horticulturae

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Online Survey of Consumer Preferences for Poinsettia Cultivars

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Abstract: New introductions necessitate ongoing studies to keep producers updated about current trends. Consumer preference study results for poinsettia cultivars may interest breeders, wholesale producers, and retail consumers. An online consumer preference survey, conducted from 15 December 2020 to 19 January 2021, was posted in the Qualtrics software platform. Email distribution lists and Facebook were both used to promote the online survey. The survey link was accompanied by a description introducing the project's purpose and expressing gratitude for participation. Qualtrics automatically collected participants' data. The survey was closed, and the data were collected on 19 January 2021 from 792 respondents. This study aimed to identify consumer preferences for traditional red, white, or pink poinsettia cultivars and novelty selections. The topmost preferred poinsettia cultivars are "Princettia Queen Pink", "Winter Rose Dark Red", "Ice Punch", "Christmas Mouse", "Princettia Pure White", and "Princettia Hot Pink". The color of poinsettia cultivars did not significantly affect the respondents' willingness to pay. However, pot size substantially impacted their willingness to pay for poinsettias. Respondents were willing to pay USD 4.89, 8.13, 12.11, and 17.14 per pot for the 4-, 6-, 8-, and 10-inch potted poinsettias, respectively. Some of the socioeconomic characteristics of the respondents influenced their decisions on how much they were willing to pay for poinsettias.

Keywords: willingness to pay; levels of liking; socioeconomic characteristics

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Citation: Posadas, B.C.; Coker, C.E.H.; Jackson, C.; Knight, P.R.; DelPrince, J.M.; Langlois, S.A.; Ryals, J.B. Online Survey of Consumer Preferences for Poinsettia Cultivars. *Horticulturae* **2023**, *9*, 449. https://doi.org/10.3390/horticulturae9040449

Academic Editor: Li-Chun Huang

Received: 6 February 2023
Revised: 26 March 2023
Accepted: 29 March 2023
Published: 31 March 2023

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1. Introduction

Poinsettia plants are available in various bract and leaf colors, modified shapes, and container sizes during Christmas. In 2018, the U.S. floriculture wholesale market for American growers produced USD 10 million or more in sales was valued at USD 4.77 billion. American growers ranked poinsettias as the second most profitable flowering plant for indoor or patio use, valued at USD 149 million, with orchids ranking the most profitable at USD 293 million [1].

The abundance of cultivars is a significant shift in the poinsettia market [2]. With over 100 cultivars available, poinsettias have been bred to offer different colors, patterns, and growth habits [3]. Considering the competitiveness of the poinsettia market, growers must target the right market segments, defining consumers, and their value [2,4]. Consumer research focuses on consumer characteristics by identifying preferences, attitudes, motivations, and buying behavior. A consumer segment is a targeted group of individuals with similar demographic traits relevant to marketing, such as age, location, gender, spending habits, and interests. To remain profitably competitive, the floral industry uses consumer market research to understand consumer preferences and product/service needs [2,5]. Understanding the customer base may allow a grower to set higher prices and achieve greater growing flexibility [2].

Online preference surveys are an evolving technology used for sociological and marketing research, generating data rapidly and in large quantities [6–8]. Online surveys provide format flexibility, such as emails with an embedded survey, link to survey URLs, and participant invitations from a website [9]. Additionally, surveys can be tailored

to suit consumer demographics, language, and purchase experience, where only pertinent questions are visible [9]. Participants can answer questions at their privacy, pace, and convenience [6,7,9].

Consumer surveys are used to gather consumer attitudes and behavioral data to forecast purchase decisions [10]. Likert scales are commonly used in survey research to measure people's attitudes and their degree of satisfaction [11]. Internet surveys were used to investigate consumer preference for organic, local, or sustainable plants [12]. The survey used a 7-point Likert scale, asking preference and demographic characteristic questions to provide producers with clear guidance on how to use sustainable practices while remaining profitable and competitive [12]. Another similar web-based survey was conducted to determine consumer preferences for container gardens' color harmony, price, and the amount of care information provided with purchase, which resulted in a potential value increase in the value of container gardening [13]. By conducting consumer surveys on preferences of cultivars, container size, and willingness to pay, results can directly increase profit margins and niche market opportunities for poinsettia producers by providing current consumer trends.

Consumer preferences for poinsettia cultivar studies are frequently conducted [14–17], but new introductions necessitate ongoing studies to keep producers updated with the current trends. Consumer preference study results for poinsettia cultivars may interest breeders, producers, wholesalers, and retailers. This study aimed to identify consumer preferences for traditional red, white, or pink poinsettia cultivars and novelty selections through an online survey of interested respondents. Specifically, it aimed to achieve the following specific objectives:

- to describe the methodology for measuring the consumer preferences for various poinsettia cultivars,
- to compare the willingness to pay and levels of liking for different poinsettia cultivars, and
- to measure the effects on consumer preferences for various poinsettia cultivars by the socioeconomic characteristics of respondents.

2. Materials and Methods

2.1. Measures of Consumer Preferences for Each Poinsettia Cultivar

2.1.1. Level of Liking

The levels of liking (LOL) for each poinsettia cultivar ranged from 1 to 7, where 1 was the lowest and 7 was the highest preference [18–20]. Respondents were asked, "Please encircle one number from 1 to 7 for each poinsettia cultivar". The liking rankings are (1–3)—strongly do not like this cultivar, 4—neither like nor dislike, and (5–7)—strongly like this cultivar.

The scientific and trade names, and breeders of the 20 cultivars included in the level of liking survey are listed in Appendix A. The 20 poinsettia cultivars were presented online in sets of two photographs. The first set was taken from the side, while the second set was taken from the top. The top and side color photographs of one poinsettia cultivar and the level of liking question were posted in the online survey (Figure 1). The same online procedures were applied to all the other 19 poinsettia cultivars.

2.1.2. Willingness to Pay

Three additional poinsettia cultivars were used in the willingness-to-pay survey (Appendix B). These three poinsettias were grown in four pot sizes for each cultivar.

Respondents were asked, "Please encircle the pot size (inches) you prefer for each poinsettia cultivar". The pot sizes are as follows: 4 inches, 6 inches, 8 inches, and 10 inches. The willingness to pay (WTP) for each poinsettia cultivar was measured in dollars per pot. Respondents were asked, "How much are you willing to pay for each poinsettia cultivar?"

The three poinsettia cultivars were presented in two color photographs each. One was taken from the side, while the other was taken from the top. The color photographs and the

willingness-to-pay question were posted in the online survey (Figure 2). The same online procedures were applied to the other two poinsettia cultivars.



Figure 1. Top and side views of a poinsettia cultivar included in the level of liking survey.

Select your level of liking based on each poinsettia variety on a scale from 1–7.

Strongly dislike this variety			Neither like nor dislike	Strongly dislike this variety		
1	2	3	4	5	6	7



Figure 2. Top and side views of a poinsettia cultivar in four pot sizes included in the willingness-to-pay survey.

Each variety included a dollar amount for each container size. Containers are sized from smallest to largest, 4-, 6- 8- and 10-inch from left to right.

Place a dollar amount (USD 0.00) in each box for each container size.

4-inch	6-inch	8-inch	10-inch

2.2. Sources of Data

An online survey was posted of the period from 15 December 2020 to 19 January 2021. The survey was designed and implemented using an online software platform (Qualtrics XM; Qualtrics, Provo, UT, USA). Email distribution lists and Facebook were used to promote the survey as starting on 15 December 2020. The survey link was accompanied by a description introducing the project's purpose and expressing gratitude for participation. Qualtrics automatically collected the participant's data. The survey was closed, and the data were collected on 19 January 2021.

The online survey asked for the respondents' socioeconomic characteristics, including the following:

Year born = respondents' age (yr.) was determined by asking respondents to state the year in which they were born.

Gender = respondents were asked to indicate their gender.

Education = formal education (yr.) was determined by asking the respondents to indicate the years of formal education completed.

HH size = respondents were asked to state how many were living in the household, including themselves.

Income = household income was reported in eight income groups: 1—less than USD 25,000; 2—USD 25,000 to USD 50,000; 3—USD 50,001 to USD 75,000; 4—USD 75,001 to USD 100,000; 5—USD 100,001 to USD 150,000, 6—USD 150,001 to USD 200,000; 7— USD 200,001 to 250,000; 8—more than USD 250,000; 9—no answer; and 10—no income.

Zip code = respondents were asked to state their household zip code.

Race = race was reported using 6 options: Native American, African American, Asian or Pacific Islander, Caucasian, Hispanic, and Other.

The respondents' personal information was collected to determine differences in willingness to pay for poinsettia cultivars. The null hypothesis is that no significant differences are expressed in consumer preferences for poinsettia cultivars by respondents from different socioeconomic groups. The variations by socioeconomic groups determine the diversity or homogeneity of the sample.

2.3. Statistical Analysis

The statistical analysis of survey data was performed using Stata 17 (StataCorp LLC, Lakeway Drive, College Station, TX, USA). The means and percentage distribution of respondents' characteristics were estimated by the procedures 'summarize' and 'tabulate' in Stata 17. The data on the levels of liking of the 20 poinsettia cultivars were ranked by one-way analysis of variance (ANOVA) in Stata 17 and the Scheffe test to determine any statistical differences by cultivar. The cultivars were ranked from highest to lowest and divided into three categories: most preferred, more preferred, and less preferred. There were twenty poinsettia cultivars compared. An empirical model was developed to determine the significant factors affecting the level of liking. Due to the deficient explanatory characteristics of the empirical model, the level of liking regression results were excluded from this manuscript.

The data on willingness to pay were analyzed using ANOVA and the Scheffe test to determine any statistical differences by cultivar and they were tabulated for container size preference. Three colors and four pot size compared. To determine the significant factors affecting willingness to pay for poinsettia cultivars, the empirical model, defined by

Equation (1) was estimated by using the ordinary least square (OLS) procedure preference. The OLS model for the willingness to pay is as follows:

$$WTP_1 = B_0 + B_1 \times CV + B_2 \times PS + B_3 \times NO\# + B_4 \times SEC + Ĕ, \quad (1)$$

where Bi = coefficients, CV = poinsettia cultivars or colors included in the survey, PS = pot size, NO# = number of poinsettias purchased in the previous year, and SEC = respondents' socioeconomic characteristics. The OLS model was estimated by using the robust variance procedure of Stata-17. The variation–inflation factor was calculated to detect the possible presence of multicollinearity. The marginal impacts of disaster events were computed using the margins procedure.

3. Results and Discussion

3.1. Respondents' Socioeconomic Characteristics

A total of 792 respondents participated in the online survey from 15 December 2020 to 19 January 2021. At least 758 respondents or 96 percent answered the questions on levels of liking for the 20 poinsettia cultivars included in the study. Survey participants bought an average of 3.61 poinsettias per household in 2019 (Table 1). Their formal educational attainment averaged 17.32 years or above college degrees. The average size of families was 2.49 persons. Most respondents were female, while less than 20 percent were males. More than 9 out of 10 participants were Caucasians.

Table 1. Respondents' previous poinsettia purchases and socioeconomic characteristics.

Characteristics	No. of Obs.	Mean or Percent	Std. Dev.
Poinsettia purchases in 2019	548	3.62	6.12
Formal education (yr)	547	17.32	2.81
Household size	548	2.49	1.19
Respondent's age (yr)	546	53.08	14.50
Male respondents (%)	100	18.28	-
Female respondents (%)	441	80.62	-
Caucasian respondents (%)	547	91.41	-
Households with income above USD 100,000 (%)	184	23.29	-
Households without income (%)	336	42.42	-

The respondents who completed the online survey belonged to different income groups. Those who received more than USD 100,000 per year amounted to more than 23 percent of all respondents. However, more than 42 percent reported no household income while 0.25 percent did not answer the income question. The category of "no income" covers respondents without income and the "no answer" category includes those who did not want to report their income. Consequently, these two groups of respondents were excluded in estimating Equation (1). The low response rate on household income is the lowest rate among all questions dealing with personal information.

3.2. Levels of Liking

The levels of liking for the 20 poinsettia cultivars ranged from 3.95 to 5.42 (Figure 3 and Table 2). The number of respondents who provided their levels of liking for each cultivar ranged from 752 to 767 or at least 95 percent. However, the proportion of respondents who provided personal information was less than 70 percent.

The most preferred cultivars received levels of liking equal to or above 5.0 out of 7.0. The topmost preferred poinsettia cultivars are "Princettia Queen Pink", "Winter Rose Dark Red", "Ice Punch", "Christmas Mouse", "Princettia Pure White", and "Princettia Hot Pink".

The second group of cultivars received levels of liking between 4.5 and 5.0. Nine poinsettia cultivars were added to the second group of preferred cultivars. The third

category of cultivars received levels of liking lower than 4.5. The least preferred ones included five poinsettia cultivars.

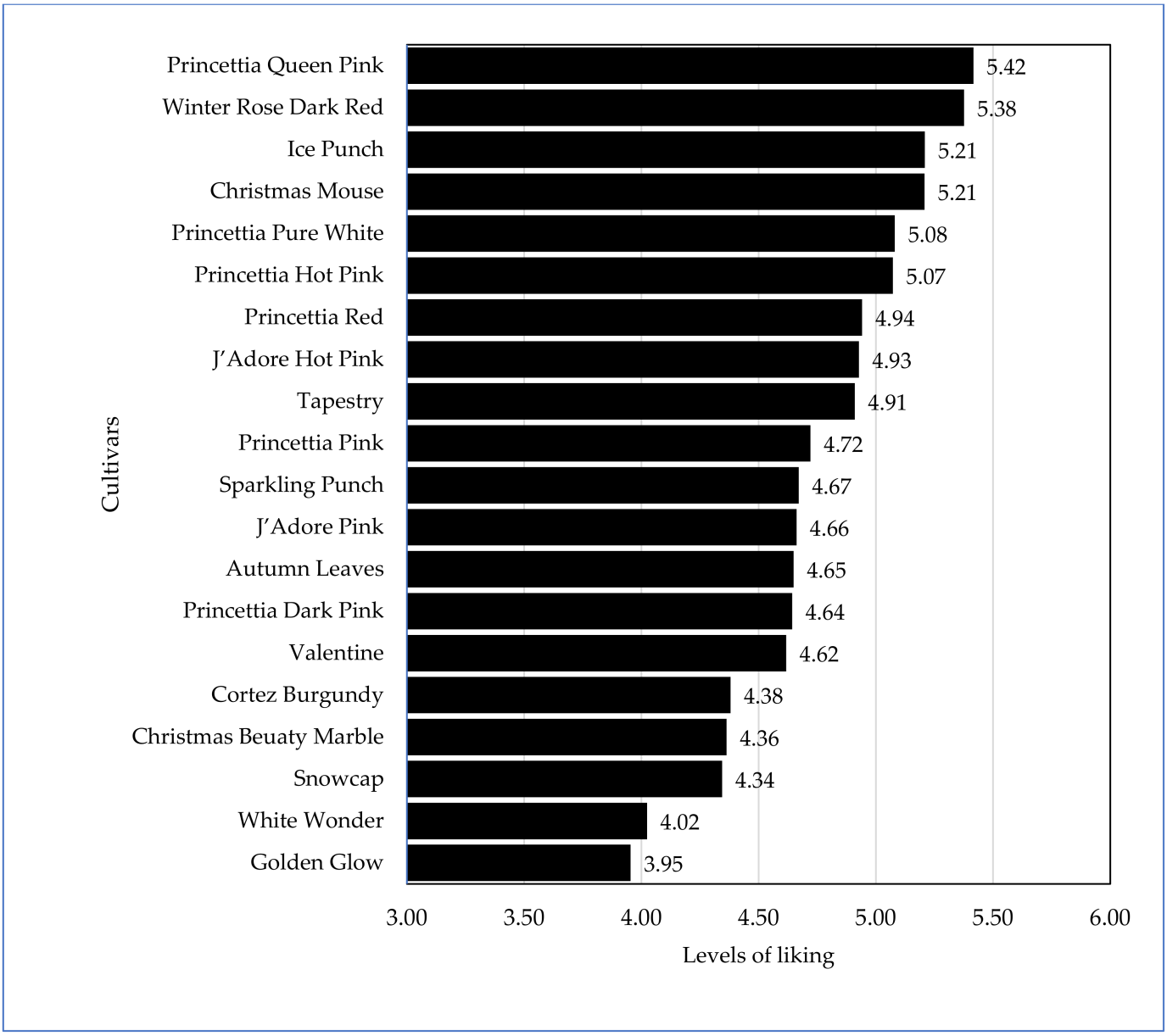


Figure 3. Levels of liking for 20 poinsettias cultivars.

3.3. Willingness to Pay by Poinsettia Cultivar and Pot Size

Respondents were asked to state their willingness to pay for three poinsettia cultivars and four pot sizes. The colors of the three poinsettia cultivars included in the survey are white, red, and pink. The willingness to pay did not significantly differ with the poinsettia colors used in the study (Table 3). The average offer was USD 10.57 per pot for all three colors.

Pot sizes were compared to the desire to pay for three poinsettia cultivars. Larger pot sizes tended to receive higher offers for willingness to pay than the smaller ones (Table 4). The respondents offered to pay from USD 4.89 to USD 17.14 per pot for the 4-inch to 10-inch potted poinsettia cultivars.

Table 2. Means and standard deviation of levels of liking for 20 poinsettia cultivars.

Cultivar	No. of Obs.	Mean	Std. Dev.
Golden Glo	768	3.95 ^{b,c,d}	1.61
White Wonder	758	4.02 ^{b,c,d}	1.59
Snowcap	758	4.34 ^{b,c,d}	1.56
Christmas Beauty Marble	758	4.36 ^{b,c,d}	1.62
Cortez Burgundy	752	4.38 ^{b,c}	1.73
Valentine	746	4.62 ^{b}	1.55
Princettia Dark Pink	764	4.64 ^{b}	1.40
Autumn Leaves	764	4.65 ^{a,b,c}	1.68
J'Adore Pink	764	4.66 ^{a,b,c}	1.53
Sparkling Punch	767	4.67 ^{b,c}	1.56
Princettia Pink	760	4.72 ^{b}	1.44
Tapestry	758	4.91 ^{b,c}	1.55
J'Adore Hot Pink	764	4.93 ^{a,b,c}	1.56
Princettia Red	767	4.94 ^{b}	1.26
Princettia Hot Pink	762	5.07 ^{a,b,c}	1.47
Princettia Pure White	765	5.08 ^{a,b}	1.54
Christmas Mouse	759	5.21 ^{a}	1.55
Ice Punch	759	5.21 ^{a}	1.61
Winter Rose Dark Red	766	5.38 ^{a,b}	1.54
Princettia Queen Pink	764	5.41 ^{a}	1.38

Means denoted by the same letter indicate no significant differences between pot sizes ($p \leq 0.05$).

Table 3. Willingness to pay for three poinsettia cultivars by color.

Pot Size	No. of Obs.	Mean	Std. Dev.
White	1972	10.56 ^{a}	7.64
Red	1870	10.57 ^{a}	7.55
Pink	1850	10.57 ^{a}	7.47
Total	5692	10.57 ^{a}	7.64

Means denoted by the same letter indicate no significant differences between pot sizes ($p \leq 0.05$).

Table 4. Willingness to pay for the three poinsettia cultivars by pot sizes.

Pot Size	No. of Obs.	Mean	Std. Dev.
4 inches	1425	4.89 ^{a}	2.83
6 inches	1419	8.13 ^{b}	4.30
8 inches	1426	12.11 ^{c}	6.35
10 inches	1422	17.14 ^{d}	9.12

Means denoted by a different letter indicate significant differences between pot sizes ($p \leq 0.05$).

Significant differences were observed among the four pot sizes of white poinsettia "Alpina". Respondents' willingness to pay ranged from USD 4.85 to USD 17.27 per pot for the 4-inch to 10-inch potted white poinsettias (Table 5).

Table 5. Willingness to pay for white poinsettia "Alpina" by pot size.

Pot Size	No. of Obs.	Mean	Std. Dev.
4 inches	496	4.85 ^{a}	2.79
6 inches	485	8.00 ^{b}	4.06
8 inches	496	12.11 ^{c}	6.25
10 inches	495	17.27 ^{d}	9.12

Means denoted by a different letter indicate significant differences between pot sizes ($p \leq 0.05$).

The willingness to pay for red poinsettia "Burning ember" was enormously different by pot size. Respondents offered to pay between USD 4.98 and USD 17.04 per pot for the 4-inch to 10-inch potted red poinsettias (Table 6).

Table 6. Willingness to pay for red poinsettia "Burning ember" by pot size.

Pot Size	No. of Obs.	Mean	Std. Dev.
4 inches	469	4.87 [a]	2.76
6 inches	460	8.17 [b]	4.33
8 inches	462	12.07 [c]	6.24
10 inches	459	17.10 [d]	8.94

Means denoted by a different letter indicate significant differences between pot sizes ($p \leq 0.05$).

Respondents' willingness to pay for pink poinsettia "Maren" also varied by pot size. Their willingness to pay spanned from USD 4.98 to USD 16.25 per pot for the 4- to 10-inch potted white poinsettias (Table 7).

Table 7. Willingness to pay for pink poinsettia "Maren" in pot size.

Pot Size	No. of Obs.	Mean	Std. Dev.
4 inches	469	4.98	2.95
6 inches	460	8.24	4.51
8 inches	462	12.17	6.59
10 inches	459	17.04	9.34

3.4. Willingness to Pay Regression Results

The response variable (WTP) was related to the factor variables (poinsettia cultivar, container size, and socioeconomic characteristics). The robust variance procedure, calculated by the regression models in Stata 17, was used in estimating the regression coefficients. The results of the variation inflation factor indicated no presence of multicollinearity. The marginal effects of factor variables on the response variable were computed using the margins procedure. Overall, the estimated equation, as defined by Equation (1), explained 38 percent of the variation in willingness to pay (Table 8).

Four explanatory variables included in the model did not significantly impact willingness to pay for poinsettia cultivars. The color of poinsettia cultivars—white, red, and pink—did not significantly affect the respondents' willingness to pay. Respondents were willing to pay an average of USD 10.57 per potted poinsettia regardless of color (Table 3). The number of previous purchases has a negative but insignificant influence on willingness to pay. The date the respondents started the online survey did not significantly impact their willingness to pay.

Household income seemed to have an insignificant effect on willingness to pay for poinsettia cultivars. Respondents' willingness to pay for poinsettia cultivars was insensitive to differences in their household incomes. Several configurations of this variable were attempted in estimating this model. However, they all resulted in the same insignificant impacts. The results imply that, since household income is not a significant determinant, the respondents considered poinsettias as necessities during the holidays.

The size of potted poinsettias significantly influenced respondents' willingness to pay. Larger potted plants commanded higher prices than the smaller ones. They were willing to pay USD 3.31, USD 7.30, and USD 12.34 more per pot for the 6-, 8-, and 10-inch over the 4-inch potted poinsettias, respectively.

It seems that female respondents offered to pay more for poinsettia cultivars than their male counterparts. They were willing to pay USD 2.23 more per potted poinsettia.

Respondents' level of formal education negatively and significantly affected their willingness to pay for poinsettia cultivars. The willingness to pay fell by –USD 0.05 per pot for yearly increases in their formal education.

Table 8. Regression results with respondents' willingness to pay per potted poinsettia as the dependent variable.

Variable	Coefficient	Robust Standard Error
Poinsettia color		
White	Base	-
Red	0.113 ns	0.220
Pink	0.217 ns	0.225
Poinsettia pot size		
4-inch	Base	-
6-inch	3.315 ***	0.160
8-inch	7.305 ***	0.209
10-inch	12.344 ***	0.283
Poinsettia purchases in 2019	−0.000 ns	0.001
Respondent gender		
Male	Base	-
Female	2.230 ***	0.243
Other	2.349 ***	0.741
Respondent formal education	−0.053 *	0.031
Household size	−0.273 ***	0.074
Household income greater than USD100,000	−0.040 ns	0.190
Respondent is Caucasian	1.077 ***	0.276
Respondent age	−0.026 ***	0.004
Date of survey	0.006 ns	0.011
Mississippi respondent	−0.876 ***	0.207
Constant	−302.823	512.810
Number of observations	4480	
F-value	194.35 ***	
R-squared	0.38	

Legend: *—significant at 10%; ***—significant at 1%; ns—not statistically significant.

On the other hand, larger sizes of household tended to offer a lower willingness to pay for poinsettia cultivars than those with smaller household sizes. Their offer to pay for poinsettia cultivars declined by –USD 0.27/pot for every one-person increase in their household.

Caucasians seemed to have a higher willingness to pay for poinsettia cultivars. Results indicated a USD 1.07/pot increase in their willingness to pay compared to the other groups.

The age of respondents exerted adverse and considerable effects on their willingness to pay for poinsettia cultivars. Their willingness to pay declined by –USD 0.02 per pot each year added to their age.

Mississippi respondents who completed the online survey seemed to have offered a lower willingness to pay for poinsettia cultivars. They showed –USD 0.87 per pot less than the respondents from other states.

4. Discussion and Conclusions

Understanding consumer preferences for new poinsettia cultivars is vital for marketing these products. This knowledge will benefit other researchers by providing a reliable method to use in this research area. Face-to-face interviews are sometimes restricted, especially during pandemic periods.

The topmost preferred poinsettia cultivars are "Princettia Queen Pink", "Winter Rose Dark Red", "Ice Punch", "Christmas Mouse", "Princettia Pure White", and "Princettia Hot Pink". Pot sizes substantially impacted respondents' willingness to pay for poinsettias. Respondents were willing to pay USD 4.89, 8.13, 12.11, and 17.13 per pot for the 4-, 6-, 8-, and 10-inch potted poinsettias. However, the survey results indicate that poinsettia color differences did not considerably impact willingness to pay.

Consumer preference for poinsettia cultivar studies is frequently assessed, but new introductions necessitate that ongoing studies be conducted to keep producers

updated with current trends. Consumer preference study results for poinsettia cultivars may interest breeders, producers, wholesalers, and retailers. The South Mississippi Experiment Station has been conducting annual evaluations of traditional red, white, or pink poinsettia cultivars, and novelty selections through consumer preference surveys of interested respondents. When added to previous results in other locations, these evaluation results provide a better understanding of consumer preferences for poinsettia cultivars. The results of these consumer preference studies will serve as an essential historical benchmark for the industry.

Author Contributions: Conceptualization, C.J., C.E.H.C., P.R.K., J.M.D. and B.C.P.; methodology: C.J., C.E.H.C., P.R.K., J.M.D. and B.C.P.; software: C.J. and B.C.P.; validation, C.J. and B.C.P.; formal analysis, C.J. and B.C.P.; investigation, C.J. and B.C.P.; resources, C.J., C.E.H.C., P.R.K., J.M.D., S.A.L. and J.B.R.; data curation, C.J. and B.C.P.; writing—original draft preparation, C.J. and B.C.P.; writing—review and editing, B.C.P., C.E.H.C., P.R.K., J.M.D., S.A.L. and J.B.R.; visualization, C.J., S.A.L. and J.B.R.; supervision, C.E.H.C., P.R.K., J.M.D. and B.C.P.; project administration, C.E.H.C., P.R.K., J.M.D., S.A.L. and J.B.R.; funding acquisition, not applicable. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The data generated by this research are not posted online.

Acknowledgments: This publication is a contribution of the Mississippi Agricultural and Forestry Experiment Station. This material is based upon work supported partly by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch project under accession number MIS-149190.

Conflicts of Interest: The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Appendix A

Table A1. Scientific and English names and breeders of 20 poinsettia cultivars used in the level of liking online survey.

Scientific Name	Trade Name	Breeder
Euphorbia pulcherrima	Autumn Leaves	Paul Ecke Ranch
Euphorbia pulcherrima	Christmas Beauty Marble	Selecta/Ball
Euphorbia pulcherrima	Christmas Mouse	Beekenkamp
Euphorbia pulcherrima	Cortez Burgundy	Syngenta
Euphorbia pulcherrima	Golden Glo	Selecta/Ball
Euphorbia pulcherrima	Ice Punch	Paul Ecke Ranch
Euphorbia pulcherrima × *E. cornastra*	J'Adore Hot Pink	Dummen Orange
Euphorbia pulcherrima × *E. cornastra*	J'Adore Pink	Dummen Orange
Euphorbia pulcherrima × *E. cornastra*	Princettia Dark Pink	Suntory
Euphorbia pulcherrima × *E. cornastra*	Princettia Hot Pink	Suntory
Euphorbia pulcherrima × *E. cornastra*	Princettia Pink	Suntory
Euphorbia pulcherrima × *E. cornastra*	Princettia Pure White	Suntory
Euphorbia pulcherrima × *E. cornastra*	Princettia Queen Pink	Suntory
Euphorbia pulcherrima × *E. cornastra*	Princettia Red	Suntory
Euphorbia pulcherrima	Snowcap	Paul Ecke Ranch
Euphorbia pulcherrima	Sparkling Punch	Paul Ecke Ranch
Euphorbia pulcherrima	Tapestry	Paul Ecke Ranch
Euphorbia pulcherrima	Valentine	Selecta/Ball
Euphorbia pulcherrima	White Wonder	Dummen Orange
Euphorbia pulcherrima	Winter Rose Dark Red	Paul Ecke Ranch

Appendix B

Table A2. Scientific and English names and breeders of three poinsettia cultivars used in the willingness-to-pay online survey.

Scientific Name	Trade Name	Breeder
Euphorbia pulcherrima	White poinsettia "Alpina"	Syngenta
Euphorbia pulcherrima	Red poinsettia "Burning ember"	Dummen Orange
Euphorbia pulcherrima	Pink poinsettia "Maren"	Paul Ecke Ranch

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