Journal of Environmental Management 402 (2026) 128980

Contents lists available at ScienceDirect

Journal of Environmental Management

journal homepage: www.elsevier.com/locate/jenvman

Research article

Sustainability signals: The role of heuristics in consumer preferences for peat alternatives

Nymphmary Daphne J. Santiago [a,*], Holger Braun [b], Benedikt Rilling [b], Carsten Herbes [b], Terese E. Venus [a]

[a] Bioeconomy Economics Research Group, University of Passau, Dr.-Hans-Kapfinger-Straße 30, 94032, Passau, Germany
[b] Institute for International Research on Sustainable Management and Renewable Energy, Nuertingen-Geislingen University, Neckarsteige 6-10, 72622, Nuertingen, Germany

ARTICLE INFO

Keywords:
Peat
Consumer preferences
Willingness to pay
Choice experiment
Biochar
Biogas

ABSTRACT

To foster principles of a circular bioeconomy, consumers must adopt more sustainable substitutes. However, for low involvement products, consumers often rely on heuristics such as regional origin rather than detailed sustainability information. To explore how these heuristics affect consumer preferences, we implemented a split-sample design to assess the impact of product origin across multiple dimensions of sustainability. We examined gardeners' willingness to pay for peat alternatives and sustainability attributes of potting soil, a typical low-involvement product in the horticultural industry in Germany. We conducted an online discrete choice experiment with 1037 respondents. Our results show that origin information influences the willingness to pay for peat alternatives, with gardeners showing a clear preference for input materials sourced within Europe even when sustainability claims would signal a better choice. Additionally, gardeners preferred potting soils with an emissions reduction claim and a certification logo. Our study suggests that including origin information on regional product labels would increase their acceptance. Our findings also suggest strong market potential for digestate and biochar as peat alternatives, but successful adoption will require coordinated efforts from industry and policymakers to guide consumers, ensure credible certification, and counteract origin-based heuristics that disadvantage sustainable, yet globally sourced products.

1. Introduction

The transition to a circular bioeconomy depends not only on technological innovations across sectors but also on consumers' willingness to adopt more sustainable products (Aza-Mengoa et al., 2025; Thøgersen, 2005; Trudel, 2019; Venus et al., 2024). While sustainability labels and environmental claims are intended to guide purchasing decisions, consumers often rely on simplified heuristics rather than detailed sustainability information, particularly when purchasing low-involvement products, which are typically inexpensive, frequently purchased and low risk products that consumers purchase with less cognitive effort (Hoyer, 1984; Hoyer and Brown, 1990; Kunamaneni et al., 2019; Meng Leong, 1993). In such contexts, consumers often rely on observable cues that reduce cognitive effort, even when these cues do not reliably reflect environmental performance.

One of the most prominent heuristics in sustainable consumption is regional origin. A dominant paradigm in sustainable discourse assumes that regional chains are more sustainable than global ones, largely based on the assumption that shorter transport distances equate to lower environmental impacts (Brunori et al., 2016). This heuristic, often reflected in calls to "buy local" or reduce "food miles" to minimize climate impact is widely promoted in sustainable food debates (Schmitt et al., 2017), yet it can be misleading. For example, Coley et al. (2009) and Grebitus et al. (2013) show that carbon emission per unit of produce over the transport chain matters more for a life-cycle assessment of climate impact. In some cases, globally sourced products can outperform regional alternatives. For example, Saunders and Barber (2008) found that, despite being transported over long distances, dairy products from New Zealand used half as much energy to get to the UK market as did regional dairy products. This demonstrates that regional origin is not a dependable proxy to guide consumers toward sustainable consumption choices.

Importantly, preferences for regional origin are not driven solely by environmental reasoning. It is also affected by consumer ethnocentrism

* Corresponding author. Dr.-Hans-Kapfinger-Straße 30, 94032, Passau, Germany.
E-mail address: Nymphmary.Santiago@uni-passau.de (N.D.J. Santiago).

https://doi.org/10.1016/j.jenvman.2026.128980
Received 23 September 2025; Received in revised form 19 January 2026; Accepted 9 February 2026
Available online 24 February 2026

(Shimp and Sharma, 1987). Consumers have been found to prefer regionally sourced products due to beliefs about superior quality, positive impacts on the local economy, and negative environmental and social impacts in the source country (Coley et al., 2009; Contini et al., 2017; Fait et al., 2022; Mengelkamp et al., 2019; Profeta and Hamm, 2019; Scherer et al., 2018). However, these assumptions become problematic when applied universally to all regional products as they reinforce positive biases toward certain goods (Lazzarini et al., 2017).

Both misleading environmental assumptions and ethnocentric preferences are particularly influential when consumers face limited time, attention, or motivation to process complex information. In these cases, simple heuristics can serve as cognitive shortcuts. This has been well-established not only for food products but also other non-food low involvement products (Hoyer, 1984; Hoyer and Brown, 1990; Kunamaneni et al., 2019; Meng Leong, 1993). As a result, sustainability labels and environmental claims may be overshadowed by more salient but less informative signals such as product origin.

One low involvement product of particular interest to sustainable production and consumption is potting soils. Potting soils play a central role in horticulture and home gardening and have attracted increasing policy attention due to efforts to phase out peat, a carbon-intensive input associated with substantial greenhouse gas emissions. Despite their environmental relevance, potting soils are typically purchased with little deliberation, which makes them an ideal case for studying how heuristics and sustainability signals interact in consumer decision-making. Thus, we examine the influence of sustainability signals on consumer preferences for low-involvement products. Our empirical case focuses on potting soil in Germany with information about the product's origin, reduced CO_2 emission claim and a certification logo as well as gardeners' preferences for potting soils.

2. Peat alternatives and consumer preferences

2.1. Peat use and policy targets in Germany

Germany is the largest peat consumer and producer in the EU (Hirschler et al., 2022), with peat serving as a major component of potting soils. As peatlands are natural carbon sinks that play a valuable role in climate protection, habitat provision, and hydrological balance (Heindorf et al., 2025; UNEP, 2022), peat extraction for horticulture purposes represents a major environmental pressure and is one of the primary contributors to peatland degradation (UNEP, 2022).

In Germany, peat currently accounts for 65% of the raw materials for professional substrates and 33% of the raw materials for consumer potting soils. A total of 4.7 million m^3 of peat was used for substrate production in Germany in 2024 (IVG and GGS, 2025). To mitigate these impact, Germany has prioritized reducing peat in horticulture (Hirschler et al., 2022). Aligned with the German "Climate Action Plan 2050," the Federal Ministry of Food and Agriculture (BMEL) developed a peat reduction strategy to eliminate peat use in hobby gardening by 2026 on a voluntary basis and to reduce its use in the commercial horticultural sector by 2030 (BMEL, 2022; BMUB, 2016). These policy efforts have helped reduce the share of peat used as a raw material in the hobby sector from 48% in 2021 to 33% in 2024, saving a total of 1.45 million m^3 (IVG and GGS, 2022, IVG and GGS, 2025).

Nevertheless, peat-based potting soils remain the most popular product in the hobby gardening market. In 2024, only 23% of products sold in this sector in Germany were peat-free (Hirschler et al., 2022; IVG and GGS, 2025; UNEP, 2022). Despite the promotion of peat alternatives and the impetus of political momentum, the transition away from peat in consumer markets has been slow. Consumer preferences represent a key obstacle (Hirschler and Osterburg, 2025). For example, cocopeat is sourced from global value chains but may be perceived negatively by consumers, although life cycle assessments show cocopeat has a lower carbon footprint than peat-based potting soils (Quantis, 2012). Other alternatives sourced from Europe, such as biogas digestate or materials from coal mine restoration, also face negative consumer perceptions (Zwicker et al., 2023) despite their superior life cycle performance. Without shifts in consumer perceptions, the consumption patterns of hobby gardeners are unlikely to change, and the goal of eliminating peat by 2026 is unlikely to be achieved.

2.2. Consumer preferences for potting soils

Potting soils have been widely studied in consumer research. The greatest focus has been on the types of substrates in potting soils, especially biogas digestate (Dahlin et al., 2017, 2019; Herbes et al., 2020) and biochar (Choi et al., 2020; Silwal et al., 2023; Thomas et al., 2021). Compost was also frequently examined (Glenn et al., 2024; Klopčič et al., 2021; Vigoroso et al., 2021; Waliczek et al., 2020), however primarily as mono material and not as ingredient of mixed potting soil products. Other materials such as coco peat or bark have not yet been covered by detailed consumer research.

Existing studies show that consumers largely reject peat (Dahlin et al., 2019; Herbes et al., 2020; Rilling et al., 2025). Although some consumers prefer peat-based products, providing information about peat increased their acceptance of peat-free products (Lehberger et al., 2025). Beyond peat, consumers value organic products (Dahlin et al., 2017, 2019; Herbes et al., 2020; Penn et al., 2025) and biochar as an ingredient (Silwal et al., 2023; Thomas et al., 2021), particularly when derived from agricultural by-products or wood waste (Choi et al., 2020; Hirschler and Thrän, 2023). Other raw materials, such as guano met both positive and negative responses from consumers (Dahlin et al., 2019; Herbes et al., 2020). In contrast, revealing that the raw materials came from a biogas plant reduced utility for consumers (Dahlin et al., 2019; Herbes et al., 2020).

Another important aspect of potting soil is its use. For example, past studies have found that consumers prefer special-purpose-products over general-purpose potting soils (Dahlin et al., 2017, 2019; Penn et al., 2025). Also, color of the soil was important as consumers preferred dark potting soil over lighter products (Dahlin et al., 2017; Rilling et al., 2025). All studies found that price is a predominant attribute (e.g. (Dahlin et al., 2019; Dahlin et al., 2017; Penn et al., 2025; Rilling et al., 2025).

Several potentially important attributes remain under explored. Specifically, the origin of materials and eco-labels have been largely overlooked for potting soil. Thus, we contribute by considering the origin of a particular substrate (coco peat) and the sustainability labels. Further, as past studies often focused on one input material, we contribute be comparing several substrate alternatives.

3. Material and methods

3.1. Choice experiment

We used a choice experiment (CE) to elicit consumer preferences and valuations. We selected CE over contingent valuation (CV) because consumers evaluate potting soil based on its different attributes (Braun et al., 2024; Rilling et al., 2025).

CEs are rooted in both McFadden's random utility theory and Lancaster theory. The former assumes consumers maximize utility within budget constraints, while the latter posits that utility derives from product attributes rather than the product itself (Lancaster, 1996; McFadden, 1994). According to this theory, the nth consumer's utility for choosing alternative j is specified by equation (1):

$$U_{njt} = \beta_i X_{njt} + \varepsilon_{njt} \quad (1)$$

where n is the individual choice probability; j is the alternative in the choice set t; β_i refers to the vector of individual parameters; X_{njt} is the vector of observed variables related to the alternative j and individual i; and ε_{njt} is the unobserved error term which is assumed to be independent

of β and X.

The theory presumes homogenous preferences and the independence of irrelevant alternatives (IIA). However, the presumption of homogenous preferences and the principle of IIA do not usually hold in reality. We assumed that hobby gardeners have varied preferences for potting soils. Hence, we employed a mixed logit model (MXL) instead of a multinomial logit model (MNL) to account for heterogeneous preferences and to assess the effect of the information treatment. The MXL model accounts for random taste variation and correlation patterns across random parameters (Train, 2002). It relaxes the IIA assumption and assumes a heterogeneous preference for individuals.

The willingness to pay (WTP) for each attribute is calculated as the ratio of the partial derivative of the utility function with respect to the attribute of interest, divided by the derivative of the utility function with respect to the variable "Price" (van Loo et al., 2011).

3.2. Defining attributes, levels, and hypotheses

Table 1 shows the attributes and levels we defined for our experiment. The definition of attributes and their levels was based on two factors: consultations with two experts in the horticulture sector and a literature review of studies examining WTP for potting soils and related products. Below, we provide further explanation for the selection of these attributes.

The choice of peat alternatives both from and not from the EU was made because phasing out peat will require both regional and international alternatives. The four alternatives were chosen based on their quality, availability, and environmental sustainability.

Biochar is a charcoal-like material produced through pyrolysis. It can be derived from various feedstocks, including waste from wood, agriculture, and food. It is highly regarded due to its capacity to store carbon when used as a soil amendment (Thomas et al., 2021). Thus, the alternative was chosen expecting a positive consumer reception.

Biogas digestate is a by-product of anaerobic digestion (Herbes et al., 2020). It is widely available in Germany as the country is the leading biogas producer in Europe and the world with close to 9900 biogas plants operating in 2023 (Fachverband Biogas, 2024). Digestate-based potting soils are available in the market, e.g. by NADU brand (NADU, 2025), adding to its relevance in Germany and to our choice list. As Dahlin et al. (2019) found that customers were deterred by "biogas residues," while "from renewable resources" attracted them, and Horschig et al. (2020) found limited approval of biogas, we offered this choice anticipating a negative consumer reception.

Coal waste from the restoration of coal mines is another peat alternative available in Germany. Several initiatives have sought to repurpose coal waste to minimize the environmental impact of coal mining (Weiler et al., 2018). Due to its association with coal mining, which is generally viewed negatively (Oei et al., 2020), we added this choice option expecting a negative consumer reception.

Finally, cocopeat, or coir pith, is a waste product of the coconut industry (Barrett et al., 2016). There are no studies yet regarding consumer preferences for coco peat. However, since it is not available in Germany and is sourced from outside Europe, we added this choice anticipating a negative consumer reception.

These peat alternatives are not perfect substitutes and could be complementary. Apart from coco peat, the alternatives would only be used in smaller quantities mixed with bulk materials such as compost. This means that a potting soil could and, in most cases will, contain a combination of different peat alternatives. We sought to determine which alternative input material is most and which least valued by target consumers.

Tied to these peat alternatives were the four levels of claimed emissions reduction shown in Table 1. Studies have shown mixed results on consumer preferences for carbon neutral labelled or products with eco-labels or reduced emission claims. Some studies have found positive preference (Canavari and Coderoni, 2020; Chen et al., 2024; Khachatryan et al., 2021; Lami et al., 2022), while others have found no influence on consumer choice (Lampert et al., 2017). In this study, we expect a positive reception from consumers.

Additionally, we examined the WTP for a product certified as ecologically and socially sustainable. Certification logos used in labeling have been established to ensure product sustainability. In Germany, the Federal Ministry of Food and Agriculture (BMEL) commissioned Meo Carbon Solutions GmbH to develop and implement an international certification system for peat substitutes. This initiative aligns with the German Federal Government's Climate Action Plan 2050 and the Peat Reduction Strategy. As several studies have shown a WTP for certified pro-environmental and sustainability attributes (Aguilar and Vlosky, 2007; Herbes et al., 2020; Liao et al., 2025; Morone et al., 2021), we included this attribute to test consumer acceptance to new labelling schemes.

Lastly, price is included as it is the main factor that affects purchasing decisions (Braun et al., 2024; Dahlin et al., 2019). Four levels were selected for price to reflect the range of current market prices of different compositions of potting soils and to avoid the number-of-levels effect (van Loo et al., 2011; Yin et al., 2017).

We employed a split-sample design in which one group received origin information (the "treatment" group) while the other did not (the "control" group). We focused on origin as studies have pointed out the importance of place-of-origin as a key factor in shopping decision-making (Czine et al., 2025; van Loo et al., 2019). Origin labeling could also not be used as an attribute since some peat alternatives, such as coco peat, can only be sourced outside of Europe. Thus, we expect that consumers in the two groups will have different preferences, and that information will affect participants in the treatment group by leading to a higher WTP for regional products compared to imported ones.

Table 1
Attributes and levels for potting soil.

Attribute	Description	Levels
Input/Material Label	Label for additional input of each peat alternative	• No label • With biochar [from EU] • With biogas digestate [from EU] • With coal from the restoration of coal mines [from EU] • With cocopeat [Not from EU]
Reduced emission claim	Label for reduction in emissions	• No reduction of emissions claim • 10% emissions reduction • 30% emissions reduction • 50% emissions reduction
Ecological and social sustainability logo	Certification from HORTICERT	• No logo • HORTICERT logo
Price	Price of the potting soil per 60 L	• 4 € • 9 € • 14 € • 19 €

Note: For the attribute "input label," the text in brackets refers to the text shown to the treatment group, who received additional information about the origin of the input material.

3.3. Experimental design and data collection

The full factorial design includes 160 profiles and 8480 choice tasks. Thus, we used fractional factorial design. To limit consumer cognitive burden (Train, 2002), we designed the experiment with 24 choice tasks divided into four blocks of six choice tasks each. An opt-out alternative was added to simulate a real shopping experience where consumers have the choice not to buy any item (Hensher, 2010; Lusk and Schroeder, 2004; van Loo et al., 2011).

Before data collection, a face-to-face pilot study was conducted at

garden shows in Wangen, Kirchheim, Baechingen, and Sinsheim, as well as with the general public at the University of Passau and Nürtingen from May to August 2024, involving 104 participants. The results were used to improve the choice design for the final survey. The choice design was created with Stata's *dcreate* command using D-efficient design (Hole, 2016), which reduces co-variances of parameter estimates and is commonly used in consumer studies (van den Broek-Altenburg and Atherly, 2020; van Loo et al., 2011). Fig. 1 shows a sample of the final choice cards and a comparison between the control group (a) and the treatment group (b).

We used a scenario description and cheap talk to mitigate hypothetical bias (Appendix 1). The order of the blocks was also randomized to ensure that each respondent received a different block of choice tasks. All other attributes not presented in the CE were assumed the same across the product alternatives. Explanations about the meaning of attributes and the corresponding levels were also provided to the participants (Appendix 2). After the CE, participants were also required to complete an exit questionnaire (Appendix 3).

We conducted an online survey in Germany in September 2024. A panel company recruited respondents, and a survey platform ran the tests. To obtain a nearly representative sample of hobby gardeners, quotas were based on national gender, state, and income statistics. Only individuals who had purchased potting soil in the past three years were included.

Our final sample consisted of 1037 participants. We also obtained ethical clearance from the Ethics Committee of the University of Passau, with reference number II/SANTI.I-07.5095/24-07-002, to ensure that participation was voluntary, and that data were handled responsibly.

4. Results

4.1. Ecological, social, and quality perceptions of peat and alternatives

Table 2 shows assessments on a 5-point Likert scale of consumer perceptions regarding the quality, ecological impact, and social impact of peat and peat alternatives, with 5 indicating a positive perception and 1 indicating a negative perception. In this assessment, "Peat" is included to measure the default consumer perception.

Examining ecological perceptions, we found significant differences between control and treatment groups for biochar, cocopeat, and biogas digestate. In the treatment group, average ecological perception of biochar decreased slightly, while cocopeat decreased markedly, possibly because it is sourced outside Europe. In contrast, perceptions of biogas digestate were slightly higher in the treatment group.

Regarding social perceptions, respondents rated peat and its alternatives low, indicating negative views of their social impact. Significant differences emerged between control and treatment groups for peat and biogas digestate: peat was rated lower in the treatment group, while biogas digestate and coal were rated slightly higher. By contrast, biochar and cocopeat were rated slightly lower in the treatment group.

The third grouping of preferences—product quality—show that peat and peat alternatives were, on average, rated above three (3) on the 5-point scale. Although peat has ideal horticultural characteristics compared to other peat alternatives, it was not rated as high as 4 or 5 by

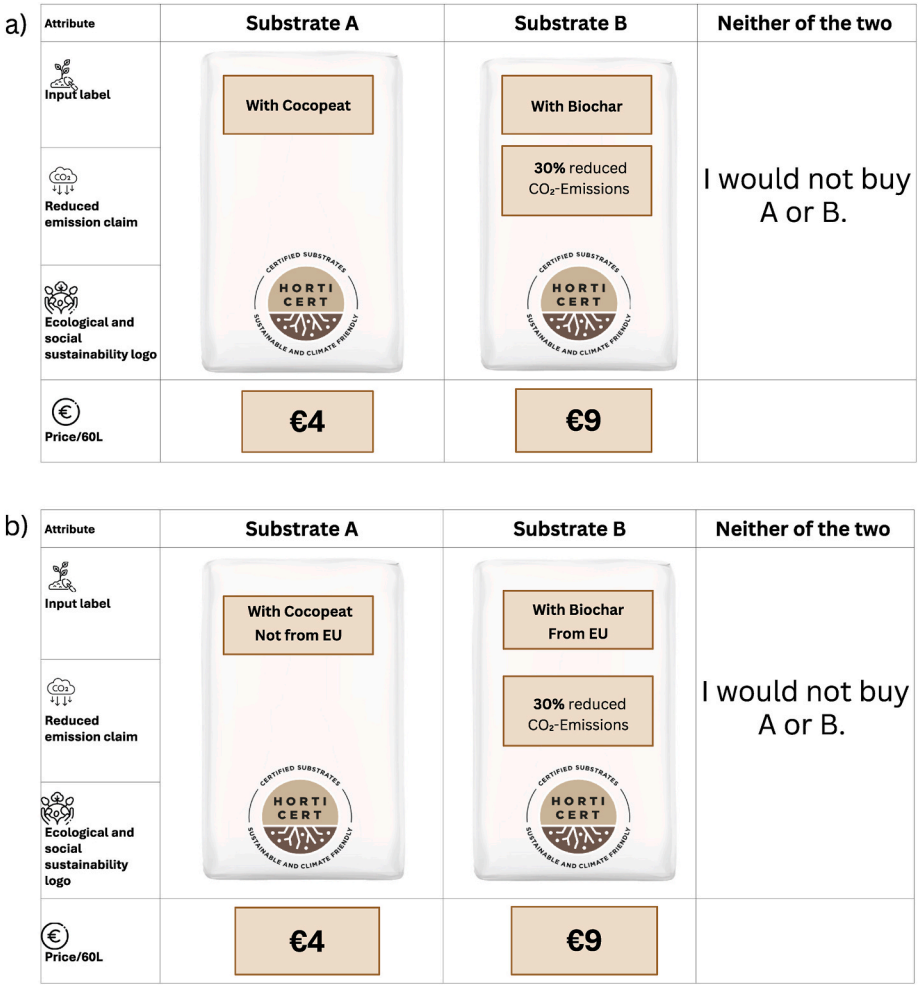

Fig. 1. Comparison of the translated choice cards for the control (a) and the treatment (b).

Table 2
Ecological, social, and quality perceptions and knowledge of peat and peat alternatives.

Variable	Control (n=524)	Treated (n=513)	Difference
Ecological (Mean)			
Peat	2.66	2.65	0.01
Biochar	3.16	3.12	0.04***
Cocopeat	3.34	2.26	0.07***
Coal	2.54	2.55	−0.01
Biogas Digestate	3.41	3.48	−0.07***
Social (Mean)			
Peat	2.82	2.73	0.09***
Biochar	2.89	2.87	0.02*
Cocopeat	2.77	2.74	0.03*
Coal	2.68	2.70	−0.03**
Biogas Digestate	3.11	3.16	−0.06***
Quality (Mean)			
Peat	3.35	3.35	0.00
Biochar	3.36	3.36	0.01
Cocopeat	3.40	3.42	−0.02*
Coal	3.06	3.08	−0.02
Biogas Digestate	3.49	3.48	0.00
Knowledge score	60.84	62.92	−2.08***

Note: ***, **, * are significant at 1%, 5% and 10% level, respectively.

the participants, indicating that they were unable to correctly evaluate the horticultural quality of peat, so by extension were unable to do so for its substitutes. Revealing origin information made no significant difference in perceptions of product quality except for the case of cocopeat, where perceptions of its quality were higher in the treatment group than in the control group.

4.2. Estimation of willingness to pay

In the MXL model, the significance and direction of the coefficients indicate preferences for potting soil attributes. Positive coefficients reflect a preference for a specific attribute, whereas negative coefficients suggest a lack of preference. Table 3 presents the results for the full sample, control and treatment groups.

In the full sample, among the peat alternatives, only biochar and biogas digestate had positive and significant coefficients at the 1% level that suggest a preference among consumers for these alternatives. The result for biochar aligned with our hypothesis, while the result for biogas digestate differed. The change in preference for biogas digestate is potentially due to increased awareness of the importance of biogas as a source of renewable energy following the onset of the war between Ukraine and Russia.

Meanwhile, cocopeat had a positive coefficient and coal had a negative coefficient, but neither was significant. The result for cocopeat differed from our hypothesis, while the result for coal aligned with our hypothesis. Our hypotheses were based on the full sample and did not account for differences within each group. However, we generally expected that origin information would influence preferences, leading consumers to favor regional products over imported ones.

Overall, in the full sample, biochar was the most valued alternative, followed by biogas digestate. Both the reduced emission logo and the HORTICERT logo had positive and significant coefficients as we hypothesized, indicating consumer preference for products with sustainability signals.

As expected, both price and the alternative-specific constant (ASC) for the no-buy option were negative and significant at 1%. A negative price coefficient indicates that consumers showed less preference for a potting soil with a higher price. A negative ASC indicates that respondents preferred to choose a potting soil rather than opt out (van Loo et al., 2021).

We further examined differences between the control and treatment groups. Significant differences in preferences for the peat alternatives were observed between the control and treatment groups. For the other attributes such as the reduced emission claim, the HORTICERT logo, and price, Table 3 shows that there were no substantial differences. In the control group, which did not receive origin information, cocopeat and biochar had positive and significant coefficients. Although biogas digestate had a positive coefficient and coal had a negative coefficient, neither was significant. In the treatment group, which received origin information, biogas digestate, biochar, and coal had positive coefficients, but only the first two were significant. Although not significant, the difference in the direction of the coefficient for coal between the two groups somehow signals the effect of origin information. The fourth alternative, cocopeat, had a negative coefficient significant at the 5% level. This suggests the preference for cocopeat is lessened when its origin outside the EU is revealed.

To further examine the effect of origin information on cocopeat, we also tested the interaction term between the information treatment and the utilities for cocopeat. The results are shown in Table 3 for the full sample. The explicit addition of information showing that cocopeat comes from outside the European Union led to negative utilities that

Table 3
Results of mixed logit model comparing between control and treatment groups and a full sample including interaction terms for individual-specific variables.

	Full sample	Control group	Treatment group	Full sample with interaction terms
	Coefficient	Coefficient	Coefficient	Coefficient
Attributes				
Biochar	0.43***	0.33***	0.53***	0.41***
	(0.09)	(0.13)	(0.14)	(0.09)
Cocopeat	0.09	0.41***	−0.28**	0.48***
	(0.09)	(0.12)	(0.14)	(0.11)
Coal	−0.07	−0.18	0.06	−0.06
	(0.08)	(0.11)	(0.11)	(0.08)
Biogas Digestate	0.38***	0.15	0.62***	0.39***
	(0.09)	(0.12)	(0.13)	(0.09)
HORTICERT Logo	0.36***	0.32***	0.37***	0. 35 ***
	(0.06)	(0.08)	(0.09)	(0.06)
Reduced Emission Claim	0.02***	0.02***	0.02***	0. 02 ***
	(0.00)	(0.00)	(0.00)	(0.00)
Price	−0.22***	−0.22***	−0.22***	−0.22***
	(0.01)	(0.01)	(0.01)	(0.01)
ASC: No buy	−2.06***	−2.09***	−2.03***	−2.09***
	(0.09)	(0.12)	(0.12)	(0.09)
Interaction terms				
Cocopeat x Information Treatment				−0.80 ***
				(0.15)
Perceptions				
Ecological x Biochar				0.16*
				(0.08)
Ecological x Cocopeat				0.43***
				(0.09)
Ecological x Coal				0.30**
				(0.07)
Ecological x Biogas Digestate				0.33***
				(0.09)
Social x Biochar				0.19**
				(0.09)
Social x Cocopeat				0.09
				(0.09)
Social x Coal				0.06
				(0.08)
Social x Biogas Digestate				0.05
				(0.09)
Observations	18,666	9432	9234	18,666
Log-likelihood	−5388.89	−2698.24	−2666.48	−5315.79
AIC	10,805.79	5424.49	5360.97	10,695.59
BIC	10,915.47	5524.62	5460.79	10,946.3

Note: ***, **, * are significant at 1%, 5% and 10% level, respectively. The figures in parentheses are standard errors.

implies a lack of preference for cocopeat when origin information was provided.

The last column of Table 3 lists the results of the MXL model's interaction terms for the individual specific variables related to ecological and social perceptions. The results show positive and significant coefficients for the interaction between ecological perceptions and peat alternatives. In terms of social perception, all coefficients were positive, but only the interaction term between social perception and biochar is significant. This implies that the more highly an individual perceives the social impact of biochar, the more likely he or she is to choose it.

To assess model goodness-of-fit, we used the Bayesian Information Criterion (BIC) and the Akaike Information Criterion (AIC), both widely used penalized model selection criteria (Kuha, 2004; Mariel et al., 2021). The MXL model presented yielded lower BIC and AIC compared to the MNL model and MXL models with fewer Halton draws. All the models presented are estimated by maximum simulated likelihood using 1000 Halton draws.

Table 4 shows the WTP for the attributes in the full sample, control and treatment groups. It also presents the results of tests for differences in mean WTP estimates between the treatment and control groups. There were no significant differences for the reduced emission claim and the HORTICERT logo since the treatment was introduced only for the peat alternatives. Attributes are assumed to be independent unless an interaction term is explicitly modeled. Consequently, we focus here only on peat alternatives between the two groups.

For all peat alternatives, there were differences in WTP between the two groups. For cocopeat, the difference was significant at the 1% level, implying that respondents who received information about the origin were less likely willing to pay for cocopeat. In contrast, for the other peat alternatives that can be sourced from Europe, the differences were also significant at the 1% level. The WTP for these alternatives was higher in the treatment group than in the control group. Respondents who received information about the origin were willing to pay more for biogas, biochar, and coal than those who did not. These results may indicate consumer ethnocentrism that suggests positive bias towards regional products.

Table A1 (see Appendix A.4.) shows the results of the MXL model's interaction terms for the attributes and the individual specific variables related to the involvement index and knowledge score. The interaction coefficients between the involvement index and peat alternatives were negative and significant, suggesting that individuals who are less involved than average have higher utilities for these input materials, while those who are more involved than average have lower utilities for them. In contrast, the coefficients for the interactions between the involvement index and reduced emission claim was positive and significant, suggesting that individuals who are more involved than average are more likely to prefer potting soils that present a quantifiable emissions reduction figure. The interaction term for knowledge score and the reduced emission claim was positive and significant, implying that individuals who scored higher than average on the test were more likely to prefer potting soils with the claim. In contrast, the interaction term for knowledge score and price was negative and significant, indicating that individuals with higher test scores were less likely to prefer potting soils with higher prices.

Table 4
Comparison of Mean WTP of peat alternatives for mixed logit between control and treatment.

Attributes	Full sample	Control	Treated	Difference	P-value
Biochar	1.95	1.49	2.42	−0.93	0.00
Cocopeat	0.35	1.90	−1.24	3.14	0.00
Coal	−0.29	−0.84	0.26	−1.11	0.00
Biogas Digestate	1.72	0.71	2.76	−2.05	0.00
Reduced Emission Claim	0.08	0.08	0.08	−0.00	0.94
HORTICERT Logo	1.58	1.51	1.65	−0.13	0.36

5. Discussion

Theoretically, our results contribute to the literature on heuristics and sustainable consumption by showing that product involvement affects the relative importance of information cues in consumer decision-making. While prior research emphasizes that low involvement increases reliance on heuristics, our findings demonstrate that this reliance systematically reorders attribute importance. Specifically, salient cues such as origin and material perceptions to dominate over verified sustainability labels. Empirically, this mechanism is reflected in our peat-related results, where preferences for specific input materials and origin cues outweigh the effects of emissions reduction claims and certification.

5.1. The effect of origin information in influencing choices

Our findings provide clear evidence of a strong origin heuristic in consumer decision-making, whereby product origin serves as a dominant cue even in the context of low-involvement products such as potting soils. This confirms that origin information can strongly affect choices when consumers rely on simplified decision rules rather than detailed attribute evaluation, consistent with earlier findings for low-involvement goods (Ahmed et al., 2004). More broadly, our results align with prior research showing a systematic bias toward domestically produced products in developed countries (Okechuku and Onyemah, 1999; Wang and Lamb, 1980) and reinforce evidence that German consumers place particularly high value on local and regional origin (Evanschitzky et al., 2008; Lampert et al., 2017; Profeta and Hamm, 2019; Scherer et al., 2018). This presents both opportunities and challenges for retailers and policymakers. Retailers offering regionally sourced products can benefit from clearly providing origin information, while this may pose potential barriers for globally sourced products like cocopeat. Consequently, for globally sourced products, retailers might consider avoiding highlighting displays of origin or instead presenting it alongside sustainability information to help mitigate potential negative biases.

5.2. The effects of reduced emissions claim and certification logo in influencing choices

We find that both sustainability attributes (emissions reduction claims and certification logo) increase a product's utility value to the consumer. This is consistent with previous research that respondents prefer products with a low environmental impact as a means of mitigating CO_2 emissions (Canavari and Coderoni, 2020; Chen et al., 2024; Lami et al., 2022). For potting soils in particular, Dahlin et al. (2019) report preferences for products made from renewable resources and carrying a peat-free label, which is in line with our findings that consumers value environmentally friendly alternatives. Growing awareness of the environmental consequences of peat extraction (Alexander and Williams, 2013) may further contribute to this pattern.

The positive value perceived by the HORTICERT logo suggests that consumers appreciate credible sustainability indicators. However, their purchasing decisions appear to be driven more by subjective beliefs about the sustainability of different input materials than by third-party certified information about environmental impact, as this attribute was less important to overall preferences than the choice of peat alternative.

5.3. Role of perceptions, knowledge, and involvement

We find that product preferences are also determined by consumer perceptions of the ecological and social impacts of the input materials. This reinforces the idea that consumer understandings of sustainability

are often affected by their subjective beliefs (van Bussel et al., 2022). This is particularly evident for cocopeat: despite its strong performance in life cycle assessments (Quantis, 2012), disclosing its global origin caused products using it to fall significantly in utility value. This highlights a challenge for fostering more sustainable consumption: imported products with superior life cycle performance may face resistance if they conflict with existing heuristics and social values held by consumers, particularly with preferences for regional products.

Contrary to expectations, the role of involvement was negatively associated with potting soils made with alternative materials or peat alternatives. While one might expect that involved gardeners would be more open to peat alternatives, our findings suggest that these individuals might prefer traditional peat due to familiarity, or skepticism toward new materials. Highly involved consumers are more resistant to change, especially if the alternatives do not offer greater performance or benefits at prices comparable to their conventional counterparts (Rahman, 2018). This aligns with previous research showing that high-involved consumers evaluate products more critically and are not easily swayed by cues (Rahman, 2018). In some instances, this does not necessarily lead to the purchase of sustainable products. It depends on which attribute highly involved consumers consider important. Our results nuance prior evidence by showing that, for low-involvement products such as potting soils, heuristic cues (e.g. origin and material perceptions) can outweigh sustainability claims even among consumers who are otherwise environmentally aware, highlighting that low involvement can override pro-sustainability intentions at the point of purchase.

Finally, consumer knowledge significantly moderates the reduced emissions claim. A potential reason for this could be that knowledge of the renewability or non-renewability of peat and peat alternatives is closely associated with CO_2 emissions. Previous research has also shown similar results indicating that knowledge influences sustainable choices (Li, 2025; Peschel et al., 2016). This implies that increasing knowledge might encourage consumers to prefer products with higher levels of emissions reduction.

5.4. Implications for stakeholders

Overall, our results show that consumers value information on input materials, CO_2 emissions reductions, and sustainability certification, although preferences are driven most strongly by the type of material used.

For retailers, origin information should be used strategically. Retailers of biochar, biogas digestate and coal would benefit from a regional label. For retailers of cocopeat, it is likely disadvantageous to disclose its origin. Retailers can address misperceptions associated with origin by using scientifically backed claims, such as the reduced emissions claim and the credible certifications.

For policymakers, the acceptance of regional peat alternatives signals potential for further investment and development of peat substitutes. This is especially true for the biogas industry, which is seeking additional income sources through digestate sales outside agriculture, and for the biochar industry, where our findings signal a positive outlook. Other alternatives, such as sphagnum (i.e., peat moss), another type of peat that has received academic and industry attention (BMEL, 2022), can also be explored.

Additionally, the lack of information about peat alternatives must be addressed to ensure their proper use, as respondents rated the quality of peat and its alternatives similarly, despite peat having the most ideal horticultural characteristics. For example, consumers using peat alternatives for the first time might be disappointed by their water retaining capacity. Without additional instructions on watering, they might encounter failures and return to peat.

The positive effect of the HORTICERT certification, commissioned by the German government to improve consumer understanding of peat alternatives, highlights the importance of standardized sustainability communication. However, as certification remains voluntary, complementary policy measures may be needed to encourage uptake, particularly given our finding that certification increases the attractiveness of peat alternatives.

6. Conclusions

To contribute to the transition towards a peat-free horticultural industry, we assess consumer preferences for potting soils containing peat alternatives and sustainability attributes in Germany. Our findings demonstrate that consumers show a clear preference for peat alternatives sourced within Europe over those sourced from outside the region. Retailers of biochar, biogas digestate, and coal should provide origin information as a marketing strategy to emphasize desirable product regionality. Retailers of products such as cocopeat can either avoid explicitly communicating origin or address information asymmetries by communicating that globally sourced products are not inherently unsustainable. Information campaigns have established the groundwork, but they have not been successful in changing consumer behavior. New ways or strategies are needed to overcome misconceptions.

Moreover, we found that consumers are willing to pay for potting soils with environmental attributes such as CO_2 reduction claims and certification logos, specifically the HORTICERT logo. Enhancing communication about these attributes could help counter the prevailing notion that regionally sourced potting soils are inherently more sustainable than globally sourced ones, and address misconceptions surrounding the ecological and social impacts of peat alternatives.

One of the limitations of this study is the inherent nature of the choice experiment, which is hypothetical. Stated intentions do not always translate into actual purchasing behavior (Hensher, 2010). The lack of real-world monetary involvement may have influenced responses. Further research using non-hypothetical scenarios could help address these biases, while investigating consumer preferences for mixtures of peat alternatives would provide deeper insights into market demand. Future studies should use qualitative methods to better understand the subjective beliefs that consumers hold about specific alternative potting soil input materials and comparison to other regions with high peat consumption. Additionally, future studies could focus on industry perceptions of labelling (e.g., additional bureaucracy) within voluntary certifications schemes.

CRediT authorship contribution statement

Nymphmary Daphne J. Santiago: Writing – original draft, Methodology, Investigation, Formal analysis, Writing – review & editing, Conceptualization. **Holger Braun:** Writing – review & editing, Resources, Conceptualization. **Benedikt Rilling:** Writing – review & editing, Resources, Conceptualization. **Carsten Herbes:** Writing – review & editing, Resources, Conceptualization. **Terese E. Venus:** Writing – review & editing, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This research was conducted as part of the project “ReValueD”, supported by the Federal Ministry of Research, Technology and Space within the Bioeconomy as Societal Change Initiative (FKZ: 031B1284). This work was also supported by the Fachagentur Nachwachsende Rohstoffe e.V. on behalf of the Federal Ministry for Food and Agriculture [grant number 2221MT018A, 2021].

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvman.2026.128980.

Data availability

Data will be made available on request.

References

Aguilar, F.X., Vlosky, R.P., 2007. Consumer willingness to pay price premiums for environmentally certified wood products in the U.S. For. Pol. Econ. 9 (8), 1100–1112. https://doi.org/10.1016/j.forpol.2006.12.001.

Ahmed, Z.U., Johnson, J.P., Yang, X., Kheng Fatt, C., Sack Teng, H., Chee Boon, L., 2004. Does country of origin matter for low-involvement products? Int. Market. Rev. 21 (1), 102–120. https://doi.org/10.1108/02651330410522925.

Alexander, P.D., Williams, R.H., 2013. Growing Market Share - Barriers to Uptake of Peat-Free Growing Media by UK Amateur Gardeners, 982. International Society for Horticultural Science, pp. 123–130.

Aza-Mengoa, G.A., Bajos-Arguello, K., Venus, T.E., 2025. The role of social innovation in the bioeconomy: The case of Costa Rica's pineapple value web. J. Environ. Manag. 393, 126748. https://doi.org/10.1016/j.jenvman.2025.126748.

Barrett, G.E., Alexander, P.D., Robinson, J.S., Bragg, N.C., 2016. Achieving environmentally sustainable growing media for soilless plant cultivation systems – a review. Sci. Hortic. 212, 220–234. https://doi.org/10.1016/j.scienta.2016.09.030.

BMEL, 2022. Going peat-free. Protecting the Climate.

BMUB. Climate Action Plan 2050 – Principles and goals of the German government's climate policy. https://ec.europa.eu/clima/sites/lts/lts_de_en.pdf.

Braun, H., Apfel, D., Rilling, B., Herbes, C., 2024. On the irrelevance of (peat-free) substrates - qualitative insights into the social practices of hobby gardeners in Germany. Clean. Responsib. Consum. 14, 100201. https://doi.org/10.1016/j.clrc.2024.100201.

Brunori, G., Galli, F., Barjolle, D., van Broekhuizen, R., Colombo, L., Giampietro, M., Kirwan, J., Lang, T., Mathijs, E., Maye, D., Roest, K. de, Rougoor, C., Schwarz, J., Schmitt, E., Smith, J., Stojanovic, Z., Tisenkopfs, T., Touzard, J.-M., 2016. Are local food chains more sustainable than global food chains? Considerations for assessment. Sustainability 8 (5), 449. https://doi.org/10.3390/su8050449.

Canavari, M., Coderoni, S., 2020. Consumer stated preferences for dairy products with carbon footprint labels in Italy. Agric. Food. Econ. 8 (1). https://doi.org/10.1186/s40100-019-0149-1.

Chen, X., Zhen, S., Li, S., Yang, J., Ren, Y., 2024. Consumers' willingness to pay for carbon-labeled agricultural products and its effect on greenhouse gas emissions: evidence from beef products in urban China. Environ. Impact Assess. Rev. 106, 107528. https://doi.org/10.1016/j.eiar.2024.107528.

Choi, Y., Lambert, D.M., Jensen, K.L., Clark, C.D., English, B.C., Thomas, M., 2020. Rank-ordered analysis of consumer preferences for the attributes of a value-added biofuel Co-Product. Sustainability 12 (6), 2363. https://doi.org/10.3390/su12062363.

Coley, D., Howard, M., Winter, M., 2009. Local food, food miles and carbon emissions: a comparison of farm shop and mass distribution approaches. Food Policy 34 (2), 150–155. https://doi.org/10.1016/j.foodpol.2008.11.001.

Contini, C., Romano, C., Boncinelli, F., Scozzafava, G., Casini, L., 2017. Does 'local' matter in restaurant choice? Results of a discrete choice experiment targeting German and Italian consumers. Agric. Food. Econ. 5 (1). https://doi.org/10.1186/s40100-017-0092-y.

Czine, P., Gorton, M., Bauerné Gáthy, A., Vuk, A., Balogh, P., Chou, Y.-C., Áron, T., 2025. Bottling it? Consumer responses to less environmentally friendly products: a choice experiment for water in plastic packaging in the UK. J. Environ. Manag. 373, 123649. https://doi.org/10.1016/j.jenvman.2024.123649.

Dahlin, J., Beuthner, C., Halbherr, V., Kurz, P., Nelles, M., Herbes, C., 2019. Sustainable compost and potting soil marketing: private gardener preferences. J. Clean. Prod. 208, 1603–1612. https://doi.org/10.1016/j.jclepro.2018.10.068.

Dahlin, J., Nelles, M., Herbes, C., 2017. Biogas digestate management: evaluating the attitudes and perceptions of German gardeners towards digestate-based soil amendments. Resour. Conserv. Recycl. 118, 27–38. https://doi.org/10.1016/j.resconrec.2016.11.020.

Evanschitzky, H., Wangenheim, F.v., Woisetschläger, D., Blut, M., 2008. Consumer ethnocentrism in the German market. Int. Mark. Rev. 25 (1), 7–32. https://doi.org/10.1108/02651330810851863.

Fachverband Biogas, 2024. Branchenzahlen 2022 Und Prognose Für 2023.

Fait, L., Groh, E.D., Wetzel, H., 2022. "I take the green one": the choice of regional green electricity contracts in the light of regional and environmental identity. Energy Policy 163, 112831. https://doi.org/10.1016/j.enpol.2022.112831.

Glenn, W., Waliczek, T.M., Drewery, M.L., 2024. Market potential for specialty compost produced from wool waste. HortTechnology 34 (3), 322–330. https://doi.org/10.21273/HORTTECH05388-24.

Grebitus, C., Lusk, J.L., Nayga, R.M., 2013. Effect of distance of transportation on willingness to pay for food. Ecol. Econ. 88, 67–75. https://doi.org/10.1016/j.ecolecon.2013.01.006.

Heindorf, C., Plieninger, T., Schüler, S., 2025. Linking co-production of peat landscapes ecosystem services and human well-being under different future scenarios: a fuzzy cognitive mapping approach. J. Environ. Manag. 391, 126315. https://doi.org/10.1016/j.jenvman.2025.126315.

Hensher, D.A., 2010. Hypothetical bias, choice experiments and willingness to pay. Transp. Res. Part B Methodol. 44 (6), 735–752. https://doi.org/10.1016/j.trb.2009.12.012.

Herbes, C., Dahlin, J., Kurz, P., 2020. Consumer willingness to pay for proenvironmental attributes of biogas digestate-based potting soil. Sustainability 12 (16), 6405. https://doi.org/10.3390/su12166405.

Hirschler, Olivier, Osterburg, Bernhard, Weimar, Holger, Glasenapp, Sebastian, Ohmes, Marie, Friederike, 2022. Peat Replacement in Horticultural Growing Media: Availability of Bio-based Alternative Materials.

Hirschler, O., Osterburg, B., 2025. Achieving peat-free hobby gardening for climate mitigation in Germany: insights into prices of growing media constituents, potting soils and policy options. Resour. Conserv. Recycl. 220, 108330. https://doi.org/10.1016/j.resconrec.2025.108330.

Hirschler, O., Thrän, D., 2023. Peat substitution in horticulture: interviews with German growing media producers on the transformation of the resource base. Horticulturae 9 (8), 919. https://doi.org/10.3390/horticulturae9080919.

Hole, A.R., 2016. Creating Efficient Designs for Discrete Choice Experiments.

Hoyer, W., 1984. An examination of consumer desicion-making for a common repeat purchase product. J. Consum. Res. 11, 822–829.

Hoyer, W., Brown, S., 1990. Effects of brand awareness on choice for a common, repeat-purchase product. J. Consum. Res. 17, 141–148.

IVG and GGS, 2022. Produktionsstatistik Hobbyerden und Kultursubstrate: Produktionsjahr 2021 [PDF]. Erden & Substrate. https://erden-substrate.info/wp-content/uploads/2025/05/IVG-Produktionsstatistiken_2021.pdf.

IVG and GGS, 2025. Produktionsstatistik Hobbyerden und Kultursubstrate: Produktionsjahr 2024 [PDF]. Erden & Substrate. https://erden-substrate.info/wp-content/uploads/2025/04/IVG-Produktionsstatistiken_2024.pdf.

Khachatryan, H., Rihn, A., Wei, X., 2021. Consumers' preferences for eco-labels on plants: the influence of trust and consequentiality perceptions. J. Behav. Exp. Econ. 91, 101659. https://doi.org/10.1016/j.socec.2020.101659.

Klopčič, M., Erjavec, K., Waldrop, M., Roosen, J., Engel, P., Galama, P., Kuipers, A., 2021. Consumers' and Farmers' perceptions in Europe regarding the use of composted bedding material from cattle. Sustainability 13 (9), 5128. https://doi.org/10.3390/su13095128.

Kuha, J., 2004. AIC and BIC. Socio. Methods Res. 33 (2), 188–229. https://doi.org/10.1177/0049124103262065.

Kunamaneni, S., Jassi, S., Hoang, D., 2019. Promoting reuse behaviour: challenges and strategies for repeat purchase, low-involvement products. Sustain. Prod. Consum. 20, 253–272. https://doi.org/10.1016/j.spc.2019.07.001.

Lami, O., Mesías, F.J., Balas, C., Díaz-Caro, C., Escribano, M., Horrillo, A., 2022. Does carbon footprint play a relevant role in food consumer behaviour? A focus on Spanish beef. Foods 11 (23). https://doi.org/10.3390/foods11233899.

Lampert, P., Menrad, K., Emberger-Klein, A., 2017. Carbon information on vegetables: how does it affect the buying process? Int. J. Consum. Stud. 41 (6), 618–626. https://doi.org/10.1111/ijcs.12375.

Lancaster, K., 1996. A New Approach to Consumer Theory.

Lazzarini, G.A., Visschers, V.H., Siegrist, M., 2017. Our own country is best: factors influencing consumers' sustainability perceptions of plant-based foods. Food Qual. Prefer. 60, 165–177. https://doi.org/10.1016/j.foodqual.2017.04.008.

Lehberger, M., Kleih, A.-K., Sparke, K., 2025. Effects of framing and knowledge on purchase intention of climate-friendly products—an experimental study on peat-free vs. peat-based potting soil. Agric. Food. Econ. 13 (1). https://doi.org/10.1186/s40100-025-00358-6.

Li, D., 2025. Impact of green advertisement and environmental knowledge on intention of consumers to buy green products. BMC Psychol. 13 (1), 220. https://doi.org/10.1186/s40359-025-02538-x.

Liao, Q., Papies, E.K., Chen, Y., Yuyi, Chen, M., Meijun, Dong, M., Lam, W.W.T., 2025. Can we prime sustainable food choices? A randomized controlled trial nested within a discrete choice experiment. Sustain. Prod. Consum. 56, 519–530. https://doi.org/10.1016/j.spc.2025.04.021.

Lusk, J., Schroeder, T., 2004. Are Choice Experiments Incentive Compatible? A Test with Quality Differentiated Beef Steaks.

Mariel, P., Hoyos, D., Meyerhoff, J., Czajkowski, M., Dekker, T., Glenk, K., Jacobsen, J.B., Liebe, U., Olsen, S.B., Sagebiel, J., Thiene, M., 2021. Environmental Valuation with Discrete Choice Experiments. Springer International Publishing. https://doi.org/10.1007/978-3-030-62669-3.

McFadden, D., 1994. Conditional Logit Analysis of Qualitative Choice Behavior.

Meng Leong, S., 1993. Consumer decision making for common, repeat-purchase products: a dual replication. J. Consum. Psychol. 2 (2), 193–208.

Mengelkamp, E., Schönland, T., Huber, J., Weinhardt, C., 2019. The value of local electricity - a choice experiment among German residential customers. Energy Policy 130, 294–303. https://doi.org/10.1016/j.enpol.2019.04.008.

Morone, P., Caferra, R., D'Adamo, I., Falcone, P.M., Imbert, E., Morone, A., 2021. Consumer willingness to pay for bio-based products: do certifications matter? Int. J. Prod. Econ. 240, 108248. https://doi.org/10.1016/j.ijpe.2021.108248.

NADU, 2025. Startseite - NADU. https://www.nadu-naturduenger.de/?srsltid=AfmBOopkYwhMhP6lRKOoEAA3ZplyNPgOdl2kgVOCG0K-2rGH6UU6Syi8.

Oei, P.-Y., Hermann, H., Herpich, P., Holtemöller, O., Lünenbürger, B., Schult, C., 2020. Coal phase-out in Germany – implications and policies for affected regions. Energy 196, 117004. https://doi.org/10.1016/j.energy.2020.117004.

Okechuku, C., Onyemah, V., 1999. Nigerian consumer attitudes toward foreign and domestic products. J. Int. Bus. Stud., 30 (3), 611 - 622.

Penn, J., Medlock, M., Kirk-Ballard, H., Hu, W., 2025. Exploring consumer preferences for potting mix characteristics using best-worst scaling. J. Agric. Appl. Econ. 57 (1), 42–59. https://doi.org/10.1017/aae.2024.33.

Peschel, A.O., Grebitus, C., Steiner, B., Veeman, M., 2016. How does consumer knowledge affect environmentally sustainable choices? Evidence from a cross-country latent class analysis of food labels. Appetite 106, 78–91. https://doi.org/10.1016/j.appet.2016.02.162.

Profeta, A., Hamm, U., 2019. Do consumers prefer local animal products produced with local feed? Results from a discrete-choice experiment. Food Qual. Prefer. 71, 217–227. https://doi.org/10.1016/j.foodqual.2018.07.007.

Quantis, 2012. Comparative Life Cycle Assessment of Horticultural Growing Media Based on Peat and Other Growing Media Constituents.

Rahman, I., 2018. The interplay of product involvement and sustainable consumption: an empirical analysis of behavioral intentions related to green hotels, organic wines and green cars. Sustain. Dev. 26 (4), 399–414. https://doi.org/10.1002/sd.1713.

Rilling, B., Braun, H., Herbes, C., Sparke, K., Kleih, A.-K., Lehberger, M., 2025. Brand, color, price or peat – what drives consumer decision preferences for potting soil? A mixed-methods approach among German gardeners. Sci. Hortic. 352, 114423. https://doi.org/10.1016/j.scienta.2025.114423.

Saunders, C., Barber, A., 2008. Carbon footprints, life cycle analysis, food miles: Global trade trends and market issues. Polit. Sci. 60 (1), 73–88.

Scherer, C., Emberger-Klein, A., Menrad, K., 2018. Consumer preferences for outdoor sporting equipment made of bio-based plastics: results of a choice-based-conjoint experiment in Germany. J. Clean. Prod. 203, 1085–1094. https://doi.org/10.1016/j.jclepro.2018.08.298.

Schmitt, E., Galli, F., Menozzi, D., Maye, D., Touzard, J.-M., Marescotti, A., Six, J., Brunori, G., 2017. Comparing the sustainability of local and global food products in Europe. J. Clean. Prod. 165, 346–359. https://doi.org/10.1016/j.jclepro.2017.07.039.

Shimp, T., Sharma, S., 1987. Consumer Ethnocentrism: Construction and Validation of the CETSCALE.

Silwal, P., Dunn, B.L., Norwood, F.B., 2023. Willingness to pay for potting mix containing Eastern redcedar biochar under alternative information sets. HortTechnology 33 (6), 554–560. https://doi.org/10.21273/HORTTECH05278-23.

Thøgersen, J., 2005. How may consumer policy empower consumers for sustainable lifestyles? J. Consum. Pol. 28 (2), 143–177. https://doi.org/10.1007/s10603-005-2982-8.

Thomas, M., Jensen, K., Lambert, D., Burton, E., Clark, C.D., Walker, F.R., 2021. Consumer preferences and willingness to pay for potting mix with biochar. Energies 14 (12), 3432. https://doi.org/10.3390/en14123432.

Train, K., 2002. Discrete Choice Methods with Simulation.

Trudel, R., 2019. Sustainable consumer behavior. Consum. Psychol. Rev. 2 (1), 85–96. https://doi.org/10.1002/arcp.1045.

UNEP, 2022. Global peatlands assessment: the state of the world's peatlands - evidence for action toward the conservation, restoration, and sustainable management of peatlands. https://doi.org/10.59117/20.500.11822/41222.

van Bussel, L.M., Kuijsten, A., Mars, M., van t Veer, P., 2022. Consumers' perceptions on food-related sustainability: a systematic review. J. Clean. Prod. 341, 130904. https://doi.org/10.1016/j.jclepro.2022.130904.

van den Broek-Altenburg, E., Atherly, A., 2020. Using discrete choice experiments to measure preferences for hard to observe choice attributes to inform health policy decisions. Health Econ. Rev. 10 (1), 18. https://doi.org/10.1186/s13561-020-00276-x.

van Loo, E.J., Caputo, V., Nayga, R.M., Meullenet, J.-F., Ricke, S.C., 2011. Consumers' willingness to pay for organic chicken breast: evidence from choice experiment. Food Qual. Prefer. 22 (7), 603–613. https://doi.org/10.1016/j.foodqual.2011.02.003.

van Loo, E.J., Grebitus, C., Roosen, J., 2019. Explaining attention and choice for origin labeled cheese by means of consumer ethnocentrism. Food Qual. Prefer. 78, 103716. https://doi.org/10.1016/j.foodqual.2019.05.016.

van Loo, E.J., Grebitus, C., Verbeke, W., 2021. Effects of nutrition and sustainability claims on attention and choice: an eye-tracking study in the context of a choice experiment using granola bar concepts. Food Qual. Prefer. 90, 104100. https://doi.org/10.1016/j.foodqual.2020.104100.

Venus, T.E., Beale, C., Villalba, R., 2024. Innovation and networks in the bioeconomy: A case study from the German coffee value chain. Circ. Econ. Sustain. 4 (3), 1751–1772. https://doi.org/10.1007/s43615-024-00357-7.

Vigoroso, L., Pampuro, N., Bagagiolo, G., Cavallo, E., 2021. Factors influencing adoption of compost made from organic fraction of municipal solid waste and purchasing pattern: a survey of Italian professional and hobbyist users. Agronomy 11 (6), 1262. https://doi.org/10.3390/agronomy11061262.

Waliczek, T.M., Wagner, N.C., Guney, S., 2020. Willingness to pay for a specialty blend compost product developed from brown seaweed harvested from coastal regions in Texas. HortTechnology 30 (3), 337–345. https://doi.org/10.21273/HORTTECH04511-19.

Wang, C.-K., Lamb, C., 1980. Foreign environmental factors influencing American consumers' predispositions toward European products. J. Acad. Market. Sci., 8 (4), 345 - 356.

Weiler, J., Firpo, B.A., Schneider, I., 2018. Coal waste derived soil-like substrate: an opportunity for coal waste in a sustainable mineral scenario. J. Clean. Prod. 174, 739–745. https://doi.org/10.1016/j.jclepro.2017.10.341.

Yin, S., Chen, M., Mo, Xu, Y., Chen, Y., Yusheng, 2017. Chinese consumers' willingness-to-pay for safety label on tomato: evidence from choice experiments. China Agric. Econ. Rev. 9 (1), 141–155. https://doi.org/10.1108/CAER-11-2015-0147.

Zwicker, M.V., Brick, C., Gruter, G.-J.M., van Harreveld, F., 2023. Consumer attitudes and willingness to pay for novel bio-based products using hypothetical bottle choice. Sustainable Production and Consumption 35, 173–183. https://doi.org/10.1016/j.spc.2022.10.021.