Willingness to Pay for Strawberries Grown on Biodegradable Mulches

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Abstract

This study evaluates consumer preferences for strawberries grown on biodegradable mulches (BDM), which is an innovative bio-technology intended to retain productive characteristics of conventional mulches and to reduce the environmental impacts of disposal. Using dichotomous-choice contingent valuation method, we assessed the Willingess-To-Pay (WTP) for strawberries grown on BDM of 1,510 consumers across different geographical areas in the United States. Different treatments on information contents were provided to consumers with information on BDM in the treatment group but not in the control group. By measuring shopping habits and perceptions on environmental friendliness, we determined that consumers are willing to pay an average of 9.4% more on strawberries grown on BDM than the ones grown on conventional, non-biodegradable mulches. In particular, consumers who are better informed and have a higher income are more likely to purchase strawberries grown on BDM.

Keywords: Biodegradable Plastic Mulches, Contingent Valuation, Strawberries, Willingness-To-Pay

JEL Classification Code: C25, C83, D12, Q51

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I. Introduction

Consumers' preferences for environmentally-friendly products support a sustainable food chain from the consumer to the producer. Shifts in environmental attitudes underlie the development of recycled products and the proliferation of environmentally-friendly producers (Mobley et al., 1995; Tsen et al., 2006). In particular, this reflects consumers' behavior in the purchase of green products at a premium (Laroche et al., 2001; Yue et al., 2010; Yue et al., 2015; Straughan & Roberts, 1999). To quantify consumers' valuation of an agricultural product grown on biodegradable mulches (BDM), we assess the willingness to pay for strawberries grown on biodegradable mulches. The advantages of BDM rest in the mitigation of plastic pollution, augmentation of food security, and sustainability of specialty crop production (Brodhagen et al., 2017; Corbin et al., 2013). To this end, our study informs industry stakeholders or policymakers on the important attributes that environmentally conscious consumers value.

Strawberries are a high-value crop of economic importance in the United States. The United States is one of the largest strawberry producers in the world, accounting for approximately 28 percent of total production (Wu et al., 2012). The annual U.S. strawberry production averaged 1.26 million tons from 2000 to 2015, and the production of strawberries in 2015 totaled 1.543 million tons, representing an increase of 2 percent from 2014 (USDA NASS, 2016). Total harvested acres moderately varied in the past 15 years, averaging 53,900 acres and yield of 23.17 tons per acre each year (USDA NASS, 2016). According to the noncitrus fruits and nuts summary report of the National Agricultural Statistics Service (NASS 2016), the monthly average retail price per pound of strawberries was $3.42/pound in 2015 compared to $2.57/pound from 2000 to 2015. California and Florida are the top two strawberry producing states, with California producing over 91 percent of strawberries in the U.S. Over the last decade, the U.S. strawberry industry has experienced an upward trend in per-person consumption, attributed to consumers' increased awareness of healthy diet expanded domestic supply driven by yield improvements, and year-round availability of imports (USDA ERS, 2014).

Typically, strawberry farmers use agricultural plastic mulches to reduce weed growth, alter soil temperature, and retain soil moisture. After the field season, these conventional plastic mulches are either abandoned in landfills or incinerated. The stockpiling or burning of those mulches is illegal, while recycling of used mulches is impractical due to contamination with residual pesticides, dirt and debris. Therefore, landfill is the most prevalent form of disposal for

the plastic mulches that constitute a sizeable amount of solid waste (Garthe and Kowal, 1993; Levitan, 2014; Moore & Wszelaki, 2016). Total consumption of plastics in the U.S. increased to a historic peak of $295.4 billion in 2015 (Barron, 2016). The agricultural films market is expected to surpass 9.2 million tons in production and exceed $15.13 billion by 2024 due to expanding production of high-quality crops (Global Market Insights Inc., 2016).

In this study, biodegradable plastic mulches are considered as an alternative to conventional petroleum-based mulches, thereby mitigating pollution from illegitimate burning or disposal. Biodegradable polymers are an enhanced material from sustainability and industrial ecology points of view due to the ease of disposal by the end of productive life , in addition to the lowering of cumulative energy use and greenhouse gas emissions (Dornburg et al., 2004). Many studies compare bio-based products and petroleum-based products, where the former is considered to be a sustainable substitute for the latter (Hayes et al., 2012). For instance, Khoo & Tan (2010) concluded that bio-bags are 80% more environmentally-friendly than plastic bags when clean and renewable energy is used throughout their life cycle production stages.

Using dichotomous-choice contingent valuation methodology, this study identifies the factors in the determination of WTP and quantification of the WTP premiums for the discernment of consumer preference on this new technology that reduces economic, environmental, and health impacts of conventional strawberries. Based on sample surveys of 1,510 randomly selected consumers, we found that consumers are willing to purchase strawberries grown on BDM with 8.3% - 10.3% premium compared to conventional strawberries. Higher income, lower shopping frequency, positive information, and environmental consciousness also make a positive contribution to consumers' WTP for strawberries grown on BDM.

The remainder of this research article is organized as follows. Section II presents the empirical methodology, and Section III summarizes the data and its collection process. Section IV analyzes the results, followed by section V which concludes with policy implications.

II. Methodology

The survey solicited information on the respondents' willingness to pay (WTP) for strawberries grown on BDM, shopping habits, environment-friendly attitudes, and demographic characteristics. Prior to fielding the survey, a pre-test sampling was completed and minor modifications were made. The survey, consisting of 21 questions, was then disseminated online

using Qualtrics^{TM} in August, 2016. Participants were randomly selected across the United States, with each participant receiving a cash incentive upon survey completion. On average, it took 10 to 15 minutes for a participant to complete the survey.

WTP analysis is commonly adopted in estimating the value consumers place on environmentally-friendly products, such as apple, coffee, etc. (e.g., Laroche et al., 2001; Loureiro et al., 2002; Royne et al., 2011; Sörqvist et al., 2013). Dichotomous-choice Contingent Valuation (CV) method is applied to estimate the WTP for strawberries grown on Biodegradable Mulches (BDM) that use environmentally-friendly production practices in the analysis of the factors that affect consumers' choices. Double-bounded logit model is widely used in estimating individual WTP based on the responses of market-type questions with dichotomous choices (Kanninen, 1993; Venkatachalam, 2004), and is asymptotically more efficient than the single-bounded model (Hanemann et al., 1991).

In addition, many studies emphasize that in their decision making, consumers are often willing to pay when provided with more information regarding production characteristics of a product or product attributes (Chen et al., 2013; Hellyer et al., 2012; Rousseau & Vranken, 2013; Vlaeminck et al., 2014). Consequently, respondents were randomly assigned to either one of the two groups; the treatment group was provided with information on the BDM, whereas the control group was not (please see the Appendix for the specific statement).

Responses to the dichotomous choice bid questions result in four possible outcomes in the double-bounded model: (1) the respondent is not willing to purchase a bio-based product at the initial price (B_0) and does not want to buy it even at the discount price (B_D) (i.e., "no" to both bids); (2) the respondent is not willing to purchase a bio-based product at the initial price (B_0) but is willing to buy it at the discounted price (B_D) (i.e. "no" followed by "yes"); (3) the respondent is willing to purchase a bio-based product at the initial price (B_0) but is not willing to buy it at the premium price (B_P) (i.e. "yes" followed by "no"); (4) the respondent is willing to purchase a bio-based product at the initial price (B_0) and also willing to purchase it at the premium price (B_P) (i.e. "yes" followed by "yes"). The individual's true WTP for a biobased product will fit into one of the following four intervals: $(-\infty, B_D)$, $[B_D, B_0)$, $[B_0, B_P)$, $[B_P, +\infty)$. For each respondent, three premium prices ($0.50/lb, $0.75/lb, $1.00/lb) or discounted prices ($0.50/lb, $0.75/lb, $1.00/lb) are randomly assigned. The survey solicited information regarding respondent's willingness to pay, shopping habits, environmentally-friendly attitudes, and demographic information. The discrete

outcomes of the bidding process are following:

$$D = \begin{cases} 1 & WTP < B_D \quad (No, No) \\ 2 & B_D \leq WTP < B_0 \quad (No, Yes) \\ 3 & B_0 \leq WTP < B_P \quad (Yes, No) \\ 4 & B_P \leq WTP, \quad (Yes, Yes) \end{cases}$$

Where WTP is the variable that denotes the individual's WTP for a biobased product. The WTP function for individual *i* is represented as:

$$Y_i = \alpha - \rho B_i + \delta H_i + \lambda' Z_i + \varepsilon_i \text{ for } i = 1, 2, \ldots\ldots, n$$

where Y_i is the individual's WTP for strawberries grown on BDM, B_i is the ultimate bid amount offered to each consumer i, H_i is the information treatment randomly provided to consumer, and Z_i is the observable characteristics of individual i. ε_i is a random variable for the unobservable characteristics, and α , ρ , δ and λ are the unknown parameters to be estimated.

III. Data

In total 1,510 questionnaires were randomly delivered across the United States. The sample included two information treatment groups with 749 respondents in the treatment group and 761 respondents in the control group. Table 1 shows the summary statistics for consumers' socio-demographic backgrounds in this study. There were 51% male and 48% female participants in the study sample, and most of the respondents (68%) did not have children under 18 living with them. The average age of individuals was around 40 years old, and the median age was approximately 35 years old compared to the US median age of 38 years old in 2015 (U.S. Census Bureau, 2016). In the sample 12% of the respondents had advanced or professional degrees or above, 39% were bachelors' degree holders, and 38% had some type of college or associate degree. The income ranged from less than $29,999 to greater than $200,000, but the majority of respondents (69%) earned less than $70,000 annually. Slightly more than half (51%) were single (never married), and 39% of respondents were married. Half of the respondents (50%) worked in the private sectors, and the majority of the sample population (77%) was identified as Whites/Caucasian (non-Hispanic). Samples were geographically dispersed in each state in approximately equal proportions. Most of the participants were from the southern region (36%) and the western region (22%) of the U.S.

Table 2 reports that the comparison of census population and sample demographic statistics. Our sample is similar to the population statistics (U.S. Census Bureau, 2016) in terms of median age, gender distribution, median household income, ethnic affiliations, and the percentage of geographic regions. However, the education level of the respondents was higher than the census data with 99.6% holding high school diploma and 50.6% with college degree or above. The marital status for single (never married) was higher than the national average with 50.9% being single, 39.1% married, and 9.3% separated/divorced/widowed. A possible reason is that participants who are technology-savvy have easy access to internet and are recruited online accordingly. In consideration of the above, our sample was broadly representative but slightly upscaled compared with the general population.

Descriptive statistics for bid variables are denoted in Table 3. The respondents usually paid an average price of $3.19 per pound of good quality fresh strawberries. Typically 27% of the respondents purchased strawberries more than once a month, and 75% often bought strawberries from retail store or supermarket. The primary grocery shopper made up a large proportion of the sample population (86%). 71% of the survey population were very likely or somewhat likely to purchase strawberries grown on BDM, and 68% had below average or no knowledge about BDM.

Respondents' factors determining strawberry purchases were measured by five-point Likert scale items (from 1 = “extremely important” to 5 = “not at all important”) in table 4. Table 4 shows that quality (61%) and freshness (64%) are extremely important factors when respondents purchase strawberries; origin of production (31%) and environmentally-friendly production practices (31%) are perceived to be moderately important by the respondents, and brand (56%) is not an important factor when respondents purchase strawberries.

Respondents’ perception of environmental friendliness was measured by five-point Likert scale items (from 1 = “strongly agree” to 5 = “strongly disagree”) in table 5. Table 5 demonstrates that most of respondents (47%) strongly agreed that they practice recycling, and 31% somewhat agreed that they recycle every product. Table 6 indicates all explanatory variables and abbreviations used with a short description in the model.

Table 7 illustrates distributions of the initial bid responses for each group, and table 8 indicates distributions of the second bid responses for each group. The frequency of “yes” response to the initial bid ($3.50/lb) was higher in the treatment (69%) than control group (63%), while the frequency of “no” response to the second bid increased with the premium prices. Participants from

the two groups (control and treatment) had no statistical difference at a 5% significance level.

IV. Results and Discussion

The results of the contingent analysis and parameter estimates are presented in Table 9 together with the estimated marginal effects of selected variables and 90% confidence intervals. The bid had a negative effect on WTP at a 1% significance level, implying that the probability of a consumer purchasing strawberries grown on BDM decreased as the bid amount increased. Information had a significantly positive effect on WTP at the 1 % level, and additional information influenced the decision process of consumers. The marginal effect shows that the provision of appropriate information will increase WTP by $0.08/lb for strawberries grown on BDM.

For demographic variables, higher income level and age had significantly positive effects on WTP at the 5% significance level. However, being male and having a child under 18 had significantly negative effects on WTP. The marginal effect shows that WTP will increase by $0.08/lb due to a higher income or being in the 18-35 age range. The WTP decreases by $0.11/lb for males or consumers with minors under 18. Loureiro et al. (2001) revealed that female respondents have a higher chance of purchasing eco-labeled apples, which, with the presence of children, are less likely to do so. In addition, Gracia et al. (2012) and Laroche et al. (2001) suggested that females are more willing to pay a price premium for sustainable or green products.

Another important set of variables is the respondents' perceptions of purchasing strawberries. Respondents that self report to being price sensitive have a negative effect on WTP at the 1% significance level. Thus, the more sensitive is the consumers to price, the less likely is he/she purchasing strawberries grown on BDM. On the other hand, environmentally-friendly production practices have a positive effect on WTP at the 1% significance level. The marginal effect shows thatWTP will decrease by $0.35/lb as price as an important factor when consumers shop for strawberries. However, WTP will increase by $0.20/lb for environmentally-friendly production practice as an important attribute to strawberries, being consistent with the finding that consumers are willing to pay $0.08 more for the "sustainable" labeled product (Yue et al., 2016). On top of that, consumers who are knowledgeable about BDM have a significantly positive effect on WTP at the 1% significance level and WTP will increase by $0.12/lb accordingly.

Environmentally-conscious consumers recycle, purchase green products, verify that a package is made of recycled materials, etc. In this study, environmentally-conscious consumers have a

significantly positive effect on WTP from purchasing environmentally-friendly products despite their relative high cost. The marginal effect shows that this type of consumers will increase the WTP by \$0.33/lb. Similarly, Loureiro et al. (2001) found that environmentally-friendly attitude significantly increased the likelihood of buying eco-labeled apples.

Following Hanemann (1989), the estimated mean WTP was calculated as $WTP = \frac{1}{\hat{\rho}}(\hat{\alpha} + \hat{Z}'\overline{X})$.

The estimated mean WTP is \$3.79 per pound for the control group and \$3.86 per pound for the treatment group as shown in table 10. WTP estimates for the two groups are individually statistically significant from zero at the 1% level but not significantly different from one another at the 5% significance level. Relatively speaking, consumers are willing to pay a 8.3% premium without any information, and 10.3% premium if information is released. The average WTP for the aggregate group is \$3.83 for a 1 lb box of strawberries with a 95% confidence interval of \$3.79 to \$3.86. They are willing to pay a 9.4% premium on the average market price of strawberries in the U.S. as in 2015 for strawberries grown on BDM. Strawberry producers could promote their product by providing information or marketing strategy to the consumers. The WTP estimates are statistically different from the average market price at the 1% significance level across groups. This result is consistent with the findings by Blend & van Ravenswaay (1999), Ethier et al. (2000), Nimon & Begihn (1999) and Yue et al. (2015). For instance, Belcher et al. (2007) revealed a 10%-20% premium for environmentally-produced beef products, while a 5% premium is identified for eco-labeled products (Loureiro et al., 2002).

Figure 1 presents the probability of a "yes" response to strawberries grown on BDM given different bid levels. The probability of a "yes" response to the initial bid is 66.2%. The maximized probability for purchase is 98.4% for a \$1.00/lb discount and the lowest level of probability is 12.8% for a \$1.00/lb premium.

V. Conclusion

The purpose of this study was to investigate the relationship between market information, consumer characteristics and willingness to pay for strawberries grown on BDMs by introducing a dichotomous-choice CV methodology. We empirically investigated the factors in the determination of WTP, and whether consumers will pay premiums for strawberries grown on BDMs or not, and estimated these premiums.

In this study, our results show that consumers are willing to pay a premium of 8.3%-10.3% for strawberries grown on biodegradable mulches over the market price ($3.50/lb). Respondents with a higher income, stronger environmental attitudes, and knowledgeable about BDMs are more likely to pay a premium of $0.08/lb, $0.33/lb, and $0.12/lb, respectively. In addition, dissemination of positive information to the potential markets will increase WTP by $0.08/lb.

This research provides important information for policymakers and industry stakeholders to understand how green technologies affect consumer WTP for strawberries (and hence, revenues). It is of particular importance to understand how food products grown in a more environmentally-sustainable manner affect consumers' willingness to pay, and how green technologies may affect the prices of strawberries upon their introduction to the market.

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Appendix

The following is the information presented to the treatment group

"Biodegradable mulches are an alternative to conventional plastic mulches and are intended to be tilled into the soil at the end of the season thereby reducing labor and disposal costs. With biodegradable mulches, which are designed to decompose in the field, farmers can avoid open field burning and landfilling of the conventional mulches. In addition, the use of biodegradable mulches may increase sustainability of specialty crop production."

Table 1: Summary statistics for demographic variables (n=1,510)

Variable	Description	Frequency
Gender	Male	51.29%
	Female	48.38%
Age	18 to 25	14.98%
	26 to 35	44.60%
	36 to 45	21.21%
	46 to 55	10.74%
	56 to 65	6.83%
	66 or above	1.33%
Education	Some high school or lower	0.40%
	High school graduate	10.68%
	Some college/technical/vocational training	26.48%
	Associate degree	11.81%
	Bachelor degree	38.62%
	Advanced or profession degree	10.48%
	Ph.D. degree	1.46%
Children	None	68.08%
	One or more	31.92%
Income	Lower than $29,999	23.99%
	$30,000 - $49,999	25.38%
	$50,000 - $69,999	19.42%
	$70,000 - $89,999	11.66%
	$90,000 - $99,999	6.56%
	$100,000 - $149,999	8.61%
	$150,000 - $199,999	1.79%
	Greater than $200,000	0.93%
Marriage	Single (never married)	50.94%
	Married	39.08%
	Separated/divorced/widowed	9.25%
Occupation	Government employee	5.37%
	Private sector employee	49.57%
	Academic institution	4.84%
	Student	5.30%
	Retired	2.72%
	Unemployed	10.14%
	Self-employed	17.56%
	Others	4.51%
Race	White/Caucasian	77.14%
	Hispanic/Latino/Spanish	5.50%
	American Indian	0.73%
	Asian	8.28%
	African American	7.16%
	Others	1.20%
Region	Northeast	19.54%
	Midwest	21.45%
	South	35.84%
	West	21.58%

Table 2: Comparison of census and sample statistics (2015)

	Census statistics	Sample statistics
Population	322,060,152	1,510
Median age (years)	38	35
Variables		
Male	49.2%	51.3%
Female	50.8%	48.4%
Children under age 18 in household	40.0%	31.9%
Education		
High school diploma	87.0%	99.6%
Bachelors' degree	30.0%	50.6%
Marital status		
Single (never married)	32.0%	50.9%
Married	49.0%	39.1%
Separated/divorced/widowed	16.0%	9.3%
Median household income	$53,889	$53,758
Race		
White/Caucasian	77.1%	77.1%
Hispanic/Latino/Spanish	17.6%	5.5%
American Indian	1.2%	0.7%
African-American	13.3%	7.2%
Asian	5.6%	8.3%
Others	2.0%	1.2%
Region		
Northeast	17.5%	19.5%
Midwest	21.1%	21.5%
South	37.7%	35.8%
West	23.6%	21.6%

Source: U.S. Census Bureau (2016)

Table 3: Summary statistics of bid responses (n=1,510)

Variable	Description	Frequency
The price paying for 1 pound box of strawberries	Less than or about $2.00	6.29%
	$2.00 - $2.49	20.13%
	$2.50 - $2.99	32.45%
	$3.00 - $3.49	21.92%
	$3.50 - $3.99	10.99%
	$4.00 - $4.49	4.57%
	Above $4.50	3.64%
Mean per pound for strawberries purchased	$3.19	
The frequency of buying strawberries	More than once a week	1.46%
	Once a week	19.56%
	More than once a month	27.32%
	Once a month	22.02%
	Every few months	22.55%
	Very few times	7.10%
The place of most often buying strawberries	Retail store/supermarket	74.83%
	Wholesale store	6.57%
	Convenience store	0.13%
	Organic store	6.77%
	Farmer's market	9.76%
	Others	1.93%
Primary grocery shopper	Yes	85.95%
	No	14.05%
How likely to purchase strawberries grown on BDM	Very likely	25.18%
	Somewhat likely	45.86%
	Neither likely nor unlikely	21.47%
	Somewhat unlikely	4.04%
	Very unlikely	2.19%
	Not sure	1.26%
Knowledge about BDM	Above average	1.79%
	Average	30.13%
	Below average	39.55%
	Nothing	28.53%

Table 4: Important criteria when purchasing strawberries (n=1,510)

Variable	Description	Frequency
Price	Extremely important	23.82%
	Very important	39.95%
	Moderately important	25.95%
	Slightly important	9.16%
	Not at all important	1.06%
Origin of production	Extremely important	6.97%
	Very important	17.66%
	Moderately important	31.41%
	Slightly important	24.04%
	Not at all important	19.32%
Brand	Extremely important	1.13%
	Very important	3.92%
	Moderately important	13.88%
	Slightly important	24.10%
	Not at all important	55.98%
Produced without chemical	Extremely important	15.44%
	Very important	23.00%
	Moderately important	26.77%
	Slightly important	21.14%
	Not at all important	12.19%
Environmentally friendly production practice	Extremely important	9.95%
	Very important	20.16%
	Moderately important	30.57%
	Slightly important	23.28%
	Not at all important	14.72%
Appearance	Extremely important	52.91%
	Very important	30.79%
	Moderately important	10.53%
	Slightly important	3.64%
	Not at all important	1.79%
Quality	Extremely important	60.88%
	Very important	32.36%
	Moderately important	4.31%
	Slightly important	0.86%
	Not at all important	1.13%
Freshness	Extremely important	64.46%
	Very important	29.44%
	Moderately important	3.91%
	Slightly important	0.86%
	Not at all important	0.73%
Nutrition/Health	Extremely important	30.97%
	Very important	34.55%
	Moderately important	22.41%
	Slightly important	7.89%
	Not at all important	3.71%

Table 5: Consumers' Attitudes for Environment (n=1,510)

Variable	Description	Frequency
I only buy products in packages that can be recycled	Strongly agree	3.31%
	Somewhat agree	18.48%
	Neither agree nor disagree	22.32%
	Somewhat disagree	34.64%
	Strongly disagree	21.26%
I have convinced my family or friends not to buy some products that are harmful to the environment	Strongly agree	5.58%
	Somewhat agree	23.37%
	Neither agree nor disagree	17.40%
	Somewhat disagree	28.15%
	Strongly disagree	25.50%
Recycling behavior	Strongly agree	9.22%
	Somewhat agree	30.84%
	Neither agree nor disagree	14.19%
	Somewhat disagree	27.25%
	Strongly disagree	18.50%
I buy 'environmentally friendly' products, even if they are more expensive	Strongly agree	5.97%
	Somewhat agree	28.40%
	Neither agree nor disagree	24.02%
	Somewhat disagree	25.48%
	Strongly disagree	16.12%
Opportunity to recycle products	Strongly agree	47.09%
	Somewhat agree	29.80%
	Neither agree nor disagree	7.35%
	Somewhat disagree	8.34%
	Strongly disagree	7.42%

Table 6: Descriptions of selected explanatory variables

Variable	Description
Bid	Random bid offered to each participant
Treatment	1 = Information about BDM is provided, 0 = no information
Knowledge	1 = Knowledgeable about BDM, 0 = otherwise
Demographics	
Gender	1 = Male, 0 = otherwise
Age	1 = Younth (age between 18 and 35), 0 = otherwise
Education	1 = Bachelor's degree or higher, 0 = otherwise
Child	1 = Present of child under18 in the household, 0 = otherwise
Income	1 = Last year income more than $50,000, 0 = otherwise
Marriage	1 = Single (never married), 0 = otherwise
Employment	1 = Full-time employed, 0 = otherwise
White	1 = White/Caucasian, 0 = otherwise
Region	
Northeast	1 = Survey conducted in Northeast, 0 = otherwise
Midwest	1 = Survey conducted in Midwest, 0 = otherwise
South	1 = Survey conducted in South, 0 = otherwise
West	1 = Survey conducted in West, 0 = otherwise
Shopping habit	
Frequency	1 = More than once a month or higher, 0 = otherwise
Location	1 = Most often buying strawberries at retail store or supermarket, 0 = otherwise
Shopper	1 = Primary grocery shopper, 0 = otherwise
Important criteria	
Price importance	1 = Extremely or very important, 0 = Otherwise
Origin importance	1 = Extremely or very important, 0 = Otherwise
Brand importance	1 = Extremely or very important, 0 = Otherwise
Chemical importance	1 = Extremely or very important, 0 = Otherwise
Eco-production importance	1 = Extremely or very important, 0 = Otherwise
Appearance importance	1 = Extremely or very important, 0 = Otherwise
Quality importance	1 = Extremely or very important, 0 = Otherwise
Freshness importance	1 = Extremely or very important, 0 = Otherwise
Nutrition importance	1 = Extremely or very important, 0 = Otherwise
Consumers' awareness	
Environmentalism	1 = Strongly or somewhat agree, 0 = Otherwise

Table 7: Distributions of the initial bid ($3.5/lb) responses for each group

Response	All Group	Control Group	Treatment Group
No	33.84%	36.66%	30.97%
Yes	66.16%	63.34%	69.03%

Table 8: Distributions of the second bid responses for each group

Response		All Group	Control Group	Treatment Group
No	$2.50	14.51%	12.62%	16.67%
	$2.75	21.13%	13.16%	30.30%
	$3.00	44.89%	47.00%	42.11%
	$4.00	36.39%	42.18%	31.36%
	$4.25	59.67%	64.86%	54.40%
	$4.50	63.61%	69.33%	58.43%
Yes	$2.50	85.49%	87.38%	83.33%
	$2.75	78.87%	86.84%	69.70%
	$3.00	55.11%	53.00%	57.89%
	$4.00	63.61%	57.82%	68.64%
	$4.25	40.33%	35.14%	45.60%
	$4.50	36.39%	30.67%	41.57%

Table 9: Coefficient estimates and marginal effects of selected explanatory variables

Variable	Coefficient	Std. Error	Z-Stats.	Marginal Effect	Std. Error	Z-Stats.	90% Confidence interval Lower bound	90% Confidence interval Upper bound
Constant	10.985***	0.654	16.793					
Bid	-3.004***	0.092	-32.710					
Gender	-0.318**	0.129	-2.467	-0.106**	0.043	-2.471	-0.176	-0.036
Age	0.234**	0.112	2.085	0.078**	0.037	2.087	0.017	0.139
Education	0.076	0.106	0.716	0.025	0.035	0.716	-0.033	0.083
Child	-0.333**	0.155	-2.143	-0.111**	0.052	-2.146	-0.196	-0.026
Income	0.224**	0.110	2.047	0.075**	0.036	2.049	0.015	0.134
Marriage	-0.017	0.128	-0.133	-0.006	0.042	-0.133	-0.075	0.064
Employment	0.065	0.111	0.589	0.022	0.037	0.589	-0.039	0.082
White	-0.206	0.128	-1.607	-0.069	0.043	-1.609	-0.138	0.001
Information	0.241**	0.102	2.356	0.080**	0.034	2.358	0.024	0.136
Frequency	-0.149	0.108	-1.383	-0.050	0.036	-1.384	-0.108	0.009
Location	-0.043	0.123	-0.348	-0.014	0.041	-0.348	-0.081	0.053
Shopper	0.026	0.154	0.169	0.009	0.051	0.169	-0.075	0.093
Price importance	-1.047***	0.115	-9.113	-0.348***	0.038	-9.273	-0.410	-0.287
Origin importance	-0.101	0.145	-0.694	-0.034	0.048	-0.694	-0.113	0.046
Brand importance	0.114	0.256	0.444	0.038	0.085	0.444	-0.102	0.178
Chemical importance	0.235	0.143	1.642	0.078*	0.048	1.643	0.000	0.156
Eco-production importance	0.600***	0.157	3.895	0.200***	0.051	3.908	0.116	0.284
Appearance importance	-0.025	0.157	-0.157	-0.008	0.052	-0.157	-0.094	0.077
Quality importance	0.190	0.292	0.651	0.063	0.097	0.651	-0.096	0.223
Freshness importance	0.149	0.294	0.508	0.050	0.098	0.508	-0.111	0.210
Nutrition importance	0.221*	0.116	1.900	0.073*	0.039	1.901	0.010	0.137
Environmentalism	0.984***	0.124	7.911	0.328***	0.041	8.039	0.261	0.394
Knowledge	0.345***	0.115	3.013	0.115***	0.038	3.018	0.052	0.177
Northeast	0.194	0.493	0.418	0.064	0.154	0.418	-0.188	0.317
Midwest	-0.177	0.462	-0.384	-0.059	0.154	-0.384	-0.311	0.193
South	0.058	0.456	0.127	0.019	0.152	0.127	-0.230	0.268
West	-0.057	0.461	-0.123	-0.019	0.153	-0.123	-0.270	0.233
Gender*Child	0.531**	0.221	2.401	0.177**	0.073	2.405	0.056	0.297

Note: * p-value < 0.1 ** p-value < 0.05 *** p-value < 0.01

Table 10: WTP estimates for strawberry grown on BDMs ($/pound)

Segmented Market	WTP	Z values	95% Confidence Interval
All group (n=1,510)	$3.83	204.16^{+++}	($3.79, $3.86)
Information*			
Control (n=761)	$3.79	152.73^{+++}	($3.74, $3.84)
Treatment (n=749)	$3.86	133.35^{+++}	($3.80, $3.91)

Note: * p-value < 0.10, ** p-value < 0.05, *** p-value < 0.01 denote the ANOVA p-values.
+++ means that the coefficient is statistically significant at $\alpha = 0.01$.

Figure 1: Probability of WTP as bid varies