



Cornhusker Economics

How Much Green to Keep the Garden Clean? An Analysis of the Willingness to Pay (WTP) of Home Gardeners for BioWRAP Technology

Background: Plastic films and mulches have been used in high-value and specialty crop production as a physical barrier to weed growth since the 1950s. Over the last decade, due to the environmental issues associated with conventional plastics (see Qi et al., 2020 for a review), use has begun shifting from conventional plastics to biodegradable polymers. In a project funded by the National Science Foundation under grant OIA-2119753, a research team from the University of Nebraska-Lincoln, Kansas State University, and South Dakota School of Mines are working on creating an alternative product that would use locally available materials to create a spray-on, biodegradable polymer that can suppress weeds and will biodegrade in a timeframe that is amenable to crop production. We broadly refer to this technology as BioWRAP (Bioplastics with Regenerative Agricultural Properties).

Previous research on the suitability of biodegradable mulches in agriculture has examined the impact of the technology on yield, soil temperature, soil moisture, water use, and weeds. Results have shown that the biodegradation ability of mulches is increased with irrigation, higher mean temperatures, and lower solar radiance. Ease of use has also been highlighted in existing studies as a motivation for biodegradable mulch adoption, as it reduces labor and waste removal costs after the end of a season (see Madin et al., 2024, for a systematic review of suitability factors).

While the product is still currently under development, the economic research team at the University of Nebraska's Department of Agricultural Economics is examining the potential markets and associated demand for a BioWRAP product. We are focusing our analysis on two types of markets for BioWRAP products: home gardeners and food consumers. Demand by food consumers will affect the willingness of producers to use BioWRAP in agricultural production. It is well known that many factors affect the willingness of agricultural producers to adopt a new type of technology. Factors include changes in production risk, the cost of the technology, the availability of relevant information, and individual preferences, among others. We hypothesize that some of the same factors will affect the willingness of home gardeners to adopt a new practice. While our work on food consumers is ongoing, in this newsletter we describe our approach and some findings about the home gardener research.

Home Gardener Market: While much of the research in the agricultural sector has focused on commercial producers and retail consumers, the home gardening market remains underexplored despite its significant size and potential. The lack of information on the demands and preferences of home gardeners leaves a gap in understanding consumer preferences and behaviors in this space. As interest in eco-friendly gardening practices grows, there is an increasing need to better understand the home gardening market to effectively meet the demands of these consumers. In 2018, 55% of U.S.

households described themselves as “Master”, “Enthusiast”, or “Casual” gardeners (Cohen, 2018). A few studies that have been done on home gardener practices suggest that a significant portion of home gardeners rely on organic methods and products, with about 18% of Missouri households (Tran et al., 2020) and 29% of Tennessee gardeners (Thomas et al., 2020) relying on organic products. This trend suggests a strong potential market for BioWRAP products focused on home gardeners, and that the size of the potential market depends on whether a BioWRAP product is certified organic.

Survey Design: To analyze the potential market for a BioWRAP product among home gardeners, we conducted an online survey in April 2024. The survey was programmed and conducted with Qualtrics. We used the Qualtrics online sampling frame to get a nationally representative group of 2000 home gardeners to answer a survey about the willingness to purchase a BioWRAP product for home garden use. The survey provided a short background on the expected benefits of the BioWRAP technology. The initial questions asked an individual which of the following methods he or she currently uses for weed suppression: 1) sprays or granular products (e.g., chemicals, organic sprays); 2) physical barriers (e.g., mulch, landscape fabric); and/or 3) physical labor (e.g., hand weeding, rototiller). Depending on the response to this question, we asked about what the person currently spends on weed suppression (for physical barriers or sprays) or how much time they spend weeding (for physical labor). All respondents who answered ‘physical labor’ were asked about their willingness to pay for a BioWRAP product that could reduce the time they spend in the garden. Respondents who answered ‘sprays/granular products’ and/or ‘physical barriers’ were asked about their willingness to pay to replace *one* of those products. If someone used both types, we randomly chose which product replacement to ask about in the follow-up questions. Given the common use of organic products in home gardening, we also asked respondents if their willingness to use a BioWRAP product depends on whether it is certified organic. Since the product development is not finalized, we do not know at this time if the final production process will be consistent with USDA certified organic guidelines.

The willingness to pay (WTP) question was designed as a double-bounded contingent valuation (DBCV) question, with values based on the current cost of weed suppression. A DBCV question approach means that a person is initially asked about WTP for a product, and the first question is followed by a second question with a higher (lower) value if the person said yes (no) to the first question. For example, consider a person who spends \$50 per year on physical barriers. Figure 1 provides an example of the structure of the WTP questions that the person would answer in the survey.

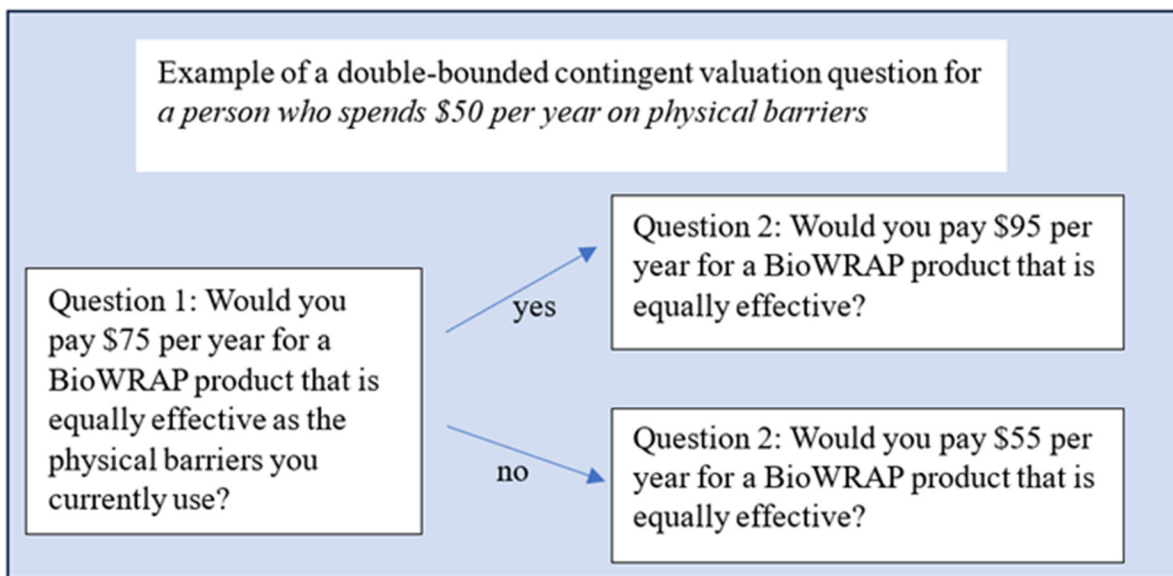


Figure 1: Sample DBCV Survey Question based on Cost

WTP questions for respondents who currently use manual weeding methods were based on reducing the time needed for weeding. For example, consider a person who spends 3 hours per week on physical labor to weed a garden. Figure 2 provides an example of the structure of the WTP questions the person would be asked to answer.

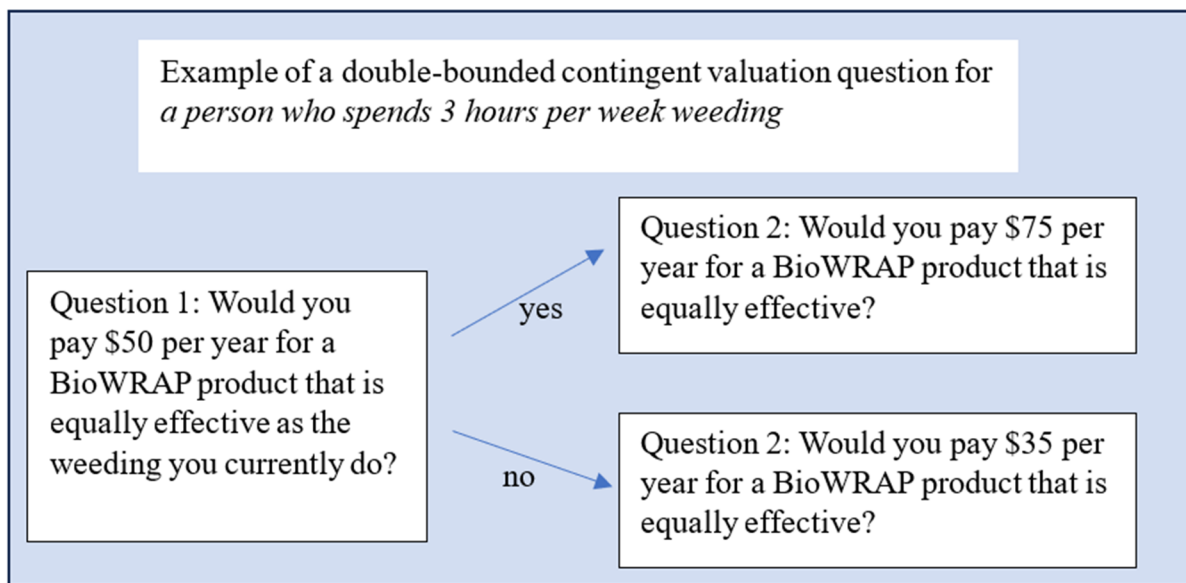


Figure 2: Sample DBCV based on Time

Survey Results and Discussion: We first provide some summary statistics on the characteristics of the respondents and their gardening behavior, and then discuss the statistical analysis of WTP for a BioWRAP product for weed suppression for a home garden.

Respondent demographics and gardening behavior: The respondents are primarily female (about 74% of all replies). Approximately 30%, 37%, 19%, and 14% have garden areas that need to be weeded which are less than 50 square feet, 50 to 200 square feet, 200 to 500 square feet, and more than 500 square feet, respectively. About 28% use spray products to control weeds, 42% use physical barriers, and 88% use manual labor (note that respondents could answer more than one, so the total sums to more than 100%). Of those who use manual labor, about 43% spend less than one hour per week and 25% spend more than two hours per week on weeding.

We asked respondents how much money they currently spend on spray products and physical barriers. For those with a smaller garden (less than 200 square feet), the majority (58%) spend between \$20 and \$50 per year on spray products, and for those with a larger garden (more than 200 square feet), 62% spend between \$25 and \$100 per year on spray products. With physical barriers, a significant minority of respondents (about 22%) do not spend any money and rely on materials they already have available. Of those that do buy material, the most frequent amount is \$20-\$29 (small gardens) and \$50-\$100 (large gardens).

Willingness to pay for a BioWRAP product: The answers to the two WTP questions described in Figures 1 and 2 create four possible ranges of the actual WTP value. For example, if the person described in Figure 2 answers ‘no’ to both Question 1 and Question 2, we know that the WTP is less than \$35 (the WTP value in Question 2). If the person answers ‘yes’ to Question 1 and ‘no’ to Question 2, we know that the WTP is between \$50 and \$75. By varying the dollar values across different respondents, we can narrow down the range and calculate a mean (average) and a median WTP for each group. We can also determine how the WTP varies based on an individual’s characteristics.

To analyze the WTP for a BioWRAP weed suppression product, we separate the sample into four groups: those who use sprays or granular products, those who use physical barriers (but pay for them), those who use free material for physical barriers, and those who use manual labor. We also evaluate WTP for those who are willing to use a product that isn’t certified organic and compare it to the WTP for a product that is certified organic.

We find that income, the size of the garden, and a stated willingness to pay more for environmentally friendly products are significant predictors of WTP for BioWRAP, particularly for those using chemical sprays or granular methods and manual labor. Not surprisingly, we find that the hours per week spent weeding is a statistically significant factor for the WTP to reduce physical labor. Table 1 includes the mean (average) and median WTP values for a BioWRAP product to replace each type of weed suppression product or activity. We consistently find that the WTP is highest to replace sprays and granular products, followed by physical barriers with a cost, manual labor, and no-cost physical barriers (in that order). Part of the reason for this ordering is that a BioWRAP product replacement for sprays or physical barriers will reduce the cost for those materials, while manual labor and free physical barriers do not currently have a monetary cost. Not surprisingly, we also find that the WTP is generally higher for a BioWRAP product if it is certified organic. The WTP for a BioWRAP product to replace free physical barriers is slightly higher for a non-organic product than an organic one (\$38 vs. \$35 for the median and \$63 vs. \$59 for the mean) but the difference is not statistically significant. The median WTP values (i.e., the price where half of respondents will purchase the product and half will not) are consistently lower than the average value. This is typical of most WTP analyses since a small number of individuals with a high WTP will affect the average value but not the median value.

Conclusions: Our results show that the home garden market is potentially a significant one for a BioWRAP product. Continued work in the development of the BioWRAP technology is necessary to determine what the cost of a retail product is likely to be, as well as whether a product will be able to get USDA certified organic status.

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	Spray or granular products	Physical barriers (with a cost)	Manual labor	Free physical barriers
	If a BioWRAP product is certified organic			
Median WTP	\$91	\$68	\$57	\$35
Average WTP	\$143	\$120	\$84	\$59
	If a BioWRAP product is not certified organic			
Median WTP	\$75	\$59	\$54	\$38
Average WTP	\$110	\$101	\$76	\$63

Table 1: Median and Average Willingness to Pay (WTP) for a BioWRAP product to replace each type of weed suppression product (based on an annual WTP value)

Gengchen Cai
Graduate Student
Department of Agricultural Economics
University of Nebraska-Lincoln

Kanij Fatema
Graduate Student
Department of Agricultural Economics
University of Nebraska-Lincoln

Karina Schoengold
Professor, Agricultural Economics
Associate Director, Nebraska Water Center
University of Nebraska-Lincoln
kschoengold2@unl.edu