CONSUMERS' ACCEPTANCE OF A LOCAL LANDRACE: THE CASE OF PURPLE CARROTS

Azucena Gracia [a,c,*], Cristina Mallor[b,c], Francesc Jurado [a,c]

[a] *Unidad de Economía Agroalimentaria y de los Recursos Naturales. Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA), Zaragoza; agracia@cita-aragon.es; fjurado@aragon.es.*

[b] *Unidad de Hortofruticultura. Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA), Zaragoza; cmallor@cita-aragon.es.*

[c] *Instituto Agroalimentario de Aragón – IA2 (CITA-Universidad de Zaragoza).*

Abstract

The aim of this paper is to study consumers' acceptance of a local purple carrot landrace that was cultivated some years ago but it is no longer in production. This landrace is now maintained in a GeneBank but it would be interesting to restore again in cultivation taking into account that there is an increasing consumers' interest in colored vegetables. Then, consumers' preferences for carrots with different characteristics (color, price, variety, and production system) were investigated, and consumers' willingness to pay (WTP) for the local purple carrot was calculated. To do that, a choice experiment was designed and an Error Component Random Parameter Logit (ECRPL) model was specified and estimated. Data come from a survey conducted in the region where this landrace was cultivated to a stratified sample of consumers by age, gender, and province of residence. A total number of 405 consumers responded to an online questionnaire. Results indicate that the local origin of the carrots was positively valued by consumers although the purple color was less value than the orange one. However, the interaction between the local origin and the purple color was positive. These two results indicate that consumers prefer the traditional orange color of the carrots but the purple carrots would be accepted if the carrots are locally produced from the traditional landrace.

Keywords: Aragon, choice experiment, preferences, willingness to pay, Spain

1. Introduction

Due to intensification of food production and globalization, only few crop varieties are commercialized while many local varieties are neglected or underutilized. Then, only few standardized crop products are offered to consumers. These neglected local varieties are maintained either *ex situ* (GeneBanks) or *in situ* (on farms) to conserve the agricultural biodiversity. The increased consumer demand for diversity in vegetables open new avenues for restoring these neglected local varieties, if products from these plant species are appreciated by consumers or at least for a segment of local consumers. In addition, consumers are increasingly interested in local food products for economic reasons (increase in farmers' income, greater added value for local stakeholders, etc.); social benefits (i.e. maintenance of the population in the territory); environmental concerns (decrease in transport and gas emissions, landscape conservation and biodiversity, etc.); and because local products are perceived fresher or of better quality.

In this work, we are interested in a local purple carrot landrace that was cultivated some years ago but it is no longer in production. This landrace is now maintained in a GeneBank but it would be interesting to restore again in cultivation taking into account that there is an increasing consumers' interest in colored vegetables. Then, the aim of this paper is to study consumers' acceptance of a local purple carrot landrace. Then, consumers' preferences for carrots with different characteristics (color, price, variety, and production system) were assessed and, in particular, consumers' willingness to pay (WTP) for the local purple carrots was calculated.

2. Materials and methods

To achieve the objective, a choice experiment (CE) was used for its ability to value multiple attributes simultaneously, its consistency with the random utility theory, and the similarity of the choice task asked of participants to their real purchase decisions (Adamowicz et al., 1998). In the choice modelling approach, consumers have to choose several times between alternative products with several attributes having different levels.

2.1. Choice experiment design

The first step in the design of a choice experiment is to choose the product to be analysed and the second, to select the attributes and levels. In our case, the selection of both, the product and attributes, was done simultaneously based on the objectives. Then, we selected a packaged of half kilo of carrots with four different attributes: price, color, variety and production system. The price levels were set, based on the market prices at the time of the experiment, at: 0.5 €/box, 0.8 €/box, 1.1 €/box and 1.4 €/box. The other three attributes had two options: orange or purple for the color attribute; local variety or not for the variety;

organic or conventional for the production system. The choice sets were generated following the Street and Burgess (2007) approach. To be able to estimate the main effects and the two-way factor interactions between the colour attribute and the other non-monetary attributes (variety and production system) with 4 attributes with 4, 2, 2 and 2 levels, respectively, and two options, we obtained 24 pairs. Thus, each respondent was asked to make four choices because we randomly split the choice sets into six blocks. Each choice set included three alternatives: two designed alternatives consisting of different products and a non-buy option.

2.2. Data collection and survey

Data were collected from an online survey conducted in the region where the local landrace was produced during July 2016. Consumers were stratified by gender, age and province of residence. Sample size was set at 400, resulting in a sampling error of ±5%, and a confidence level of 95.5% (k = 2) when estimating proportions (p = q = 0.5). The questionnaire was structured in three parts: first, consumption and purchase habits; second, the choice experiment task; and third, questions on socio-demographic characteristics (i.e. age, family size, income and education level, residence province). Before the final questionnaire was distributed, a pilot survey was conducted to a sample of respondents (N = 15) to test for understanding and response time. Previous to the choice experiment task, participants must read a cheap talk script (Cummings and Taylor, 1999) to encourage and motivate respondents to reveal their true preferences in order to minimize possible hypothetical bias.

2.3. Model specification and estimation

The utility function is derived from the Lancaster theory (Lancaster, 1966) where utility is a function of the products attributes and some unobservable components that are assumed stochastic (random utility theory, McFadden, 1974). In the empirical application and for the selected attributes and levels, the utility function specified for individual *n*, alternative *j* at choice situation *t*, is defined as follows:

$$U_{njt} = ASC + \beta_1 PRICE_{njt} + \beta_2 COL_{njt} + \beta_3 VAR_{njt} + \beta_4 ORG_{njt} + \beta_5 VAR_{njt} COL_{njt} + \beta_6 ORG_{njt} COL_{njt} + \varepsilon_{njt} \quad (1)$$

where, n is the number of respondents, j which represent the available options of choice sets (alternative A, B and the non-buying option) and t the number of choice sets. The constant ASC represents the alternative specific and it coded as a dummy variable that takes the value 1 for the non-buying option and the value 0 for other. It was expected that ASC would be negative and significant, indicating that consumers have lower level of utility when they select the non-buying option against other alternatives (A and B). The price variable (PRICE) was defined by the price levels in the design. A negative impact of the price on utility is expected while the effects of the other variables are the main objectives. The attributes of colour (purple), - variety and - production system are represented by dummy variables (COL, VAR and ORG, respectively). Finally, interactions between the colour and the other two non-monetary attributes were also calculated by multiplying the dummy variables (VAR*COL and ORG*COL). The interaction between variety and production system variable was not designed because the objective of this study is focused on the colour of the carrots. Instead of assuming homogenous preferences, heterogeneity is allowed and the Error Component Random Parameters Logit model (RPL) was estimated using the NLOGIT 5.0.

3. Results and discussion

The final sample consisted of 405 consumers and the summary statistics for its characteristics are shown in Table 1. This sample is representative of the population in terms of gender, age and province of residence. Half of respondents were female (51%) with an average age of 47.72. With respect to age, we observed an exact representation of all age ranges. However, respondents with secondary education are under-represented while participants with higher level of education are over-represented. It is worth mentioning that the high proportion of participants with university level is common in the majority of studies because they are more disposed to respond to questionnaires (Verhoef, 2005).

Equation (1) was estimated assuming that price is a fixed coefficient and that the coefficients for the attribute-levels dummy variables (COL, VAR and ORG) are random following a normal distribution. From the estimated parameters of the ECRPL model, the marginal WTPs for each of the attributes, the marginal WTPs for each of the interactions and the total marginal WTPs for the combination of the two attributes with the colour, including the interaction factor terms were calculated (Table 2).

The ASC and the PRICE coefficients were negative and statistically significant. The first one indicates that the utility for consumers was higher for the designed options than the non-buy option. Additionally, the PRICE variable coefficient indicated that the utility of this attribute is negative as stated by the economic theory.

Table 1. *Socio- demographic characteristics of the sample (% unless stated)*

Characteristics	Sample (n=405)	Population[1,2]
Gender: Female	51.36	50.93
Age (Average)	47.72	42.68
18–34	21.23	21.63
35–44	21.98	20.94
45–54	19.26	19.20
≥ 55	37.53	38.22
Education level		
Primary	23.21	17.00
Secondary	29.63	50.00
Higher	47.16	33.00
Income level[3]		
≤ 1500 €/month	21.16	N/A
1501–3500 €/month	43.33	N/A
> 3500 €/month	35.51	N/A
Household size (average)	2.87	2.53
Province of residence		
Huesca	14.32	17.00
Teruel	18.77	11.00
Zaragoza	80.25	72.00
Other	0.99	0.00

[1] INE – Padrón continuo (1 de Enero, 2016); [2] Education at a glance: OCDE Indicators, OCDE (2014); [3] 1.98 % of the participants not know or prefer not to say

Table 2. *ECRPL estimations for the choice experiment model*

	Parameters		WTPs (€/package)		Total WTPs (€/package)
	Estimation	T-ratio (z)	Estimation	T-ratio(z)	Estimation
Mean					
ASC	– 5.8161***	– 9.65	---	---	
PRICE	– 2.8341***	– 7.50	---	---	
COL	-1.4589***	-4.03	-0.51**	-3.41	
VAR	0.6451**	1.99	0.23**	2.31	
ORG	0.8209***	3.61	0.29***	3.53	
VAR*COL	1.3558**	2.41	0.48**	2.07	0.20
ORG*COL	0.0089	0.03	0.00	0.03	-0.22
Standard Deviation					
COL	3.2681***	8.62			
VAR	1.5059***	4.83			
ORG	1.6231***	4.32			
VAR*COL	2.3993***	3.94			
ORG*COL	1.2331*	1.93			
σ^2	3.1177***	8.52			
Log L	– 1163.27				
$\chi 2$	1232.96***				
# of observations	1620				

The negative and statistically significant value of the parameter estimate for COL variable indicated that the utility for the purple carrots was lower than for the orange ones. In other words, consumers' valuation for purple carrots was negative. On the other hand, the positive and statistically significant value of the parameter estimate for VAR and ORG indicated that the utility for the carrots produced from the local landrace and the organic production system was higher than the utility derived by the non-local landrace and the conventional system, respectively.

The only estimated interaction parameter statistically different from zero at the 5% significance level was VAR*COL. The positive value for this interaction indicated that consumers' utility for purple carrots produced from the local landrace is higher than the sum of the utilities derived by either the purple or the local landrace carrots. Thus, the purple colour is negatively value by consumers but if the carrots are purple because they are produced from the local landrace, consumers' valuation would be positive. Then, the purple colour and the local landrace can be considered as complement attributes.

The marginal WTPs for each attribute indicated that consumers were willing to pay an extra price of +0.23 € per package of carrots from the local landrace, +0.29 € per package for the carrots organically produced and –0.51 € per package for the purple carrots. This means that on average, 0.23 and 0.29 is the price premium that consumers were willing to pay to purchase a package of carrots produced from the local landrace or organically produced, respectively. Then, the most value attribute, *ceteris paribus*, is the organic but closely followed by the local landrace. On contrary, –0.51 represented the discount for consumers to purchase a package of purple carrots, meaning that they prefer the orange carrots. However, taking also into account the WTPs for the interactions, if the purple carrots are produced from the local landrace, consumers would positively value these purple carrots (0.20 €/package). On contrary, purple carrots organically produced would still be negatively value (-0.22 €/package).

Findings indicate that the local origin of the carrots was positively value by consumers although the purple color was less value than the orange one. However, the interaction between the local landrace and the purple color was positive. These two results indicate that consumers prefer the traditional orange color of the carrots but the purple carrots would only be accepted if the carrots are locally produced from the traditional landrace.

This study has been carry out in a multidisciplinary project context about agro-biodiversity, with the aim to identify and recover several landraces of vegetables at risk of genetic erosion. Among such landraces, we select the purple carrot with the purpose of assess and valorize this local product. However, such valorization passes not only from the farmers, but also from consumers. It is why we need to know firstly the consumers' acceptance. The obtained results clearly indicate that the purple carrot will be an interesting product for producers, but only if the consumers are appropriately informed about its local origin as a landrace.

These results encourage continuing with the carrot research project through a breeding program or selection process, with the aim of obtain homogeneous material that can be guarantee the quality of the product reaching the consumer, and also the commercial production improvement for the growers. Once we have selected the material, seeds will be transfer to local growers along with the recommended strategy to commercialize the carrots for consumers' acceptance.

The results also confirm the importance of involving a multidisciplinary group that allows take decisions along all the value chain for designing a recovery strategy, taking into account both grower and consumer preferences.

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