Garden Consumers' Behavior and Attitudes Toward Woody Plants and Water Conservation in Two Selected Communities[1]

Andrew R. King[2], Marco A. Palma[3], Bridget K. Behe[4], R. Thomas Fernandez[4], Lynnell Sage[4], Charles R. Hall[2], and Michael A. Arnold[2]

Abstract

Sustainability is one of the most important topics facing today's Green Industry. Consumers are increasingly savvy, but previous studies have shown some misperceptions concerning new terminology in the agricultural lexicon. With the recent focus on water issues in large portions of the United States, water conservation is a facet of sustainability that is at the forefront. Previous research has shown that consumers of ornamental horticulture products value energy-saving production practices over those that conserve water, but that could change as water becomes more of a concern. The objective of this study was to determine the attitudes and behaviors of different consumer segments (based on previous plant purchases) concerning water conservation and to identify patterns for each segment. An in-person survey was administered to 108 participants in East Lansing, MI, and College Station, TX, in May of 2013. Participants were asked to provide demographic information, details about plant and garden supply purchasing history and attitudes and behavior toward water conservation and woody plant production. Eight segments were identified through cluster analysis based on previous plant purchases. Clusters included 'avid plant purchasers', 'tree purchasers', 'intermediate plant purchasers', 'culinary plant purchasers', 'indoor plant purchasers', 'flowering perennial purchasers', 'herb plant purchasers' and 'non-plant purchasers'. Attitudes toward water conservation and woody plant production were relatively homogenous though general patterns did emerge. 'Avid plant purchasers' expressed a high level of interest (4.1/5) in woody plants while 'non-plant purchasers' were least interested (1.6/5). Attitudes toward water conservation were statistically similar ($P \leq 0.05$) among all segments except for 'culinary plant purchasers' who expressed greater knowledge (3.4/5) and 'non-plant purchasers' who expressed less (2.3/5) than the overall mean (3.0/5).

Index words: green marketing, blue marketing, cluster analysis, consumer preferences, water conservation.

Significance to the Horticulture Industry

This research provides a breakdown of horticultural consumer segments based on the type of ornamental plants they purchase. Consumers participating in this study were generally from university-centered communities and reported education levels greater than those reported in other green-industry consumer surveys. Other demographic characteristics in the current work were similar to those seen in other studies. The segmentation in the current study provides a more focused view of important groups of green industry consumers and therefore allows nursery and greenhouse professionals the opportunity to tailor their product mix, labeling, and marketing messages. Information about each segment's demographics, purchasing history, and attitudes toward water conservation and woody nursery crops is also included in the work. Attitudes toward water conservation did not vary widely among market segments; however, most participants considered the topic interesting and important and the average participant (3.7/5) reported taking part in water conservation practices. As water conservation increases in importance, however, blue marketing (water conservation) will likely convey different advantages among consumer segments, though all segments considered it somewhat important and interesting. Woody landscape plants were also considered to be of some personal importance by participants (3.4/5), but interest and knowledge on the subject varied. Some horticultural consumer segments that spent relatively little money on landscape plants expressed high amounts of interest in them (4.0/5), representing a group of consumers that should be explored by woody plant marketers. Participants also provided information regarding the percentage of plants they bought that were produced locally, and the types of stores where they purchased most of them. Such information could prove very valuable to growers and retailers in developing consumer-centric marketing strategies, as different green industry firms can apply these findings to bolster sales to segments in which they have underperformed or to fortify sales to segments that comprise large portions of their current clientele.

[1]Received for publication December 8, 2014; in revised form July 8, 2015. This project was funded by **The Horticulture Research Institute, 1200 G Street NW, Suite 800, Washington DC 20005**.

[2]Department of Horticultural Sciences, Texas A&M University, College Station, TX 77843-2133; corresponding author: aking@tamu.edu.

[3]Department of Agricultural Economics, Texas A&M University, 2124 TAMU, College Station, TX 77843-2124.

[4]Department of Horticulture, Michigan State University, 1066 Bogue St., East Lansing, MI 48824.

Introduction

The green industry complex is comprised of allied input suppliers: nursery, greenhouse and sod growers, wholesale distribution firms, horticultural service firms, and retail firms (Hall 2010). This industry has experienced a significant economic downturn over the past 7 to 10 years due to the 'great recession' that is perhaps most closely associated with fluctuation in the U.S. housing market (Hall 2010). From 2007 to 2012, the green industry in the U.S. experienced declining sales in dollars in a majority of the categories delineated by the USDA Census of Agriculture, including losses of over $0.5 billion in floriculture crops and almost $1.5 billion in other nursery crops (USDA 2014).

During the same period of time, interest in sustainable business and cultural practices has increased (Yue et al. 2010a, Yue et al. 2010b). Market research from around the world has pointed to consumers' increased willingness to pay for eco-labeled products, ranging from apples, furniture, apparel and seafood (Blend and Van Ravenswaay 1999, Nimon and Beghin 1999, Thompson and Kidwell 1998, Veisten 2007, Wessels et al. 1999, Yue et al. 2009). As this trend continues,

it is important for the green industry to optimize and market sustainable practices while offering products at acceptable price points to consumers. This optimization begins with a thorough understanding of what type of sustainable practices consumers consider valuable and those considered superfluous. Yue et al. (2011) uncovered a relative disinterest by many consumers for green industry products produced via organic methods and conversely a high amount of interest in products that were produced locally. Further, the study showed that consumers were more interested in purchasing plants in some form of sustainable container (biodegradable/compostable) than in recyclable containers. Findings such as these highlight the importance of fine-tuning green industry marketing strategies via market study, as utilization of research from other disciplines (Willer et al. 2008) could lead a green industry professional to expend resources on unnecessary or detrimental strategies. Identifying whether target market segments will respond positively to certain products or marketing strategies is a necessity when working inside the framework of a highly competitive industry (Hall 2010).

Green Industry market segments have been the focus of recent research (Behe et al. 2013, Behe et al. 2010, Hall et al. 2010, Yue et al. 2012). While most market research has utilized traditional conjoint part-worth utilities to segment samples (Campbell et al. 2004, Hall et al. 2010), market segments have been determined on the basis of several different criteria. Behe et al. (2010) highlighted market segments based on the types of plants that a participant had purchased in the past. Three segments were found; 'low use plant buyers' of whom few purchased any type of plant, 'woody plant buyers' who purchased mainly flowering shrubs and trees, and 'herbaceous plant buyers' that was comprised of a high percentage of flowering annual, perennial and indoor plant purchasers. Select environmental practices (i.e., recycling behavior and composting practices) of these segments were compared, and it was determined that 'herbaceous plant buyers' were generally more focused on eco-friendly practices, followed by 'woody plant buyers' and 'low use plant buyers'.

A similar segmentation or clustering process was utilized in Behe et al. (2013) in a follow-up study to that previously discussed. Again, consumers were clustered by previous plant purchases. The participants were sorted into nine segments in this study and it was determined that, similar to previous studies (Behe et al. 2010, Hall et al. 2010), this segmentation was valuable in that it uncovered differences among the groups in ecopractices and preference for production practices, container types and production origin. Another study where clusters were determined based on information other than output from a conjoint analysis was Wehry et al. (2007), in which select Pennsylvania gardeners were administered a survey at the Philadelphia Flower Show. Segments were divided based on participants' answers to four survey questions, uncovering their interest and history in purchasing locally-produced products, their product evaluations, and their perceived horticultural ability and knowledge. Three distinct segments, 'avid gardeners', 'novice gardeners' and 'casual gardeners', were identified. This clustering elucidated preferences of the target group for the Pennsylvania Gardener Selects (PGS) plant promotional program.

In association with the increasing interest in sustainable agriculture, new terminology has been introduced to consumers (Campbell et al. 2014). Campbell et al. (2014) investigated the perception and comprehension of U.S. and Canadian consumers in relation to the terms 'organic' and 'local'. The authors uncovered some misperceptions by consumers for both of these terms, and concluded that marketers should take care to avoid the use of terminology that confused the average consumer. Behe et al. (2013) found (through conjoint analysis procedures) that consumers were more interested in purchasing plants produced using energy-saving production techniques than those labeled sustainable or water-saving. In reality, energy and water-saving production practices are necessary facets of any sustainable production protocol. With water quantity and quality becoming an increasingly important issue in recent years, it is conceivable that consumers will begin to place more value on the use of water-saving practices, both during production and in the landscape.

Objectives of the current research were to: 1) determine if consumer segments (based on previous plant purchases) exhibited attitudinal or behavioral patterns concerning water conservation, 2) determine if consumer segments exhibited attitudinal or behavioral patterns concerning landscape plants, 3) identify potential patterns in the share of market segment plant purchases that were produced locally, 4) elucidate potential patterns of market segments concerning the types of firms they patronize, and 5) elucidate potential patterns of market segments concerning the type of firm where they purchase most plants and garden supplies.

Materials and Methods

Utilizing the findings of the aforementioned studies investigating the value of green marketing (sustainability) and blue marketing (water conservation), we developed a survey comprised of questions investigating participants' demographics, horticultural expenditures, preferences in regard to plant type and where it is purchased, knowledge and attitudes toward plant species, and water conservation. Demographic and socioeconomic questions included gender, age, number of adults in the household, number of minors in the household, ethnicity, education level, area of residence (i.e. metropolitan, suburban or rural) and annual income. Purchasing behavior questions included the dollar amount spent on garden supplies (excluding mechanical equipment, i.e., lawn mowers, tillers, etc.) in the previous six months, type of firms patronized, type of firm from which the largest portion of supplies were purchased and the percentage of plant purchases that were produced locally. Additionally, questions were crafted to investigate a participant's knowledge, interest, usage, recall and personal importance of woody plants and water conservation. Participants were asked to respond utilizing a 5 point Likert scale (1 = strongly disagree; 2 = moderately disagree; 3 = neither agree nor disagree; 4 = moderately agree; 5 = strongly agree). During analysis, questions pertaining to woody plants were grouped into five categories; knowledge (i.e., I know a lot about outdoor woody plants.), interest (i.e., compared to other people, I am interested in outdoor woody plants.), usage (i.e., I use outdoor woody plants around my home.), recall (i.e., I can immediately identify my preferred outdoor woody plant(s) even if it is displayed with others.) and personal importance (i.e., outdoor woody plants are important to me.). Water conservation questions were also combined by topic, knowledge (i.e., I am knowledgeable about water conservation practices), interest (i.e., I am interested in water conservation relative to

other people), usage (i.e., I am engaged in water conservation practices) and personal importance (i.e., water conservation is an important issue in my community.) Each topical group was comprised of at least two questions and at most seven. A mean was calculated utilizing a participant's answers for each of the questions in a topical group.

Participants were segmented based on the types of plants they had purchased in the previous six-month period, following Behe et al. (2013) and Behe et al. (2010). A cluster analysis (JMP Pro 10, SAS Inst. Inc., Cary, NC) was conducted following the methodology of Behe et al. (2013), Campbell et al. (2004), and Hall et al. (2010). Multiple statistical techniques were employed for segmentation along with the utilization of both objective and subjective methods to determine the optimum number of segments. Hierarchical clustering methods employed included Average linkage, the Centroid method, Complete linkage and Ward's linkage. Objective stopping procedures (pseudo *t*, pseudo f, and cubic clustering criterion) were utilized to identify commonalities in the segment number proposed by each statistical method.

The instruments utilized in the research were approved by committees reviewing research on human subjects at each institution involved. The surveys were administered in person to consumers in East Lansing, MI, and College Station, TX, in May 2013. The in-person method of administration was required in order to conduct portions of the larger study that are outside the scope of the current article, otherwise an internet-based approach would have been more efficient for the survey alone (Cobanoglu et al. 2001, Dillman et al. 2009, McCullough 1998). Participants were solicited by way of postcards (utilizing mailing lists obtained from previous studies), internet advertising, and social media outlets. Responses were collected from 108 participants from two states and all were included in the following analysis. Inference based on similar sample sizes were found in previous studies (Behe et al. 1997, Berghage and Wolnick 2000) and the statistical power analysis herein was supported by Cohen (1992) and Green (1991).

Results and Discussion

Participants from Michigan and Texas comprised 46.3 % (n = 50) and 53.7% (n = 58) of total participation, respectively (Table 1). Over two-thirds of the participants (71%) were female, a closely representative sample of typical green industry consumers (Behe et al. 2010, Yue and Behe 2008). Participants ranged in age from 18 to 84 with a mean of 42.8 years, also representative of typical green industry consumers according to Behe et al. (2010) and Yue and Behe (2008). Participants lived in households comprised of 1.16 other adults on average and they lived with a mean of 0.83 minors per residence. Mean household income for the participants was $72,200 while the median income was $59,999. Each

Table 1. Comparison of demographic characteristics for eight consumer segments from 108 participants of an in-person survey.

	Total	Tree purchasers		Avid plant purchasers		Intermediate plant purchasers		Herb plant purchasers		Indoor plant purchasers		Flowering perennial purchasers		Culinary plant purchasers		Non-plant purchasers	
Variable																	
Female (%)[z]	71	78	NS[x]	54	NS	56	NS	85	NS	86	NS	79	NS	71	NS	75	NS
Mean age[y]	42.8	46.2	NS	42.1	NS	44.4	NS	45.9	NS	42.7	NS	42	NS	38	NS	39.6	NS
Adults/household	1.16	1.17	NS	1.23	NS	1.17	NS	1.0	NS	0.86	NS	1.15	NS	1.65	NS	0.5	**
Minors/household	0.83	0.72	NS	1.46	NS	0.39	*	1.15	NS	0.29	NS	0.92	NS	1.12	NS	0.25	**
Income ($ in thousands)	72.2	101.2	*	68.3	NS	65.6	NS	70.8	NS	47.1	NS	83.6	NS	61.9	NS	61.4	NS
Education (%)[z]																	
Less than high school degree	0	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
High school degree/GED	6.5	11.1	NS	0	***	5.6	NS	0	***	0	***	14.3	NS	5.9	NS	12.5	NS
Some college	16.7	27.8	NS	30.8	NS	11.1	NS	23.1	NS	14.3	NS	14.3	NS	5.9	NS	0	***
2-year college degree	6.5	5.6	NS	7.7	NS	11.1	NS	7.7	NS	0	***	0	***	11.8	NS	0	***
4-year college degree	38.9	33.3	NS	38.5	NS	50.0	NS	30.8	NS	71.4	NS	35.7	NS	17.6	NS	62.5	NS
Master's degree	20.4	5.6	NS	23.1	NS	22.2	NS	23.1	NS	14.3	NS	14.3	NS	41.2	*	12.5	NS
Professional degree	11.1	16.7	NS	0	***	0	***	15.4	NS	0	***	21.4	NS	17.6	NS	12.5	NS
Ethnicity (%)[z]																	
African American	7.4	0	***	0	***	5.6	NS	0	***	28.6	*	0	***	29.4	***	0	***
Asian	6.5	0	***	0	***	5.6	NS	0	***	14.3	NS	7.1	NS	11.8	NS	25.0	*
Caucasian	78.7	94.4	NS	100	***	88.9	NS	78.7	NS	57.1	NS	78.6	NS	41.1	***	75.0	NS
Hispanic/Latino	5.6	5.6	NS	0	***	5.6	NS	15.4	NS	0	***	0	***	11.8	NS	0	***
Native American	0	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS	0	NS
No response	3.7	0	***	0	***	0	***	7.7	NS	0	***	14.3	*	5.9	NS	0	***
Area of Residence (%)[z]																	
Metropolitan	13.9	11.1	NS	15.4	NS	22.2	NS	15.4	NS	28.6	NS	14.3	NS	5.9	NS	0	***
Suburban	63.9	44.4	NS	76.9	NS	55.6	NS	53.8	NS	71.4	NS	78.6	NS	58.8	NS	100	***
Rural	22.2	44.4	*	7.7	NS	22.2	NS	30.8	NS	0	***	7.1	NS	35.3	NS	100	***
State of Residence (%)[z]																	
Michigan	46.3	50.0	NS	69.2	NS	38.9	NS	46.2	NS	42.9	NS	64.3	NS	29.4	NS	25.0	NS
Texas	53.7	50.0	NS	30.8	NS	61.1	NS	53.8	NS	57.1	NS	35.7	NS	70.6	NS	75.0	NS
No. of participants	108	18		13		18		13		7		14		17		8	
Percentage of participants	100	17		12		17		12		6		13		16		7	

[z]Each segment mean is compared with the overall mean for plant purchasers using Pearson's X^2 test.

[y]Each segment mean is compared with the overall mean for plant purchasers using a t test.

[x]NS, *, **, ***: indicate nonsignificance or significance at $P \leq 0.05$, 0.01, 0.001 level, respectively, as determined by Student's t test or Pearson's X^2 test of each segment mean compared with the overall mean.

Table 2. Comparison of plant purchase proportions for eight market segments from 108 participants of an in-person survey[z].

	Total	Tree purchasers		Avid plant purchasers		Intermediate plant purchasers		Herb plant purchasers		Indoor plant purchasers		Flowering perennial purchasers		Culinary plant purchasers		Non-plant purchasers	
	x	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*
Plant type purchased (%)																	
Annual flowering plant	60	77	NS[y]	100	***	72	NS	92	*	43	NS	71	NS	0	***	0	***
Vegetable plants	62	94	***	100	***	44	NS	31	*	14	**	57	NS	94	**	0	***
Herbs	52	94	***	92	***	6	***	100	***	0	***	0	***	76	*	0	***
Flowering perennials	47	89	***	100	***	22	*	31	NS	0	***	100	***	0	***	0	***
Flowering shrubs	29	22	NS	54	*	39	NS	46	NS	0	***	43	NS	6	*	0	***
Non-flowering shrubs	10	17	NS	8	NS	28	**	0	***	0	***	14	NS	0	***	0	***
Fruit producing trees	18	33	NS	23	NS	6	NS	0	***	0	***	0	***	53	***	0	***
Evergreen trees or shrubs	9	22	*	15	NS	11	NS	0	***	0	***	14	NS	0	***	0	***
Shade trees	12	28	*	15	NS	6	NS	0	***	0	***	29	NS	6	NS	0	***
Indoor flowering potted plants	41	6	***	100	***	0	***	38	NS	100	***	86	***	35	NS	0	***
Did not purchase	7	0	***	0	***	0	***	0	***	0	***	0	***	0	***	100	***
No.	108	18		13		18		13		7		14		17		8	
Market size (%)	100	17		12		17		12		6		13		16		7	

[z]Each segment mean is compared with the overall mean for plant purchasers using Pearson's X^2 test.

[y]NS, *, **, ***: indicate nonsignificance or significance at $P \leq 0.05$, 0.01, 0.001 level, respectively, as determined by Pearson's X^2 test of each segment mean compared with the overall mean.

range of income level provided on the survey (arranged in $20,000 increments) was representative of at least 1.9% of all participants. Ranges including $140,000 to $159,999, $160,000 to $179,999 and $200,000 or more each represented the household income of 1.9% of participants while $120,000 to $139,999 represented 2.8% and $180,000 to $199,999 represented 3.7%. All other household income ranges were representative of at least 9% of participants responding, including those who preferred not to provide household income information. Over three-quarters of participants were Caucasian (78.7%), 7.4% were African American, 6.5% were Asian, 5.6% were Hispanic/Latino and 3.7% of participants preferred not to respond. No participant held less than a high school degree while nearly 40% of participants had earned 4-year college degrees. Master's degrees were held by just over 20% of participants, 16.7% had attended some college, 11.1% had a professional degree and those who had a 2-year college degree or a high school degree each accounted for 6.5% of participants. Education reported by participants in the current study was generally greater than that reported by participants in other green industry survey studies (Behe et al. 2010, Yue and Behe 2008). This discrepancy could be due in part to a smaller sample size and the university-dominated communities of both of the current survey locations. Almost two-thirds of participants lived in an area considered suburban (63.9%), with 22.2% from rural areas and 13.9% from metropolitan regions.

A majority of participants had purchased annual flowering plants (60%), vegetable plants (62%) and herbs (52%) in the previous six-month period (Table 2). Almost half of the participants had purchased flowering perennials (47%) and 41% had purchased indoor flowering plants. Woody plants including fruit-producing trees, shade trees, non-flowering shrubs and evergreen trees and shrubs were each purchased by less than 20% of participants. Flowering shrubs were the exception with 29% of participants having purchased them in the selected time frame. Only 7% of participants had not purchased any plants in the previous six-month period. These 'non-purchasers' were still included in the analysis of the current research, as Behe et al. (2013) had argued that this segment of the general public would become increasingly important as horticultural markets continue to mature, in light of sales growth declines (Hall and Dickson 2011). Therefore participants were not accepted nor disqualified based on any demographic, socioeconomic or purchasing behavior characteristic.

The most common result of the cluster analyses performed resulted in the stopping procedures proposing two clusters. Kotler and Armstrong (2001), however, recommend selecting market segments that are differentiable and actionable. The next most appropriate segment number was eight in a majority of the linkages utilized. When the model was fit with eight clusters, it formed segments that were similar to those found in Behe et al. (2013). The first segment formed was the 'culinary plant purchasers' that was characterized by the large proportion of members (n = 17) that had purchased plants from the vegetable, herb, and fruit-producing tree categories, along with no member purchases of annual flowering plants, flowering perennials, non-flowering shrubs, or evergreen trees and shrubs (Table 2). The second cluster that emerged was the 'non-purchasers', characterized by a complete absence of plant purchases over the previous six-month period. The next cluster identified was the 'intermediate plant purchasers'. This group purchased plants from almost all categories listed, however, only small proportions of them did so. The only category that greater than 50% of the segment purchased from was annual flowering plants (72%), a number that was not significantly different than the mean for all participants (Table 2). The fourth segment to emerge was 'herb plant purchasers'. Each member of this segment had purchased herb plants in the previous six-month period. They were also characterized by at least 30% purchasing proportions for all categories of annual and perennial plants and no purchases of non-flowering shrubs, fruit-producing trees, evergreen shrubs and trees or shade trees. The only woody category purchased by this segment

was flowering shrubs (46%). The emergence of 'tree purchasers' represented the fifth segment. These consumers were the only segment that exhibited significantly different purchasing proportions than the mean in the evergreen tree and shrub and shade tree categories and 33% of the members purchased fruit-producing trees ($P = 0.09$).

The sixth segment formed was 'avid plant purchasers', the only group that did not display significantly lower purchasing proportions than the mean for any plant category listed (Table 2). All of the members of this segment purchased annual flowering plants, vegetable plants, flowering perennials, and indoor flowering potted plants and 92% of them purchased herb plants. The next segment to emerge was the 'indoor plant purchasers'. Members from this group purchased only annual flowering plants, vegetable plants, and indoor flowering potted plants during the previous six-month period. Less than half of them purchased annual flowering plants, just 14% of them purchased vegetable plants while 100% of them purchased indoor flowering potted plants. The final segment formed was the 'flowering perennial purchasers'. All members of this segment purchased flowering perennial plants in the previous six-month period and were one of only three segments to display a proportion over 50% for that category. Otherwise, the segment displayed similar purchasing proportions to the 'intermediate plant purchasers' except that no members purchased herb plants or fruit-producing trees during the specified time.

Mean expenditures for garden supplies for the six-month period prior to the survey was $161.40 (Table 3). No mean expenditure amount for a segment was significantly different than the overall mean, except for those of 'avid plant purchasers' who spent approximately $100 more than average and 'indoor plant purchasers' who spent approximately $100 less than average. Interestingly, 'non-plant purchasers' spent a

Table 3. Comparison of consumer behavior, woody plant attitudes and water conservation attitudes for eight market segments from 108 participants of an in-person survey.

	Total	Tree purchasers		Avid plant purchasers		Intermediate plant purchasers		Herb plant purchasers		Indoor plant purchasers		Flowering perennial purchasers		Culinary plant purchasers		Non-plant purchasers	
	x	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*	*x*	*p value*
Variable																	
Expenditures on garden supplies ($)[z]	161.4	205.8	NS	261.2	*	123.2	NS	129.3	NS	67.6	**	195.2	NS	153.4	NS	78.1	NS
Proportion of plant purchases locally produced (n = 74)	43.8	57.1	NS	60.7	NS	44.2	NS	44.8	NS	18.0	**	51.6	NS	35.2	NS	5.2	***
Type of firm patronized (%)																	
Independent garden center[y]	45.4	77.8	**	38.5	NS	27.8	NS	69.2	NS	14.3	NS	64.3	NS	35.3	NS	0	***
Home improvement/hardware	70.4	77.8	NS	100	***	72.2	NS	69.2	NS	57.1	NS	71.4	NS	58.9	NS	37.5	*
Supermarket/grocery store	47.2	61.1	NS	69.2	NS	22.2	*	53.8	NS	85.7	*	57.1	NS	29.4	NS	12.5	*
Mass-merchandiser	17.6	33.3	NS	30.8	NS	16.7	NS	7.7	NS	100	***	28.6	NS	5.9	NS	0	***
Internet-based	17.6	27.8	NS	61.5	***	16.7	NS	7.7	NS	14.3	NS	14.3	NS	17.6	NS	12.5	NS
Print catalog	11.1	5.6	NS	46.2	***	0	***	0	***	14.3	NS	100	***	23.5	NS	0	***
None	7.4	0	***	0	***	5.6	NS	0	***	0	***	7.1	NS	11.8	NS	50.0	***
No response	1.9	0	***	0	***	0	***	0	***	0	***	0	***	5.9	NS	12.5	*
Type of firm patronized for most purchases (%)																	
Independent garden center	20.4	38.9	*	23.1	NS	11.1	NS	23.1	NS	0	***	35.7	NS	11.8	NS	0	***
Home improvement/hardware	41.7	44.4	NS	46.2	NS	38.9	NS	38.5	NS	57.1	NS	35.7	NS	41.2	NS	37.5	NS
Supermarket/grocery store	10.2	5.6	NS	0	***	11.1	NS	15.4	NS	42.9	***	7.1	NS	11.8	NS	0	***
Mass-merchandiser	2.8	0	***	0	***	11.1	*	0	***	0	***	7.1	NS	0	***	0	***
Internet-based	6.5	11.1	NS	15.4	NS	5.6	NS	7.7	NS	0	***	7.1	NS	0	***	0	***
Print catalog	1.9	0	***	7.7	NS	0	***	0	***	0	***	0	***	5.9	NS	0	***
None	8.3	0	***	0	***	5.6	NS	0	***	0	***	7.1	NS	17.6	NS	50.0	***
No response	8.3	0	***	7.7	NS	16.7	NS	15.4	NS	0	***	0	***	11.8	NS	12.5	NS
Woody plant knowledge/interest (1=strongly disagree; 5=strongly agree)																	
Knowledge[x]	2.6	2.6	NS	3.1	NS	2.3	NS	2.7	NS	2.8	NS	2.8	NS	2.9	NS	1.6	***
Interest	3.7	3.8	NS	4.1	*	3.5	NS	3.6	NS	4.1	NS	3.9	NS	3.4	NS	2.8	*
Usage	3.3	3.8	NS	3.8	NS	3.1	NS	3.2	NS	3.3	NS	3.6	NS	2.9	NS	2.1	*
Recall	3.0	2.9	NS	3.2	NS	2.8	NS	3.2	NS	3.1	NS	3.0	NS	3.3	NS	1.7	***
Personal importance	3.4	3.5	NS	3.6	NS	3.4	NS	3.0	NS	4.0	NS	3.6	NS	3.1	NS	2.8	NS
Water conservation knowledge/interest (1=strongly disagree; 5=strongly agree)																	
Knowledge	3.0	2.9	NS	3.3	NS	2.8	NS	3.0	NS	3.1	NS	2.8	NS	3.4	***	2.3	*
Interest	3.7	3.6	NS	3.8	NS	3.8	NS	4.0	NS	4.0	NS	3.6	NS	3.8	NS	3.5	NS
Usage	3.7	3.7	NS	3.8	NS	3.6	NS	3.7	NS	3.5	NS	3.4	NS	4.0	NS	3.3	NS
Personal importance	4.1	4.1	NS	4.0	NS	4.2	NS	4.1	NS	4.4	NS	4.1	NS	4.1	NS	3.8	NS
No.	108	18		13		18		13		7		14		17		8	
Market size (%)	100	17		12		17		12		6		13		16		7	

[z]Each segment mean is compared with the overall mean for plant purchasers using a t test.

[y]Each segment mean is compared with the overall mean for plant purchasers using Pearson's X^2 test.

[x]Conglomeration of survey questions about this topic.

mean of $78.10 but that number was not significantly different than the overall mean. It does indicate, however, that though they did not purchase plants, they did purchase other products produced by the green industry. Annual income was not a good predictor of garden expenditures. 'Avid plant purchasers' spent the most on garden supplies, however their mean annual income was not different than the overall mean (Table 1). The only segment to exhibit a mean household income that was significantly different than the overall mean was 'tree purchasers' who earned almost $30,000 more than average while their mean garden expenditures were approximately $44 more than the overall sample mean ($P = 0.20$), a difference that was not statistically significant (Table 3). As for the segment with the least garden supply expenditures, the mean household income of 'indoor plant purchasers' was not statistically different than the overall mean, but it was $25,100 less than the overall mean (Table 1). This income discrepancy could represent a difference of practical rather than statistical significance.

Other demographics differed minimally among segments from a statistical standpoint. No difference in age was detected among segments, with 'culinary plant purchasers' exhibiting a mean age of 38, 'tree purchasers' exhibiting a mean age of 46.2, and all other means for segments falling between these two (Table 1). The 'indoor plant purchasers' and 'non-plant purchasers' segments each had a mean of less than one additional adult per household, however only the 'non-plant purchasers' mean of 0.5 was significantly different than the overall mean. Similarly for minors per household, the lowest means were found for 'non-plant purchasers' (0.25) and 'indoor plant purchasers' (0.29) and again only 'non-plant purchasers' were significantly different from the overall mean. 'Intermediate plant purchasers' also had a mean (0.39) that was different than the overall mean. Education level was similar among all segments. No participants held less than a high school degree. The only non-zero proportion of significance was found in the 'culinary plant purchasers' segment where 41.2% of the members had received a Master's degree, a rate that was 20.8% higher than average. All segments contained at least 50% 4-year college graduates or more, while only 'culinary plant purchasers' consisted of at least 50% members with Master's degrees or more. Though there were segments where select education levels were not represented (particularly professional degree, 2-year college degree and high school/GED), overall education levels among the segments were similar. Caucasian was the only ethnicity represented in each of the eight segments. 'Avid plant purchasers' was the only segment comprised solely of members of one ethnicity (Caucasian) while 'tree purchasers' was similar with 94.4% Caucasian membership. 'Culinary plant purchasers' was the only segment made up of less than 50% Caucasian members and was one of two segments including 'intermediate plant purchasers' that was comprised of members from all four ethnicities represented in the study. Significantly high percentages of African American participants were found in the 'culinary plant purchasers' (29.4) and 'indoor plant purchasers' (28.6) segments. Asian members accounted for 25% of the 'non-plant purchasers' segment while no segment had proportions of Hispanic/Latino members that were different than the overall mean (5.6%). Participants that did not disclose their ethnic heritage were found in three segments and comprised a significantly high proportion (14.3%) in the 'flowering perennial purchasers'. All of the 'non-plant purchasers' segment reported to live in suburban areas while 44.4% of 'tree purchasers' were from a rural area (twice greater than the overall mean). Conversely, no rural residents were found in the 'indoor plant purchasers' segment. No segment displayed a significantly different proportion of participants from either state represented. Almost 70% of 'avid plant purchasers' and 65% of 'flowering perennial purchasers' lived in Michigan, while over 70% of 'culinary plant purchasers' and 'non-plant purchasers' lived in Texas.

Campbell et al. (2014) investigated the perceptions and misperceptions of U.S. and Canadian consumers regarding the terms 'local' and 'organic'. Though there are regulatory definitions in both countries and in many states regarding what is considered organic, researchers found that the definition of local varied from consumer to consumer with some basing the definition on geography while others considered distance. Participants in the current research were asked to estimate the percentage of their plant purchases that were locally produced. The mean for locally produced plant material across all segments was 43.8% (Table 3). Campbell et al. (2014) measured this variable with a 1 to 5 scale where 1 = never purchased and 5 = always purchased and the mean score was 3.24, finding that participants purchased locally produced plants between 'some' (3 = sometimes) and 'most' (4 = most times) of the time. This result is confirmed in the present study. Segments did respond differently to local production purchasing inquiries. 'Non-plant purchasers' purchased the lowest proportion of locally produced plants (5.2%) by more than 10% and 'indoor plant purchasers' also purchased less than average (18.0%). No segment purchased significantly more percentages of locally produced plants than others, however 'avid plant purchasers' purchased 60.7% ($P = 0.07$).

Participants were asked to identify the types of firms that they purchased their plants and garden supplies from over the previous six-month period (Table 3). Firm types listed included independent garden centers, home improvement or hardware stores, supermarkets or grocery stores, mass-merchandisers, internet-based firms, and print catalogs. Participants could also answer 'none patronized' or 'no response'. Overall, 70.4% of participants had purchased from a home improvement or hardware store, just over 45% had purchased from a supermarket/grocery store or an independent garden center and 17.6% had purchased from a mass-merchandiser or an internet-based firm. Approximately 11% purchased from a print catalog, while 7.4% did not purchase from any of these types of firms and 1.9% did not respond. Firm types patronized varied among the eight segments as significant non-zero results were found for all but the 'culinary plant purchasers' segment. All groups except for 'intermediate plant purchasers', 'herb plant purchasers' and 'non-plant purchasers' purchased plants and garden supplies from all of the firm types listed. All 'avid plant purchasers' made purchases from a home improvement or hardware store and were the only segment to do so at a higher rate than the overall mean. Approximately two-thirds of 'avid plant purchasers' made purchases from a supermarket or grocery store (69.2%) or an internet-based firm (61.5%), the highest percentage of internet-based consumption recorded. Interestingly, fewer 'avid plant purchasers' reported purchasing from an independent garden center (38.5%) than from a print catalog (46.2%), though no statistical comparison was conducted.

Over three-quarters of 'tree purchasers' made purchases from home improvement or hardware stores (77.8%) or from independent garden centers (77.8%); the latter was the only segment proportion that was greater than the overall mean (Table 3). This segment purchased at proportions of 61.1, 33.3 and 27.8% from supermarket/grocery stores, mass-merchandisers and internet-based firms, respectively, neither of which were significantly different than the overall mean. 'Intermediate plant purchasers' did not make any purchases from print catalog firms during the time period referenced and 25% fewer of them purchased from supermarket/grocery stores ($P = 0.03$) than the overall mean. 'Herb plant purchasers' displayed similar purchasing proportions to the overall means for all firm types listed except for print catalogs (0%). All 'indoor plant purchasers' purchased from a mass-merchandise company and 85.7% of them also purchased from a supermarket or grocery store. This segment also displayed a relatively low percentage of independent garden center purchasers (14.3, $P = 0.10$). All 'flowering perennial purchasers' had made purchases from a print catalog firm and a relatively large proportion had purchased from an independent garden center (64.3%, $P = 0.16$). 'Culinary plant purchasers' displayed means that were no different than the means for the overall sample, however they did display relatively high percentages of print catalog purchasers (23.5%, $P = 0.10$), and 11.8% reported no purchases from the types of firms listed. The 'non-plant purchasers' segment displayed significantly lower than average means for all firm types except for internet-based firms (12.5%, $P = 0.71$). Half of this segment had not purchased from any of the firms listed during the referenced period and 12.5% did not respond.

Participants were also asked to identify the type of firm from which most of their plants and garden supplies were purchased. Overall, most plants and supplies were purchased at home improvement or hardware stores (41.7%), followed by independent garden centers (20.4%) and supermarkets or grocery stores (10.2%) (Table 3). Only 6.5% of participants purchased most of their plants or supplies from internet-based firms while only 2.8% and 1.9% purchased most from mass-merchandisers and print catalogs, respectively. Equal proportions (8.3%) of participants did not make most purchases from any of the types of firms listed or did not respond. Within segments, 'tree purchasers' was the only group in which a significantly greater proportion purchased most of their plants and supplies from independent garden centers (38.9%, $P = 0.05$). No members of this segment purchased most of their plants or supplies from mass-merchandisers or print catalogs.

Means for the 'avid plant purchasers' segment were statistically similar to those for the overall sample, however the 15.4% ($P = 0.19$) and 7.7% ($P = 0.12$) that purchased most of their plants and supplies from internet-based firms and print catalogs, respectively, were each relatively high (Table 3). 'Intermediate plant purchasers' and 'herb plant purchasers' also displayed similar means to the overall sample mean.

Mass-merchandise companies provided most of the plants and supplies for 11.1% ($P = 0.03$) of 'intermediate plant purchasers', the highest mean exhibited, and 0% of 'herb plant purchasers' (Table 3). No participant from the 'intermediate plant purchasers' or 'herb plant purchasers' made most of their purchases through a print catalog. 'Indoor plant purchasers' only reported purchasing most of their plants and supplies from two firm types; 57.1% from home improvement or hardware stores and 42.9% ($P \leq 0.001$) from supermarkets or grocery stores, the highest mean recorded for that category. No members of the 'flowering perennial purchasers' purchased most of their plants and garden supplies from print catalogs. All other firm type categories for this segment were similar to the overall means, though the mean for independent garden centers was relatively high ($P = 0.15$). No members of the 'culinary plant purchasers' reported most of their purchases from mass-merchandisers or internet-based firms. Almost 20% of participants in this segment did not buy most of their plants or supplies from any of the listed types of firms and an additional 11.8% did not respond. Half of 'non-plant purchasers' responded that they did not make most of their horticultural purchases at any of the firm types listed, 12.5% did not respond, and the other 37.5% of them purchased most of their supplies from home improvement or hardware stores.

Overall sample agreement means for woody plant inquiries included a score of 2.6 for knowledge, 3.7 for interest, 3.3 for usage, 3.0 for recall and 3.4 for personal importance (Table 3). No segment displayed a significantly higher woody plant knowledge agreement score than the overall mean; however 'non-plant purchasers' did exhibit a significantly low score (1.6, $P \leq 0.001$). 'Intermediate plant purchasers' also displayed a relatively low score (2.3, $P = 0.09$), though not significantly different than the overall sample mean. 'Avid plant purchasers' displayed a woody plant knowledge agreement score of 3.1 ($P = 0.19$). Woody plant interest was greatest in 'avid plant purchasers' (4.1, $P = 0.04$). Again, 'non-plant purchasers' displayed a significantly lower score (2.8, $P = 0.02$) than the overall mean. 'Non-plant purchasers' reported the lowest woody plant usage score (2.1, $P = 0.02$), which coincides with their reporting of no plant purchases in the previous six-month period. A woody plant usage score of 3.8 was reported for the 'avid plant purchasers' ($P = 0.13$) and 'tree purchasers' ($P = 0.45$). 'Flowering perennial purchasers' reported a usage score of 3.6 that was also relatively high, though not significantly different than the overall mean. Woody plant recall agreement scores were relatively consistent across segments with the exception of 'non-plant purchasers' that reported a significantly lower score than the mean (1.7, $P \leq 0.001$). 'Culinary plant purchasers' reported a relatively high woody plant recall score (3.3, $P = 0.12$), though not significantly different than the overall mean. This result was interesting considering their relatively low woody plant purchasing habits over the time referenced. No segment reported a mean agreement score for the personal importance of woody plants that differed from the overall sample mean. 'Indoor plant purchasers' reported a relatively high score (4.0, $P = 0.12$), which was not expected in light of the fact that they purchased no woody plants in the previous six-month period, however it does agree with their relatively high woody plant interest score (4.1, $P = 0.19$). 'Avid plant purchasers' and 'flowering perennial purchasers' both reported a woody plant personal importance score of 3.6, though neither was significantly different than the overall mean. Interestingly, 'avid plant purchasers' did not consider woody plants significantly more important than the overall sample mean, though they did find them more interesting.

These results, though not all statistically significant, do point to patterns in the data, such as 'avid plant purchasers' reporting agreement scores among the highest observed

for all of the woody plant attitude and behavior inquiries. As expected, the 'non-plant purchasers' differed from the overall sample mean in every woody plant category except the personal importance of woody plants (Table 3). Perhaps this is due to a relatively small sample size or perhaps they were displaying an appreciation for a subject in which they were not personally interested. By reporting means among the highest observed, 'Indoor plant purchasers' displayed how interested they are in woody plants, though relatively few of them had purchased any in the referenced period. This highlights a market segment that could be persuaded to purchase more woody plants in the future.

Participants reported agreement scores of 4.1 for the personal importance of water conservation, 3.7 for water conservation interest and usage and 3.0 for how much they know about the subject of water conservation (Table 3). 'Culinary plant purchasers' reported the highest score for water conservation knowledge (3.4, $P \leq 0.001$). All other segments reported knowledge scores that were similar to the sample mean, except for the 'non-plant purchasers' that reported a score of 2.3 ($P = 0.05$). No other mean agreement score for any water conservation inquiry was significantly different than the overall sample mean. 'Herb plant purchasers' reported a relatively high interest in water conservation (4.0, $P = 0.24$), though all segment scores for this topic were within 0.5 points. 'Culinary plant purchasers' reported a relatively high water conservation usage score (4.0, $P = 0.14$); however, like the topic of interest, scores did not vary widely. As for personal importance of water conservation 'non-plant purchasers' reported a relatively low score (3.8, $P = 0.19$), while 'indoor plant purchasers' reported a relatively high mean score of 4.4 ($P = 0.23$), though no segment mean was significantly different than the sample mean.

Overall, of the four general inquiries about water conservation attitudes and behavior, segment mean agreement scores differed more than 0.6 points in only the topic of knowledge. The attitudes and behaviors of the participants related to water conservation were much more homogeneous than those related to woody plants. Perhaps the sensitive and seemingly imminent nature of water issues in certain areas of the U.S. has given rise to a heightened sense of awareness and interest where water conservation is concerned; however, it is also important to consider the effect of the relatively high education level of the participants in the current work in comparison to the education level observed in other studies of green industry consumers.

The results of the current research display general patterns in the attitudes and behaviors of plant-type market segments in select communities toward water conservation and woody plants. Even with a limited sample size, trends became apparent. 'Non-plant purchasers' reported less knowledge and interest in woody plants and less water conservation knowledge than the average plant consumers in this study. 'Indoor plant purchasers' reported relatively high woody plant interest; however, they spent significantly less on horticultural supplies than the average participant in the previous six-month period. Firm type preferences were also clearly seen among segments, yielding useful information for firms attempting to satisfy current clientele or attract new consumers. Some segments were clearly defined by how much they spent on plants and supplies and what percentage of locally-produced goods they purchased. Segments also differed somewhat demographically. All of this information can be used to implement new, more efficient and more focused horticultural marketing strategies.

As the green industry continues to mature, it is imperative for marketing efforts to become increasingly focused. One area in which this focus has been and should continue to be directed is sustainable production. Previous research, however, has shown that individual consumers place value on different aspects of sustainable production; therefore, further dissection of the facets of sustainability will be necessary. Recent water issues in regions of the country under persistent drought conditions have brought water conservation to the forefront of ecological discussions, and therefore the Green Industry should continue to focus on how consumers react to products grown or manufactured via water-saving practices and that conserve water after installation. The market segments discovered in this study expressed relatively homogenous attitudes toward various aspects of water conservation though it was clear that most participants considered the issue interesting and of personal importance. The attitudes and behaviors of green industry consumers toward water conservation practices should be investigated further in various locations.

Literature Cited

Behe, B.K., B.L. Campbell, C.R. Hall, H. Khachatryan, J.H. Dennis, and C. Yue. 2013. Consumer preferences for local and sustainable plant production characteristics. HortScience 48:200–208.

Behe, B.K., B.L. Campbell, J.H. Dennis, C.R. Hall, R.G. Lopez, and C. Yue. 2010. Gardening consumer segments vary in ecopractices. HortScience 45:1475–1479.

Behe, B.K., P.B. Redman, and J.M. Dole. 1997. Consumers prefer red poinsettia cultivars. HortTech. 7:438–441.

Berghage, R.D. and D.J. Wolnick. 2000. Consumer color preference in New Guinea impatiens. HortTech. 10:206–208.

Blend, J.R. and E.O. Van Ravenswaay. 1999. Measuring consumers' demand for ecolabeled apples. Amer. J. Agr. Econ. 81:1072–1077.

Campbell, B.L., H. Khachatryan, B.K. Behe, J.H. Dennis, and C.R. Hall. 2014. U.S. and Canadian consumer perception of local and organic terminology. Intl. Food Agribus. Mngmt. Rev. 17:21–40.

Campbell, B.L., R.G. Nelson, R.C. Ebel, W.A. Dozier, J.L. Adrian, and B.R. Hockema. 2004. Fruit quality characteristics of Satsuma mandarins that affect consumer preferences. HortScience 39:1664–1669.

Cobanoglu, C., B. Warde, and P. Moreo. 2001. A comparison of mail, fax, and web-based survey methods. Intl. J. Market Res. 43:441–452.

Cohen, J. 1992. A power primer. Psych. Bul. 112:155–159.

Dillman, D., J. Smyth, and L. Christian. 2009. Internet, Mail, and Mixed-mode Surveys: The Tailored Design Method. John Wiley & Sons, Inc., NJ. p. 400–412.

Green, S.B. 1991. How many subjects does it take to do a regression analysis? Multiv. Beh. Res. 26:499–510.

Hall, C.R. and M.W. Dickson. 2011. Economic, environmental, and health/well-being benefits associated with green industry products and services: A review. J. Env. Hort. 29:96–103.

Hall, C.R. 2010. Making cents of Green Industry economics. HortTech. 20:832–835.

Hall, C.R., B.L. Campbell, B.K. Behe, C. Yue, R.G. Lopez, and J.H. Dennis. 2010. The appeal of biodegradable packaging to floral consumers. HortScience 45:583–591.

Kotler, P. and G. Armstrong. 2001. Principles of Marketing. 9th Ed. Prentice Hall, Upper Saddle River, NJ. p. 226–229.

McCullough, D. 1998. Web-based market research: The dawning of a new age. Direct Marketing 61:36–38.

Nimon, W. and J. Beghin. 1999. Are eco-lables valuable? Evidence from the apparel industry. Amer. J. Agr. Econ. 81:801–811.

Thompson, G.D. and J. Kidwell. 1998. Explaining the choice of organic produce: Cosmetic defects, prices, and consumer preferences. Amer. J. Ag. Econ. 80:277–287.

USDA National Agricultural Statistics Service. 2014. Census of Agriculture 2012. http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_US/st99_1_002_002.pdf. Accessed November 2, 2014.

Veisten, K. 2007. Willingness to pay for eco-labelled wood furniture: Choice-based conjoint analysis versus open-ended contingent valuation. J. For. Econ. 13:29–48.

Wehry, R.H., K.M. Kelley, R.D. Berghage, and J.C. Sellmer. 2007. Capturing consumer preferences and interests in developing a state plant promotional program. HortScience 42:574–580.

Wessels, C.R., R.J. Johnson, and D. Holger. 1999. Assessing consumer preferences for ecolabeled seafood: The influence of species, certifier, and household attributes. Amer. J. Agr. Econ. 81:1084–1089.

Willer, H., M. Yuseffi-Menzler, and N. Sorensen. 2008. The world of organic agriculture: Statistics and emerging trends 2008. International Federation of Organic Agriculture Movements (IFOAM), Germany. 2 Nov. 2009. http://orgprints.org/13123/4/world-of-organic-agriculture-2008.pdf. Accessed November 2, 2014.

Yue, C., T. Hurley, and N.O. Anderson. 2012. Heterogeneous consumer preferences for native and invasive plants: Evidence from experimental auctions. HortScience 47:1091–1095.

Yue, C., J.H. Dennis, B.K. Behe, C.R. Hall, B.L. Campbell, and R.G. Lopez. 2011. Investigating consumer preference for organic, local or sustainable plants. HortScience 46:610–615.

Yue, C., C. Grebitus, M. Bruhn, and H.H. Jensen. 2010a. Marketing organic and conventional potatoes in Germany. J. Intl. Food Agribus. Mark. 22:164–178.

Yue, C., C.R. Hall, B.K. Behe, B.L. Campbell, J.H. Dennis, and R.G. Lopez. 2010b. Are consumer willing to pay more for biodegradable containers than for plastic ones? Evidence from hypothetical conjoint analysis and non-hypothetical experimental auctions. J. Agr. Appl. Econ. 42:757–772.

Yue, C., F. Alfnes, and H.H. Jensen. 2009. Discounting spotted apples: Investigating consumers' willingness to accept cosmetic damage in an organic product. J. Agr. Appl. Econ 14:29–46.

Yue, C. and B.K. Behe, 2008. Estimating U.S. consumers' choice of floral retail outlets. HortScience 43:764–769.