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Consumer Survey of Selected Garden Chrysanthemum Cultivars in Mississippi

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SUMMARY. The objective of this survey was to determine the levels of liking and willingness to pay for selected garden chrysanthemum (*Dendranthema × grandiflorum*) cultivars, and to measure relative influence of socioeconomic characteristics on consumer preferences and valuations. The survey was conducted during the 2003 Fall Flower and Garden Fest at the Truck Crops Experiment Station in Crystal Springs, Miss. Nine garden chrysanthemum cultivars were presented to 579 survey participants in three pot sizes. Respondents preferred 'Mithra Maroon', 'Venus Purple', 'Amory Yellow White', 'Adonis Purple', and 'Road Runner Bronze' more than 'Night Hawk Lemon', 'Freya Salmon', 'Amata Purple', and 'Starlet Ivory'. Of the five preferred cultivars, however, respondents were willing to pay more for 'Mithra Maroon', 'Road Runner Bronze', and 'Amory Yellow White'. Consumers of White or Caucasian origin liked the cultivars less and were willing to pay less for them as compared to other respondents who reported other racial origins, primarily Native Americans and African Americans. The levels of liking for the cultivars were similar for participants of different gender classification, but female respondents were willing to pay more for the cultivars. Respondents who previously bought chrysanthemums reported higher level of liking for the cultivars but were not willing to pay more for them. Participants who were interviewed on Saturday liked the cultivars more but were willing to pay less than those who were interviewed on Friday. Larger-sized households tended to like the cultivars less and were not willing to pay more for the cultivars. Respondents did not like the cultivars in larger-sized pots and were not willing to pay more for plants in larger-sized pots included in the survey.

Chrysanthemums were the third largest value potted flowering plant (\$78.5 million) next to poinsettias (*Euphorbia pulcherrima*) (\$252.3 million) and orchids (Orchidaceae) (\$107.8 million) in 2003 (Jerardo, 2003). Herbaceous perennials, which included hardy/garden chrysanthemums, accounted for 25% of the total sales of bedding and garden

plants in 2003 (Jerardo, 2003). Recent data released by the U.S. Department of Agriculture (Jerardo, 2003, 2004) indicated that the U.S. chrysanthemum market, consisting of cut flowers, potted florist plants, and garden plants, grew at a nominal annual rate of 2% during the last decade (Posadas et al., 2004). Most growth came from the expanded production of garden plants,

which offset the decline in potted florist plant production. The cut chrysanthemum market is primarily supplied by imports. Domestic production contributed 22% of the value and 16% of the volume of total U.S. consumption of cut chrysanthemums. Per-household chrysanthemum consumption in the U.S. in 2002 was \$0.88, consisting of \$0.21, \$0.27, and \$0.40 for cut flowers, potted florist plants, and garden plants, respectively. Between 1992 and 2002, cut chrysanthemums averaged \$1.27 per bunch on the wholesale market. The <5-inch-diameter and ≥5-inch-diameter pots florist chrysanthemums averaged \$1.48 and \$3.56 wholesale per pot, respectively. The wholesale price of garden chrysanthemums averaged \$0.91 and \$1.85 per pot for <5-inch-diameter and ≥5-inch-diameter pots, respectively.

With a growing domestic market for garden chrysanthemums, nursery growers have to make informed investment and production decisions based on the "potential buying decisions" for new cultivars by retail consumers. Surveying consumers to understand their needs and preferences can help growers predict current and future demands for chrysanthemums of various types and flower color. The expected margins between wholesale prices of garden chrysanthemums and the consumers' willingness to pay would also limit wholesalers and retailers' decisions to add these plants in their product lines. The objectives of the survey were to determine the levels of liking and willingness to pay for selected chrysanthemum cultivars, and to measure relative influence of socioeconomic characteristics on consumer preferences and valuations.

Materials and methods

Recent investigations of consumer preferences for horticulture products revealed insights into the buying decisions at the retail level. Kelley et al. (2001) used cluster analysis to analyze survey results to determine characteristics important in containerized edible flowers that could be sold in retail outlets. Using conjoint analysis, differences in consumer preferences among

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Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
2.54	inch(es)	cm	0.3937

combinations of edible-flower species and colors over other assortments were observed across selected demographic characteristics such as age, gender, and income (Kelly et al., 2002). Behe et al. (1992a) developed profiles of consumer groups who purchased floral products from supermarkets by using cluster analysis. Principal component analyses of results of floral product consumers surveyed in supermarkets identified factors that were useful in market segmentation and were used to define five market segments of supermarket-floral customers (Behe et al., 1992b). Berghage and Wolnick (2000) surveyed consumers to gain insight into preferences for flower and leaf color in new guinea impatiens (*Impatiens hawkeri*). Oppenheim (1996) used the means-end theory to provide an insight into the factors that influence consumer choice, and complements the more commonly used market research techniques. Hudson and Griffin (2004) examined consumer willingness to pay for cut flower product attributes using a choice-based experiment through mail survey. Klingeman et al. (2004) found that willingness to pay for powdery-mildew (*Microspora pulchra*)-resistant flowering dogwood (*Cornus florida*) was relatively consistent across four locations. Factors affecting consumer demand for landscape nursery products and services can be paired with consumer awareness of integrated pest management (IPM) terminology and practices to create an effective market strategy for newly developed powdery-mildew-resistant dogwood cultivars. Anderson et al. (1996) concluded that sweet corn (*Zea mays*) marketing based on IPM certification positively influenced consumer reactions to IPM and a more extensive, diverse marketing strategy would enhance consumer awareness and willingness to pay for the product.

The consumer survey was conducted on 17 and 18 Oct. 2003 (Friday and Saturday, respectively) during the Fall Flower and Garden Fest at the Truck Crops Experiment Station in Crystal Springs, Miss. Nine cultivars of market-size garden chrysanthemums were presented to 579 consumer survey participants in three different pot sizes. All containers were manufactured by the same company and made of the same materials and color. The containers were 8 × 5-inch and 9 × 6-inch black mum pans, and 10 ×

9-inch black standard pots. Four of the nine cultivars ('Adonis Purple', 'Amor Yellow White', 'Freya Salmon', 'Road Runner Bronze') were presented in all three pot sizes. 'Venus Purple', 'Starlet Ivory', 'Mithra Maroon', and 'Amata Purple' were potted in 8 × 5-inch or 9 × 6-inch pots. The remaining cultivar, 'Night Hawk Lemon', was presented in 10 × 9-inch pots.

The level of liking [LOL (Eq. 1)] model for the nine cultivars was estimated by using the ordered logit method (Aldrich and Nelson, 1984; Long, 1997; Maddala, 1983; Powers and Yu, 2000; Pyndick and Rubinfeld, 1991). The choice of ordered logit method was prompted by the type of data used in estimating the LOL model. The dependent ordinal variable, LOL had a limited range of values that was measured from responses to the question "how much do you like this cultivar?" The possible LOL values ranged from 1 to 7, where (1, 2, 3) = strongly do not like this cultivar; (4) = neither like nor dislike the cultivar; and (5, 6, 7) = strongly like this cultivar. The independent variables included in Eq. 1 were eight dummy variables representing the cultivars, annual household income, one dummy variable each for race, gender, and interview date, previous purchases, age, education, household size, and pot size. Annual household income was reported in five income groups, namely: 1 = <\$25,000, 2 = \$25,000–\$50,000, 3 = \$50,001–\$75,000, 4 = \$75,001–\$100,000, and 5 = >\$100,000. As a standard practice in regression analysis, one of the cultivars, 'Night Hawk Lemon', was excluded from the models to eliminate the problem of singularity. Based on several regression runs, it did not matter which cultivar was excluded from the LOL model or used as a reference group, the rankings by cultivar and coefficients of the remaining independent variables were the same. The specifications of the LOL (Eq. 1) equation that was estimated by using EVIEWS 5 (Quantitative Micro Software, Irvine, Calif.) were as follows:

$$Y = \beta_0 + \beta_1 xX_1 + \beta_2 xX_2 + \beta_3 xX_3 + \beta_4 xX_4 + \beta_5 xX_5 + \beta_6 xX_6 + \beta_7 xX_7 + \beta_8 xX_8 + \beta_9 xX_9 + \beta_{10} xX_{10} + \beta_{11} xX_{11} + \beta_{12} xX_{12} + \beta_{13} xX_{13} + \beta_{14} xX_{14} + \beta_{15} xX_{15} + \beta_{16} xX_{16} + \beta_{17} xX_{17} + \beta_{18} xX_{18} + \beta_{19} xX_{19} + \beta_{20} xX_{20} + \beta_{21} xX_{21} + \beta_{22} xX_{22} + \beta_{23} xX_{23} + 0 \quad (\text{Eq. 1})$$

where Y = level of liking (seven-point scale); X_1 = (1 if cultivar is 'Road Runner Bronze', 0 if otherwise); X_2 = (1 if cultivar is 'Amory Yellow White', 0 if otherwise); X_3 = (1 if cultivar is 'Adonis Purple', 0 if otherwise); X_4 = (1 if cultivar is 'Freya Salmon', 0 if otherwise); X_5 = (1 if cultivar is 'Venus Purple', 0 if otherwise); X_6 = (1 if cultivar is 'Mithra Maroon', 0 if otherwise); X_7 = (1 if cultivar is 'Amata Purple', 0 if otherwise); X_8 = (1 if cultivar is 'Starlet Ivory', 0 if otherwise); X_9 = annual household income (5 groups); X_{10} = annual household income squared; X_{11} = (1 if race is white, 0 if otherwise); X_{12} = (1 if gender is male, 0 if otherwise); X_{13} = number of chrysanthemums bought in 2002; X_{14} = number of chrysanthemums bought in 2002 squared; X_{15} = (1 if interview date is Saturday, 0 if otherwise); X_{16} = respondent age (years); X_{17} = respondent age squared (years); X_{18} = formal education completed (years); X_{19} = formal education completed squared (years); X_{20} = number of persons in the household; X_{21} = number of persons in the household squared; X_{22} = pot size (inch²); X_{23} = pot size squared (inch²); β_i = regression coefficients; and 0 = regression error term.

The marginal LOL with respect to changes in any of the independent variables was expected to be zero. If marginal LOL was greater than zero, then an increase in the value of an independent variable would raise respondent's LOL for the garden cultivars. If the marginal LOL value was less than zero, then the respondent's LOL would be inversely related to the independent variable.

The willingness to pay [WTP (Eq. 2)] model for the nine cultivars was estimated by using tobit method (Aldrich and Nelson, 1984; Bernt, 1991; Long, 1997; Maddala, 1983). Tobit was selected due to the characteristics of some of the variables in the WTP model where upper limits were imposed. The WTP for the cultivars was based on the respondents' responses to the open-ended question, "How much are you willing to pay for this plant (in dollars)?" It should be noted that this open-ended approach to soliciting WTP had some serious limitations. In order to eliminate the effects of extreme values, 43 WTP valuations exceeding \$25/plant were excluded from the analysis. The specifications of the WTP (Eq. 2) equation that were estimated

by using EViews 5 (Quantitative Micro Software, 2004) were as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \beta_{16} X_{16} + \beta_{17} X_{17} + \beta_{18} X_{18} + \beta_{19} X_{19} + \beta_{20} X_{20} + \beta_{21} X_{21} + \beta_{22} X_{22} + \beta_{23} X_{23} + \beta_{24} X_{24} + \beta_{25} X_{25} + 0 \quad (\text{Eq. 2})$$

where Y = willingness to pay (\$/plant), X_1, \dots, X_{23} as defined in Eq. 1, X_{24} = level of liking, X_{25} = level of liking squared, and β_j , 0 as defined earlier.

The marginal WTP with respect to changes in any of the independent variables was expected to be zero. If marginal WTP was positive, then an increase in the value of any of the independent variables would lead to an increase in the respondent's WTP for the garden cultivars. If the marginal value was less than zero, then the respondent's WTP would decrease as the value of the independent variable increased.

Results and discussion

The 579 respondents of the consumer survey were participants of the Flower and Garden Fest who could be considered as persons who had some interest in flowers. About 70% of all the respondents bought chrysanthemum plants in 2002, 16% reported not buying, and 15% did not have any answer. On the average, 6.5 ± 7.4 plants (mean \pm SD) were bought by the respondents in 2002. Most of the respondents were females (82.6%), and Caucasians or Whites (84.9%). The average participant was about 58.1 ± 13.6 years old, had 2.3 ± 1.1 persons in his/her household, completed 14.4 ± 2.7 years of formal education, and realized household income averaging \$55,900 \pm \$38,900 per year (Table 1).

LEVELS OF LIKING MODEL. The majority of the participants (78.6%) strongly liked the cultivars (ratings of 5–7), 16.2% neither liked nor disliked the cultivars (ratings of 4), and 5.2% strongly did not like the cultivars (ratings of 1–3). The mean and median LOL for all cultivars were 5.5 and 6.0, respectively. Results of ordered logit analysis of the LOL model showed that the odds that respondents would like or dislike the cultivars were significantly determined by the chrysanthemum cultivar, race, gender, previous

Table 1. Socioeconomic characteristics of respondents to the consumer survey of selected chrysanthemum cultivars conducted during the 2003 Fall Flower and Garden Fest in Crystal Spring, Miss., categorized according to whether they bought or did not buy chrysanthemums in 2002.

Item	Bought	Did not buy	Total
Respondents' gender			
Male (%)	10.5	6.9	17.4
Female (%)	59.8	22.8	82.6
Total (%)	70.3	29.7	100.0
Respondents' race			
Native American (%)	7.4	3.2	10.7
Caucasian or White (%)	66.4	18.5	84.9
African American or Black (%)	1.9	1.1	3.1
Others (%)	1.0	0.4	1.3
Total (%)	76.7	23.3	100.0
Respondents' age			
[mean \pm SD (years)]***	58.8 \pm 12.7	55.2 \pm 16.7	58.1 \pm 13.6
Household size			
[[mean \pm SD (no. persons)]]	2.3 \pm 1.1	2.3 \pm 0.8	2.3 \pm 1.1
Formal education			
[mean \pm SD (years)]	14.4 \pm 2.6	14.3 \pm 2.9	14.4 \pm 2.7
Household income			
[mean \pm SD (\$1000/year)]***	56.8 \pm 31.0	51.9 \pm 29.5	55.9 \pm 0.8
2002 chrysanthemum purchases			
[mean \pm SD (no./year)]***	8.0 \pm 7.4	0.0 \pm 0.0	6.5 \pm 7.4

***Significant at $P \leq 0.001$.

Table 2. Ordered logit results of the level of liking of respondents to the consumer survey of selected chrysanthemum cultivars conducted during the 2003 Fall Flower and Garden Fest in Crystal Spring, Miss.

Independent variable	Coefficient	SE
Mithra Maroon	0.7096***	0.1214
Venus Purple	0.5041***	0.1222
Amory Yellow White	0.4823***	0.1118
Adonis Purple	0.3901***	0.1092
Road Runner Bronze	0.2605**	0.1120
Starlet Ivory	0.0694	0.1215
Amata Purple	0.0499	0.1246
Freya Salmon	-0.0153	0.1111
Annual household income	-0.0378	0.0881
Annual household income (squared)	-0.0040	0.0142
White	-0.2707***	0.0630
Male	-0.2964***	0.0509
No. of chrysanthemums purchased in 2002	0.0179***	0.0052
No. of chrysanthemums purchased in 2002 (squared)	-0.0001	0.0001
Saturday	0.2922***	0.0395
Age	-0.0002	0.0105
Age (squared)	0.0000	0.0001
Years of formal education	-0.0081	0.0411
Years of formal education (squared)	-0.0010	0.0014
Household size	-0.1478**	0.0430
Household size (squared)	0.0164**	0.0044
Pot size	-0.0186*	0.0105
Pot size (squared)	0.0003***	0.0000
No. of observations after adjustment	8748	
Likelihood ratio (LR) index ^z	0.0242	
Likelihood ratio (LR) statistic ^y	650.6085***	

^zLR index is an analog of R^2 reported in linear regression models.

^yLR statistic is the test for the overall significance of the model.

***, **, *Significant at $P \leq 0.05$, 0.01, and 0.001 respectively.

chrysanthemum purchases, date of interview, household size and pot size (Table 2). There were no significant influences exerted by the respondents' household income, age, and years of formal education on the LOL for the cultivars included in the survey.

The dummy variables representing five cultivars significantly influenced respondents' LOL for the cultivars. Based on the respondents' marginal LOL for the cultivars, their preference rankings could be categorized into two groups. The more preferred group of cultivars included 'Mithra Maroon', 'Venus Purple', 'Amory Yellow White', 'Adonis Purple', and 'Road Runner Bronze'. The less preferred group of cultivars included 'Night Hawk Lemon' (excluded cultivar), 'Freya Salmon', 'Amata Purple', and 'Starlet Ivory'. The significant marginal LOL values of the first group indicated that respondents had higher tendencies to like the first five cultivars more than the last four cultivars included in the survey.

Race and gender had significant negative effects on LOL for the nine cultivars. Male respondents stated lower level of liking for the cultivars as compared to female respondents. Consumers of White or Caucasian origin did not like the cultivars as much as the other respondents who reported other racial origins, primarily Native Americans and African Americans.

Previous purchases of chrysanthemums tend to have a strong positive influence on respondents' LOL for the cultivars. The marginal LOL with respect to previous purchases was positive at the average purchases reported by the respondents, indicating that respondents who bought chrysanthemums previously showed higher liking for the cultivars.

It seemed that the date of interview influenced respondents' LOL for the cultivars. Those who were interviewed on Saturday liked the cultivars more than those who were interviewed on Friday.

Household size played a significant role in constraining respondents' LOL for the cultivars. The marginal LOL with respect to household size was negative at the reported average size, indicating that respondents who had larger households stated lower liking for the cultivars.

Pot sizes adversely affected respondents' LOL for the cultivars since the

Table 3. Tobit results of the willingness to pay of respondents to the consumer survey of selected chrysanthemum cultivars conducted during the 2003 Fall Flower and Garden Fest in Crystal Spring, Miss.

Independent variable	Coefficient	SE
Constant term	14.8931***	1.4490
Mithra Maroon	0.9894**	0.3953
Road Runner Bronze	0.8780*	0.3816
Amory Yellow White	0.7773*	0.3719
Amata Purple	0.6701	0.3899
Adonis Purple	0.6021	0.3728
Freya Salmon	0.5248	0.3770
Starlet Ivory	0.4739	0.3882
Venus Purple	0.3374	0.3890
Annual household income	1.6814***	0.2200
Annual household income (squared)	-0.1807***	0.0352
White	-0.5786***	0.1974
Male	-0.2058	0.1634
No. of chrysanthemums purchased in 2002	-0.0539**	0.0219
No. of chrysanthemums purchased in 2002 (squared)	0.0022**	0.0008
Saturday	-0.3157**	0.1079
Age	-0.2200***	0.0288
Age (squared)	0.0020***	0.0003
Years of formal education	-0.0651	0.0796
Years of formal education (squared)	0.0006	0.0027
Household size	-1.6110***	0.1319
Household size (squared)	0.1453***	0.0161
Pot size	-0.1047***	0.0265
Pot size (squared)	0.0013***	0.0002
Level of liking	-0.5986*	0.3039
Level of liking (squared)	0.1381***	0.0293
No. of observations after adjustments	6555	
R ²	0.1989	
SE	4.4386	

***, **, *Significant at $P \leq 0.05$, 0.01, and 0.001, respectively.

marginal LOL with respect to pot size was negative at the average pot size.

WILLINGNESS TO PAY MODEL

Approximately two-thirds of all respondents stated their WTP for the nine cultivars. The mean and median WTP for all the cultivars were \$8.83/plant and \$8.00/plant, respectively. About 35% of all the participants who responded to this question stated that they were willing to pay \$5/plant or less for the cultivars. Participants who offered \$6–10/plant for the cultivars accounted for 42.2%, while 14.5% of participants stated that they were willing to pay \$11–15/plant. Approximately 5.6% of the respondents offered \$16–20/plant, and the remaining 2.7% were willing to pay more than \$20/plant for the cultivars.

Tobit results of the WTP model for all nine cultivars showed that consumer valuations were significantly influenced by the type of cultivars, household income, race, previous purchases of chrysanthemums, interview date, age, household size, pot size, and level of

liking (Table 3). The respondents' gender and years of formal education did not influence respondents' valuations of the cultivars.

The dummy variables representing three cultivars exerted significant influence over respondents' willingness to pay. These results showed that respondents' willingness to pay for the cultivars could be grouped into two levels. First, participants were willing to pay more for 'Mithra Maroon', 'Road Runner Bronze', and 'Amory Yellow White' than 'Night Hawk Lemon' (excluded cultivar). These are the same three of the five cultivars that respondents tend to like more. Second, the dummy variables representing 'Amata Purple', 'Adonis Purple', 'Freya Salmon', 'Starlet Ivory', and 'Venus Purple' were not statistically significant, indicating that respondents were not willing to pay more for them than 'Night Hawk Lemon'. As such, respondents were willing to pay less for these second group of five cultivars than the first group of three cultivars.

Annual household income exerted significant influence on the WTP for all cultivars as stated by respondents. The marginal WTP with respect to income was positive at the average annual household income, indicating that respondents with higher incomes were willing to pay more for the cultivars.

Race exerted negative influence on respondents' WTP for the nine cultivars. Consumers of White or Caucasian origin comprised 84.9% of all respondents and were willing to pay \$0.58 less per plant as compared to respondents who reported other racial origins, primarily Native Americans and African Americans.

Respondents' purchases of chrysanthemums in 2002 exerted significant influence over their stated WTP for the cultivars. The marginal WTP with respect to previous purchases was negative for average purchases in 2002.

Interview date influenced respondents' willingness to pay for the cultivars. Participants who were interviewed on Saturday liked the cultivars more, but were willing to pay less than those who were interviewed on Friday.

Age exerted strong negative influence over respondents' WTP for the cultivars. The marginal WTP with respect to age was negative at the reported average age, revealing the tendency for relatively older respondents not to offer higher prices for the cultivars.

Household size had a significant negative effect on the respondents' WTP for the cultivars. At the reported average household size, the marginal WTP with respect to household size was negative, expressing the unwillingness to pay more for the garden cultivars by respondents with relatively larger-sized households.

Pot size had a very strong negative influence over the respondents' WTP for the cultivars. The marginal WTP with respect to pot size was less than zero at the average pot size, implying that respondents were not willing to pay more for plants in the larger-sized pots included in the survey.

The level of liking variable exerted significant positive effect on respondents' willingness to pay for the cultivars. At the average LOL rating for all cultivars, the marginal WTP with respect to LOL would be positive, implying that respondents who liked

the cultivars more would tend to be willing to pay more for them.

Conclusions

Respondents preferred 'Mithra Maroon', 'Venus Purple', 'Amory Yellow White', 'Adonis Purple', and 'Road Runner Bronze' more than 'Night Hawk Lemon', 'Freya Salmon', 'Amata Purple', and 'Starlet Ivory'. Of the five preferred cultivars, only 'Mithra Maroon', 'Road Runner Bronze', and 'Amory Yellow White' were cultivars for which respondents were willing to pay more.

Participants of White or Caucasian origin liked the cultivars less and were willing to pay less for the cultivars as compared to other respondents who reported other racial origins, primarily Native Americans and African Americans. The levels of liking for the cultivars were similar for participants of different gender classification, but female respondents were willing to pay more for the cultivars.

Respondents who previously bought chrysanthemums stated higher level of liking for the cultivars but were not willing to pay more for them. Participants who were interviewed on Saturday liked the cultivars more but were willing to pay less than those who were interviewed on Friday.

Participants with larger-sized households liked the cultivars less and were not willing to pay more for the cultivars. Respondents did not like the cultivars in larger-sized pots and were not willing to pay more for plants in larger-sized pots included in the survey.

The results of this survey, which were limited to participants in a flower and garden show, provided insights on consumer preferences for the new chrysanthemum cultivars. The new cultivars that nursery growers should consider for commercial production should be initially limited to those that the participants liked most and were willing to pay more. The promotion of the new cultivars should be concentrated on consumer groups who stated higher liking and willingness to pay for them.

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