

Consumer Preferences for Kiwiberries: Implications of Experimental Auctions

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Abstract. In the current global market, the development of novel products is important for staying competitive. The development of horticultural products often manifests as new cultivars. Gauging consumer interest is an important step in cultivar development because it is a resource-intensive process. The present study used an experimental auction to measure consumers' willingness to pay (WTP) for novel fruit referred to as kiwiberries (*Actinidia arguta* and *Actinidia kolomikta*) and explore consumer segmentation for their preferences. The mean WTP for 6-ounce packages of kiwiberries ranged from \$1.63 to \$2.19, depending on species and cultivar. Four groups of consumers were identified in relation to their WTP for kiwiberries. Using survey data, socio-demographic variables such as age, education, and neophobic attitudes were significantly different between the mixed kiwiberries price premium and kiwiberries discounting groups. These findings suggest that consumers with variety-seeking tendencies have a WTP for kiwiberries that is comparable to that for other berries. Marketing strategies for these groups are proposed.

Global production and new cultivar introductions have resulted in the increased availability of diverse fruits and berries on the market. Ultimately, consumers drive the demand for food innovation because they have different preferences for food products (Drescher et al. 2008; Lee and Brown 1989), with certain consumer segments showing greater interests in health (Asioli et al. 2017) or product innovation (Nazzaro et al. 2019). Regarding the horticultural market, the demand for innovation results in the development of new cultivars with improved fruit quality (Iezzoni et al. 2015; Jaeger et al. 2003; Weil 1998). Every year, new fruit cultivars are introduced, offering improved production, better pest resistance, or superior taste. Cultivar success has been shown to depend on the grower, processor, and consumer acceptance, and breeding efforts to meet these innovation demands often take years, with considerable resource requirements. An example of one successful product innovation and diversification with years of development in the horticulture market is the kiwifruit (*Actinidia chinensis*).

The fuzzy kiwifruits familiar in the US marketplace are typically the green-flesh *Actinidia chinensis* var. *deliciosa* 'Hayward'. Green kiwifruit was introduced into the United States in the late 1970s, making these fruits relatively recent introductions. 'Hayward' was

developed in the 1930s, and it remains the predominant cultivar of kiwifruit produced globally (Ferguson 2016). However, the demand for innovation spurred exploration into the more than 60 identified species in the genus *Actinidia* for opportunities for the improvement and development of novel kiwifruit cultivars. One instance of such successful innovation is the golden-flesh 'Gold3' kiwifruit of *Actinidia chinensis* var. *chinensis*. Golden kiwifruit was introduced in the 1990s, and it has grown to compete with green kiwifruit (Ferguson 2016; Patterson et al. 2003). To further meet the demand for new fruit varieties, further *Actinidia* species are being cultivated for production.

Actinidia arguta and *Actinidia kolomikta* are two *Actinidia* species on the market receiving growing interest (Cossio et al. 2015; Latocha et al. 2018). These species are often referred to as kiwiberries and present novel fruit qualities, such as smooth, edible green skin and smaller size compared with kiwifruit. In addition to providing a novel eating experience, nutritional qualities of *A. arguta* have been reported (Latocha et al. 2015; Pinto et al. 2020; Wojdyło and Nowicka 2019; Wojdyło et al. 2017). Studies that examined the chemical composition of kiwiberries reported high levels of vitamin C (Leontowicz et al. 2016; Nishiyama et al. 2004), high levels of polyphenols related to antioxidant activity (Wojdyło and Nowicka 2019; Wojdyło et al. 2017), and the presence of various minerals beneficial for human health (Jin et al. 2014; Latocha 2017). Nutritional substances such as vitamins, minerals, and phenolic compounds like those found in *A. arguta* are associated with health benefits obtained from consuming fruit (Beattie et al. 2005;

Paredes-López et al. 2010; Pinto et al. 2020). Diets diverse in fruits and vegetables have been linked to the increased intake of nutrients and improved health (Herforth et al. 2019; Lachat et al. 2018). The novel eating experience and nutritional profile of kiwiberries indicate that this crop necessitates further consideration for crop development to bring diverse, nutritious food opportunities to the market.

Currently, *A. arguta* Ananasnaya is one of the most widely planted kiwiberries cultivars in the United States (Fisk et al. 2006), and it is widely planted throughout global production regions, along with Weiki and Geneva (Latocha et al. 2018). *A. arguta* has been favored for production because it typically produces larger fruit (~10–12 g) with a range of flavors. However, production of *A. arguta* in cold climates results in challenges because extreme winter and low spring temperatures often result in yield loss. Hence, despite its smaller fruit size (~3–5 g), *A. kolomikta* is another species that should be investigated for its production value because of its improved cold-hardiness. However, the kiwiberries is relatively uncommon throughout the United States, and consumer acceptability is currently unknown.

From the perspective of a new product, understanding the WTP of the consumer is a critical step in marketing kiwiberries. Consumer studies have examined *A. arguta* fruit qualities, such as sweetness and flavor, and their impact on consumer preferences in New Zealand (Hunter et al. 2020) and Belgium (Vanhonacker and Debersaques 2017). Hunter et al. (2020) indicated a favorable increase in kiwiberries-liking ratings as the soluble solids content (SSC), which is a proxy for sweetness, increased. Similarly, Vanhonacker and Debersaques (2017) found that after tasting fruit, 85% of participants rated the flavor of kiwiberries as favorable. Although fruit quality attributes such as flavor are important influences on repeat purchasing (Gilbert et al. 1996), studies have suggested that the cost of a product, rather than sensory qualities influencing taste, impacts first-time consumer purchasing habits (Jaeger and Harker 2006; Steptoe et al. 1995). Pricing was indicated as a possible concern by Vanhonacker and Debersaques (2017) in Belgium because only 18% of participants were willing to pay €2.50 (US\$2.64) for kiwiberries. This is why consumer WTP should be investigated to improve the marketing of new and novel fruit.

One method of estimating WTP is the use of experimental auctions, which obtain realistic estimations of WTP by implementing nonhypothetical consequences such as an exchange of real goods for real money (Lusk 2003). During experimental auctions, participants with the highest bid win but pay an *n*th-price (second, third, etc.). Vickrey (1961) showed that during such an auction, this is a weakly dominant strategy for participants to bid their true WTP. An experimental sealed-bid auction aims to reduce the probability of overbidding and underbidding because other participants' bids are unknown, which incentivizes truthful bidding (Lusk and Hudson 2004; Yue et al. 2010). If participants bid lower than their true WTP, they are at risk for missing a profitable transaction.

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Conversely, if participants bid higher than their true WTP, then they risk paying more than their real WTP. The advantages of experimental auctions include utility in group settings, placing participants in an active market, and eliciting WTP estimations for each participant. However, the following are limitations to the use of experimental auctions: they require participants to estimate product values without external inputs like posted prices; they may be impacted by participant preferences at the time of evaluation; and they are more costly than hypothetical approaches such as a conjoint analysis (Lusk et al. 2004; Yue et al. 2010). Experimental auctions have been used to estimate the consumers' value of many agricultural products (Alfnes and Rickertsen 2003; Fan et al. 2019; Froehlich et al. 2009; Gallardo et al. 2018; Hayes et al. 1996; Jaeger and Harker 2006; Lund et al. 2006; McAdams et al. 2013; Short et al. 2018; Tegene et al. 2003; Umberger and Feuz 2004; Yue et al. 2009, 2011, 2016).

Previous studies have explored the importance of the relationship between kiwifruit quality and consumer preference (Ball et al. 1998; Crisosto and Crisosto 2001; Gilbert et al. 1996; Harker et al. 2006, 2009, 2019; Hunter et al. 2020; Jaeger and Harker 2006; Jaeger et al. 2003, 2011; Latocha and Janjowski 2011; Marsh et al. 2006). A few studies have investigated the WTP for kiwifruit (Jaeger and Harker 2006) and kiwiberry (Vanhonacker and Debersaques 2017). Currently, the WTP for kiwiberry has been estimated using survey methods (Vanhonacker and Debersaques 2017). The primary objective of this research was to determine consumers' WTP and explore consumer segmentation in terms of preferences for novel kiwiberries and other berries. This research provides important marketing implications for the target market(s) and insights regarding pricing strategies for kiwiberries.

Materials and Methods

Products. The products in this experiment were four types of kiwiberries: 'Geneva3', 'Passion Popper', 'Krupnoplada', and Nahodka Seedling 6. Geneva3 and Passion Popper are both cultivars of *A. arguta*, whereas Krupnoplada and Nahodka Seedling 6 are a cultivar and seedling, respectively, of *A. kolomikta*. To compare consumer preferences for kiwiberries and their close substitutes on the market, we also included four other types of berries: strawberry (*Fragaria × ananassa*), raspberry (*Rubus idaeus*), blackberry (*Rubus fruticosus*), and blueberry (*Vaccinium corymbosum*). Strawberries, raspberries, blackberries, and blueberries all met the requirements for US Department of Agriculture grade 1 because they were uniform, well-colored, well-developed, not overripe, and free from damage or disease. A random sampling of 25 berries at the point of consumption were juiced to examine the SSC and titratable acidity (TA). The mean SSCs were 6.72°Brix (strawberry), 8.34°Brix (raspberry), 10.56°Brix (blueberry), and 6.48°Brix (blackberry). The mean TA values were 0.7 g/100 mL

(strawberry), 1.47 g/100 mL (raspberry), 0.66 g/100 mL (blueberry), and 0.76 g/100 mL (blackberry). The kiwiberries were grown by the researcher's laboratory, and the market substitute berries were provided by a third-party vendor, with each fruit type consisting of a single cultivar. Fruit samples for tasting were prepared for auction by washing fruit and then placing a single berry in a 1-ounce clear plastic cup with a lid. Each fruit type was given a randomized three-digit numeric code that corresponded to a clamshell package of the fruit on a display table for participants. Fruit samples were arranged in a randomized order at participant stations along with an attribute rating booklet, bidding sheet, and survey. Fruit packages for auction bidding were displayed in 6-ounce clear plastic clamshells with the exception of strawberry, which was packaged in a 1-pound clear plastic clamshell to reflect common market packaging for each fruit type.

The timing for the experiment was chosen as a midpoint between the kiwiberry species *A. kolomikta* and *A. arguta*, which ripen in August and September, respectively, in Minnesota. Ripeness was determined by observing seed coloration (with black indicating near ripeness), estimated percent softening of fruit on the vine, and °Brix, which serves as a proxy for the percent of sugar in the fruit juice. Firm fruit from the *A. kolomikta* genotypes 'Krupnoplada' and Nahodka Seedling 6 were harvested on 20 Aug, with a sampling of five berries averaging 7.8°Brix and 6.9°Brix at harvest, respectively. Fruits were stored in low-flow plastic clam shells in an ethylene-free 4 °C cooler. Fruits from *A. arguta* 'Geneva3' and 'Passion Popper' were selectively harvested for early softening fruits on 5 Sep, averaging 7.5°Brix and 8.3°Brix at harvest, respectively. SSC and TA were additionally sampled at the point of consumption using a random sample of five fruit. The mean SSCs for kiwiberry samples were 13.2°Brix (Krupnoplada), 10.4°Brix (Nahodka Seedling), 13.8°Brix (Passion Popper), and 15.1°Brix (Geneva3). The mean TA values for kiwiberry samples were 1.57 g/100 mL (Krupnoplada), 1.57 g/100 mL (Nahodka Seedling), 1.24 g/100 mL (Passion Popper), and 1.26 g/100 mL (Geneva).

Experimental procedure. Previously, experimental auctions have been used to value a wide variety of food quality attributes (Alfnes and Rickertsen 2003; Brown et al. 2005; Hobbs et al. 2005; Jaeger and Harker 2006). A second-price sealed-bid auction is an auction during which bidders submit sealed bids, the price is set to the second highest bid, and the winner is the participant with the highest bid. The second-price auction is a popular mechanism because it is theoretically demand-revealing, it is easy to explain, and its market-clearing price is endogenous. The experimental auction methods of Yue et al. (2016) and Short et al. (2018) were used as a framework for this study.

The experiment was conducted at the University of Minnesota, St. Paul, with a total of 96 participants. Participants were recruited by placing advertisements in local newspapers and on social media. To be eligible for the experiment, participants had to be at least 18 years of

age and purchase groceries. Of the 105 individuals who registered, 98 attended; of those, 96 provided complete information to be included in the study. Participants were scheduled for one of five sessions that occurred over 2 d, with ~20 participants scheduled per session. Experiment sessions were conducted in a conference room. Auction booklets were provided to participants to follow the experimental procedure, and randomized fruit cups were provided for each participant to taste the fruits. Fruits in packages were displayed on a table for participants to examine.

The experiment began by leading participants through a detailed explanation and practice examples of second-price auctions to ensure their understanding. This included how the identification of a product winner would occur. Then, participants were instructed to taste the eight fruits and fill out an attribute rating sheet for each fruit as they tasted. The presentation order of fruits for participants was randomly arranged between sessions to prevent the potential ordering effect on tasting results. After tasting and rating all the fruits, participants were asked to silently examine corresponding labeled packages of each fruit on display at the back of the room. Then, they were asked to complete a prepared bid sheet that listed each fruit sampled. Participants were not allowed to communicate with each other during the bidding process.

After all participants' bid sheets were collected, researchers sorted the bids from highest to lowest for each fruit and identified the winner(s) for each. The binding product for each participant was drawn. Only when participants won their binding product were they required to purchase the product. After submitting bid sheets, participants completed a survey asking questions about their demographics, shopping behaviors, and likelihood of trying new foods. Demographics included, but were not limited to, questions about age, sex, income, relationship status, and education level. Questions about shopping behavior focused on the frequented shopping location. Finally, participants were provided with statements such as "I purchase new, different, or innovative food" or "I seldom taste or experiment with new, different, or innovative foods" and asked to indicate their agreement with the statement (1 being strongly disagree; 7 being strongly agree). Table 1 shows the summary statistics for demographic questions. Table 3 shows the summary statistics of the shopping location and habit questions. After completing these questions, participants who did not win were paid \$30 to compensate for their time, and winners received their respective fruit package and \$30 minus the market price of the fruit they won.

Data of the participants were compiled and analyzed. All bids were adjusted to reflect 6-ounce package prices for comparison between all berries. To investigate participants' heterogeneous preferences for kiwiberries, we compared their bids for the two species of kiwiberries to their bids for other berries henceforth, referring to strawberry, raspberry, blueberry, and blackberry. Specifically, we compared the

bids for each kiwiberry to the mean bids for other berries. Participants were grouped into different groups based on whether they bid higher for one of the two kiwiberry species (*A. arguta* price premium or *A. kolomikta* price premium), a combination of both species (mixed kiwiberry price premium), or neither (kiwiberry discounting) compared with the average bid of the other berries. Analyses of variance (ANOVAs) were used to determine significant differences in fruit attribute ratings, demographics, and shopping habits across the groups.

Results

Table 1 shows the summary statistics of sociodemographic backgrounds for the 96 auction participants. The average age of participants ranged from 51 to 60 years. Approximately 71% of participants identified as female. Thirty-six percent of participants reported education of some college or less; 36.46% reported a college diploma or some graduate school; 27.08% reported having a graduate degree or higher. The average annual income was between \$50,000 and \$65,000. Fifty percent of participants had either a part-time or full-time job, whereas the remaining participants were students, retired, or unemployed. Forty-six percent of participants were either in a relationship or married. The average household size was two people, with most participants reporting having no children younger than 12 years in the household (89.52%). Most participants (81.25%) reported not being members of environmental groups.

Eight percent of participants reported consuming berries once per month or less. Thirteen percent (13.54%) of participants consumed berries multiple times per month, and 18.75% reported eating berries once per week. Approximately 58% of participants reported eating berries multiple times per week (45.83%) or daily (13.54%).

Figure 1 uses histograms to display the distribution of bids for 6-ounce package of berries. The berries in the top row (other berries instead of kiwiberries) of Fig. 1 display normal distributions of bids from approximately \$0.00 to \$5.99, with a mean bid of approximately \$1.12 to \$2.48, depending on the berry. The bids for kiwiberries have a broader spread, with both *Actinidia* species having two slight peaks based on the observed density line. *A. kolomikta* is skewed toward the lower bid values. Bids for *A. arguta* ranged from \$0.00 to \$5.99, with mean bids of \$2.00 and \$2.19 for 'Geneva3' and 'Passion Popper', respectively (Table 2). The bids for *A. kolomikta* ranged from \$0.00 to \$4.99, with a mean bid of \$1.63 and \$1.65 for 'Krupnopladnaya' and Nahodka Seedling, respectively.

Figure 2 further shows the observed distribution of kiwiberry bids by graphing the difference between participants' bids for kiwiberry species and the average bid for other berries. The horizontal axis of Fig. 2 is the bid difference between *A. arguta* and other berries, and the vertical axis is the bid difference between *A. kolomikta* and other berries. Participants were

Table 1. Summary statistics [mean, standard deviation (SD), sample %] of the 96 participants in the kiwiberry experimental auctions (N = 96).

	Sample %
Age	
1 = 18–30 years	25%
2 = 31–40 years	8.33%
3 = 41–50 years	2.08%
4 = 51–60 years	18.75%
5 = 61–70 years	30.21%
6 = >70 years	15.62%
Mean (SD)	3.68 (1.86)
Sex	
0 = Female	70.83%
1 = Male	29.17%
Educational Level	
1 = Some high school education	0%
2 = High school diploma	5.21%
3 = Some college education	31.25%
4 = College diploma	26.04%
5 = Some graduate school education	10.42%
6 = Graduate degree	27.08%
Mean (SD)	4.23 (1.29)
Income	
1 = <\$15,000	9.47%
2 = \$15,001–\$25,000	15.79%
3 = \$25,001–\$35,000	11.58%
4 = \$35,001–\$50,000	13.68%
5 = \$50,001–\$65,000	4.21%
6 = \$65,001–\$80,000	13.68%
7 = \$80,001–\$100,000	13.68%
8 = \$100,001–\$150,000	10.53%
9 = >\$150,000	7.37%
Mean (SD)	4.80 (2.52)
Employment Status	
0 = Retired/unemployed/student	50.00%
1 = Full-time/part-time employed	50.00%
Mean (SD)	0.50 (0.50)
Relationship status	
0 = No relationship	37.50%
1 = In a relationship	62.50%
Mean (SD)	0.62 (0.49)
Presence of children younger than 12 years at home	
No	89.58%
Yes	10.42%
Mean (SD)	0.10 (0.31)
Household size	
Mean (SD)	1.98 (1.01)
Environmental group membership	
No	81.25%
Yes	18.75%
Mean (SD)	0.19 (0.39)
Frequency of berry consumption	
1 = Daily	13.54%
2 = Multiple times per week	45.83%
3 = Once per week	18.75%
4 = Multiple times per month	13.54%
5 = Once per month	6.25%
6 = Less than once per month	1.04%
7 = Never	1.04%
Mean (SD)	2.60 (1.23)

grouped into one of four groups: *A. arguta* price premium; *A. kolomikta* price premium; mixed kiwiberry price premium; or kiwiberry discounting. The upper right quadrant of Fig. 2 shows that some participants placed higher bids for both kiwiberry species compared with other berries (mixed kiwiberry price premium group). The lower right quadrant of Fig. 2 shows participants with higher bids for one or both of the *A. arguta*, but not *A. kolomikta* (*A. arguta* price premium group). The lower left quadrant shows participants who placed lower bids for kiwiberries compared with other berries (kiwiberry discounting group). Interestingly, the group for those

who bid high for one or both of the *A. kolomikta* was somewhat obscured because participants tended to favor only one, not both, resulting in low *A. kolomikta* average bids (*A. kolomikta* price premium group).

The differences between groups for kiwiberry bids are more apparent in Fig. 3, which shows boxplots according to the kiwiberry cultivar and kiwiberry price premium group. The bids of the kiwiberry discounting group were lower than those of all other groups for all kiwiberries, whereas the mixed kiwiberry price premium group placed bids comparable or higher than those of the other kiwiberry price

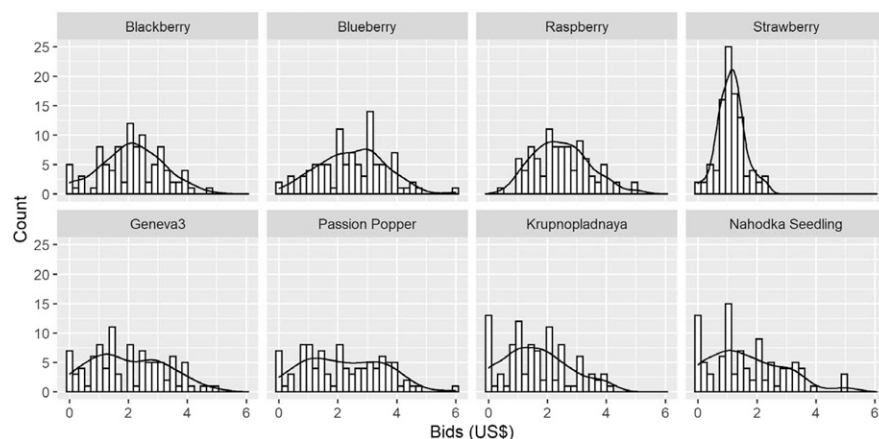


Fig. 1. Histograms of bids for 6-ounce berry samples ($N = 96$ for each sample) with distribution curves overlaid. Strawberry bids have been adjusted to reflect bid amounts per 6-ounce package rather than the 1-pound package presented at the auction. Bids for other berries (blackberry, blueberry, raspberry, and strawberry) are shown in the top row. Bids for *Actinidia arguta* ('Geneva3' and 'Passion Popper') and *A. kolomikta* ('Krupnopladnaya' and Nahodka Seedling) are shown in the bottom row.

premium groups. Figure 3 further confirms that the *A. arguta* price premium group bid higher for *A. arguta* than for *A. kolomikta*, and vice versa for the *A. kolomikta* price premium group. Table 2 further displays each group's mean bid, standard deviation (SD), and a pairwise comparison of all fruit bids between groups. The pairwise comparisons indicated that these groups' WTP significantly differed for kiwiberries, raspberry, and strawberry. Blackberry and blueberry showed no difference between groups. Raspberry and strawberry bids were significantly different ($P < 0.10$) between the *A. arguta* price premium and kiwiberry discounting groups (Table 2), but not for the mixed kiwiberry price premium and *A. kolomikta* price premium groups. Bid differences between groups for the kiwiberry cultivars had mixed results; however, for all kiwiberries, the means between the mixed kiwiberry price premium and kiwiberry discounting groups remained significantly different at $P < 0.10$ (Table 2). For 'Geneva3' and 'Passion Popper', the *A. arguta* price premium groups' bids significantly differed from that of the kiwiberry discounting group at $P < 0.01$. The highest

mean bid for kiwiberry was \$2.88 for 'Passion Popper' by the *A. arguta* price premium group.

To identify profiles for these groups, participants' sociodemographic and purchasing habit variables were compared among groups. Table 3 shows the mean, SD of these variables, and ANOVA results. Age and education were the only two sociodemographic variables that demonstrated statistically significant differences among groups. Although age was not significant across all groups ($P = 0.109$), a pairwise comparison between groups indicated that the mixed kiwiberry price premium group (mean age range, 41–50 years) was significantly different from the kiwiberry discounting group (mean age range, 51–60 years). Education was highly significantly different between the *A. arguta* price premium and both *A. kolomikta* price premium and kiwiberry discounting groups. The mean education level for the *A. arguta* price premium group was college diploma, whereas the mean education levels for the *A. kolomikta* price premium and kiwiberry discounting groups were high school diploma and some college.

Purchasing habits differed among groups in terms of participants' grocery purchasing stores and their attitude toward new products. For stores, cooperatives were visited by the mixed kiwiberry price premium group more frequently than by the kiwiberry discounting group. Other stores such as convenience stores, high-end retailers, supermarkets, and roadside markets were not significantly different between any of the groups. In terms of attitudes, the kiwiberry discounting group had a higher rating for negative purchasing attitudes (i.e., seldom taste and experiment with new foods; afraid of eating foods not tasted before; reluctant to try foreign or new foods) than all other groups, with a significantly higher rating than the *A. arguta* price premium and mixed kiwiberry price premium groups. *A. arguta* price premium and mixed kiwiberry price premium groups showed positive attitudes toward interest in new foods or variety-seeking attitudes.

Further differences between groups were observed when examining participant ratings of fruit quality attributes (Table 4). The first panel of Table 4 reports the means and SD s of attribute ratings for all kiwiberry cultivars for each group. For 7 of the 12 attributes, the mixed kiwiberry price premium group differed significantly from the kiwiberry discounting group, with the former having a higher rating for all attributes. The *A. arguta* and *A. kolomikta* price premium ratings were between those of the mixed and discounting groups. The second panel of Table 4 shows the mean attribute ratings for other berries for each group. There were no significant differences noted between groups for any of the attribute ratings of other berries. However, other berries' attributes were rated higher than kiwiberries' attributes.

In addition to between-group differences, within-group differences of attribute ratings of kiwiberries and other berries were examined. For the kiwiberry discounting group, all mean ratings were significantly different between kiwiberries and other berries. For the three kiwiberry price premium groups, sweetness and tartness were not significantly different at $P = 0.10$. Additionally, for the mixed kiwiberry price premium group, the overall flavor was not

Table 2. Mean willingness-to-pay (US\$; WTP) and standard deviation (SD) for all berries for each kiwiberry groups determined by the difference between WTP for kiwiberries and other berries are presented.

Fruit Bids	Groups									
	All participants		<i>Actinidia arguta</i> price premium		<i>Actinidia kolomikta</i> price premium		Mixed kiwiberry price premium		Kiwiberry discounting	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Blackberry	2.12	1.05	2.11	1.26	2.34	0.76	2.21	1.11	1.94	0.86
Blueberry	2.48	1.13	2.79	1.31	2.55	1.06	2.55	1.14	2.13	0.95
Raspberry ⁱⁱⁱ	2.47	0.94	2.82	1.04	2.43	0.98	2.51	0.92	2.15	0.8
Strawberry ⁱⁱⁱ	1.12	0.46	1.32	0.43	1.14	0.46	1.17	0.48	0.91	0.4
Geneva3 ^{iii,iv,vi}	2.00	1.26	2.68	1.11	1.43	0.77	2.48	1.19	0.93	0.71
Passion Popper ^{i,iii,iv,vi}	2.19	1.34	2.88	1.02	1.23	0.91	2.85	1.20	0.97	0.68
Krupnopladnaya ^{ii,vi}	1.63	1.11	1.36	0.89	1.66	0.96	2.32	1.06	0.85	0.74
Nahodka Seedling ^{ii,v,vi}	1.65	1.24	1.12	0.70	2.16	0.70	2.46	1.30	0.76	0.66

ⁱ Means of the *A. arguta* price premium group were significantly different from those of the *A. kolomikta* price premium group at $P < 0.10$.

ⁱⁱ Means of the *A. arguta* price premium group were significantly different from those of the mixed kiwiberry price premium group at $P < 0.10$.

ⁱⁱⁱ Means of the *A. arguta* price premium group were significantly different from those of the kiwiberry discounting group at $P < 0.10$.

^{iv} Means of the *A. kolomikta* price premium group were significantly different from those of the mixed kiwiberry price premium group at $P < 0.10$.

^v Means of the *A. kolomikta* price premium group were significantly different from those of the kiwiberry discounting group at $P < 0.10$.

^{vi} Means of the mixed kiwiberry price premium group were significantly different from those of the kiwiberry discounting group at $P < 0.10$.

Table 3. Mean and standard deviation (*SD*) of sociodemographic, purchasing store, and attitude variables of the kiwiberry groups. Groups were determined by the difference between the willingness-to-pay (WTP) for kiwiberries and other berries.

	<i>A. arguta</i> price premium group		<i>A. kolomikta</i> price premium group		Mixed kiwiberry price premium group		Kiwiberry discounting group		ANOVA
	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>	<i>P</i> value
Sociodemographic									
Age (yr) ⁱⁱⁱ	52.71	18.11	53.71	17.94	46.58	19.85	57.89	17.36	0.108
Sex	0.19	0.39	0.43	0.50	0.27	0.45	0.36	0.48	0.522
Education (yr) ^{i,ii,iii}	17.24	1.81	14.86	1.08	16.40	2.11	15.07	2.16	0.001
Income (US\$)	59,286	34,903	57,143	49,821	63,875	45,482	65,000	45,562	0.951
Household members	1.86	0.71	2.00	1.33	2.08	1.06	1.93	1.00	0.870
Purchasing location and attitudes									
Mass merchandiser	1.29	0.45	1.43	0.5	1.23	0.42	1.29	0.45	0.720
Cooperative ⁱⁱⁱ	1.24	0.43	1.00	0.00	1.32	0.47	1.07	0.26	0.037
High end retail	1.14	0.35	1.29	0.46	1.25	0.43	1.32	0.47	0.560
Supermarket	1.52	0.50	1.29	0.46	1.55	0.50	1.68	0.47	0.280
Convenience store	1.05	0.21	1.00	0.00	1.05	0.22	1.07	0.26	0.900
Discount store	1.38	0.49	1.71	0.46	1.50	0.50	1.68	0.47	0.140
Roadside	1.29	0.45	1.57	0.50	1.27	0.45	1.32	0.47	0.480
Negative purchasing ^{ii,iii}	-0.30	0.81	0.07	0.99	-0.16	0.87	0.44	0.90	0.019

ⁱ Means of the *A. arguta* price premium group were significantly different from those of the *A. kolomikta* price premium group at $P < 0.10$ or better.

ⁱⁱ Means of the *A. arguta* price premium group were significantly different from those of the kiwiberry discounting group at $P < 0.10$ or better.

ⁱⁱⁱ Means of the mixed kiwiberry price premium group were significantly different from those of the kiwiberry discounting group at $P < 0.10$ or better.

such as health and safety (Onwezen and Bartels 2011; Raudenbush and Frank 1999). Product information for intangible features such as labeling for production location, product safety,

and promoting product health benefits could help market novel fruit products to concerned consumers by reducing perceived risks (Nazzaro et al. 2019).

Marketing strategies for the variety-seeking groups, which included the *A. arguta* price premium, *A. kolomikta* price premium, and mixed kiwiberry price premium groups, should

Table 4. Mean and standard deviation (*SD*) for 12 attribute ratings ($N = 96$ for each attribute) of kiwiberry and other fruits by the kiwiberry groups. The between-group and within-group significance are shown.

	<i>A. arguta</i> price premium group		<i>A. kolomikta</i> price premium group		Mixed kiwiberry price premium group		Kiwiberry discounting group		ANOVA
	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>	<i>P</i> value
Attribute rating: kiwiberries									
Overall liking ⁱ	4.97	1.24	4.64	1.61	5.47	0.91	4.34	1.35	0.002
Overall appearance ⁱ	5.12	1.13	4.64	1.74	5.40	0.78	4.71	1.24	0.059
Overall flavor ⁱ	4.90	1.10	4.68	1.61	5.36	0.85	4.28	1.28	0.002
Shape ⁱ	5.44	1.18	5.62	1.06	5.61	0.92	4.88	1.16	0.046
Color	5.51	1.16	5.11	1.55	5.69	0.77	5.14	1.10	0.150
Size	5.32	1.15	5.00	1.68	5.67	1.03	5.00	1.28	0.120
Cosmetic defect	4.70	1.15	4.12	1.61	5.14	1.13	4.64	1.30	0.150
Sweetness ⁱ	4.76	1.24	4.68	1.31	5.22	0.97	4.38	1.21	0.030
Tartness ⁱ	4.71	1.30	4.79	0.80	5.03	1.08	4.31	1.06	0.087
Juiciness ⁱ	5.01	1.24	4.54	1.58	5.38	0.89	4.54	1.31	0.026
Texture ⁱ	4.26	1.39	4.46	1.41	5.07	1.03	4.04	1.45	0.009
Firmness ⁱ	4.20	1.41	4.04	1.67	4.86	0.92	4.02	1.51	0.039
Attribute rating: other berries									
Overall liking	5.91	0.93	6.00	1.18	5.91	0.67	5.92	0.91	0.990
Overall appearance	6.49	0.67	6.36	1.28	6.41	0.58	6.42	0.60	0.970
Overall flavor	5.50	0.96	6.04	0.64	5.59	0.77	5.63	1.18	0.640
Shape	6.56	0.62	6.75	0.38	6.47	0.63	6.40	0.70	0.580
Color	6.63	0.45	6.75	0.29	6.54	0.56	6.46	0.68	0.560
Size	6.29	1.11	7.00	0.00	6.31	0.74	6.19	0.88	0.230
Cosmetic defect	5.61	1.19	5.61	1.34	5.64	1.10	5.54	1.23	0.980
Sweetness	5.27	1.05	5.21	1.21	5.37	1.01	5.35	1.35	0.980
Tartness	5.18	1.32	4.86	1.14	5.15	1.03	5.18	1.29	0.930
Juiciness	5.97	0.81	6.00	0.92	5.78	0.89	5.72	1.17	0.780
Texture	5.95	0.98	6.50	0.52	5.83	0.86	5.73	1.08	0.320
Firmness	6.11	0.89	6.14	1.24	5.96	0.82	5.81	1.01	0.680

P values of the ANOVA to compare the attribute ratings of kiwiberries and other berries within each group

Overall liking	0.010	0.097	0.017	<0.001
Overall appearance	<0.001	0.058	<0.001	<0.001
Overall flavor	0.078	0.060	0.210	<0.001
Shape	<0.001	0.023	<0.001	<0.001
Color	<0.001	0.017	<0.001	<0.001
Size	0.008	0.014	0.003	<0.001
Cosmetic defect	0.018	0.097	0.051	0.011
Sweetness	0.160	0.440	0.530	0.007
Tartness	0.260	0.910	0.590	0.008
Juiciness	0.006	0.056	0.050	0.001
Texture	<0.001	0.008	0.001	<0.001
Firmness	<0.001	0.020	<0.001	<0.001

ⁱ Means of the mixed kiwiberry price premium group were significantly different from those of the kiwiberry discounting group at $P < 0.10$.

consider the promotion of the novelty of kiwiberries in terms of convenience and flavor. Promoting novel characteristics might be effective for consumers interested in kiwiberries because this promotes the uniqueness of the eating experience for groups that value new experiences. When considering where to market kiwiberries to the kiwiberries price premium groups, most shopping locations are ubiquitous among the groups. However, supermarkets, discount stores, and cooperatives are locations for marketers to consider because these were the most frequently reported shopping locations for the mixed kiwiberries price premium group.

The attribute ratings of the studied berries can be used by breeders and producers to inform breeding goals or production methods to improve fruit quality. Visual fruit quality attributes were the highest-rated kiwiberries attributes within kiwiberries price premium groups, indicating that participants liked the appearance of the fruit. Eating experience attributes (texture and firmness) for kiwiberries more frequently received low scores across groups. Texture and firmness deterioration could have occurred because *A. kolomikta* berries were harvested before the auction to ensure adequate fruit availability. Texture can be impacted by harvest timing, storage conditions, or differences in cultivar, and each component could be targets for improvement (Fisk et al. 2006). Although texture and firmness were low-rated attributes, all kiwiberries attributes were consistently rated lower than the other berries. This could have been caused, in part, by participants' biased familiarity with the other berries, which might have increased their ratings. Additionally, the fruit provided for the other berries was of exceptionally high quality, with larger, uniform fruit that might have been superior to that of berries typically available for purchase. Despite these possible factors impacting attribute ratings, fruit qualities related to the eating experience and taste remain targets for breeders.

Although kiwiberries is a novel product with relatively low production in the United States, most participants in this study indicated a WTP for kiwiberries that was comparable with that for other berries. However, the results show differences in WTP between *A. arguta* and *A. kolomikta* cultivars, with *A. arguta* Passion Popper having a higher average WTP for participants in the kiwiberries price premium groups. The underlying neophobic attitudes of participants disliking kiwiberries warrants further investigation to determine why the unfavorable attitudes arose and if those unfavorable attitudes stemmed from unfamiliarity with the product or other concerns. Overall, there are opportunities for the future development and improvement of kiwiberries for consumers ready to buy.

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