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USA Consumer Demand for Passionfruit: Results from a Choice Experiment

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ABSTRACT

The passionfruit industry is expanding in the US, and consumers are becoming more aware of these products. This changing market reality necessitates a study on consumer preference for passionfruit products so breeders, growers, traders, and retail outlets can be updated on current and projected trends to meet market demand. In July 2023, an online consumer preference study and choice experiment was distributed via a Qualtrics survey to 849 residents in four US states: Florida, California, Texas, and New York. Respondents were asked to select a passionfruit that would have been purchased in a hypothetical retail outlet between two options with different product attributes and prices or decide not to make a purchase. We used a multinomial logit model to evaluate the effects of product characteristics (i.e. yellow or purple, fruit with mature wrinkled skin or not, grown within the state or imported, organic or not) and consumer profiles (i.e. race, age, education level, income, gender, household size) on consumer choice for passionfruit. The respondents were willing to pay more for purple, organic, and US-grown passionfruit and less for wrinkled passionfruit. This analysis allowed us to determine which consumers to target to expand the US market for fresh passionfruit and provide insights into introducing previously unknown fruits in markets in the Global North.

KEYWORDS

Consumer preferences; demographic determinants; fresh passionfruit; specialty crops; willingness to pay

Introduction

The dishes offered on menus in restaurants and bars, and the produce found in supermarkets across the United States, have changed radically over the last few decades. Tropical fruits such as lychee (*Litchi chinensis*), starfruit (*Averrhoa carambola*), and mango (*Mangifera indica*), previously only found in specialty or niche markets, are now widely available outside urban areas. This trend has been led by the expansion of ethnic restaurants, mainly Latin American and Asian, and the growth of immigrant populations that demand these products integral to their diets (Lee et al., 2014; Tomić et al., 2018). Passionfruit (*Passiflora edulis*) is one of these products that has been gaining attention among US consumers (Stafne et al., 2023) and growers (Posadas et al., 2023).

While passionfruit has been grown in the United States for over a century, it was mostly raised in home gardens and by small-scale growers for self-consumption, occasionally sold in roadside stands or local farmers' markets. Just under a decade ago, passionfruit was unavailable in most grocery stores nationwide. This reality has greatly changed as passionfruit in drinks and food products has grown by

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20% on United States menus over the past four years. Sixty-seven percent of consumers indicated they would like to try a beverage featuring passionfruit flavor (Chilled Magazine, 2022). The steady growth in passionfruit demand, paired with the high prices offered in supermarkets and other retail outlets, has made US tropical fruit growers and the industries that support them hopeful for the market potential for domestic passionfruit production. Our study identifies opportunities in the passionfruit market by analyzing US consumers' preferences for this fruit, which not only helps the passionfruit industry meet demand for fresh passionfruit in the US but also guides lesser-known fruit industries to develop markets in the US and other countries in the global North.

To examine the market potential for fresh passionfruit, we employed a choice experiment (CE) using a multinomial logit (MNL) analysis to determine consumers' preferences and willingness to pay (WTP) for attributes of passionfruit (i.e., yellow or purple fruit with mature wrinkled skin or not, grown within the state or imported, organic or not). This type of analysis also allowed us to determine the preferences by market segment (i.e., race, age, education level, income, gender, household size) of the respondents. Such techniques have been used in previous research to understand consumer demand for produce, including sliced fresh pears (*Pyrus communis*) in North America (Ikiz et al., 2018), local fruit in Peru (Blare et al., 2019), tomatoes (*Lycopersicon esculentum*) in Germany (Meyerding et al., 2019), and for leafy greens in the US (Seong et al., 2024).

This article examines the results from a consumer survey with 849 respondents, providing insights into consumers' preferences for passionfruit and potential demand for other relatively new tropical fruits and produce that have the potential to penetrate the US market and other countries in the Global North. It is divided into four sections. The next section provides an overview of market trends in the US for passionfruit, underlining the need to better understand the demand for this fruit. We then explore other research on consumer demand for tropical fruits, providing an underpinning for our analysis of fresh passionfruit. The following section describes the methods we employed to collect data on consumer preferences for passionfruit demand. Next, we describe our data analysis methods and present the results from the study. We conclude with insights on what the results mean for creating a passionfruit industry in the United States; opportunities for US farmers, processors, traders, and retailers to fill this demand. Additional discussion will cover the next steps in developing this market and supply chain; insights into what this study means for creating markets for other produce in the Global North; and the next steps in research needed to determine consumer demand and how to establish markets for previously unknown fruits.

Market trends

Passionfruit is a perennial vine cultivated commercially in tropical and subtropical areas for its aromatic and sweet fruit. There is growing interest in the fruit thanks to its unique flavor profile, aroma, and phytochemical properties. Passionfruit is rich in vitamin C, vitamin E (tocopherols), and carotenoids with significant antioxidant activity (alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein, zeaxanthin, and lycopene). There are three main commercial species: *Passiflora edulis*, *P. edulis f. flavicarpa*, and *P. liguralis*. *Passiflora edulis* produces purple-skinned fruit with a semi-tart flavor. *Passiflora edulis f. flavicarp*a produces a yellow-skinned fruit with a tarter flavor than the purple variety. It is the most economically important species cultivated worldwide. *Passiflora liguralis* is also known as sweet granadilla because of its sweeter flavor compared to the other two species (Garcia et al., 2023).

Passionfruit originates from Brazil, which remains the largest producer of passionfruit globally (Castillo et al., 2020). However, the majority of Brazil's production is consumed domestically, with relatively small volumes available for export. Outside Brazil, other major producers of fresh passionfruit include Ecuador, Indonesia, and Colombia. Among them, Ecuador is the leading global exporter, primarily supplying processed passionfruit products. In 2019, Ecuador exported approximately 150,000 metric tons of passionfruit, mostly frozen pulp (Roberts et al., 2018). Passionfruit is also cultivated in Peru, the Caribbean, and several African countries (Bailey et al., 2021). In Africa, Kenya

stands out as a key producer, exporting mainly fresh passionfruit to European markets. In Asia and Oceania, Indonesia has a large passionfruit industry, but exports remain limited, mainly in the form of juice. Notably, Indonesia shares similar seasonal production peaks with Australia (Roberts et al., 2018).

The growing market for fresh fruits, especially for nontraditional and tropical fruits in the US and other countries in the Global North, could provide a potential opportunity for US passionfruit growers who cannot compete with lower-priced imported products (Huang, 2010). This increasing demand for fresh produce has been demonstrated in berry markets in the US and avocados throughout the Global North (Huang et al., 2023; Sobekova et al., 2013). In fact, since the 80 s, the trade in fruits and vegetables has been growing faster than any other commodity not only in North America but also in the European Union and East, Southeast, and South Asia with the offer having diversified greatly (Huang, 2010; Jaffee and Gordon, 1993; Regmi and Gehlhar, 2005; Van der Meer, 2006). In Europe, this trend has manifested in a growing market for "novel" foods (Beghin and Gustafson, 2021; Boccia and Punzo, 2020; Gellynck and Kühne, 2008; Günden et al., 2024; Lähteenmäki, 2013; Laureati et al., 2024; Menrad, 2003), which includes many fresh tropical fruits and vegetables that are not part of the traditional diet (Altendorf, 2018; Cornara et al., 2020; Santeramo et al., 2018; Sgroi et al., 2023). Because of this increasing demand for fresh fruits, there is a need to understand if this market demand applies to fresh tropical fruits in the US and the Global North, such as fresh passionfruit. Understanding the size of this market can help those interested in the industry (i.e.,growers, marketers, processors, and policy makers) make investment decisions to take advantage of this potential opportunity.

Consumer preferences research

Research on fresh passionfruit and tropical fruit market expansion emphasizes consumer acceptance as a key factor. Sabbe et al. (2008) used factor analysis to examine purchase intentions for passionfruit in Belgium, while De Souza Silva et al. (2020) assessed key characteristics for a new variety (*Passiflora cincinnata Mast.*) to support market growth. In the sensory domain, Rocha and Bolini (2015) analyzed sweetener preferences in passionfruit juice, and Deliza et al. (2005) applied free-choice profiling to evaluate consumer perceptions. In analyzing exotic fruit juices, Ngo et al. (2013) explored how sensory and psychological factors influence market acceptance of passionfruit-based beverages. These studies inform strategies for introducing passionfruit products to non-tropical markets, providing insights for our study examining US consumer acceptance of fresh passionfruit, considering varietal preferences, consumer segments, and country of origin effects.

Quality plays an important role in understanding consumer preferences. Consumer quality evaluation follows a two-stage perception process: quality expectation and experienced quality (Steenkamp, 1990). Expectations about quality are based on informational stimuli (price or brand), which allows the consumer to make assumptions about the product's quality attributes. Tangible and intangible consumption attributes form the basis for experienced quality (experience and credence quality attributes). Experienced quality is based on aroma, taste, and texture attributes; it forms the physical basis for quality evaluation (Barrett et al., 2010). Credence quality attributes are related to intangible attributes, such as origin, production method, and health benefits, which are difficult to evaluate based on product consumption.

In the context of fresh fruits, origin and farming methods have received considerable attention (Berlin et al., 2009; Miller et al., 2017; Tsakiridou et al., 2011). Origin is an important factor related to consumer food preferences; previous studies have found domestic produce to be preferred over imports and local or regional food to be preferred over food with less specified origins (Blare et al., 2019; Fernqvist and Ekelund, 2014; Loureiro and Hine, 2002; Migliore et al., 2017). Feldmann and Hamm (2015) reviewed the scientific literature on local food from the consumer's perspective. One major finding is that local food is not perceived as expensive, and consumers were WTP a premium for this local food.

Consumer preferences for organic products have also received considerable attention. In the case of fresh organic fruit, consumers with children who showed strong food safety and environmental concerns were more likely to buy fresh organic apples (*Malus domestica*) (Loureiro et al., 2001). Age, race, and income have also been found to influence the preference for certified organic produce. Chamberlain et al. (2013) indicated that African Americans, Asian Americans, and Hispanics under 37 years of age, with children living in households with incomes greater than $25,000, were more likely to buy certified organic produce. Thus, these characteristics of fruit quality, origin, and use of organic production practices are necessary to fully understand consumer preferences for particular characteristics of fresh produce, including tropical fruits like passionfruit.

Considering that fresh passionfruit is likely a new product to many US consumers, we wanted to understand how consumers reacted to novelty and potential interest in yellow passionfruit, which has not been as prevalent in the US market. To better understand consumer responses, we assessed food neophobia's role in consumers trying a new, lesser-known fruit like fresh passionfruit. Food neophobia is the reluctance or tendency to avoid novel foods (Pliner and Hobden, 1992). Food neophobia is a personality trait that can help better understand consumer preferences (Nezlek and Forestell, 2019). Understanding the role of food neophobia and its potential impact on consumers' preferences and behavior has important implications for marketing in understanding how to promote new fruits while considering consumers' potential responses.

Methods

Data collection

CEs are based on random utility theory, which states that consumers derive utility from the attributes of a good rather than the good itself. This allows researchers to estimate the implicit prices consumers assign to different product attributes by showing respondents different choice situations with varying attribute tradeoffs (Greene, 2017). In this survey, respondents were shown a series of eight choice situations in which they could select one of two hypothetical passionfruit purchases or indicate that they would buy neither by selecting the opt-out alternative. (Table 1 and Figure 1). Each passionfruit presented to the participant was randomly assigned five attributes: skin color, skin texture, country or region of origin, organic status, and price. The attributes and relevant levels selected for the CE were based on discussions with industry experts, US passionfruit growers, and market information. The four prices were based on the average market prices for fresh passionfruit in the four sample states in July 2023.

The CE was conducted in July 2023 via a Qualtrics survey of 849 US residents in Florida, California, Texas, and New York. The selection of states included in the survey was based on two primary criteria: acreage and production versus no acreage and production of passionfruit, as well as large consumption of passionfruit. The states of Florida and California have large acreage and production of passionfruit. Texas and New York were selected as large consuming states of passionfruit. The Qualtrics survey entitled "Passionfruit: Developing An Emerging Specialty Fruit Crop Industry" was approved by the University of Florida Research Operations as an Exempt Study with Protocol no. ET00018645 on 26 April 2023. Respondents had to be the primary grocery shoppers above 18 years old to participate in the survey. It was distributed evenly between the four US states: two that currently produce fresh

Table 1. Passionfruit attributes included in the choice experiment.

Attribute	Levels
Color	Purple, Yellow
Skin	Smooth, Wrinkled
Origin	'Product of your Country," "Product of your State," "Imported"
Organic Status	None, Organic
Price ($/fruit)	0.99, 1.99, 2.99, 3.99

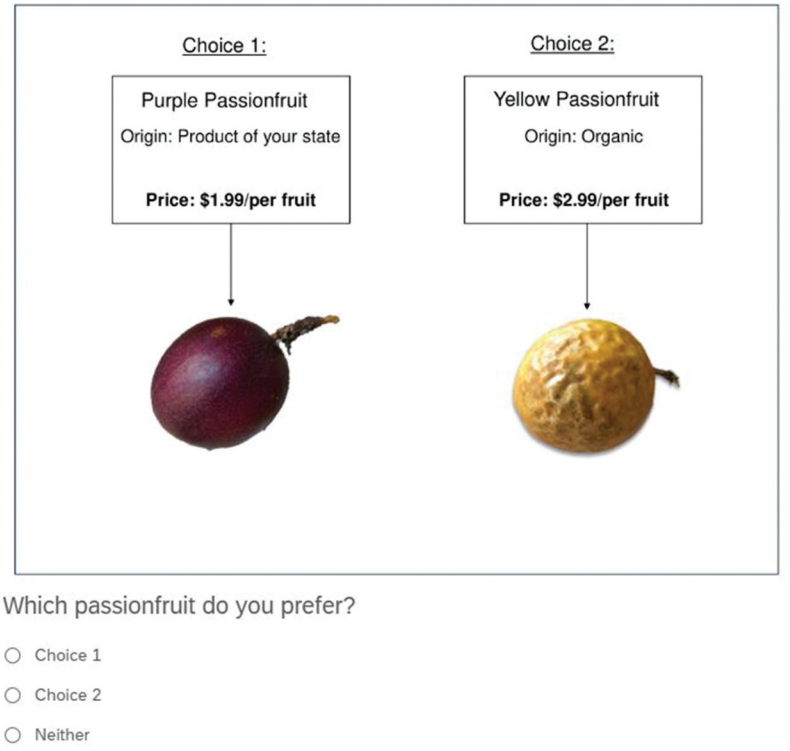

Figure 1. An example of a choice card presented to respondents

passionfruit, Florida and California, and two that do not, New York and Texas. We included New York and Texas, representing the largest regions with large populations in the Northeast and Southwest.

Respondents residing in passionfruit-producing states had an additional attribute option within the CE for the origin of "Produced in Your State." The CE followed a two-step design process. First, attributes and levels were established to create a full set of alternative profiles. Then, choice sets were selected to maximize D-efficiency (Greene, 2012). The CE was divided into two blocks of eight questions to reduce cognitive load. The two fruit options were also presented visually (Figure 1). To mitigate hypothetical bias – common when participants are not required to make actual purchases – introductory screens, a "cheap talk" script, and relevant images helped simulate a realistic shopping experience (Penn and Hu, 2018). Additionally, respondents completed a seven-item version of the food neophobia scale from the Food Attitudes Survey (FAS) instrument (Raudenbush et al., 1995), demonstrating their agreement with food behavior statements on a 5-point Likert scale.

Empirical analysis

Following random utility maximization theory (McFadden, 2001), we assume that the utility an individual derives from their consumption of an alternative with a bundle of attributes in a choice scenario is specified as

$$U_{ijt} = \beta_i X_{ijt} + \varepsilon_{ijt}$$

where U_{ijt} is the utility of individual i (i = 1, 2, . . . , N) derived from alternative j (j = 1, 2, . . . , M) in scenario t (t = 1, 2, . . . , W). X_{ijt} is a vector of observed variables that relates to individual i for alternative j in scenario t, and β_i represents the corresponding unobserved individual-specific

coefficient vectors, which are assumed to follow a normal distribution with the density function $f(\beta|\theta)$ where θ is the fixed parameter vector of the normal distribution and ε_{ijt} is a random term that is assumed to be an independently and identically distributed extreme value. The full empirical specification for our model is

$$U_{ijt} = \beta_{i1} Price_{ijt} + \beta_{i2} Color_{ijt} + \beta_{i3} Skin_{ijt} + \beta_{i4} Origin_{ijt} + \beta_{i5} Organic_{ijt} + \varepsilon_{ijt}$$

Based on the recommendations of previous methodological research on consumer preferences (Greene and Hensher, 2010; Greene et al., 2006), we used the mixed logit (also called random parameter logit) and generalized mixed logit models to explicitly control for heterogeneity. These models relax the assumption of the standard conditional logit model of independent and irrelevant alternatives (IIA), which may lead to biased results in cases of heterogeneous preferences. Recent studies highlight that consumer preferences are often heterogeneous for novel food products due to differences in familiarity and availability (Colombo et al., 2009). Mixed logit and GMNL are appropriate in this setting because they allow us to capture both random taste variation and scale heterogeneity, providing a more flexible representation of consumer choice behavior for our broad sample.

The first model that relaxes the IIA assumption is the mixed logit model (MIXL), which can be specified as follows:

$$U_{ijt} = \beta_{ijt}{}' * X_{ijt} + \varepsilon_{ijt}$$

where, $\beta_{ijt} = \beta_{HAT} + L * u_{ijt}$. U_{ijt} is the utility of individual i choosing alternative j, X_{ijt} is a matrix of the characteristics of individual i choosing alternative j. β_{HAT} represents the population mean, and u_{ijt} is the individual-specific error term with a mean of 0 and variance of 1. L represents the lower triangular matrix of the Cholesky decomposition. The ε_{ij} error term follows a Gumbel distribution and is independently and identically distributed (IID), while the u_{ij} error term is also IID but has other non-Gumble distributions.

The second model we employ is the generalized mixed logit model (GML) which builds on the mixed logit model (ML) by introducing a scale effect, or intra-respondent choice dispersal, which can also affect preference heterogeneity (Greene and Hensher, 2010). The GML can be expressed as the following:

$$U_{ijt} = \beta_i{}' * X_{ijt} + \varepsilon_{ijt}$$

The β coefficients in the GML model behave as random variables with a given distribution, which is what allows the variation of preference across individuals. That is,

$$\beta_i = \theta_i * \beta + [\gamma + \theta_i(1 - \gamma)] * L * u_i$$

and given that $0 \leq \gamma \leq 1$,

$$\theta_i = exp\left(-\frac{\tau^2}{2} + \tau^* * w_i\right), w_i \sim N(0, 1)$$

Results

Demographics

The demographic characteristics of our sample of 849 respondents as compared to the US population based on the 2023 census data are shown in Table 2. The majority of the respondents were less than 44 years old, while over one-third of the entire US population were in that age group. About 57% were women in our sample while there were 50.4% in the entire U.S. population. Approximately 30% of our sample reported income above $100,000 per year, while 37.5% of the entire U.S. population reported similar annual income. Almost 60% were White, and 24% were Black. About one-third said that they

Table 2. Demographic characteristics of survey respondents.

Variable	Sample	The U.S. Census (2023)
Age	24.0%	8.7%
18 - 24	26.6%	13.6%
25 - 34	23.9%	13.1%
35 - 44	10.1%	12.1%
45 - 54	6.5%	12.6%
55 - 64	7.3%	17.5%
65+		
Female	57%	50.5%
Income	16%	15.8%
<$25,000	19%	18.2%
$25,000–$49,999	16%	16.2%
$50,000–$74,999	14%	12.4%
$75,000–$99,999	30%	37.5%
>$100,000		
Race	59.4%	75.3%
White	23.7%	13.7%
Black	2.9%	1.3%
American Indian or Alaska Native	5.1%	6.4%
Asian	2.3%	0.3%
Native Hawaiian		
Hispanic	34%	19.5%
Education	3.4%	13.6%
Some high school or less	18.1%	27.5%
High school graduate	31.2%	25.2%
Some college or less	22.8%	21.1%
Bachelor's degree	22.4%	12.5%
Graduate degree		
Household Size	2.9	2.54
Passionfruit Consumer	61%	
(= 1 if participant purchased passionfruit in the past 6 months)		
Fruit Consumption	38.8%	
Daily	27.7%	
4–6 times a week	23.9%	
2–3 times a week	8.8%	
Once a week	0.7%	
Never		
Neophobia Scale	17.9	
(Scale out of 35 to measure the tendency to avoid new foods)		

$N = 849$.

were Hispanic. Those with some college or less comprised 31%, 23% had earned a bachelor's degree, and 22% completed a graduate degree. The average household size was 2.9 persons.

About 61% stated that they consumed passionfruit during the past six months. Most respondents consumed fruit daily; 28% consumed 4–6 times a week, and 24% consumed 2–3 times a week. The modified Neophobia Scale, which measures the tendency of respondents to avoid new food, averaged 17.9 out of a scale of 35. This is well below the neophobia threshold of 22, indicating that respondents are only moderately neophobic – they may be somewhat hesitant to try new foods but are open to doing so under the right circumstances.

Consumer preferences

We employed a multinomial logit analysis in the preference space to evaluate the effects of various attributes on consumer choices for passionfruit (Table 3). The coefficients indicate the direction and strength of each attribute's influence on consumer preference. The "Price" variable demonstrates a consistently negative and significant effect across all models, confirming the expected sensitivity of consumers to higher prices. Attributes such as "Purple" and "Organic" had significant positive effects in certain contexts, particularly out-of-state markets.

Table 3. Estimated coefficients of the preference space for fresh passionfruit.

	Models			
	Generalized Mixed Logit		Mixed Logit	
	In-State	Out-State	In-State	Out-State
None	−36.609	−477.4	−2.57***	−2.131***
	(22.429)	(339.197)	(0.131)	(0.121)
Price	−0.177***	−0.872***	−0.215***	−0.269***
	(0.045)	(0.245)	(0.032)	(0.027)
Purple	0.024	−0.038	0.289**	0.437***
	(0.085)	(0.16)	(0.089)	(0.099)
Wrinkled	−0.645**	−1.04**	−0.429***	−0.54***
	(0.21)	(0.316)	(0.07)	(0.074)
Organic	0.567**	0.806**	0.107	0.246**
	(0.196)	(0.264)	(0.099)	(0.092)
US	2.195	0.477*	0.044	0.332***
	(6.867)	(0.232)	(0.188)	(0.072)
In-State	1.013**	–	0.223	–
	(0.313)		(0.117)	
Tau	2.503***	4.026***	–	–
	(0.349)	(0.36)		
Gamma	2.313***	1.458***	–	–
	(0.527)	(0.238)		
Log Likelihood	−2178.3	−1744.7	−2230.7	−1832.2

Note: Standard errors are reported in parentheses, for *** 1%, **5%, and *10% significance levels.
No. of respondents = 470, 379.
No. of choice observations = 8461, 6823.

Table 4. Consumers' willingness to pay in USD for fresh passionfruit with the specified characteristics.

	Models			
	Generalized Mixed Logit		Mixed Logit	
	In-State	Out-State	In-State	Out-State
Purple	0.14	0.04	1.35***	1.62***
	(0.47)	(0.18)	(0.393)	(0.38)
Wrinkled	−3.63*	−1.19***	−1.99***	−2.00***
	(1.49)	(0.11)	(0.52)	(0.35)
Organic	3.20*	0.92***	0.50	0.91**
	(1.37)	(0.15)	(0.43)	(0.34)
US	12.37	0.55**	0.21	1.23***
	(38.64)	(0.19)	(0.88)	(0.28)
In-State	5.71*	–	1.04	–
	(2.29)		(0.65)	

Note: for *** 1%, **5%, and *10% significance levels

Notably, the "Wrinkled" attribute negatively impacted preference across all models, indicating a strong aversion to passionfruits perceived as less fresh or of lower quality. The "US" attribute was more valued in out-of-state markets, suggesting a preference for domestic products among consumers further from the production source. The "In-State" variable was also significant, highlighting local production's importance for in-state consumers. Finally, the alternative specific constant for the "None" option was significant and negative in one of our models and insignificant in the other. This indicates that respondents benefited more from selecting one of the hypothetical passionfruit options than opting out of the experiment. These results highlight that both intrinsic (color, skin quality) and extrinsic (origin, price) factors significantly affected consumer preferences, providing a foundation for understanding the WTP analysis (Table 4).

Table 5. Interaction effects between each product attribute and individual demographic characteristics of "in-state" respondents.

	Dependent variable:			
	Purple	Wrinkled	Organic	Product of Your State
	(1)	(2)	(3)	(4)
Neophobia Scale	−2.550	0.998	0.943	1.451
	(12.790)	(2.439)	(5.389)	(0.984)
Household Income	34.135	−6.758	14.650	−0.786
	(34.415)	(6.563)	(14.501)	(2.649)
Household Size	54.933	−14.681*	32.481*	−0.463
	(40.789)	(7.778)	(17.187)	(3.139)
Age	10.805	−5.607	15.952	−1.297
	(31.878)	(6.079)	(13.432)	(2.454)
Male	−237.996	28.627	−68.894	18.412
	(450.684)	(85.944)	(189.897)	(34.687)
Hispanic	−173.874*	32.303*	−57.451	0.170
	(100.499)	(19.165)	(42.346)	(7.735)
Education	−1.617	−1.756	3.499	−0.590
	(39.182)	(7.472)	(16.510)	(3.016)
White	102.507	−6.375	26.024	19.367*
	(134.079)	(25.568)	(56.495)	(10.320)
Black	23.907	−13.655	29.835	9.637
	(156.582)	(29.860)	(65.976)	(12.051)
Native American or Native Alaskan	115.551	−19.169	37.978	4.234
	(273.216)	(52.101)	(115.121)	(21.028)
Asian	−606.529***	121.511***	−273.037***	−29.699*
	(209.780)	(40.004)	(88.392)	(16.146)
Observations	437	437	437	437
Log Likelihood	−3,623.597	−2,899.456	−3,245.905	−2,502.958
Akaike Inf. Crit.	7,275.194	5,826.913	6,519.810	5,033.917

Note: for *** 1%, **5%, and *10% significance levels.

Willingness to pay

Table 4 illustrates the results from the multinomial logit model in the WTP space, providing monetary valuations for the passionfruit attributes. The coefficients translate consumer preferences into WTP, offering insights into how much consumers value each attribute.

In this analysis, "Purple" emerged as a significantly valued attribute both for "In-State" and "Out-State" fruit. The WTP for "Wrinkled" was negative, showing a significant discount for fruits with this attribute. For "In-State" fruit, the WTP for wrinkled passionfruit was $3.63 less than for smooth passionfruit in the GML estimates and was $1.99 less in the MXL. For out-of-state respondents, the discount was $1.19 in the GML and $2.00 in the ML. Organic certification commanded a higher WTP for both "In-State and Out-State" fruit, reflecting a strong consumer preference for organic products. Additionally, the "US" attribute demonstrated significant WTP, especially in out-of-state markets, aligning with preferences for domestic production (Table 3).

We analyzed attributes such as "Purple," "Wrinkled," "Organic," and "Made in State" across variables like household income, size, ethnicity, and age to gain a deeper understanding of consumer heterogeneity (Table 5). Notably, larger households showed a significant preference for organic products but a strong aversion to wrinkled fruits, indicating differing priorities based on household composition. Participants identifying as Hispanic exhibited a negative preference for purple-skinned passionfruit, suggesting cultural or aesthetic associations with this attribute. They also preferred wrinkled passionfruit. Asian consumers had a significant negative association with purple, organic, and made-in-state fruits but positively valued the wrinkled attribute, revealing potential cultural or perception-based divergences. White respondents had a substantial preference for passionfruit grown in their state.

Discussion

The results of the multinomial logit models provide helpful insights into which markets and consumer segments US fresh passionfruit producers should target. Considering that this study had a large sample size and was conducted across the US, it provides very important insights about consumer preferences in a major Global North economy, where there have been large changes in the composition of the produce, particularly of fruit, available in retail markets (Huang, 2010). Indeed, in the Global North "novel" foods – including high-value crops and healthy superfoods – often attributed to tropical fruits-, as well as functional foods, genetically modified foods, and plant-based protein products – have become increasingly prevalent not only in grocery stores but also in research to understand this trend, particularly consumer studies (Beghin and Gustafson, 2021; Boccia and Punzo, 2020; Gellynck and Kühne, 2008; Günden et al., 2024; Lähteenmäki, 2013; Laureati et al., 2024; Santeramo et al., 2018).

In addition to reinforcing evidence of the growing demand for tropical fruits such as passionfruit and other novel fruits in the Global North (Altendorf, 2018; Cornara et al., 2020; Sgroi et al., 2023), the respondents who consume passionfruit had a neutral neophyte scale. This result demonstrates that consumers who are adventurous in trying new foods and those who are not are interested in this relatively new fruit in the US market, passionfruit. This result alone demonstrates a real possibility for fresh passionfruit to have a bigger share in the US fruit markets, not just in specialty markets for the adventurous shopper but also in supermarkets and other large retail vendors targeted to mass consumer markets.

The responses revealed a clear preference for organically grown passionfruit in both models. The "In State" consumers in the GML, which has a better fit than the ML, had WTP estimates more than three times more for organic fruit. There is a wealth of evidence to support consumers' WTP for organic fresh fruit, including in the US, where higher income and more educated consumers in the Mid-Atlantic region were WTP for fresh organic produce (Govindasamy et al., 2018). Similar results have been found that consumers with higher incomes are more educated, more concerned for environmental protection, more health conscious, and have young children who are WTP more for organic fresh produce. This result for young children is consistent with our result, demonstrating a preference of larger households for organic passionfruit. These results are consistent both in countries in the Global North, like Spain (Gil, 2000) and Italy (Boccaletti, 2000), as well as in the Global South in Ghana (Owusu and Owusu Anifori, 2013), Thailand (Sriwaranun et al., 2015), and India (Nandi et al., 2017), indicating their applicability worldwide.

The results do demonstrate a preference for domestically and even locally grown fruit, which corroborates the wealth of literature on consumer preferences and WTP for locally grown produce (Blare et al., 2019; Feldmann and Hamm, 2015; Fernqvist and Ekelund, 2014; Loureiro and Hine, 2002; Migliore et al., 2017). Interestingly, in our study, the "US" attribute was valued in out-state markets, suggesting a preference for domestic products among consumers further from the production source. The GML also found that the "In-State" variable was significant, highlighting the importance of local production for in-state consumers. This aligns with other studies that have demonstrated a greater WTP and preference, especially in a large country like the US, for more localized state or regional produce over similar products being identified as being from the same county (Carpio and Isengildina-Massa, 2009; Onken et al., 2011).

Notably, the "Wrinkled" attribute negatively impacts preference across all models, indicating that many passionfruit consumers in the United States cannot recognize a ripe passionfruit. This result demonstrates the need to educate consumers on properly determining when a novelty fruit is ripe and how to consume it. This outcome supports research on kiwifruit (*Actinidia deliciosa*), which found that consumers do not know how to identify when a novelty fruit is ripe (Harker et al., 2007). Indeed, the Hispanic and Asian participants in the study demonstrated a preference for wrinkled, mature fruit, as they come from cultures that are more familiar with the fruit and utilize passionfruit in their meals (Rodriguez-Amaya, 2003).

In the ML, consumers' WTP was 68% higher for purple passionfruit, indicating that US passionfruit growers could potentially benefit from focusing on this type. However, the GML did not show a significant effect on the color of the fruit. The preference for purple is likely dependent on a consumers' familiarity with one variety of passionfruit over the other. Hispanic and Asian consumers preferred the yellow passionfruit as these yellow fruits are more prominent in Latin America and Asia (Rodriguez-Amaya, 2003). Our results demonstrated that these two ethnic groups had an aversion to purple fruit. Passionfruit markets would benefit from understanding this market segmentation regarding marketing varieties to different consumers and the marketing channels they frequent.

With the growing demand by consumers for ethnic and novel foods in the US, Europe, and other countries in the Global North, including tropical fruits such as passionfruit, an opportunity could exist for fresh passionfruit (Govindasamy et al., 2010; Lee et al., 2014; Mangan et al., 2008; Santeramo et al., 2018; Tomić et al., 2018). Based on consumption trends for passionfruit in other countries, especially in Latin America and Asia, locally grown fresh passionfruit could have market potential, distinguishing fresh fruits from competition for processed products (Bailey et al., 2021; Roberts et al., 2018). These results suggest opportunities for targeted marketing strategies based on demographic segmentation to take advantage of these growing market opportunities for little-known fruits in the US market. Growers and marketers can better position passion fruit in the market by understanding the nuanced preferences of specific consumer groups. The findings underscore the value of tailoring campaigns and product offerings to maximize appeal across diverse consumer bases.

Some caution is also needed when interpreting these results. For instance, careful consideration would be needed to determine if organic passionfruit production would be the most profitable option for US passionfruit growers, marketers, and processors. While the results demonstrated in the GML that "In-State" consumers were WTP much more for organic passionfruit, this result did not hold in the ML. Second, the premium for organic passionfruit would be 46%, considering that the average price at the time of the experiments was $1.99 per fruit. In certain contexts, this premium might not cover the extra expense needed to grow organic passionfruit, especially the additional labor costs to control pests, diseases, and weeds (Uchoa et al., 2021).

Additional research is also needed to understand if these market trends for passionfruit would translate into consumer demand in the US and other markets in the Global North for tropical and other little-known fruit and produce in these markets. While this survey had a very large sample size of consumers across the US, providing a good estimate of consumer preferences across the country, it could be enhanced by complementary research that uses experiments and sensory analysis for consumers. Such research would test the fruit in real-life situations to see if these preferences and WTP estimates would be similar in these contexts that could better control for hypothetical bias in localized contexts. Experiments with treatment effects for ripe and unripe or very localized fruit could provide greater detail and insight for growers, processors, and the retail sector, providing fruit that meets consumer preferences and expanding the market for these lesser-known fruits and produce.

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