0.03)BCD a	0.01 (0.03)BCD a
Ethnicity																		
African-American and Asian-American/Pacific Islander	0.16 (0.08) A b	0.00 (0.06) ABC a	−0.16 (0.09) C a	−0.15 (0.05) C a	−0.04 (0.06)ABC a	0.19 (0.07)A ab	−0.15 (0.05)C a	0.04 (0.04)ABC a	0.10 (0.06)ABC a	0.06 (0.06)ABC a	−0.09 (0.06)ABC a	0.04 (0.07)ABC a	0.14 (0.05)AB a	−0.14 (0.05)BC a	−0.04 (0.05)ABC a	0.04 (0.05)ABC a	−0.07 (0.03)ABC a	0.07 (0.03)ABC a
Hispanic/Latino Native American and Other	0.18 (0.12) A b	−0.17 (0.07) B a	−0.02 (0.12) AB a	−0.10 (0.06) AB a	0.13 (0.07) AB a	−0.02 (0.07) AB b	−0.04 (0.07) AB a	−0.04 (0.04) AB a	0.08 (0.06)AB a	0.08 (0.06)AB a	−0.05 (0.06)AB a	−0.04 (0.07)AB a	0.14 (0.06)AB a	−0.14 (0.06)AB a	−0.12 (0.04)AB a	0.12 (0.04)AB a	0.03 (0.04)AB a	−0.03 (0.04)AB a
White-Caucasian	0.47 (0.04)A a	−0.09 (0.02)EF a	−0.38 (0.03)H b	−0.25 (0.03)G a	0.04 (0.02)CD a	0.21 (0.03)B a	−0.05 (0.03)DEF a	0.02 (0.02)CDE a	0.03 (0.03)CDE a	0.02 (0.02)CDE a	−0.03 (0.02)DEF a	0.00 (0.03)CDEF a	0.10 (0.02)BC a	−0.10 (0.02)F a	−0.03 (0.01)DEF a	0.03 (0.01)CDE a	−0.03 (0.01)DEF a	0.03 (0.01)CDE a

the growth of one and two-person households and on the speed of population aging in developed countries (Euromonitor International, 2006; Senauer, Asp, & Kinsey, 1991). In addition, the choice of package size has been reported to be dependent on the product segment. According to Draskovic (2010), participants preferred portion size packaging (smaller packages) for soft drinks, especially if the packaging lacked a resealing feature (Draskovic, 2010).

For the attributes with the least impact on purchase decisions (material, package integrity, and stem-free/stem-on, Table 2) no differences were found between cluster 1 and 2 and no preferences expect to a strong one for bio-based packaging materials versus petroleum-based ones (Table 4). In contrast, no preference was shown for any of the three proposed methods of disposal among participants.

Gender

Examining the importance of the seven attributes by gender (Table 2), no significant differences were found between male and female participants for individual attributes. However, different importance patterns were identified across attributes. Females grouped the seven attributes into four groups of importance while males grouped them into only three groups. Females rated price as the most important attribute, followed by shelf life and container size. Container size (again resulting from overlapping) and disposal method formed the third group of important attributes, followed by a fourth group including material, package integrity and stem on/off. In contrast, males rated price and shelf life as the most important attributes, followed by shelf life (again resulting from overlapping), container size and disposal method. Material, package integrity and stem on/stem off were the three factors with the lowest importance for male participants.

As shown in Table 4, females rated the price of $3/pound as significantly more preferable ($P \leqslant 0.05$) compared to males. Also, females rated the highest price of $5/pound as significantly less preferable ($P \leqslant 0.05$) compared to males. Regarding shelf life, males preferred 9 days more than any other duration while females showed strong affinity for both 6 and 9 days. Males showed no preference for any container size, but females preferred the larger containers (16 and 32 oz) over the smallest one (8 oz). Ragaert et al. (2004) also found significant differences between female and male preferences for the packaging of fresh produce. Women perceived the credence attributes and information on the package at purchase as more important than men. Following the same pattern as the clusters, no preference was found regarding the 'disposal method', and both males and females preferred bio-based over petroleum-based containers as packaging material for fresh, sweet cherries. In contrast, according to a report released by Thomson Reuters, women are 14% more likely than men to select environmentally friendly packaging over non-green, more convenient alternatives (Roderick, 2011). The difference between these findings and our findings could be resulting from a mix between convenience and 'green', combination which has not been covered in our study. Additionally, no preferences were found for 'package integrity' and 'stem off/stem on' between males and females.

Age

No significant differences were found between participants of all tested age groups for individual attributes but importance differences were identified across attributes (Table 2). The youngest group (<40 years old) rated price and shelf life as the most important attributes. The group of participants between 40 and 60 years old rated price, shelf life and container size as the most important attributes, while the oldest group (>60 years old) rated price only as the most important attribute and shelf life. The oldest participants (>60 years) rated the prices of $3/pound and $5/pound as significantly more and less preferable ($P \leqslant 0.05$), respectively, compared to the youngest segment (<40 years; Table 4). In contrast, Murray and Delahunty (2000) reported that older consumers expressed a preference for more expensive packaged cheeses. Participants older than 40 years, preferred 6 and 9 days for the shelf life of the fresh, sweet cherries while the youngest segment (<40 years old) only preferred 9 days ($P \leqslant 0.05$). While the two older segments had no preference on container size, the youngest segment significantly preferred the largest container of 32 oz ($P \leqslant 0.05$). This could be justified by the possibility of larger households with children who still live with their parents. All of the age segments showed no preference for disposal method. In contrast, Raymond (2009) reported that more than 67% of the population older than 25 years says that they always recycle. Regarding sources of packaging material, the younger segment had no preference while the two older segments preferred bio-based over petroleum-based plastics. This suggests a generation difference between younger and older consumers, which may have caused the older consumers to prefer bio-based plastics. In agreement, Raymond (2009) reported that 61.7% of the Millennials (17–25 years) indicated that packaging has somewhat an impact on the environment while 56.5% of the GenXers (25–40 years), 58.8% of the Boomers (41–55 years) and 75.9% of the Matures (55+ years) said it has a big impact. In addition, GenXers and Matures are willing to pay more for products that score high on the eco scale while Millennials view themselves as poor and therefore, price is their primary purchasing consideration. None of the age groups showed any preference for the integrity of the package or the stem.

Number of adults older than 18 years per household

Table 2 shows a correlation between the population segment 'number of adults older than 18 years per household' and the attribute 'package integrity' when consumers select a package for a fresh produce like cherries ($P \leqslant 0.05$). Households with one to three adults rated the importance of package integrity higher than households with four or more adults. Significant differences were observed between households with a low number of adults. While households with one adult rated price as most important, those with two adults rated shelf life as important as price. The difference could be due to the type of package pictured: a smaller or larger sized package. Households with three adults consider price, shelf life and container size as the most important attributes. It seems that households of four or more adults do not prioritize on packaging since they rated 'integrity of the package' and 'container size' lower.

Number of children younger than 18 years per household

Participants with no children younger than 18 years old living in their household rated disposal method significantly lower ($P \leqslant 0.05$) than participants with one child (Table 2). In contrast, the ones without children preferred bio-based versus petroleum-based containers, while parents with one or more children did not have any preference. As expected, the group without children was more inclined to the longest proposed shelf life period (9 days), and parents with three or more children younger than 18 years old living in the same household preferred the largest container of 32 oz (Table 4).

Education

Participants with high school education and with college education rated the importance of all tested attributes in a similar way (Table 2). Price, or price and shelf life were the most important attributes for them followed by the rest of the attributes. Participants with graduate degrees rated with the same importance price, shelf life, container size and disposal method. Additionally, the same group rated ($P \leqslant 0.05$) attributes like material, package integrity and stem on/stem off significantly lower. A significant

difference was found also for the attribute of material, where participants with graduate degrees rated it significantly low ($P \leqslant 0.05$) compared to the high school and college graduates (Table 4). Therefore, it appears that participants with graduate degrees may recognize the impact of packaging on the environment based on the importance given to disposal method but they do not have a strong preference for the type of material to be used. In contrast, high school and college graduates preferred bio-based materials over petroleum-based ones ($P \leqslant 0.05$; Table 4). This may be explained by the influence that modern marketing and advertising strategies have over consumers who are convinced to purchase environmentally friendly products, but do not have the knowledge needed to validate these ecological claims. Other difference among these groups was that participants with college educations valued the maximum shelf life of 9 days more compared to the other two groups which showed no preference between 6 and 9 days (Table 4).

Ethnicity

'White-Caucasians', the major group of participants, significantly differed from other ethnicities in various attributes. 'White-Caucasians' rated shelf life as significantly more important ($P \leqslant 0.05$) compared to the group of 'Hispanic/Latino, Native American and Other'. The latter group also rated the disposal method significantly lower ($P \leqslant 0.05$) compared to the group of 'African-American and Asian-American or Pacific Islander' (Table 2). 'White-Caucasians' rated the prices \$3/pound and \$5/pound as significantly more and less preferable ($P \leqslant 0.05$), respectively, compared to other ethnicities (Table 4). Also 'White-Caucasians' showed significantly higher ($P \leqslant 0.05$) affinity towards 9 days of shelf life compared to the rest of the ethnicities. Only 'White-Caucasians' showed a preference for bio-based over petroleum based packaging materials. This may be a consequence of limited knowledge over alternative packaging materials made of renewable resources on the side of the other ethnicities and agrees with the replies in the second part of the survey, where 45.54% of the total population could not identify the raw materials used to produce bio-based containers. The group of 'Hispanic/Latino, Native American and Other' had no preference of shelf life for fresh cherries, may be due to social beliefs/customs to consume fresh fruits/cherries as soon as possible from the time of purchase.

Conclusions

This study shows that specific packaging and produce attributes affect consumer purchasing decisions of fresh produce in general and sweet cherries in particular ($P \leqslant 0.05$).Based on the reported results, a successful commercialization of fresh produce in general could be expected if this is packaged in containers made from bio-based materials and with an extended "best by" date. This matches with the containers larger than 8 oz, made of bio-based rigid plastic and capable of extending shelf life to 6–9 days preferred for stem-free sweet cherries. These results show that consumers are concerned about the impact of food packaging on the environment. However, there is a lack of knowledge about materials in bio-based containers and disposal methods available after use since there was no preference for the disposal method, and a considerable fraction of consumers (45.5%) was not able to identify the sources of bio-based plastic packaging materials.

The way in which this study has been performed has several limitations. Consumers were placed in a hypothetical purchasing situation instead of in real purchase situations, much like auctions. Using text and not using photographs or other images may have drawn more attention to all factors, but likely not to any one factor present. Absent or not represented factors may also play a role in the consumer purchase decision. Our smallest utility for any attribute level was 5.98 for stems as evaluated by respondents >age 60 years. This is a small utility score and, given that it is relatively low, there may not be absent factors that play a dramatic or very large role. It is unlikely that a large factor or attribute may have been missed since the dispersion of utility scores ranged from roughly one-quarter to 5% of the decision. The sample for this study was drawn by convenience but as reported, the results presented in this study can be considered representative of the 2010 US population. A random sample of all US residents would have been cost prohibitive in addition to any incentives which may have been required to entice their participation. The study was conducted online and therefore, the 23% of the US population that does not have Internet access was most probably excluded.

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