The impact of nontraditional irrigation water on consumers' perception of food and non-food items: A field experiment in the United States

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ABSTRACT

The agricultural and fashion industries are both heavy users of water, which can result in detrimental consequences for areas that experience high rates of drought. One potential solution to meet the increasing needs for irrigation water is the use of recycled water for the irrigation of edible and inedible crops. The main obstacle in the further adoption of this practice by agriculture depends on consumer's acceptance of this concept, as they generally demand a reduction in price to purchase products made with recycled water. This study, involving 201 participants, employs an in-person framed field experiment to compare the effect of recycled water on participants' monetary bids for food and nonfood items produced with recycled and conventional irrigation water. Results suggest that consumers respond least favorably in fresh produce irrigated with recycled water compared to the nonfood products irrigated with recycled water, too. Hence, this finding indicates that inedible crops irrigated with recycled water are not stigmatized as usually happens with edible crops since, for most consumers, the origin of the recycled water on them is too apparent. Additionally, the majority of the demographic characteristics did not affect consumers' likelihood of purchasing food and nonfood products irrigated with recycled water. Based on these results, it appears that recycled water is more appealing in the irrigation of inedible crops. These findings are useful for policymakers to gradually convey to the public the benefits of recycled water in the agricultural industry.

Keywords

Recycled water; Irrigation water; Consumer preferences; Food products; Non-Food products

1. Introduction

The global growth in food demand causes increased pressure on the land and water resources of our planet. Postel (2000) mentions that many environmentalists categorize the water scarcity problem as the most severe threat to human health and natural ecosystems. The water scarcity problem is predominantly a food problem (Brown, 1995). Water is significant in rainfed agriculture, crucially significant in semiarid dryland agriculture, and extremely significant in irrigated agriculture (Howell, 2001). Irrigation was one of the largest consumers of water in 2015 and withdrawals for irrigation and irrigated acres increased by 2 percent between 2010 and 2015 (Dieter, 2018). Besides the food crops, there are also nonfood crops that require large amounts of water during their production stages.

Cotton as a material presents many benefits (natural, renewable, and recyclable) but its production and processing have been criticized for the excessive use of water. In their study about the water footprint of cotton production, Chapagain et al. (2006) mention that cotton is responsible for approximately 2.6 percent of the global water use. For the most part, cotton is grown and harvested intensively in the Southern states in the USA, a broad region known as the “Cotton Belt”. Irrigated crops are dominant in many states but droughts like the one in California that lasted from 2013 to 2016 led to groundwater overdraft and decline of the aquifer levels, primarily for irrigation purposes (GAO Report, 2019). The correlation between irrigation for cotton and water stress is indisputable for several areas in the USA and especially for areas with cotton crops (Figure 1, Figure 2).

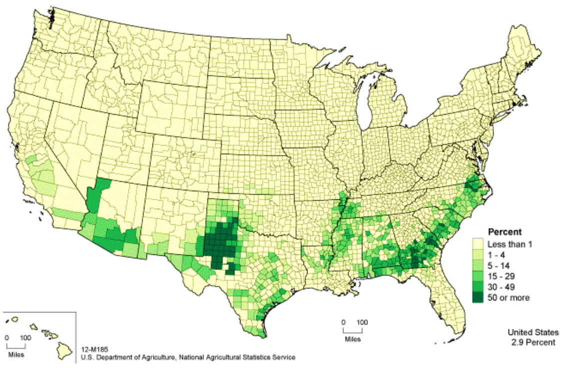

Fig. 1. Acres of upland cotton harvested as percent of harvested cropland acreage, 2012. (Source: USDA, 2018)

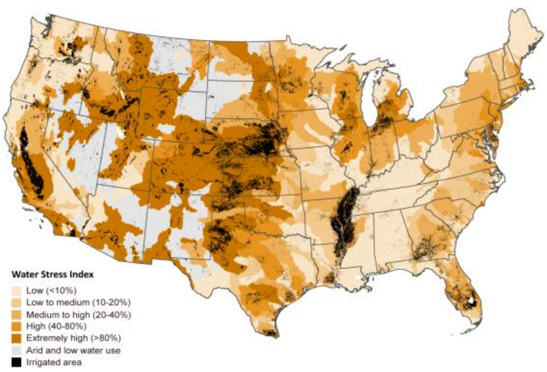

Fig. 2. Irrigated areas (2012) and water stressed areas (2015) across the contiguous United States. (Source: GAO, 2019)

Water stress and unavailability in several cultivated areas are expected to modify our ability to produce food and fiber on our working lands. Hence, the current situation along with the prolonged periods of drought in the southeastern United States (1998-2002, 2007 & 2011) creates a challenging environment for policymakers who attempt to find alternative and efficient ways to address increased water demand. Agriculture and fashion industry are both characterized as “thirsty businesses”. Due to the rapidly growing population, irrigation is a vital factor during the production stages in meeting the food and fiber needs (Howell, 2001). A potential decrease in water supplies could lead to slower growth that restricts economic prospects.

"*The fashion industry is the second-biggest consumer of water, generating around 20 percent of the world's wastewater and releasing half a million tons of synthetic microfibers into the ocean annually*" (UN, 2020)[1]. Fashion today is obsessed with aesthetic appearance and rarely do consumers consider "what is inside". The fashion industry like the agriculture sector consumes extremely high volumes of water. The intensive water use takes place not only in cotton cultivation but also during the textile processing stages. This is really challenging as it is expected that water use will increase by 50% by 2030, something that will be stressful for cotton-producing countries such as India and China, and states in the U.S. that are in regions that suffer from high or medium to high levels of water stress (Pulse of Fashion Industry, 2017).

Does the environment have enough water to maintain ecosystems, agriculture, and local economies that depend on it? Solutions that recommend the expansion of the irrigation mechanisms in dry areas, will probably cause further stress to the already depleted water bodies and aquifers. There is a strong push within the agriculture and fashion industry that promotes the production of food and fiber with less water or with alternative sources of water such as recycled water. A potential solution to face the problem of water scarcity is the adoption of recycled water that is highly treated wastewater from a big variety of sources such as domestic sewage, industrial wastewater, and stormwater runoff (California Department of Water Resources, 2018[2]). States like Arizona, California, Florida, and Texas are all together responsible to produce approximately 85% of the recycled water within the United States (EPA, 2012; McNabb, 2017). Although the use of recycled water in agriculture demonstrates positive effects on the environment as a sustainable, safe, and cost-effective solution (United States Environmental Protection Agency, 2017), acceptance is hindered by perceptions of risk. The "yuck" factor associated with recycled water is the main reason that leads to the decrease of consumers' WTP for products made of it (Po et al., 2005). Consumers' lack of acceptance of recycled water prevents farmers from adopting alternative irrigation water as their domain concerns are related to the way that U.S. consumers will perceive food produced with recycled water (Rozin et al., 2015; Haddad et al., 2009; Kecinski et al., 2017). *But how consumers will react to the use of recycled water in the irrigation of inedible crops, like cotton? Do nonfood items produced using recycled irrigation water evoke negative reactions?*

To the best of our knowledge, there is no other study that fully unpacks consumers' preferences towards nonfood products that were produced with recycled water. The aim of this study is to fill this gap. In total, 201 individuals participated in this study, from multiple locations in the state of Delaware that enabled the collection of data from a large cross-section of the population. We try to understand if, when faced with the "yuck" factor of closer-contact uses, participants consciously choose to not consume products made with recycled water. The term "closer-contact uses" refers to the high probability of ingestion or personal contact, such as drinking, or cooking and those

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[1] UN Alliance For Sustainable Fashion addresses damage of "fast fashion": (Source: https://www.unep.org/news-and-stories/press-release/un-alliance-sustainable-fashion-addresses-damage-fast-fashion)

[2] "California: Department of Water Resources" (Source: https://water.ca.gov/Programs/California-Water-Plan/Update-2018)

actions are perceived as less preferable than indirect uses (i.e., gardening). We also try to understand the opposite, if the "yuck" factor is ameliorated when participants are asked to purchase nonfood items that contain recycled water.

This study uses the Becker-DeGroot-Marschak (BDM) mechanism where respondents were given $15 and had the opportunity to bid, in a range between $0-$15, for 6 products (three food items and three nonfood items) totally. The products we used for the food items were strawberries irrigated with recycled water, strawberries irrigated with conventional water, and strawberries irrigated with unspecified type of water. The products we used for the nonfood items were T-shirts made of cotton irrigated with recycled water, T-shirts made of cotton irrigated with conventional water, and T-shirts made of cotton irrigated with unspecified type of water. Additionally, respondents completed a questionnaire on their water preferences for food and nonfood products. Last, participants provided demographic information as part of the questionnaire.

If individuals in an experiment are asked to indicate their WTP for recycled water strawberries versus their WTP for conventional strawberries, one expects the WTP for the conventional strawberries to be higher because of the feeling of disgust. Accordingly, participants will be indifferent or more reluctant in purchasing and wearing a recycled water all cotton T-shirt compared to a conventional one. Our results indicate that recycled water had an overall negative impact on the offered bids for the recycled water food products, a finding that is consistent with the literature, since aversion related to the consumption of recycled water strawberries is the most significant. In addition, we observe that there was no statistically significant difference in the offered bids between the recycled water T-shirts and the conventional water T-shirts, indicating that feelings of disgust are ameliorated when recycled water is used for the irrigation of nonfood crops. We also find evidence of a supplementary relationship where individuals place higher bids for the strawberries that were irrigated with an unspecified type of water compared to the recycled water irrigated ones. The same pattern is found in the case of T-shirts, where participants' willingness to pay is greatest when the T-shirts are made of cotton that was irrigated with an unspecified type of water, but the statistical relationship for this finding was not significant. In other words, consumers would prefer not to know the origin of the water that was used in the production methods of some products.

The remainder of this article is organized according to the following structure: Section 2 reviews the literature on recycled water including the factors of environmental consciousness, consumers' perceptions of water recycling, and consumers' perceptions of recycled textile products. Section 3 outlines the experimental design. Section 4 discusses the collected data and outlines the data analysis whereby we employ multiple paired t-tests and a random effects tobit model to analyze the impact of explanatory factors on preferences for food and nonfood products produced with recycled and conventional water. Finally, the remainder of the article discusses the results and conclusions of this analysis and indicates significant policy implications of this research.

2. Literature Review

The following section reviews existing literature on recycled water. The factors of environmental consciousness, consumers' perceptions of water recycling, and consumers' perceptions of recycled textile products are presented.

2.1. Factors of Environmental Consciousness

In earlier studies of consumers' ethical attitudes, it has been pointed out that subjects with greater environmental knowledge appear to be more environmentally active and more likely to engage in pro-environmental purchase behaviors (Schahn & Holzer, 1990; Zanoli & Naspetti, 2002; Meinhold & Malkus, 2005; Lin, 2009; van Birgelen et al., 2009; Laureati et al., 2013). This evidence highlights that knowledge and environmental awareness are necessary conditions for participation in proenvironmental purchases. Based on this, actions that promote the use of recycled water can be endeavored by increasing consumer awareness of the benefits that such methods yield. However, Kim and Damhorst (1998) found that general environmental consciousness did not predict proenvironmental attitude. In addition to this element, for the clothing sector, Momberg et al. (2012) indicate that environmental knowledge is not a necessary condition that necessarily leads to sustainable apparel decision making.

Other studies (Roberts, 1996; Thompson & Kidwell, 1998; Blake, 2001; Nordlund & Garvill, 2002; Brookshire & Norum, 2011) indicate the role that income plays in purchasing decisions related to eco-conscious products. Many environmentally friendly products are more expensive than conventional ones. For that reason, most consumers cannot afford environmentally friendly products. On the other hand, there are consumers who believe that the additional cost of organic cotton or organic food is counterbalanced by the environmental benefits that its production entails.

Furthermore, there is ample evidence that women are willing to pay more for organic products (Davis et al., 1995; Hutchins & Greenhalgh, 1997; Thompson & Kidwell, 1998; Meier-Ploeger & Woodward, 1999; Laroche et al., 2001; Hustvedt & Bernard, 2008; Brookshire & Norum, 2011) and families with children under the age of 18 pay a premium price for organic food (Thompson & Kidwell, 1998; Batte et al., 2007; Laroche et al., 2001; Hustvedt & Bernard, 2008). It is usual for big families to pursue more positive attitudes toward environmental practices compared to the small families (Brooker, 1976; Grunert, 1991). Also, it seems that younger consumers are more willing to act environmentally compared to the older ones (Brookshire & Norum, 2011).

2.2. Consumers Perceptions of Water Recycling – Psychological Approach

Research indicates that emotions play an important role in interpreting public acceptance of water recycling. It was found that psychological variables were significantly associated with willingness to use recycled water (Haddad et al., 2009). Daniel Kahneman[3], argues that individuals make judgements using two contrasting systems. One of these systems is slow and operates according to a formal risk calculus

[3] Daniel Kahneman, Biographical
(Source: https://www.nobelprize.org/prizes/economic-sciences/2002/kahneman/biographical/)

and the other is fast, based on positive or negative emotional responses. The way that emotion impacts any specific decision will be driven by the elicited emotions (Lerner & Keltner, 2000) that will be either ‘’immediate’’ or ‘’anticipated’’ (Mellers, 2001). Also, the terms “recycled water” and “treated wastewater” differ in the degree of acceptance by the public. This is obvious in the study of Menegaki et al. (2009) where the term “recycled water” was more acceptable than the term “treated wastewater”. In the food sector, Rozin and Fallon (1987) indicate that food rejection is a combination of the following four factors: i) the perceived danger due to the following ingestion, ii) aversion that is related to sensory factors, iii) unsuitability that refers to the inedibility of the food item, and (iv) disgust because of the origin of the contamination. Although there are several forces encouraging the use of recycled water in the production of food, the above forces counteract these ones.

The “yuck” factor has been cited in the literature as a barrier to water reuse since the beginning of public attitudes studies towards reuse back in the 1970s (Po et al., 2003). The feeling of disgust plays an essential role in individuals' hesitance against goods produced with recycled water (Rozin et al., 2015). It might be described as a reaction that is driven by the fear people feel concerning the impending potential outcomes on their health. Consequently, this kind of repugnance can impose serious constraints on efforts that expect to give a solution to some large-scale environmental problems (Roth, 2007). Some people have mentioned that they associated the disgust emotion with their own mental image of raw sewage and could not move beyond it. Past research on recycled potable water indicates that the closer the risk of personal contact or ingestion, the less acceptable it is (Lease et al., 2014). Bruvold (1988) mentions that water recycling for “very close contact” uses (i.e., drinking, showering) was acceptable at a lower degree compared to the “low contact” uses (i.e., toilet flushing). Accordingly, Po et al. (2005) support that the acceptance of reused water declined with the increase of personal contact that people had with a product. Also, Savchenko et al. (2018) found that consumers were less willing to pay for fruits irrigated with recycled water, while Dolnicar and Hurlimann (2010) found that 92% of Australian participants were more eager to use recycled water for garden watering and a significantly lower percentage of 36% for drinking. This behavior is partially explained by the fact that fruits are usually consumed raw, so there is higher physical proximity due to the following ingestion. Fielding et al. (2019) mentions that “*the acceptance of uses that are still somewhat distant, such as irrigating fruit and/or vegetable crops, range from as low as 44%* (Browning-Aiken et al., 2011) *to as high as 90%* (Roseth, 2008)”. There are more than 40 studies that have estimated levels of acceptance of recycled wastewater for a variety of purposes and some of them involve human contact (Fielding et al., 2018). Rozin et al. (2000) developed the concept of the three basic principles as requirements for the emotional response: ‘’*a sense of oral incorporation, a sense of offensiveness, and contamination potency*’’. In addition to Rozin's work, Miller (1998) highlighted that the mouth represents the core entrance to the body and that "*taste is the core sense, the mouth the core location, ingestion, and rejection via spitting or vomiting the core actions*".

In their study, Lease et al. (2014) found that consumers were willing to try foods containing recycled water. This acceptance could be interpreted as a pro-environmental behavior. Nevertheless, a big part of the studies that examine the public acceptance of recycled water end up with the same results denoting those individuals are willing to use recycled water only in cases that require low "bodily" contact but are hesitant toward the adoption of water recycling for uses that include a high personal contact. This suggests that efforts to shift attitudes about water recycling through the design of campaigns that aim to convey the right messages to the public have to reconsider the seriousness of disgust reactions.

2.3. Research on topics related to recycled water

The literature has investigated cases where participants are directly asked about their willingness to use recycled water or purchase goods produced with recycled water. Nonetheless, limited work has managed to point out successfully the kind of personal characteristics that relate to high or low levels of acceptance towards alternative water sources. The explanatory factors that were identified include trust in different sources of information (Whiting et al., 2019), and the public policymakers (Hurlimann & McKay, 2004; Po et al., 2005), risk perception and negative feelings (Po et al., 2005; Baggett et al., 2006; Hurlimann, 2008), previous experience or contact with water reuse (Dishman et al., 1989; Hurlimann, 2007). Interestingly, the study of Li et al. (2018) found that participants' willingness to pay was higher when the wine was made from grapes irrigated with an unspecified type of water revealing an unknown aspect of consumers' behavior related to recycled water. Last, demographic variables like age, gender, higher education level have been widely investigated, but the association is quite low, especially for the age.

2.4. Consumer perceptions of recycled textile products

Green consumers and consumption represent a certain lifestyle or desire to be a specific kind of person (Moisander & Pesonen, 2002). For instance, most consumers think of themselves as environmentalists, but according to Solomon and Rabolt (2004) there is a behavior gap in consumers' ethical interest and purchasing behavior in the clothing field. More specifically, in most cases when individuals buy clothes, they do not actually think about sustainability. Instead, attributes like price, color, style, and fit are the most important factors when they must choose among fashionable clothes. This is also obvious in the study of Brookshire and Norum (2011), where consumers that declared stronger environmental attitudes were less likely to pay a premium for organic and sustainable cotton shirts. Hence, in the clothing industry, fashion and trends are the main driving factors for consumer choices (Solomon & Rabolt, 2004). Green clothing may be perceived negatively in the marketplace as green products are generally characterized by several negative stereotypes such as the small number of choices, the higher prices compared to their virgin counterparts and drawbacks related to their visual appearance (Meyer, 2001).

According to Ellis et al. (2012), studies that measure the willingness of consumers to pay a price premium for sustainable apparel products are young, female, well-educated urban dwellers, and usually are married with at least one child living at home (Arbuthnot, 1977; Weigel, 1977; Banerjee & McKeage, 1994; Laroche et al., 2001). Swinker and Hines (1997), indicate that the intention of buying recycled textiles is driven by pro-environmental attitudes, but its effect declines when a higher price is involved. People usually tend to choose conventional cotton clothing over organic cotton clothing when a relatively higher price associated with organic cotton clothing is taken into consideration. In their survey, Hustvedt and Bernard (2008) found that participants required a discount once they were informed that socks were made with polylactic acid (PLA), a fiber made from corn. On the other side, participants were willing to pay the greatest premiums for socks labeled as organic and non-GM and less for socks that were produced with conventional methods. Therefore, they concluded that the premium on non-GM fibers suggests that sustainable production systems which are not organic may be successful if the essential information about their attributes is provided. Lin (2009) mentions that institutional surveys have reported a 30-45 percent higher premium in the cost of organic cotton products and a 12.5 percent higher cost for organic cotton apparel (Nimon & Beghin, 1999; Elzakker, 1999; Kogg, 2003). Moreover, a handful of studies (Adler & Clark, 2006) "seek" the main differences between various consumer profiles related to their preferences for traditional and organic cotton items. Ellis et al. (2012) used a revealed preference experimental auction methodology and compared participants' willingness to pay for organic and conventional cotton T-shirts. They found that consumers were willing to pay a 25 percent premium for an organic cotton T-shirt over the visibly similar T-shirt made from conventional cotton.

It is worth noting that more recent studies of willingness to pay for environmental goods have focused on food. Within the body of literature focused on water recycling food consumption, the related perceived disgust and the adoption of organic food products, no research has sought to examine the acceptance of fibers produced with recycled water. In 2021, Li and Roy's study discusses that generally studies have established that recycled water purposed for uses such as irrigation of nonfood crops or foods which undergo further processing are more widely accepted (Po et al., 2003; Savchenko et al., 2019). In addition, there is no study that fully unpacks the differences between "controversial" items and especially, the use of recycled water in the production methods of food and apparel. This article expands on the intuition that consumers do not experience disgust when recycled water is used for the irrigation of non-edible crops. There has been limited attention devoted to how consumers are responding to eco-textiles in general and the newer recycled fibers. To date, there is no study that investigates consumers' perception about fibers produced with recycled water.

This study uses a non-hypothetical field experiment involving actual purchase decisions to evaluate consumers' acceptance between food and nonfood items. Moreover, it examines consumers' knowledge, attitudes, and beliefs concerning apparel produced with recycled water. Our field experiment provides insight into both behavioral responses and WTP for two unrelated categories of products produced with recycled water. Furthermore, our unique experiment allows us to observe potential stigma effects not only in the purchase of food but also in the purchase of nonfood items produced with recycled water. This study contributes to the literature by addressing two questions:

(1) “Do people experience more disgust toward food items produced with recycled water or apparel produced with recycled water?”.

(2) “Is there stigma in nonfood crops that are irrigated with recycled water?”.

A review of the literature revealed that issues associated with environmentally responsible consumption are popular topics among researchers. While there are significant movements toward sustainable production, the future concerning the use of recycled water in the production of apparel garments depends on the consumer’s acceptance of the concept. We do need to shed light on consumers’ needs and compromises that they are determined to take for their contribution to sustainability. Consumers must be convinced about whether a specific choice would have an actual impact on the environment and will be safe for themselves. In this way, farmers will be less reluctant to adopt alternative irrigation for the food and nonfood crops and retailers will feel much more confident about the appeal of this category of sustainable products to consumers. A thorough review of literature from the fields of environmental consciousness, recycled water and consumer acceptance informed the following hypothesis to be tested in this study:

H1: Potential disgust related to oral ingestion reigns higher than the one associated with skin contact. Or, in other words, products containing recycled water and specifically those having higher proximity to the ingestion of recycled water will be associated with lower offered bids (Table 1).

Table 1: Hypotheses and results

Conjecture	**Hypotheses**	**Result**
We anticipate that type of water will impact bidding behavior.	Food product (Strawberries) *H0*: bidrecycled = bidconventional *H1*: bidrecycled ≠ bidconventional	Paired ttest: Strawberries: *Reject H0 (p<0.05)*
We anticipate that type of water will not impact bidding behavior.	Nonfood product (T-shirts) *H0*: bidrecycled=bidconventional *H1*: bidrecycled ≠ bidconventional	Paired ttest: T-shirts: *Cannot Reject H0 (p > 0.(*
We anticipate that the unknown type of water will impact bidding behavior.	Food product (Strawberries) *H0*: bidrecycled = bidunspecified *H1*: bidrecycled ≠ bidunspecified	Paired ttest: Strawberries: *Reject H0 (p<0.05)*
We anticipate that the unknown type of water will not impact bidding behavior.	Nonfood product (T-shirts) *H0*: bidrecycled = bidunspecified *H1*: bidrecycled ≠ bidunspecified	Paired ttest: T-shirts: *Cannot Reject H0 (p > 0.(*

3. Experimental Design

We conducted a framed field experiment to elicit consumer WTP for strawberries (1 lb) irrigated with different water sources and all cotton T-shirts made from cotton irrigated with different water sources, too. A Becker-DeGroot-Marschak (BDM) auction was used (Becker et al., 1964), which is incentive-compatible in experimental settings (Irwin et al., 1998), demand-revealing (Irwin et al., 1998; Messer et al., 2010; Li et al., 2018), is preferred for the elicitation of values in field settings (Lusk et al., 2001; Rousu et al., 2005), and that under this mechanism participants have the incentive to place their true maximum WTP. Horowitz (2006) indicates that the BDM approach is preferable than the Vickrey auction and the nth-price auctions, as they are not always incentive compatible, even for non-random goods. However, even in the case that participants are certain about the value of the item, the BDM does not remain incentive compatible if they do not maximize their expected utility. Therefore, it is very important for the participants in the BDM to not believe that their answers will affect the actual price of the product, otherwise, they will have an incentive to give strategic answers. Furthermore, BDM is used for the investigation of any relationship between stigma and demand for food products. In their study, Kanter et al. (2009), using the BDM method, analyzed WTP for different types of milk and found that stigma is a crucial factor that influences demand for a category of milk produced with the rBST hormone.

In the auction, participants placed bids on each of the following categories of items: (1) T-Shirts made from cotton produced with conventional water, (2) T-Shirts made from cotton irrigated with recycled water, (3) T-Shirts made from cotton with no specification of the source of irrigation water used, (4) strawberries irrigated with conventional water, (5) strawberries irrigated with recycled water, and (6) strawberries with no specification made of the type of irrigation water used. Before the auction, each participant was given the definitions for conventional and recycled water.

For this study, participants were recruited at a branch of the Department of Motor Vehicles, a local ice cream parlor, and a Life-long Learning Center in the U.S. Mid-Atlantic region. These various locations enabled the collection of data from a large cross-section of the population. The under-evaluation products were displayed on a table and they were clearly visible to all visitors in each location while another table near the entrance of the establishment provided the tablet computers loaded with the experiment. The sample was selected by approaching individuals at the establishment and inviting them to participate in a research study concerning water and several products that had been irrigated with the water. After signing the informed consent and reading the instructions (which included several detailed examples of the auction process), participants completed the comprehension checks involving five multiple choice questions designed to familiarize them with the BDM mechanism. In their study, Plott and Zeiler (2005), found that providing detailed training mostly surpassed misunderstandings concerning bidding in such auctions.

At the beginning of the experiment, each participant received the amount of \$15 that could be used to purchase products in the auction via private bids made on tablet computers provided to them. The participants could state any amount between \$0.00 and \$15.00 for each product. By moving the button on a slider, each participant i was asked to indicate the highest amount (B_{ij}) he or she was willing to pay for each product j. After the bidding rounds were completed, the computer program randomly chose one round for implementation and assigned a random market price (R_{ij}) to that product. The outcome of the auction was determined by

$$Randomly\ Selected\ Product\ \ ij = \begin{cases} Purchase\ if\ B_{ij} \geq R_{ij} \\ No\ Purchase\ if\ B_{ij} < R_{ij} \end{cases}$$

where the bid, B_{ij}, and the price, R_{ij}, were censored from below at $0 and from above at $15. Participants were encouraged to state their true WTP for each of the six products and approach each item as an independent decision (Becker et al., 1964). When a participant's bid was greater than or equal to the randomly generated price, the individual purchased the product, and the randomly generated price was deducted from the $15 that participants received. When a participant's bid was less than the random price, the participant was not eligible to buy the product and received the initial $15 participation fee. When participants bid less than their real WTP they do not have the chance to gain utility from the purchase of the product. The category of the participants that bid more than their real WTP will be forced to pay a greater amount of money compared to their perceived value. Hence, respondents had no incentive to place bids that understate or overstate their true maximum WTP (Irwin et al., 1998).

Lusk and Shrogen (2007) indicate that it is of high significance for participants to have a training concerning the mechanism before the beginning of the experiment. Hence, having a good understanding of the experiment will help individuals to reveal their true demand. In their study, Plott and Zeiler (2005) found that providing detailed training mostly surpassed misunderstandings concerning bidding in such auctions. In the present experiment, participants were provided with five practice rounds before they declared their bids. In each round the following question was provided:

If your bid is $6 and the randomly drawn number is $10, what is the outcome?

(A) You purchase the product for $10 and have $5 remaining.
(B) You will not purchase the product and have $15 remaining.

Once the participants answered each practice question, the Python-based computer program informed them if their answers were correct. Participants completed the comprehension checks involving five multiple-choice questions designed to familiarize them with the BDM mechanism.

The survey collected data on the individuals' demographic characteristics (see Appendix A for the survey questions). Once the auction and survey were complete, the administrators gave the products to the participants who purchased the product (strawberries or T-shirt) when they submitted a bid greater than or equal to the randomly determined price. In this case, the balance of the $15 participation fee in cash after deducting the cost of the product, and one of the six products was handed to them in a standard paper bag. Participants who did not purchase a product, because they placed a lower bid than the randomly drawn price, received the $15 participation fee and no product.

4. Results

4.1. Demographic Characteristics and Consumption Behavior

Table 2 reports the demographic characteristics of the participants. The average age was 43.6 years with a minimum of 18 and a maximum of 92. The majority of our participants were women (60%) and 67% were their households' primary shoppers. In general, the sample population's income and education levels ranged widely. In terms of marital status, 63% indicated that they do not have child/children under the age of 18.

Table 3 summarizes the participants' fruit and vegetable consumption behavior. Participants were asked the frequency/month of consuming fruit. The highest frequency was 0-5 times per month (21%) and followed by those who indicated that they consume fruits 26-30 times per month (18%). In the question "*What is the percentage of organic foods in your overall vegetable and fruit consumption?*", we found that the category 41-50% included the 20% of the sample and the category 91-100% included just the 2% of the sample.

Table 2: Summary of participants' demographics

Variable	Categories	Number (%)
Gender (N=197)	Female	118 (60%)
	Male	79 (40%)
	Other	0 (0%)
Age (N=195)	Mean	43.6
	Minimum	18
	Maximum	92
Primary household shopper (N=197)	Yes	132 (67%)
	No	65 (33%)
Income (N=195)	Less than $10,000	24 (12%)
	$10,000–$14,999	11 (6%)
	$15,000–$24,999	22 (11%)
	$25,000–$34,999	20 (10%)
	$35,000–$49,999	21 (11%)
	$50,000–$74,999	36 (18%)
	$75,000–$99,999	20 (10%)
	$100,000–$149,000	23 (12%)
	$150,000–$199,999	6 (3%)
	$200,000–$249,999	5 (3%)
	$250,000 and above	7 (4%)
Education (N=196)	Grade school	2 (1%)
	Some high school	10 (5%)
	High school graduate	48 (25%)
	Some college credit	46 (23%)
	Associate degree	19 (10%)
	Bachelor's degree	39 (20%)
	Graduate degree/Professional	32 (16%)
Child/Children under 18 (N=196)	No	123 (63%)
	Yes	73 (37%)

Note: The total number of participants was 201, however, due to missing survey responses, the number of observations was slightly lower for the above categories.

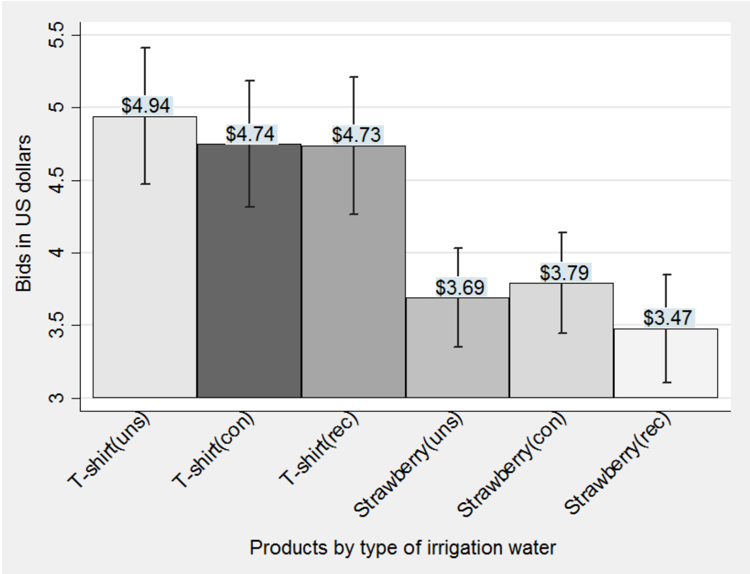
Table 3: Summary of fruit and vegetable consumption behavior

Variable	Categories	Number (%)
Fruit consumption frequency (N=195)		
	0-5	40 (21%)
	6-10	33 (17%)
	11-15	28 (14%)
	16-20	23 (12%)
	21-25	13 (7%)
	26-30	36 (18%)
	30+	22 (11%)
Organic vegetable and fruit consumption (N=200)		
	0-10	35 (18%)
	11-20	24 (12%)
	21-30	26 (13%)
	31-40	25 (13%)
	41-50	39 (20%)
	51-60	8 (4%)
	61-70	13 (7%)
	71-80	17 (9%)
	81-90	9 (5%)
	91-100	4 (2%)

Note: The total number of participants was 201, however, due to missing survey responses, the number of observations was slightly lower for the above categories.

Graph 1 presents the average WTP bids in the experiment for each of the six products offered. In the category of non-food products (T-shirts), we find that consumers are willing to pay more for T-shirts made from cotton irrigated with unspecified type of water ($4.94), followed by conventional water ($4.74), and recycled water ($4.73). We do not find the same trend in average WTP for the category of food products (strawberries): Strawberries for which water type is specified as conventional generate the highest WTP ($3.79), followed by unspecified type of water ($3.69), and recycled water ($3.47). However, the mean WTP on T-shirts made from cotton irrigated with recycled water versus T-shirts made from cotton irrigated with conventional water relative to the corresponding unspecified all cotton T-shirts are almost identical and not statistically different.

The above results indicate that when recycled water is used in the production of apparel consumers do not respond negatively compared to the conventional counterparts. This is consistent with the findings in Table 4, where respondents indicated that they would prefer the use of recycled water in the production of nonfood items in a percentage of 40%, while the 60% of the rest sample stated that they would prefer the use of conventional water (30%) and they would not care for the water source that is used (30%). On the other side, when recycled water is used in the production of edible items it mainly acts as a deterrent factor to their consumption and consequently consumers undervalue such goods demanding lower prices. This is also, consistent with the results in Table 4, where participants in a percentage of 43% stated that they would prefer conventional water to produce edible crops, followed by recycled water in a percentage of 30%, and those who do not care for the origin of water (27%).

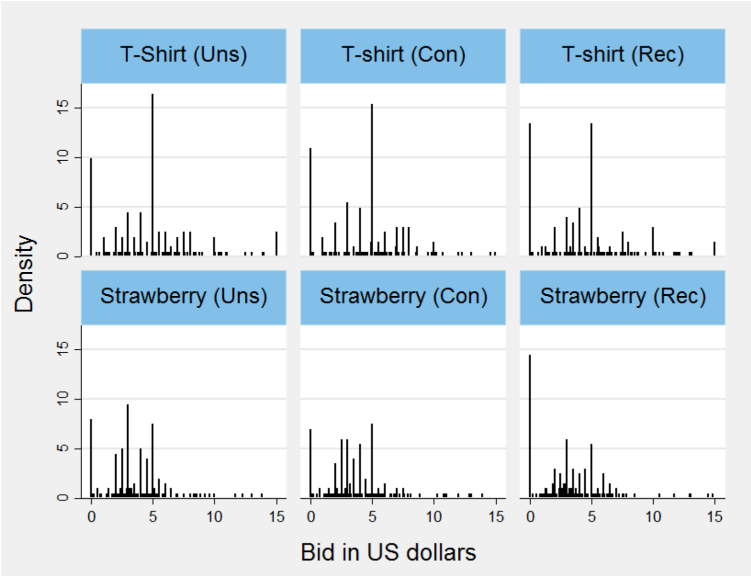


Graph 1: Average Bids for food and non-food products

Table 4: Summary of fruit and vegetable consumption behavior per category of water source

Variable (N=201)	Categories	Percentage
Food crop	Recycled water	30%
	Conventional water	43%
	Do not care	27%
Non-food crop	Recycled water	40%
	Conventional water	30%
	Do not care	30%

The experimental data revealed many $0 bids (Graph 2). Most of the answers were between $0 and $7. It is worth noting also that there were clusters of bids around $5 for T-Shirts and $3.50 for strawberries. These observations could be regarded as the participants' perceived market prices for those products. One could think that a T-shirt has a higher average market price compared to a package of strawberries, and thus the offered bids for the T-shirts will be higher in general. Recent studies have shown that external market prices play a significant role in consumer bidding behavior during experimental auctions. In their study, Harrison et al. (2004) indicates the three main problems that must be addressed when designing experiments intended to elicit homegrown values: i) field-price censoring, ii) beliefs about field prices are affiliated, and iii) subjects may have affiliated beliefs about the quality of the laboratory commodity itself. Especially, they reanalyze observations in a seminal elicitation study (Hoffman et al., 1993) recommending measures to face the above problems. The problem of field-price censoring arises from the availability of immediate counterparts in regular supermarkets and stores leading individuals to not rationally bid higher than the price they perceive as regular. Nevertheless, the present study did not collect data on the participants' perceptions of market prices as the products under evaluation were labelled with the type of irrigation water.



Graph 2: Histograms of bids separated by product type (T-Shirt or strawberry) and type of irrigation water (unspecified, conventional, or recycled)

4.2. Random-Effects Tobit Regression

Since participants' bids are restricted to a range of \$0 to \$15, we use a random effects two-limit Tobit model to analyze the data. We assume that a latent variable, B^*, represents a participant's true WTP for the products offered in an auction round. The latent variables are related to the observed bid, B_{ij}:

$$Bij=\begin{cases} 0 \\ 15 \end{cases} B_{ij}^* = X_{ij}' \beta + u_i + \varepsilon_{ij}$$

- If $B_{ij}^* \leq 0$
- If $0 < B_{ij}^* < 15$
- If $B_{ij}^* \geq 15$

where i represents the participant and j represents the product offered in the auction round each time. X_j is a vector of the relevant demographic variables and a series of dummy variables indicating the product auctioned in the round. β is a vector of the coefficients to be estimated, u_i is the between-entity error term, and ε_{ij} is the within-entity error term.

The results presented in Table 5 further analyze consumers' preferences for products associated with conventional and recycled water by separating the results by food and non-food products. We find that there is a discount in WTP for all the categories of food products (strawberries). The discount for recycled strawberries (-\$1.58, p=0.00) is larger than the discount for the conventional (-\$1.14, p=0.00) and unspecified (-\$1.26, p=0.00) strawberries. Additionally, the discount is much larger compared to the one for recycled all cotton T-shirts (-\$0.26, p=0.41) and conventional all cotton T-shirts (-\$0.22, p=0.48). A convincing explanation for this finding, based on the bibliography and the studies related to the acceptance of recycled water, is that recycled water generates the “ick” factor, especially for edible items leading to the decrease of WTP. Therefore, individuals are willing to pay less than $1.58 to buy strawberries irrigated with recycled water, less than $1.14 to afford strawberries irrigated with recycled water and less than $1.26 to purchase strawberries irrigated with unspecified type of water, compared to T-shirts made with cotton irrigated with unspecified type of water.

Table 5: Results from random effects Tobit model on participants' willingness to pay for food and non-food products based on water type for strawberry and cotton irrigation—by product.

	Bid	**Coefficient**	**Std. Error**	**p-Value**
T-shirt	Conventional	-0.22	0.32	0.48
	Recycled	-0.26	0.32	0.41
Strawberry	Unspecified	-1.26*	0.32	0.00
	Conventional	-1.14*	0.32	0.00
	Recycled	-1.58*	0.32	0.00
_cons		4.81	0.23	0.00

Notes: *1%, 5% significance level.
N=1206; Prob > Chi2=0.000.
128 left-censored observations at bid <= 0.
1,069 uncensored observations.
9 right-censored observations at bid >= 15.

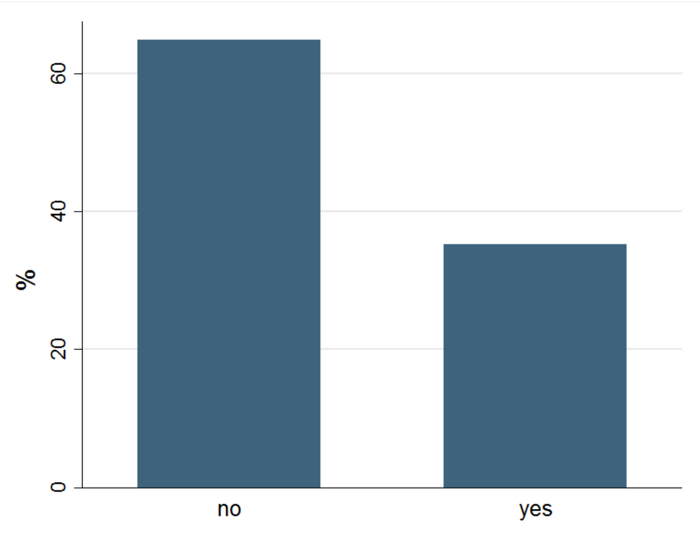
We are also interested in understanding consumer heterogeneity in WTP for T-shirts. In Table 6, the results of the regression indicate that individuals who have income between $15,000-$24,999 are willing to pay more than $2.24 for T-shirts compared to other buyers with income less than $10,000. Participants who have income between $35,000-$49,999 are willing to pay more than $2.45 for T-shirts compared to other buyers with income less than $10,000. Furthermore, those who indicated that they educate themselves about the way that their clothes are produced, they are willing to pay more than $1.28 to buy T-shirts compared to other buyers that do not educate themselves.

It is worth noting that most respondents, in a percentage of 65% indicated that they do not educate themselves concerning the way their clothes are produced while a small percentage of 35% educate themselves about the procedures are applied during the apparel production (Graph 2). At this point, we notice that generally there is a big difference between marketing to a customer and educating him. The fashion industry is one of the largest industries in the world and its supply-chain includes agriculture, manufacturing, processing, recycling, and disposal. The future of sustainable textile largely depends on its ability to reduce the use of resources (i.e., water) and for that reason many companies should educate the customers on the use of recycled water and the potential benefits for the environment and the society. Interestingly, only income from the demographic variables produced statistically significant results.

Table 6: Results from random effects Tobit model on participants' willingness to pay for T-shirts.

Bid	**Coef.**	**Std. Error**	**p-Value**
Age	-0.01	0.01	0.30
Female	-0.56	0.54	0.30
Income			
$15,000-$24,999	2.24*	1.11	0.04
$35,000-$49,999	2.45*	1.18	0.04
Education	0.09	2.72	0.97
Children under 18	-0.71	0.56	0.20
Organic apparel	0.31	0.81	0.70
Nonfood crop irrigation preferences	1.18	0.69	0.09
Fashion education			
Yes	1.28*	0.61	0.03
Primary Shopper	-0.89	0.61	0.15
_cons	4.54	2.75	0.10

Notes: *5% significance level
N=188; Prob > Chi2= 0.260.
22 left-censored observations at bid <= 0.
165 uncensored observations.
1 right-censored observations at bid>=15.



Graph 3: Participants' responses in the question: "Do you educate yourself about how your clothing is produced?"

Additionally, we tested the heterogeneity in WTP for strawberries. In Table 7, the results of the regression indicate that individuals who consume a high percentage of organic fruit and vegetable are willing to spend more when they purchase strawberries. However, none of the demographic variables produces statistically significant results. It might be that for this sample consumers' consumption behaviors largely drive the differences in WTP. This could be also due to the constitution of the sample that consequently affects consumers' consumption behavior and their declared WTP. As well, a larger sample could result in a wider variety of purchasing habits.

Table 7: Results from random effects Tobit model on participants' willingness to pay for strawberries.

Bid	Coef.	Std. Error	p-Value
Age	-0.01	0.01	0.34
Female	-0.29	0.41	0.48
Income	1.39	0.98	0.16
Education	-0.66	2.04	0.74
Children under 18	-0.37	0.44	0.40
Food crop irrigation preferences	-0.06	0.47	0.88
Fruit consumption frequency	-0.00	0.01	0.52
% of organic fruit and vegetable consumption	0.01*	0.00	0.04
Primary Shopper	0.14	0.46	0.75
_cons	5.22	1.93	0.00

Notes: *5% significance level
N=188; Prob > Chi2=0.2958.
13 left-censored observations at bid <= 0.
175 uncensored observations.
0 right-censored observations.

4.2. Paired t-test

To measure the effect of water irrigation source on the change in WTP for food and nonfood products we conduct t-tests. More specifically, a paired t-test was run on a sample of 201 individuals to determine whether there was a statistically significant mean difference between the offered bids for the T-shirts made from cotton irrigated with recycled water (**rtsh**) and T-shirts were made from cotton irrigated with conventional water (**ctsh**) (Table 8). A second paired t-test was run on the same sample to investigate if there was a statistically significant mean difference between the offered bids for the strawberries irrigated with recycled water (**rstb**) and strawberries irrigated with conventional water (**cstb**) (Table 9). We also conduct t-tests for the category of nonfood items produced with recycled and unspecified type (**untsh**) of water (Table 10) and the category of food items irrigated with recycled and unspecified type of water (**unstb**) (Table 11).

According to the “Mean” column (Table 8), we can see that the mean offered bid for the recycled water T-shirts (rtsh) is lower than the one for the conventional water T-shirts (ctsh). There is a negative mean difference between the two products (recycled T-shirts and conventional T-shirts) of 0.01 dollars (Mean) with a standard deviation of 2.30 dollars (Std. Dev.), and a standard error of the mean of 0.16 dollars (Std. Err.). Here, the p-value for the difference between the two variables, rtsh and ctsh is greater than 0.05, so we conclude that the mean difference is not statistically significantly different from 0.

Additionally, looking at the “Mean” column (Table 9), we notice that the offered bid for the recycled strawberries (rstb) is lower than the one for the conventional strawberries (cstb). There is a negative mean difference between the two products (recycled strawberries and conventional strawberries) of 0.31 dollars (Mean) with a standard deviation of 1.91 dollars (Std. Dev.), and a standard error of the mean of 0.13

dollars (Std. Err.). Here, the p-value for the difference between rstb and cstb is lower than 0.05, so we conclude that the mean difference is statistically significantly different from 0. Moreover, the power analysis for the two-sample means test (rstb and cstb) was conducted and the results revealed a power of 0.80 (80%) which indicates that there is an 80 percent chance of detecting a difference as statistically significant, if in fact a true difference exists as it occurs in this case.

Table 8: Results from the paired t-test between the recycled water (rtsh) and conventional (ctsh) T-shirts

Variable	Obs.	Mean	Std. Err.	Std. Dev.
rtsh	201	4.73	0.24	3.40
ctsh	201	4.74	0.21	3.11
diff	201	-0.01	0.16	2.30

Notes: *5% significance level
mean (diff) = mean (rtsh-ctsh), t = -0.0626
H0: mean (diff) = 0, degrees of freedom = 200
Ha: mean (diff) < 0, Ha: mean (diff)! = 0, Ha: mean (diff) > 0
Pr (T<t) = 0.4751, **Pr (|T|>|t|) = 0.9501**, Pr (T>t)) = 0.5249

Table 9: Results from the paired t-test between the recycled water (rstb) and conventional (cstb) strawberries

Variable	Obs.	Mean	Std. Err.	Std. Dev.
rstb	201	3.47	0.18	2.66
cstb	201	3.79	0.17	2.49
diff	201	-0.31	0.13	1.91

Notes: *5% significance level
mean (diff) = mean (rstb-cstb), t = -2.3194
H0: mean (diff) = 0, degrees of freedom = 200
Ha: mean (diff) < 0, Ha: mean (diff)! = 0, Ha: mean (diff) > 0
Pr (T<t) = 0.0107, Pr (|T|>|t|) = 0.0214, Pr (T>t)) = 0.9893

Accordingly, the "Mean" column in Table 10, reveals that the mean offered bid for the recycled water T-shirts (rtsh) was lower than the one for the unspecified type of irrigation water T-shirts (untsh). There is a negative mean difference between the two products (recycled water T-shirts and unspecified water T-shirts) of 0.20 dollars (Mean) with a standard deviation of 2.39 dollars (Std. Dev.), and a standard error of the mean of 0.16 dollars (Std. Err.). Here, the p-value for the difference between rtsh and ctsh is greater than 0.05, so we conclude that the mean difference is not statistically significantly different from 0.

In Table 11, we clearly see that the mean offered bid for the recycled water strawberries (rstb) was lower than the one for the unspecified type of irrigation water strawberries (unstb). There is a negative mean difference between the two products (recycled water strawberries and unspecified type of water strawberries) of 0.21 dollars (Mean) with a standard deviation of 1.49 dollars (Std. Dev.), and a standard error of the mean of 0.10 dollars (Std. Err.). Here, the p-value for the difference between rstb and unstb is lower than 0.05, hence we understand that the mean difference is statistically significantly different from 0. Also, the power analysis for the two-sample means test (hypothesis for the rtsh and untsh) was conducted and the results revealed a power of 0.80 (80%) which indicates that there is an 80 percent chance of detecting a difference as statistically significant, if in fact a true difference exists.

Table 10: Results from the paired ttest between the recycled water (rtsh) and unspecified type of water (untsh) T-shirts

Variable	Obs.	Mean	Std. Err.	Std. Dev.
rtsh	201	4.73	0.24	3.40
untsh	201	4.94	0.23	3.36
diff	201	-0.32	0.16	2.39

Notes: *5% significance level
mean (diff) = mean (rtsh-untsh), t = -1.2076
H0: mean (diff) = 0, degrees of freedom = 200
Ha: mean (diff) < 0, Ha: mean (diff)! = 0, Ha: mean (diff) > 0
Pr (T<t) = 0.1143, **Pr (|T|>|t|) = 0.2286**, Pr (T>t)) = 0.8857

Table 11: Results from the paired ttest between the recycled water (rstb) and unspecified type of water (unstb) strawberries

Variable	Obs.	Mean	Std. Err.	Std. Dev.
rstb	201	3.47	0.18	2.66
unstb	201	3.69	0.17	2.44
diff	201	-0.21	0.10	1.49

Notes: *5% significance level
mean (diff) = mean (rstb-unstb), t = -2.0216
H0: mean (diff) = 0, degrees of freedom = 200
Ha: mean (diff) < 0, Ha: mean (diff)! = 0, Ha: mean (diff) > 0
Pr (T<t) = 0.0223, **Pr (|T|>|t|) = 0.0445**, Pr (T>t)) = 0.8857

The results we derived from the paired t-tests (Table 11) confirm one of our hypotheses which supports that the WTP for the strawberries with the unspecified type of water irrigation will be higher compared to the one for the strawberries irrigated with recycled water. We find that when it is about food consumers prefer not to know. This is in accordance with the results from the study of Li et al. (2018), where they conducted a framed field experiment to evaluate consumers' responses to California and French wines made from grapes produced with recycled, conventional, and an unspecified type of water for irrigation. Participants' willingness to pay was greatest for the wine that was made from grapes irrigated with an unspecified type of water.

Does level of contact with alternative sources of water differently affects consumers' WTP for food and nonfood products produced with recycled water? The results we derived from the paired t-tests (Table 8, Table 9) confirm the main hypothesis of our study supporting that potential disgust related to oral ingestion reigns higher than the one associated with skin contact. Foods produced using recycled irrigation water evoke negative reactions compared to nonfood products. The "yuck" factor associated with wastewater makes many consumers avoid such food products. Therefore, the degree of contact with recycled water is of crucial importance for the acceptance of the procedure. Here, respondents were more familiar with the use of recycled water to produce T-Shirts and much less familiar with the use of recycled water for food production. It is certainly proved that potential disgust related to oral ingestion is higher than the one associated with skin contact.

4.2. Regression results

Additionally, we test the effect of other variables on WTP for the undervaluation food and nonfood products. We assume that gender and age affect the difference in WTP for recycled and conventional water produced products. We assume that consumers with a higher education level will be willing to pay more for recycled water products compared to their conventional counterparts. We run two multiple regressions:

• T-shirts made with cotton that was irrigated with recycled water (rtsh) (I)
• Strawberries irrigated with recycled water (rstb) (II)

$$Bid\,rtsh = a + b_1 age + b_2 gender + b_3 education + b_4 income + b_5 child18 + b_6 prshop + b_7 watpr + u_1 \quad (I)$$

$$Bid\,rstb = \gamma + b_1 age + b_2 gender + b_3 education + b_4 income + b_5 child18 + b_6 prshop + b_7 watpr + u_2 \quad (II)$$

where Bid*rtsh* and Bid*rstb* are the dependent variables that indicate the offered bid for the recycled water T-shirts and the recycled water strawberries, respectively. The independent variables are **age**, **gender**, **education**, **income, child18** which indicates if there are children under the age of 18 in respondents' household, **prshop** indicating the participants are the primary shoppers of their household, and **watpr** that reveals consumers' preferences related to the type of water they typically drink (tap, filtered, or bottled water). Further understanding on how consumers are influenced by the presence of recycled water in the production process of food and nonfood products, can have important implications in the policy making and marketing field.

The following tables (Table 12 & Table 13) present the results from the regressions we run for the recycled T-shirts and the recycled strawberries. The total number of participants was 201, however, due to missing survey responses, the number of observations was slightly lower.

In Table 12, considering the significance level of 5%, we find that income is statistically significant (p=0.04). More specifically, the individuals are willing to pay more than $2.42 for T-shirts made of cotton irrigated with recycled water compared to the participants that declared income less than $10,000. This finding makes sense if we think that sustainable products are considered more expensive and people with higher income can afford. Also, this category of consumers might be sensitive for environmental issues and educate themselves about problems like water scarcity. Additionally, the variable "child18" that is referred to the number of children under the age of 18 in a household, is statistically significant (p=0.02) and indicates participants with children at their household are willing to pay less than $1.34 compared to participants that do not have children under 18. Here, a possible explanation for this finding is that families with children may not be able to afford environmentally friendly products thinking that they are more expensive in comparison with the conventional counterparts. Therefore, we cannot support with certainty that their denial to pay more for recycled water all cotton T-shirts is also associated with negative reactions of disgust. The results we derived from the regression in Table 13, does not provide us with any statistically significant results, something that could be due to the small number of our sample.

Table 12: Results from the regression for the recycled water T-shirt

Bid*rtsh*	**Coef.**	**Std. Err.**	**p-Value**
Age	-0.02	0.01	0.13
Gender	-0.26	0.56	0.63
Education			
Some high school	-2.20	2.75	0.42
High school graduate	-2.37	2.57	0.35
Some college credit	-3.20	2.58	0.21
Associate degree	-1.05	2.65	0.69
Bachelor's degree	-2.29	2.61	0.38
Graduate degree/Professional	-1.46	2.70	0.58
Income			
$35,000-$49,999	2.42*	1.17	0.04
Children under 18 (child18)	-1.34*	0.59	0.02
Primary shopper (prshop)	-0.39	0.61	0.52
Water preference (watpr)			
Filtered water	0.43	0.80	0.59
Bottled water	0.67	0.78	0.39
Other	1.17	2.68	0.66
_constant	7.54	2.64	0.00

Notes: *5% significance level, N=191; Prob. > F = 0.28, R-squared=0.13, Adj R-squared=0.02

Table 13: Results from the regression for the recycled water T-shirt

Bid*rstb*	**Coef.**	**Std. Err.**	**p-Value**
Age	-0.01	0.01	0.25
Gender	-0.38	0.44	0.38
Education			
Some high school	0.15	2.14	0.94
High school graduate	-1.23	1.99	0.53
Some college credit	-1.59	2.01	0.42
Associate degree	0.50	2.06	0.80
Bachelor's degree	-0.58	2.03	0.77
Graduate degree/Professional	-0.90	2.10	0.66
Income			
$10,000-$14,999	0.42	1.04	0.68
$15,000-$24,999	0.26	0.84	0.75
$25,000-$34,999	-1.09	0.90	0.22
$35,000-$49,999	0.50	0.91	0.58
$50,000-$74,999	-1.12	0.79	0.87
$75,000-$99,999	-0.24	0.89	0.78
$100,000-$149,999	-0.35	0.94	0.70
$150,000-$199,999	-1.28	1.47	0.38
$200,000-$249,999	-0.06	1.42	0.96
$250,000 and above	-0.09	1.24	0.94
Children under 18 (child18)	-0.72	0.46	0.11
Primary shopper (prshop)	-1.16	0.47	0.72
Water preference (watpr)			
Filtered water	0.47	0.62	0.44
Bottled water	0.11	0.60	0.84
Other	-0.45	2.08	0.82
_constant	5.60	2.05	0.00

Notes: *5% significance level, N=191; Prob. > F = 0.42, R-squared=0.12, Adj R-squared=0.00

5. Conclusions

The agricultural industry is the largest consumer of fresh water in the United States as well as in many other countries. In addition, the fashion industry is considered the third largest user of water globally. The textile and fashion industries have a long and complex supply chain, starting from agriculture to manufacturing, logistics and retail. Each production step has an environmental impact due to many factors and one of them is the excessive use of water. The fashion industry uses water throughout the production process for textiles and garments. Cotton has been characterized as a thirsty crop and its cultivation in water stressed areas across the US exaggerates the issue of water shortage. There is a push not only in the agriculture industry but also in the agriculture industry to reconsider their water footprint and start thinking of alternative and sustainable ways to reduce it. Hence, both the agriculture and fashion industries play a crucial role in promoting sustainable water usage.

Using alternative sources of water is an environmentally friendly, cost-effective, and safe method to irrigate crops. Although the benefits the use of recycled water entails, several studies conducted in some countries have revealed several opponents in both the agriculture (from the side of producers) and marketing (from the side of consumers) sectors. Especially, there is a reluctance among the farmers concerning the adoption of this relatively new technology, as consumers are not very familiar with the use of alternative water sources and therefore there is a risk of rejection of such products by consumers, as they associate recycled water with the image of raw sewage that was before. Such reactions could affect their WTP especially for food products irrigated with recycled water and subsequently prevent producers' adoption of the concept. But it is still unknown the way that people react towards nonfood items produced with recycled water.

This paper touches upon consumers' preferences for the effect of different types of water on WTP for strawberries (food) and all cotton T-shirts (nonfood) with the aim to suggest recommendations to address associated environmental problems and make consumers a driving force able to shape the future of sustainable water sources. We examine consumer preferences in the context of food and nonfood items produced using recycled wastewater for irrigation. Our results indicate that the use of recycled water in the irrigation of food and nonfood crops affected consumers' acceptance of such products at a different level. Especially, there is a decline in WTP for strawberries irrigated with recycled water and this is in line with the decrease in WTP that has been detected in studies related to the acceptance of recycled water in food products. On the other hand, when we examined the effect of recycled water on T-shirts, we found that there was not any effect on participants' WTP for T-shirts made from cotton irrigated with recycled water compared to the ones irrigated with conventional water. These results confirm the main hypothesis of this study as it is obvious that potential disgust related to oral ingestion is higher than the one associated with skin contact. Perhaps individuals do not have access to information related to the current drought in many US states (see: Current Map | U.S. Drought Monitor (unl.edu)) and the effect of agricultural production (i.e., cotton) on the water supply.

This survey is an attempt to explore some of the beliefs and social understandings of the use of recycled water for the irrigation of edible and inedible crops. Our findings provide valuable and useful insights into how consumers respond to the use of recycled water on food and nonfood items. Looking forward, including a question about individuals' behavior on the use of recycled water during the dyeing process may increase future research. Using recycled water not only in the irrigation of inedible crops but also during the production stages of textiles may help to better reform our understanding of what drives consumers' decisions and behaviors. In the future, it may also be interesting to study how the use of recycled water in the production process of underwear influences consumers' decision making when compared to apparel. This could further explain if respondents face higher disgust when recycled water is used in the production process of underwear compared to clothes. The agriculture and textile industries have a tremendous impact on the global environment and health which requires governments, private sector, and consumers to put in greater efforts to make them truly sustainable. The use of recycled water not only in the initial step of the clothing supply chain but also during the manufacturing is a promising and viable solution that may be perceived positively by most consumers. Finally, more research on this topic is needed to further support our findings.

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Appendix A

A.1 EXPERIMENTAL INSTRUCTIONS

Instructions:
Please read these instructions carefully. Please do not communicate with other participants. If you have questions, please raise your hand and an administrator will come to you.
In today's study, you will be asked to indicate the *highest amount of money you would pay* for certain products. This amount will be called your bid.
You will receive $15 for participating in this study.
Below we will explain how you can use this money to place bids on certain products.
All decisions you make are real decisions ‐ this means that you will place bids of real money on real products.

Process:
We will ask you to bid <u>the highest amount of money you are willing to pay</u> for a number of products. These products will be on display at the main table.
You will fill out a short survey.
At the end, one of your bids for a product will be randomly selected for implementation.
The computer will draw a random price for the selected product.
If your bid for that product is higher than the random price, you will purchase the product at the random price. If your bid is lower than the random price, you will not purchase any product.
Any purchases you make will be deducted from the $15 you receive for your participation.

Rules for Bidding:
Your bids must be between $0 and $15.
Once you have placed your bids for all the products, the computer will randomly choose one product for implementation.
For the chosen product, the computer will randomly generate a price between $0 and $15.
If your bid for that product is higher or equal to the random price, you will receive the product and pay only the random price.
If your bid is lower than the random price, you will not receive the product and receive the $15.
It is most beneficial for you to accurately bid the highest amount of money you are willing to pay for the product.

Example 1:
Suppose the highest amount of money you are willing to pay for the product is $10, so you bid $10. Suppose this product is randomly selected at the end of the study.
Possible Outcomes:

If the randomly drawn price is $5, then you will receive the product and pay $5 – because your bid was higher than the random price. The $5 will be deducted from your balance of $15, so you will receive the product and $10 ($15-$5).
If the randomly drawn price is $10, then you will receive the product and pay $10 – because your bid was equal to the random price. The $10 will be deducted from your balance of $15, so you will receive the product and $5 ($15-$10).

If the randomly drawn price is $12, then you will not receive the product because your bid was lower than the random price. You will receive $15 and no product.

Example 2:
Say that the highest amount of money you are willing to pay for the product is $15, so you bid $15.
Possible Outcomes:
If you bid $15 you will definitely receive the product because any random price will be equal to or less than $15, for example:
If the randomly drawn price is $15, then you will receive the product and pay $15 – because your bid was equal to the random price. The $15 will be deducted from your balance of $15, so you receive the product and $0 ($15-$15).
If the randomly drawn price is $2, then you will receive the product and pay $2 – because your bid was higher than the random price. The $2 will be deducted from your balance of $15, so you receive the product and $13 ($15-$2).

Example 3:
Say that the highest amount of money you are willing to pay for the product is $0, so you bid $0.
Possible Outcomes:
If you bid $0 you will either receive the product for free ($0) and still receive $15, or you will not receive the product and receive $15, for example:
If the randomly drawn price is $0, then you will receive the product and pay $0 – because your bid was equal to the random price. The $0 will be deducted from your balance of $15, so you receive the product and $15 ($15-$0).
If the randomly drawn price is $2, then you will not receive the product and will be paid $15 – because your bid was lower than the random price.

Appendix B

B.1 ROBUST REGRESSIONS

Table 1: Results from robust regression

	Bid	Coefficient	Std. Error	p-Value
T-shirt	Conventional	0.02	0.26	0.93
	Recycled	-0.18	0.26	0.47
Strawberry	Unspecified	-1.06*	0.26	0.00
	Conventional	-1.00*	0.26	0.00
	Recycled	-1.30*	0.26	0.00
_cons		4.49	0.18	0.00

Notes: *1%, 5% significance level.
N=1206; Prob > F=0.000.

Table 2: Results from robust regression on participants' willingness to pay for T-shirts.

Bid	Coef.	Std. Error	p-Value
Age	-0.01	0.01	0.37
Female	-0.77	0.53	0.14
Income			
$35,000-$49,999	2.41*	1.16	0.03
Education	-0.37	2.67	0.88
Children under 18	-0.41	0.55	0.45
Organic apparel	-0.07	0.79	0.92
Nonfood crop irrigation preferences	0.85	0.67	0.20
Fashion education			
Yes	1.17*	0.59	0.05
Primary Shopper	-0.57	0.60	0.34
_cons	4.75	2.70	0.08

Notes: *5% significance level
N=188; Prob > F= 0.22.

Table 3: Results from robust regression on participants' willingness to pay for strawberries.

Bid	Coef.	Std. Error	p-Value
Age	-0.00	0.01	0.98
Female	0.23	0.35	0.50
Income	1.79*	0.84	0.03
Education	-1.77	1.76	0.31
Children under 18	-0.27	0.38	0.46
Food crop irrigation preferences	-0.26	0.40	0.50
Fruit consumption frequency	-0.00	0.01	0.97
% of organic fruit and vegetable consumption	0.01	0.00	0.12
Primary Shopper	-0.03	0.39	0.92
_cons	4.58	1.66	0.00

Notes: *5% significance level
N=188; Prob > F=0.71.

Table 4: Results from the robust regression for the recycled water T-shirt

Bid*rtsh*	**Coef.**	**Std. Err.**	**p-Value**
Age	-0.01	0.01	0.28
Gender	-0.51	0.58	0.37
Education			
Some high school	-2.22	2.85	0.43
High school graduate	-2.55	2.66	0.33
Some college credit	-3.40	2.68	0.20
Associate degree	-1.14	2.75	0.67
Bachelor's degree	-2.13	2.71	0.43
Graduate degree/Professional	-1.22	2.80	0.66
Income			
$35,000-$49,999	2.59*	1.21	0.03
Children under 18 (child18)	-1.22*	0.61	0.04
Primary shopper (prshop)	-0.38	0.63	0.54
Water preference (watpr)			
Filtered water	0.15	0.83	0.85
Bottled water	0.52	0.81	0.51
Other	1.93	2.77	0.48
_constant	7.33	2.74	0.00

Notes: *5% significance level, N=191; Prob. > F = 0.30

Table 5: Results from the robust regression for the recycled water strawberries

Bid*rstb*	**Coef.**	**Std. Err.**	**p-Value**
Age	-0.00	0.01	0.41
Gender	-0.09	0.39	0.80
Education			
Some high school	-1.41	1.93	0.46
High school graduate	-1.60	1.80	0.37
Some college credit	-1.99	1.81	0.27
Associate degree	-0.29	1.86	0.87
Bachelor's degree	-1.03	1.83	0.57
Graduate degree/Professional	-1.07	1.89	0.57
Income			
$10,000-$14,999	0.72	0.93	0.44
$15,000-$24,999	0.10	0.76	0.89
$25,000-$34,999	-0.94	0.81	0.24
$35,000-$49,999	0.01	0.82	0.98
$50,000-$74,999	-0.22	0.71	0.75
$75,000-$99,999	-0.10	0.80	0.89
$100,000-$149,999	-0.71	0.85	0.40
$150,000-$199,999	-1.05	1.32	0.42
$200,000-$249,999	-0.08	1.28	0.94
$250,000 and above	-0.08	1.21	0.93
Children under 18 (child18)	-0.62	0.41	0.13
Primary shopper (prshop)	-0.06	0.43	0.88
Water preference (watpr)			
Filtered water	0.06	0.56	0.90
Bottled water	-0.13	0.54	0.80
Other	-0.20	1.87	0.91
_constant	5.58	1.85	0.00

Notes: *5% significance level, N=191; Prob. > F = 0.76

B.2 SURVEY QUESTIONS

Please answer the following questions:

(1) What is your age?

(2) What is your gender?
Male
Female
Other (please specify)

(3) What is your profession?
Government
Education
Business
Agriculture
Healthcare
Student
Other (please specify)

(4) Are you:
Politically liberal
Politically moderate
Politically conservative
Other (please specify)

(5) Which category best describes your <u>household</u> income (before taxes) in 2016?
Less than $10,000
$10,000-$14,999
$15,000-$24,999
$25,000-$34,999
$35,000-$49,999
$50,000-$74,999
$75,000-$99,999
$100,000-$149,999
$150,000-$199,999
$200,000-$249,999
$250,000 and above

(6) What is the highest level of education that you have completed?
Grade school
Some high school
High school graduate
Some college credit
Associate degree
Bachelor's degree
Graduate degree/Professional

(7) Do you have a child/children under the age of 18 years old in your household?

Yes
No

(8) How often do you consume fruit?
__times per month

(9) Are you the primary shopper in your household?
Yes
No

(10) Do you think millennials (individuals born between 1981 and 1997) are more likely to prefer using recycled water for crop irrigation?
Yes
No
Not sure

(11) Do you think individuals in your community are more likely to prefer using recycled water for crop irrigation?
Yes
No
Not sure

(12) Do you think the majority of consumers prefer using recycled water for crop irrigation?
Yes
No
Not sure

(13) Did you know that social norms (what most people do) can influence our decisions?
Yes
No
Not sure

(14) What is the percentage of organic foods in your overall vegetable and fruit consumption?
Non-Organic (100%) – *slider* – Organic (100%)

(15) Do you grow your own food?
Yes
No

(16) Which do you prefer?
Local Food
Non-Local Food
Do not care

(17) What type of water do you typically drink?
Bottled Water

Tap Water
Filtered Water
Other (please specify)

(18) Are you concerned about water availability in these areas?
Your Community
Yes
No
Your State
Yes
No
United States
Yes
No
Worldwide
Yes
No

(19) How concerned are you about climate change in these areas?
Your Community:
Not At All (1) – *slider* – Very Concerned (5)
Your State:
Not At All (1) – *slider* – Very Concerned (5)
United States:
Not At All (1) – *slider* – Very Concerned (5)
Worldwide:
Not At All (1) – *slider* – Very Concerned (5)

(20) Do you prefer conventional water or recycled water for use in food crop production?
Conventional
Recycled water
Do not care

(21) Do you prefer conventional water or recycled water for use in non-food crop production?
Conventional
Recycled water
Do not care

(22) How much do you trust information from the following sources:
Newspaper:
Strongly Disagree (1) – *slider* – Strongly Agree (5)
Government:
Strongly Disagree (1) – *slider* – Strongly Agree (5)
Non-profit organization:
Strongly Disagree (1) – *slider* – Strongly Agree (5)
Science:
Strongly Disagree (1) – *slider* – Strongly Agree (5)

(23) Do you prefer clothing made from organic cotton?
Yes
No
Do not care

(24) Do you educate yourself about how your clothing is produced?
Yes
No