

A competitive strategy for vegetable products: traditional varieties of tomato in the local market

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Abstract

The aim of this article is to analyse whether growing traditional horticultural varieties would be a profitable alternative so farmers could attend to their traditional activity in rural areas without the loss of income. Besides, it is intended to provide results to help promote vegetable consumption. Research is focused on tomato, one of the main horticultural crops from the important agricultural region of south-eastern Spain. The proposed solution for growers to improve profits is to cultivate traditional tomato varieties for local markets. Whether consumers are willing to pay the premium price for these products is analyzed and the influence of several attributes on willingness to pay is evaluated. To accomplish these aims, two methods have been used: a hypothetical method, the contingent valuation, and an experimental method, the Vickrey auction. Results show that local market consumers very positively value these varieties and are willing to pay very high premium prices, especially for the traditional flavour from their own area of influence.

Additional keywords: contingent valuation, profitable alternatives, rural development, tomato flavour, Vickrey auctions, willingness to pay.

Resumen

Una estrategia competitiva para los productos hortofrutícolas: variedades tradicionales de tomate en el mercado local

El objetivo de este trabajo es analizar si el cultivo de hortalizas de variedades tradicionales podría ser una alternativa rentable para que los agricultores de zonas rurales puedan dedicarse a su actividad tradicional sin pérdidas de renta. Adicionalmente, el trabajo pretende proporcionar resultados que puedan ayudar a promocionar el consumo de hortalizas. La investigación está centrada en el tomate, uno de los principales cultivos hortícolas del sudeste de España, que constituye una región agrícola importante. La alternativa propuesta para el mantenimiento de las rentas agrarias es cultivar variedades tradicionales de tomate dirigidas a los mercados locales. En el trabajo se analiza si los consumidores están dispuestos a pagar el sobreprecio por estos productos y se valora la influencia que tienen varios atributos en la disposición a pagar. Para ello se ha utilizado un método hipotético, la valoración contingente, y un método experimental, la subasta tipo Vickrey. Los resultados muestran que los consumidores de los mercados locales valoran estas variedades muy positivamente y están dispuestos a pagar altos sobreprecios, especialmente por el sabor tradicional de su área de influencia.

Palabras clave adicionales: alternativas rentables, desarrollo rural, disposición a pagar, sabor del tomate, subastas Vickrey, valoración contingente.

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Introduction

The influence of agricultural activity is waning in the Spanish economy. Many agricultural enterprises subsist due to inertia, habit, tradition and/or cultural identification, and/or due to the importance of self consumption where production is used for the subsistence of the rural population.

Similar problems affect rural communities all around the European Union (EU). Even though the EU has 11 million farmers with more than 40% of its area used for agriculture, the survival of rural economies can no longer be taken for granted. As a consequence, rural development becomes a basic pillar of the current Community Agricultural Policy.

The development of rural areas is being promoted. However, in many cases the consequence of the means used is the relative decline of the influence of agriculture in the economic system. This decline is caused by the increase of non-agricultural, principally artisanal and recreational, activities.

This paper aims to study an alternative by which producers, consumers and governments can all be winners. The strategy proposed is to offer traditional tomato varieties (*Solanum lycopersicum* L.) to local market consumers to benefit from two potential, competitive advantages: (1) the sensory features of the best traditional variety and (2) consumer preference for local products (ethnocentrism and environmental concerns) (Sharma *et al.*, 1995).

Traditional varieties represent an important genetic and crop heritage, and possess sensory characteristics that consumers esteem (Ruiz *et al.*, 2005). The main problem with these varieties is their high market price, a direct consequence of production costs. These higher costs are basically due to lower productivity than commercial hybrids, since resistance to virosis is lower in spite of adaptation to the area. To compensate for higher costs, traditional varieties are offered on the market at a higher price. Market tendencies indicate that a wide sector of consumers prefer high quality products (Grunert, 2002; Roosen, 2003) with better sensory characteristics in spite of a higher price. So, farmers could produce traditional varieties without losing income.

There are two main reasons for recommending local markets. First, the market in foreign countries will always be more difficult. Competition from other countries is

added to consumer preference in those countries for their own products. This characteristic, called consumer ethnocentrism, motivates the decision to buy local products. There is a positive relationship between consumer ethnocentrism and a preference for local products, while a negative relationship exists between ethnocentrism and the preference for foreign products. (Verlegh and Steenkamp, 1999). Moreover, emerging consumer concerns such as *food miles* should be considered when studying local preferences. The study by Pretty *et al.* (2005) demonstrates that food chain transport is one of the main contributors to the environmental cost of the food basket. So, consumers might shift their preferences towards locally produced food for environmental reasons.

Therefore, traditional varieties in local markets achieve the triple objective of contributing to the sustainability of rural communities, satisfying consumer demands for taste and environmental protection, and assisting public health authorities in finding ways to promote vegetable consumption.

Tomato was chosen since it is the horticultural crop that contributes the most to the value of Spain's horticultural production (24% in 2006) and also since vegetables represent 23% of the value of the nation's plant production, contributing to it the most. Moreover, this contribution is increasing in recent years (Ministry of Environmental, Marine and Rural Area, 2007).

The specific problems of this crop affect the local market as well as intercommunity exportation, where Spanish tomato competes directly with tomato from other countries with lower production costs such as Morocco, Turkey and Poland. Nevertheless, possibilities could still exist for the Spanish tomato, particularly if it becomes differentiated and adequate commercial strategies are established.

This study was centred on the province of Alicante, located in the Community of Valencia in south-eastern Spain. The surface area dedicated to tomato production in this province in 2006 was 614 ha (6% of the total surface area dedicated to horticultural crops). Production was 72,676 t, making tomato the fourth crop in surface area and the first in production volume (The Government of Valencia Department of Agriculture, Fishery and Food, 2006). A good number of traditional varieties exist in this province. Two varieties are outstanding among them, 'De la Pera'¹ and 'Muchamiel'². Both were evaluated in this research.

¹ 'De la Pera' is a traditional landrace originated in the area of "Vega Baja" (Alicante, Spain), while the 'Tomate de Pera' designation includes several improved varieties and commercial F1 hybrids. For example, the 'Roma' commercial variety is a well-known 'tomate de pera' variety.

² 'Muchamiel' is a traditional landrace originated in the area of Muchamiel (Alicante, Spain).

As stated above, the main problem with these varieties is their high market price. In a paper by Del Campo *et al.* (2006) where the 'De la Pera' variety is compared to a commercial hybrid in the greenhouse as well as in the field, the profitability threshold was about 22% higher in the traditional variety tomato.

Although a segment of consumers is willing to pay more for high quality products, the specific maximum price that tomato consumers would be willing to pay for traditional tomato varieties needs to be studied.

Therefore, the object of this research was to determine whether traditional tomato varieties would be a profitable alternative for farmers in the province of Alicante. It would be determined whether the price that consumers would be willing to pay is enough to compensate the higher production costs that this crop entails. This question was studied through an experiment consisting of tasting the product and seeing the guarantee label. The study was conducted in a concrete geographical area as a case-study that could later be generalized for other regions.

Methodology

Two methods were used for determining consumer willingness to pay (WTP): contingent valuation and the 2nd price Vickrey auction. The former is a hypothetical method and the latter is experimental. Therefore, it was deemed convenient to show both results in this paper.

Contingent valuation

Contingent valuation belongs to the group of direct or hypothetical methods based on information furnished by individuals themselves when asked for their valuation of the object under analysis (Azqueta, 1994).

The contingent valuation method has been traditionally used for determining the value of goods that have no market. Nevertheless, in the past decade, it has been applied to research on food safety, with the aim of estimating WTP to avoid the potential risk from consuming a given food (Henson, 1996; Lin *et al.*, 1996; Moon and Balasubramanian, 2003; Loureiro and Hine, 2004; Curtis and Moeltner, 2006).

Contingent valuation has also been applied on some occasions to agrofood marketing. Outstanding contribu-

tions were made to: the determination of WTP for an organic food (Misra *et al.*, 1991; Weaver *et al.*, 1992; Buzby *et al.*, 1998; Gracia *et al.*, 1998; Sánchez *et al.*, 2001), and explicative factors of food consumption (Verbeke *et al.*, 2000; Loureiro, 2003; Maynard *et al.*, 2004; McCluskey *et al.*, 2007).

The target population was vegetable buyers, since one of the directives of the contingent valuation method is to apply it to goods that are familiar to the surveyees (Cummings *et al.*, 1986; Bateman and Turner, 1993). The sample comprehended 425 adult vegetable buyers from the province of Alicante (for a 4.9% error and a 95.5% confidence level). They were selected through random sampling with proportional fixation for type of habitat (rural / urban) and age. The survey was taken by two properly trained pollsters during the months of July and August, 2004.

In the questionnaire, besides the necessary questions for determining WTP, others were included to permit the characterization of those surveyed.

In the first place cards were shown to the consumers with a photograph of traditional varieties (Muchamiel and De la Pera), the objects of the study. Consumers were to select the traditional variety that they preferred the most. Once they had selected the traditional variety, they were asked whether or not they were willing to pay a certain price for a traditional variety tomato compared to a hybrid variety tomato having similar characteristics. The reference price³ of this tomato was €1.5 kg⁻¹, a medium price when the survey was conducted. The price vector selected reflects current price levels in Spanish supermarkets for this product. In order to prevent any bias in the guide price, the sample was divided into four subsamples (Riera, 1994). A different starting surcharge (50%, 100%, 150%, and 200%) was assigned to each subsample in this question. In the second, open format, question consumers were requested to indicate the maximum surcharge they would be willing to pay for the traditional variety tomato.

For data analysis a descriptive statistical analysis with measures of central tendency and dispersion was carried out. SPSS 13.0 Statistical Software was used.

A logit or logistic regression analysis was also performed. This is a multivariate technique that permits the study of the relationship between a dependent dichotomic variable (WTP in the contingent valuation closed question) and one or more independent variables

³ Different food outlets were surveyed in Alicante to obtain a sample of existing prices for tomato. A total of 20 prices were obtained, with a mean price of €1.5.

(Hair *et al.*, 1999). The dependent variable takes the value of 1 if the event occurs, i.e. if the interviewee pays the surcharge for the selected traditional variety tomato and 0 if it does not take place, i.e. if the interviewee does not pay the surcharge. The logit model equation is as follows:

$$p = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_i)}} \quad [1]$$

where p : probability of paying; β_0 , β_1 : equation coefficients and X_i : surcharge variable.

Through a simple transformation and under the hypothesis that the individual utility function is linear, the means and the medium of WTP coincide. Therefore, the average WTP can be calculated using the following expression (Hanemann, 1984):

$$E(WTP) = -\beta_0 / \beta_1 \quad [2]$$

where $E(WTP)$ is the willingness to pay the expected value, and β_0 and β_1 are the estimated coefficients for the constant and the explanatory variable in the estimated logit model, respectively.

Vickrey auctions

Since on occasion the hypothetical bias has been criticized that contingent valuation methods imply (List,

2003), other authors use experimental methods to measure WTP. Experimental auctions are found among these methods, which approximate the real market for products since they use real products and money.

There are various types of auctions, normally classified according to the method to determine the winner and the end price. In a sealed-bid auction, buyers secretly write their bids on a piece of paper, sealing them in envelopes before handing them to the auctioneer. While in the open bid auction, bidders make their bids out loud. There are also several methods for determining auction prices. The most common one is known as the first-price auction, where the highest bidder pays the quantity of his bid and takes the auctioned article. In the second-price auction, the highest bidder buys the auctioned article for a price equal to the bid of the second-highest bidder (Experimental Economic Center, 2006). The type of auction chosen for this paper is the second-price, sealed-bid auction, also known as the Vickrey-type auction because it was explained by Vickrey (1961).

The applications of experimental auctions to agro-food products are shown on Table 1.

The proposed objectives of the experimental auction for traditional tomato varieties are the determination of: the maximum price that consumers are willing to pay for the varieties under consideration, Muchamiel and De la Pera, and the influence of a guarantee and flavour label on WTP.

Table 1. Main applications of experimental auctions to agrofood products

Reference	Type of product	Country	Sample size
Melton <i>et al.</i> (1996)	Fresh pork chops	USA	36
Hayes <i>et al.</i> (2002)	Irradiated pork sandwich	USA	87
Lange <i>et al.</i> (2002)	Champagne	France	57
Noussair <i>et al.</i> (2002)	GM meat	France	112
Sanogo and Masters (2002)	Infant foods	Mali	240
Soler <i>et al.</i> (2002)	Organic olive oil	Spain	120
Huffman <i>et al.</i> (2003)	Vegetal oil/tortilla chips/ potatoes	USA	172
Jaeger <i>et al.</i> , (2004)	GM foods	USA	164
Lusk <i>et al.</i> (2004)	Beef rib eye steaks	USA	180
Noussair <i>et al.</i> (2004)	Orange drinks and chocolate bars	France	194
Umberger and Feud (2004)	Meat	USA	248
Brown <i>et al.</i> (2005)	Food safety	Canada	163
Hobbs <i>et al.</i> (2005)	Beef and pork products	Canada	204
Kassardjian <i>et al.</i> (2005)	Genetically modified apples	New Zealand	82
Stefani <i>et al.</i> (2006)	Spelt packs	Italy	111
Hobbs <i>et al.</i> (2006)	Bison meat	Canada	459

GM: genetically modified

Data collection was accomplished through 6 sessions at a 15 day interval during the month of July, 2004. Each session was composed of 6 to 10 participants. The total number of participants was 50. The requisite for participating in the auction was to be a customary tomato purchaser. Participants were selected from among personnel and students of Miguel Hernández University at Elche who are responsible for daily shopping in Orihuela (Alicante).

In each session 2 kg of tomatoes were auctioned. One was from the Muchamiel variety and the other, De la Pera. During the auction participants could see both varieties of tomato, which were in boxes similar to those found at points of sale, although no information was shown about them. A box of a hybrid tomato variety was also displayed, whose price did appear (€1.5 kg⁻¹), so they would have a reference for bidding.

Before the auction began, participants received €15 for participating. This quantity is far above what 2 kg of tomatoes could cost, which guaranteed that participants would not have to use their own money for the auction. Next, instructions for the auction were explained to them, and participants had to sign a paper promising to acquire the product if they won the auction. Participants were also informed that the best strategy was to bid exactly what the product was worth to them.

As commented above, the aim was to determine the influence of two variables on WTP: flavour and the guarantee label. Two experiments were designed for this, and each was carried out on two experimental groups. The other two groups to complete the 6 sessions were control groups, where no experiment was done.

The auction began with the Muchamiel tomato variety and two rounds of training. Previous studies have demonstrated the need to conduct trial rounds, since inexperienced individuals often make bids that are different from their valuations (Kagel and Roth, 1995). The auction continued with six more rounds for this tomato. Once the Muchamiel auction finished, the De la Pera tomato was auctioned, again in six rounds. Some researchers manifest that bids in successive rounds respond more to a strategic process by participants who tend to approach prices announced by the auctioneer, than to a learning process (Knetsch *et al.*, 2002). Despite this, it was opted to include multiple rounds since it has been shown that prices stabilize after a certain number of rounds (Soler *et al.*, 2002).

Rounds were similar for all six groups of bidders. In each round, attendees had to write down their bid individually. The winner of the round was the person who

had offered the highest bid. Nevertheless, since it was a Vickrey-type auction, the second-highest bid established the market price. Between the 3rd and the 4th rounds, each experimental group was subjected to the corresponding experiment: tasting the product in the case of flavour and being shown the guarantee label on the product for measuring the influence of that distinguishing mark. Then bidding continued. When the auction ended, one of all the rounds was chosen at random for each tomato variety. The winner of each auction was the individual who won the chosen round. The drawing to determine the winner for both tomato types was held after sessions had ended to prevent the Muchamiel tomato winner (auctioned first) to influence the auction for the De la Pera tomato (auctioned second).

Once the auction concluded, participants were requested to answer a brief questionnaire on their sociodemographic data, frequency of purchasing tomato, lifestyle and buyer attitudes. The area the person surveyed came from was also annotated, which could be a Muchamiel production area, a De la Pera area, or neither of the two. This final question was asked to determine whether a relationship existed between WTP and the origin of the person surveyed.

Results and discussion

Determination of willingness to pay using contingent valuation

WTP was estimated for each tomato variety individually. Previously, a question for choosing the preferred tomato—De la Pera or Muchamiel—was introduced in the questionnaire. Consumers were to select their preferred traditional variety about which they would later indicate their WTP. Of those surveyed, 36.5% showed a preference for the *expected value* of Muchamiel, 33.4% for De la Pera, and 30.1% were indifferent to these varieties.

The indicated preference was verified as directly related to the spontaneous recognition of these varieties and to the origin of those surveyed. Therefore, among the individuals who preferred the Muchamiel variety, those predominated who named it spontaneously and who were from the Muchamiel crop area. It occurred similarly with those who preferred the De la Pera variety (Table 2). When carrying out the Chi-square test, significant differences appeared between both consumer groups at 5% and at 10% respectively.

Table 2. Percentage of consumers who show a preference for Muchamiel and De la Pera tomato according to their spontaneous knowledge of these varieties and consumer origin

	Muchamiel	De la Pera	Total
Percentage of consumers who prefer each variety	36.5	33.4	
Spontaneous knowledge*			
Ignorance of both varieties	23.2	28.9	25.9
Knowledge of the Muchamiel variety	33.5	2.8	18.9
Knowledge of the De la Pera variety	12.3	39.4	25.3
Knowledge of both varieties	31.0	28.9	30.0
Consumer origin**			
Muchamiel area	31.0	22.5	26.9
De la Pera area	42.6	56.3	49.2
Neither area	26.5	21.1	23.9

*, ** There are significant differences in the chi-square test at 5% and 10% respectively

As mentioned in the section on methodology, the mixed format question was used in the contingent valuation. In the first question consumers indicated only whether they would be willing to pay a certain surcharge above the commercial hybrid price. The sample had been divided into four groups and each one showed a different price (€ kg⁻¹): 2.25 (50% surcharge), 3 (100% surcharge), 3.75 (150% surcharge) and 4.5 (200% surcharge). In order to prevent a bias in the guide price, it was verified by means of an ANOVA (analysis of variance) that in spite of their WTP rising surcharges as the assigned surcharge increased, no significant differences were indicated in surcharges in the open question for each subsample. From the four consumer subgroups that preferred Muchamiel, 54.5% answered affirmatively from the subgroup asked whether they would pay at least €2.25 kg⁻¹; of those asked for €3 kg⁻¹, 36.1% agreed; 11.4% said they would be willing to pay €3.75 kg⁻¹; and 10.0% answered affirmatively in the case of €4.5 kg⁻¹ or more. In the group that preferred De la Pera, 46.9% of the corresponding subgroup answered that they were willing to pay €2.25 kg⁻¹ or more; 25.0%, at least €3 kg⁻¹; 6.7%, more than €3.75 kg⁻¹; and 0.0% would pay €4.5 kg⁻¹ or more (Table 3).

The second contingent valuation question asked consumers to indicate the maximum price they would be willing to pay for the traditional variety tomato.

Descriptive results show that, in the case of consumers who preferred Muchamiel, 89% would pay a quantity equal to or higher than the average price for conventional tomato. In the group that preferred De la Pera, 86% would pay the same or more.

From this moment on, only consumers were considered who would pay the same or more than for conven-

tional tomato. The average price indicated by consumers is €2.76 kg⁻¹ (83.79% more) in the case of the Muchamiel tomato and €2.68 kg⁻¹ (78.42% more) in the case of the De la Pera variety (Table 4).

Logistic regression models and surcharges calculated by using the Hanemann transformation referred to in the methodology section are also shown (Table 5).

The majority of requisites for logistic regression were sufficiently fulfilled. For Muchamiel, the -2LL decreased from 174 to 150, the Cox and Snell R^2 was 0.176 and the Nagelkerke R^2 was 0.245. Data fit the model since the Chi-square in the Hosmer and Lemeshow test was not significant. The percentage of cases correctly classified was 73.2%. For the De la Pera variety, the -2LL decreased from 126 to 90, the Cox and Snell R^2 was 0.257 and the Nagelkerke R^2 was 0.398. The Chi-square was insignificant again in the Hosmer and Lemeshow test, and the percentage of cases correctly classified was 82.9%.

Using the logistic regression model coefficients and through the Hanemann transformation it was found that the average price which consumers would pay for the Muchamiel variety tomato was €2.59 kg⁻¹ (a 72.6% surcharge), and the price they would pay for the De la Pera

Table 3. Percentage of consumers who are willing to pay a specific premium price for a tomato of the Muchamiel or De la Pera variety

Premium price	Muchamiel	De la Pera
50%	54.5%	46.9%
100%	36.1%	25.0%
150%	11.4%	6.7%
200%	10.0%	0.0%

Table 4. Muchamiel and De la Pera tomato prices and premium prices (% in parentheses) over the average price of a conventional tomato

	Muchamiel	De la Pera
N	138	122
Mean	2.76 (83.79%)	2.68 (78.42%)
Median	2.60	2.50
Mode	3.00	3.00
Standard Deviation	0.94	0.86
Minimum	1.50	1.50
Maximum	6.00	6.00

N: number of cases

variety was €2.50 kg⁻¹ (a 66.4% surcharge). These prices are quite similar, although somewhat lower than those obtained from the descriptive statistical analysis in the open question.

Determination of the WTP using the Vickrey Auction method

Average surcharges from the experimental auction are shown on Table 6. In the case of Muchamiel, 68% of the consumers would pay a quantity equal to or higher than the average price for conventional tomato; for De la Pera, 84% would pay the same or more. The average surcharge from the six auctions for Muchamiel was €2.72 kg⁻¹ (an 81.3% surcharge), and €2.37 kg⁻¹ (a 58.06% surcharge) for De la Pera. Muchamiel obtained a higher surcharge than De la Pera, which also occurred in the results from the consumer survey.

The prices obtained through contingent valuation and experimental auction were also compared by means of a one-way ANOVA. Significant differences at 10% have been found in both varieties of tomato, with the prices obtained through experimental auctions being lower in both cases.

Table 7 shows the average surcharges from each round for Muchamiel and De la Pera varieties for each experiment. The price was observed to increase in all cases.

To determine the influence of the experiment (flavour and guarantee label), significant differences were sought between the average price from rounds 1 to 3 (before the experiment) and the average price from rounds 4 to 6 (after the experiment). Significant differences were observed in all cases, even in the control group, which was determined through a t-test for related samples (Table 8).

Since differences appeared in all cases, even in the control group, they could be due to the auction procedure itself. To establish whether they were due to the auction itself, or to the application of the experiment, it was necessary to determine whether the differences in prices were greater in auctions where the influence of flavour and label were measured than in the control auctions. Therefore, the differences between prices from bids 1 to 3 and bids 4 to 6 were compared to the differences between the control auction and the auctions for determining the influence of flavour and label. On Table 9 the differences in average prices are shown from rounds 4 to 6 and from rounds 1 to 3 for each variety and for each variable tested.

Thus the difference observed in the price between the first and the later rounds in the Muchamiel tomato is €0.38 kg⁻¹ in the control auction, €0.87 kg⁻¹ in the auctions that tested the label, and €0.87 kg⁻¹ when testing flavour. In the De la Pera tomato, this difference in price is €0.45 kg⁻¹ in control auctions; €0.84 kg⁻¹ in auctions testing the influence of the label; and €1.08 kg⁻¹ when aiming to determine the influence of flavour.

A Dunnett test was conducted to compare average prices from control auctions to auctions measuring label and flavour. This test shows that although prices are higher when both variables were tested than in the control auction, significant differences appear only when

Table 5. Variables obtained from the logit model for Muchamiel and De la Pera varieties

	β	SE	Wald	Df	Sig.	Exp(β)
Muchamiel						
Surcharge	-0.018	0.004	21.214	1	0.000	0.982
Constant	1.306	0.449	8.464	1	0.004	3.693
De la Pera						
Surcharge	-0.031	0.006	23.398	1	0.000	0.969
Constant	2.059	0.646	10.143	1	0.001	7.837

SE: standard error. Df: degrees of freedom. Sig: significance

Table 6. Descriptive statistics for prices and premium prices (% in parentheses) of the Muchamiel and De la Pera varieties (results from Vickrey Auction)

	Average premium price (%) for	
	Muchamiel	De la Pera
N	34.00	42.00
Mean	2.72 (81.01%)	2.37 (58.06%)
Median	2.28	2.15
Mode	1.78 (a)	1.80 (a)
Standard Deviation	1.06	0.63
Minimum	1.60	1.50
Maximum	5.15	3.73

N: number of cases

the tested variable was flavour and only in the case of De la Pera tomato.

Perhaps this is because a high percentage of the individuals subjected to the auction experiments came from the De la Pera area of influence. So the flavour of this variety is what they identified with the tomato that they traditionally ate a few years ago, which tastes the best to them.

Conclusions

Proposing profitable alternatives for the agricultural sector is a priority for public authorities, since progressive abandonment of the land and substitution for other, basically urban, activities does not contribute to the sustainability of our planet. On the other hand, finding ways to promote fruit and vegetable (F&V) consumption is an important challenge for public health authorities in the EU.

The cultivation of traditional varieties of tomato is proposed in this paper as a possible alternative for farmers, so they would not have to relinquish their activity. The higher costs of these crops, basically due to lower productivity and greater susceptibility to virosis, are inconveniences which are not rectifiable a priori, especially when combined with the increasing competition of tomato from other countries.

The frequently forgotten local market could be an attractive objective to producers who could simultaneously exercise greater control over their product in the presumably shorter distribution chain. Spanish consumer preference for higher quality, recognized local products and their rejection of “food miles” could make the local market adequate for these varieties. The fundamental problem is whether consumers would accept the prices that farmers should obtain to compensate for higher costs.

As determined through this research, prices that consumers would be willing to pay for these tomato varieties are high enough to compensate amply for the additional cost of cultivation. From the results it is deduced that a high percentage of consumers would pay more for a local, traditional tomato variety (Muchamiel or De la Pera). The average price that those consumers are willing to pay would well compensate the higher costs of cultivation. The average price in € kg⁻¹ in the case of Muchamiel was 2.76 (an 83.79% surcharge) when obtained directly, 2.59 (a 72.55% surcharge) obtained from logistic regression and 2.72 (81.01% surcharge) from Vickrey auction. For De la Pera, it was 2.68 (a 78.42% surcharge) when obtained directly, 2.49 (a 66.4% surcharge) from logistic regression and 2.37 (a 58.06 % surcharge) from Vickrey auction.

Table 7. Average prices for the Muchamiel and De la Pera varieties (results from each auction round)

	Muchamiel			De la Pera		
	Control	Label	Flavour	Control	Label	Flavour
Round 1	1.72	2.22	2.33	1.57	1.56	1.92
Round 2	1.72	2.56	2.77	1.81	1.87	2.22
Round 3	1.80	2.74	3.15	2.00	2.05	2.66
Average 1-3	1.74	2.50	2.75	1.80	1.83	2.26
	Experiment ¹			Experiment ¹		
Round 4	1.90	3.20	3.41	2.14	2.32	3.06
Round 5	2.18	3.35	3.69	2.22	2.64	3.40
Round 6	2.28	3.58	3.76	2.38	3.05	3.56
Average 4-6	2.12	3.38	3.62	2.25	2.67	3.34

¹ The experiment consisted of tasting the product and seeing the guarantee label

Table 8. Test of related samples between the average price from rounds 1-3 and the average price from rounds 4-6 for Muchamiel and De la Pera tomato varieties in three types of auctions (flavour, label and control group)

		Paired differences				t	Df	Sig. (2-tailed)
		Mean	SD	95% Confidence interval for the difference				
				Lower	Upper			
Control	Muchamiel	-0.38	0.29	-0.57	-0.18	-4.32	10	0.002
	Pera	-0.45	0.32	-0.63	-0.27	-5.33	13	0.000
Label	Muchamiel	-0.87	0.42	-1.19	-0.55	-6.27	8	0.000
	Pera	-0.84	0.36	-1.05	-0.62	-8.39	12	0.000
Flavour	Muchamiel	-0.87	0.93	-1.40	-0.33	-3.50	13	0.004
	Pera	-1.08	0.76	-1.50	-0.66	-5.49	14	0.000

SD: Standard deviation. Df: degree of freedom

It can also be deduced that contingent valuation provides higher prices than experimental auctions. In real markets consumers are perhaps more conservative than in hypothetical ones, where the demand is overestimated. This cannot be generalised because of the small sized sample used in the auctions.

Although consumers are willing to pay more for traditional tomato varieties, the label and flavour were not very important. Significant differences appeared only when the tested variable was flavour and only in the case of De la Pera tomato. Perhaps this is because a high percentage of the individuals subjected to the auction experiments came from the De la Pera tomato area of influence and they identified the flavour with their idea of "traditional tomato flavour" which happened in the case of De la Pera tomato. Therefore, the recovery of

traditional varieties could foster an increase in vegetable consumption.

The role of the Public Administration could therefore be to provide adequate information. Campaigns should be established to promote the purchase of the product. Tasting the product should be included with the aim of increasing consumer knowledge about these traditional varieties in local markets.

On the other hand, agricultural subsidies should not be expected by farmers, because they might not last. The initiative should be taken by farmers' associations and cooperatives. Traditional varieties should be promoted in the local market because they could represent a profitable alternative for farmers. A low cost strategy to promote the product could be attendance at local fairs or gastronomic events where producer associations can

Table 9. Differences in price from rounds 4 to 6 and from rounds 1 to 3

		Mean	SD	95% Confidence level for the mean		Min.	Max.
				Lower bound	Upper bound		
Muchamiel	Control	0.38	0.29	0.18	0.57	0.05	0.87
	Label	0.87	0.42	0.55	1.19	0.25	1.32
	Flavour	0.87	0.93	0.33	1.40	-1.23	2.35
	Total	0.71	0.68	0.47	0.94	-1.23	2.35
De la Pera	Control	0.45	0.32	0.27	0.63	0.08	1.23
	Label	0.84	0.36	0.62	1.05	0.45	1.67
	Flavour*	1.08	1.76	0.66	1.50	-0.17	2.72
	Total	0.79	0.58	0.61	0.97	-0.17	2.72

* Dunnett's test was conducted to compare average surcharges (significant differences in the chi-square test at 5%) from auctions that compared label and flavour to control auctions. SD: Standard deviation. Min: minimum. Max: maximum

promote local varieties. Besides, a guarantee brand to protect traditional varieties of horticultural products in the Community of Valencia could be requested by cooperatives and/or producer associations.

These results can be extended to other vegetable products, although first it must be determined whether they are sufficiently valued by consumers.

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