Southern vegetable buyers' preferences for cherry tomatoes based on production practice and detailed information on location of production

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Abstract

Labeling strategies are often discussed in the context of direct-to-consumers marketing for small family farms. Substantial research has been conducted in order to identify preferences for different labeling strategies. Some studies have also highlighted the substitution or complementarity effect that may occur across the different labels. Using a large choice experiment with 1820 respondents across six southern states, we assess buyers' preferences for co-labeling strategies based on the association of a production practice and certification (USDA Organic and Certified Naturally Grown, CNG) and six different production locations (Local area to imported). We focus on pint baskets of cherry tomatoes since these are popular items among purchasers of fresh produce. Based on the results provided by a Bayesian Mixed Logit model, we derived the respondent-specific posterior distribution of the partworth associated with each production location and regressed each of those against demographic indicators. We find that most buyers substitute organic and CNG while a few would consistently choose the same production practice option. Our findings also underscore that price or an indication of origin predominantly guide nearly half of buyers' choices. Additionally, we find that the premium for CNG is superior to the organic one. Lastly, older respondents and respondents with a higher degree of education value produce grown in and around "their area" over state and country origins.

Keywords: USDA Organic, Certified Naturally Grown, Locally Grown, Willingness to pay, Choice experiment.

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Introduction

Labeling strategies are often discussed in the context of direct-to-consumer marketing for small family farms, translating the importance of agricultural products' extrinsic characteristics, also known as credence attributes, and their impact on buyers' willingness to pay. Substantial research has been conducted in order to identify buyers' preferences and the price premiums associated with specific labeling strategies such as the organic certification (Yiridoe et al., 2005; Batte et al., 2007; Haghiri et al., 2009; Li and Kallas, 2021), "locally grown" (Darby et al., 2008; Carpio & Isengildina-Massa, 2009; Onken & Bernard, 2010; Hu et al., 2012), or a label indicating the absence of genetically engineered material (McFadden & Lusk, 2017).

Moser et al. (2011) concluded over a decade ago that the attribute "local" is generally relevant to the decision to buy fresh fruits and vegetables. Local products are assumed to be fresher and better tasting and, most importantly, they may enhance the trust of consumers who personally know the producers of their fruits and vegetables (e.g., Midmore et al., 2005; Rodriguez-Ibeas, 2007; Thilmany et al., 2008). Locally grown has also been highlighted as the most important production attribute by "Direct Primary purchasers" (Bond, Thilmany and Bond, 2006).

With no clear definition or regulating body in place to monitor such claims (Moser et al., 2011), research does not provide a clear conclusion on "locally grown". It tends to be always ranked higher than other origin-based brands such as "Country of Origin Labeling" (COOL) (Loureiro and Umberger, 2003; Umberger, 2004; Mabiso et al., 2005; Lusk et al., 2006; VanSickle, 2008), "State branding" like Arizona Grown, South Carolina Grown or Georgia Grown (Carpio et al., 2009; Grebitus et al., 2016; Naasz et al., 2018) or "region-of-production" branding such as Vidalia (e.g., Carter et al., 2006; Deselnicu et al., 2013). While some other studies underscored that consumers were willing to pay a substantial premium for

locally grown produce if labeled with more precise information on the actual origin like a state or regional branding program (Curtis et al., 2014; Shi et al., 2016).

Adding other labels such as USDA organic certification (e.g., Meas et al., 2015; Jensen et al., 2019), "pesticide-free" (Baker 1999), "non-GMO verified", "Certified Naturally Grown" and "Sustainably grown" add to the complexity for consumers and most studies conclude that the local attribute outranks production attributes. For instance, McFadden and Lusk (2017) pointed out that in the presence of a non-GMO material label, organic is not necessarily valued, i.e., consumers are not willing to pay more for both labels as their perception is that organic does not include GM material.

Consequently, numerous studies have been highlighting the potential substitution or complementarity effects that may occur across these different labels (e.g., Meas et al., 2015; James et al., 2009; Yue & Tong, 2009; Adams and Salois, 2010; Onozaka & McFadden, 2011; Campbell et al., 2014; Chen et al., 2015; McFadden & Huffman, 2017) and proposed that the attribute "local" overlaps with the organic certification or informative labeling like "non-GMO". More specifically, Meas et al. (2015) found strong substitution between organic and local production claims in consumers' willingness to pay for these products stating that "local has become the new organic". Curtis, Gumirakizab and Bosworth (2014) results illustrated this point with products grown conventionally in Utah ("locally") outweighing either organically or conventionally grown of unknown origin.

Ditlevsen et al. (2020) point out that the debate between complementarity and substitution remains active. While Denver and Jensen (2014) or Hempel and Hamm (2016b) suggest two profiles of local products consumers (those who prefer organic and those who do not), other research (Adams and Salois, 2010; Hasselbach and Roosen, 2015) found a strong positive interaction effect, meaning that the willingness to pay for organic was markedly higher, if the product was also local.

In the context of this debate and based on recent studies (Lang and Rodrigues, 2022), we argue that most studies evaluate each production label separately and that only few researches have been focused on how consumers interact with both concomitantly. Therefore, our objective is two-fold. In terms of advertising strategy for small family farms, we need to understand more specifically what precise geographic level is associated with "local" in the context of buying fresh produce. We also need to clarify how it plays into buyers' preferences and willingness to pay a premium when this indication of origin is associated with a production certification such as USDA organic or CNG. With limited resources to market their produce, small farmers could benefit from the understanding of labeling and co-labeling strategies that would best attract and retain their buyers.

Background on labeling strategies

The motives for consuming organic food are manifold (Truong et al., 2021). A key assertion is that consumers balance the potential benefits and costs of organic products (Bezawada and Pauwels, 2013). Well documented benefits given by consumers would include health, nutritional value, taste, animal welfare, ethics, and environmental protection (e.g., Bourn and Prescott, 2002; Fotopoulos and Krystallis, 2002; Makatouni, 2002; Zanoli and Naspetti, 2002) whereas costs would typically be represented by organic being more expensive than conventional products and more difficult to find in the exact form, flavor, and quantity the consumer prefers (Michelsen et al., 1999).

With regard to product origin, there are specific benefits being associated with local such as quality and freshness, vitality of rural areas and short transportation distances (Roininen, Arvola, and Lähteenmäki, 2006). Another key assertion lies in the fact that many consumers perceive benefits of local foods to be rather similar to expected benefits from organic foods (e.g., Hempel & Hamm, 2016a, b; Wägeli & Hamm, 2016, Denver & Jensen, 2014).

Compared to organic and locally grown, and to our knowledge, reasons to buy CNG are not very well referenced in the literature. In the few studies comparing organic and "natural" (Abrams et al., 2010; Anstine, 2007; Chambers et al., 2018; Gifford & Bernard, 2011; Onken, Bernard and Pensek, 2011, cited in Lang and Rodrigues, 2022), insights suggest that consumers associate "naturalness" with both labels as well as healthiness and quality pointing out a substitution effect between the two.

Data and Methods

Survey design

USDA organic, Certified Naturally Grown and Unspecified Production Practice (UPP) were established as the three invariable alternatives regarding production practice for each choice set. We added a variation of six different origins going from "grown in my metro area or county" to "imported". Average prices for the different production labels were calculated based on observed data online and in local stores, at farmers markets and supermarkets which represent the typical place of purchase. Then, a 12.5% rate was applied to make prices vary around the average for each production label. Setting the production attributes while making the origin and price attributes vary aimed at better understanding how consistent buyers are regarding their production preferences. In terms of product, we presented a pint baskets of cherry tomatoes since these are popular items among purchasers of fresh produce (table 1).

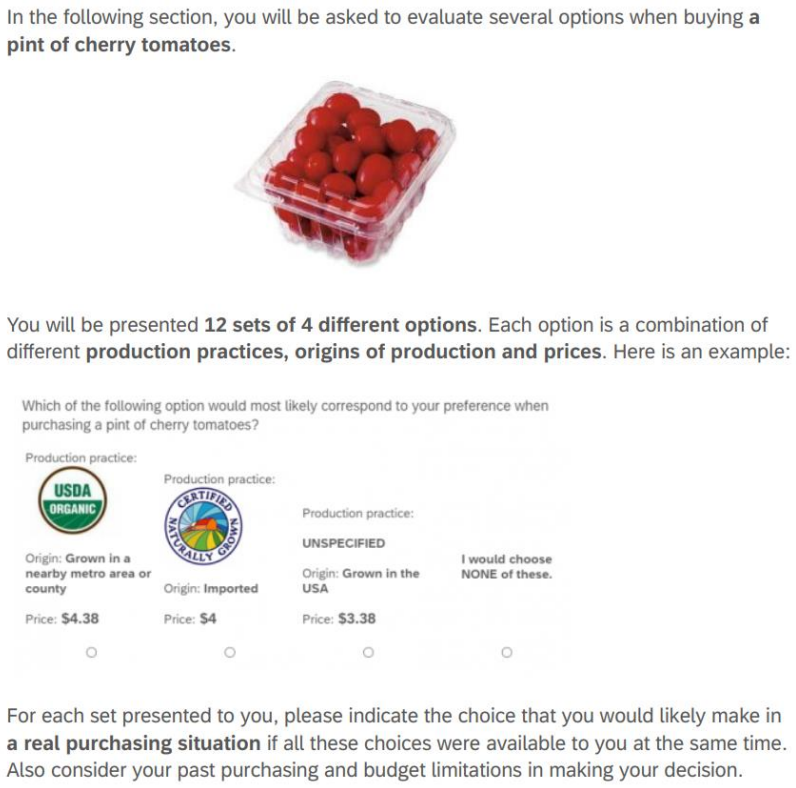
Table 1. Choice experiment attribute levels

Attribute	Levels
Production practice	USDA Organic (alternative 1), Certified Naturally Grown (alternative 2), Unknown production practice (alternative 3)
Location of production	Grown in my metro area or county, Grown in a nearby metro area or county, Grown in my state, Grown in a neighboring state, Grown in the USA, Imported
Prices	Organic: $3.75, $4.38, $5.00, $5.63, $6.25, $6.88 CNG: $3, $3.5, $4, $4.5, $5, $5.5 UPP: $2.25, $2.63, $3.00, $3.38, $3.75, $4.13

Our final design was established using SAS (mkt commands) and maximizing D-efficiency, whereby D-efficiency allows for comparison of the orthogonal balance of the design with design efficiency (Kuhfeld, 2003 and 2010). The 36 choices were then divided in 3 blocks in order to limit respondent fatigue. Each respondent was asked to choose among the 4 alternatives (3 production practices and the opt out option) offered across 12 choice sets randomly presented.

Before prompted to select their preferred option, respondents were given some information illustrated by Figure 1.

Figure 1. Qualtrics presentation of the choice experiment



Data

An online survey was administered equitably in six Southern states; Alabama, Florida, Georgia, North Carolina, South Carolina and Tennessee, in December 2021. Participants were recruited using Qualtrics, a panel provider. Participants were informed that the purpose of the study focused on purchase of fresh produce directly from farmers. Quotas were applied on demographic variable such as gender (60% female, 40% male), geographic location (N=300 per state) and the purchase of fresh produce in the last month from the state they live in (50%). The final sample comprised 1820 respondents. General questions were related to produce point of purchase, amount of the expense on a weekly basis, responsibility of grocery shopping and frequency of purchase. Table 2 presents the demographic information of our sample.

Table 2. Sample population demographics (N=1,820)

Age	**All 6 states**
1923 – 1964 (Silent and Boomers)	24.6%
1965 – 1980 (Gen X)	22.7%
1981 – 1996 (Gen Y)	37.0%
≥ 1997 (Gen Z)	15.7%
Gender	
Male	41.9%
Female	57.6%
Non-binary	0.4%
Prefer not to say	0.1%
Ethnicity	
White/Caucasian	72.1%
African American	21.0%
Hispanic or Latino	5.3%
Asian	3.4%
Native American	1.9%
Native Hawaiian or Pacific Islander	0.4%
Other	1.0%
Education level	
Less than high school diploma	3.7%
High school diploma or GED	22.4%
Some college	20.9%
2-year college degree	11.4%
4-year college degree	25.3%
Master's degree	12.7%
Doctoral degree	1.6%
Professional degree (JD, MD)	2.1%
Income	
Less than $50,000	34.9%
$50,000 - $99,999	36.5%
$100,000 - $149,999	16.6%
More than $150,000	7.7%
Prefer not to answer	3.9%
Living area	
Rural	29.5%
Suburban	50.3%
Urban	20.2%

Respondents to our online survey (N=1820) were asked general questions about their buying behavior regarding produce. Among the primary sources for purchasing produce (multiple choice): major supermarket is the primary source with 70.2% of our sample then grocery stores with 58.3%. 27.9% checked local farmers' market; 6.4% online farmers' market and, 3.9% Community Supported Agriculture (CSA). 12.8% get their produce at a convenient store. 11.2% mentioned that they grow their own produce.

To the question: "*How much does your household spend weekly on fruits and/or vegetables?*", majority of respondents (37.6%) spend between $25 and $49; 31.3% spend less than $25 and 24.1% between $50 and $99; and, 7.2% spend $100 or more. 75.3% declared they were primary shoppers and 19% shared the grocery shopping equally.

Some respondents were eliminated from the sample due to pervasive inconsistencies or lack of response. The majority who were dropped checked the opt out option in over half the scenarios. The final sample yielded 1725 respondents.

Model Specification

In order to evaluate the willingness to pay and utility of co-labeling alternatives, we used a choice experiment method, a widely used technique to understand consumer preferences for attributes of agricultural produce (e.g., Maples et al., 2018). We estimate a Bayesian Mixed Logit model (Train, 2009) to analyze the choices of the respondents. Briefly, we specify the utility obtained by the nth respondent of the jth alternative for choice experiment task t to be $U_{njt} = x_{njt}\beta_n + \varepsilon_{njt}$, where x is a 1xk vector of attributes, ε_{njt} is iid extreme value, and for the random coefficients we have $\beta_n \sim N(b, D)$. Maximum utility is implied by the observed choice $y_{nt} = i$ if and only if $U_{nit} > U_{njt}$ for all $j \neq i$.

The Bayesian Mixed Logit model of Train (https://eml.berkeley.edu/Software/abstracts/train1006mxlhb.html) uses a hierarchical Bayes procedure which specifies the prior for b to have

extremely large variance; whereas the priors for each person's β_n is the density of β_n in the population and this prior has parameters b and D. As Train points out, Bayesian parameter estimates are consistent for the fixed number of draws used in estimation as opposed to maximum simulated likelihood estimation which requires that the number of draws used in estimation must increase with sample size for consistency to be obtained. Upon convergence of the Bayesian estimator, b_n can be considered as the mean of the posterior distribution of β_n, so that the individual level random coefficients can be estimated. In our study, these individual level coefficients can be interpreted as partworths that can be associated with individuals and their characteristics.

Choice results

The following segment of analysis is based on the results of the choice experiment using different attributes: price, origin and production practices labels. The Bayesian Mixed logit model was estimated using unknown production practice and USA origin as the base case. Additionally, the price parameter was not specified to be random for two reasons. First, as Train explains, identification of all parameters of a Bayesian Mixed Logit model is often impossible unless one or more parameters are specified as fixed. Second, since our focus is on the distribution of the partworths across the respondents for the production practices and locations, a fixed price coefficient provides a cleaner interpretation of the partworths. The estimation results are presented in table 3.

Table 3. Bayesian Mixed Logit Regression Results

	b		Diagonal elements of D	
	Mean	**StDev**	**Mean**	**StDev**
Price -	-0.6326	0.0152		
Organic	1.6715	0.0769	6.3453	0.3593
CNG	1.9869	0.0604	3.6438	0.1992
Import -	0.9781	0.0565	1.5595	0.1642
Near-State	0.1319	0.0344	0.0919	0.0293
MyState	0.2542	0.0363	0.1630	0.0434
Near-Area	0.3447	0.0372	0.1175	0.0421
My Area	0.2544	0.0388	0.3060	0.0707

The estimated premium a CNG pint of cherry tomatoes is slightly higher than for organic version, respectively $3.14 and $2.64, compared to an unknown production practice (UPP). Literature usually calculates the organic premium (e.g., Dentoni et al., 2009; Dimitri and Greene, 2002; Onozaka and Thilmany McFadden, 2011; Sackett, Shupp, and Tonsor, 2016; Zepeda and Leviten-Reid, 2004 cited in Maples, 2018) and most buyers expect higher prices when it comes to organic produce which constitutes a potential explanation of these higher premiums. However, to our knowledge, no studies have specifically compared organic and CNG. Therefore, the finding that these premiums are comparable may be an indication of substitution between organic and CNG.

These results can be more easily interpreted by calculating the distribution of draws in the population implied by b and the estimated D. This takes into account both sources of variation in the partworth parameters.

Table 4. Estimated variation of individual partworths

	Mean	StDev	Share<0
Organic	1.6995	2.5132	0.2527
CNG	2.0147	1.9239	0.1480
Import -	-0.9657	1.2328	0.7802
Near-State	-0.1340	0.3026	0.6675
MyState	0.2512	0.4009	0.2662
Near-Area	0.3474	0.3482	0.1595
My Area	0.2615	0.5538	0.3187

The results in Table 4 clearly show that respondents have widely varying assessments of the values of all the attributes. For each partworth, its standard deviation generally exceeded the (absolute) value of its mean. With regard to production practice, 25% of respondents reveal a negative partworth for organic and about 15% reveal a negative partworth for CNG. We interpret this result as suggesting that a non-negligible portion of respondents are price sensitive and consequently are not willing to pay the price premiums for the organic and CNG options.

Estimates for origin show an association between close geographic location to the respondent such as grown in a nearby area or county, grown in my metro area or county and grown in my state with implied values of $0.55, $0.41 and $0.40 respectively. However, grown in a neighboring state or imported have less value than grown in the USA with $-0.21 and $-1.53 respectively. A large proportion of respondents reveal a negative partworth (78%) when the origin of the cherry tomatoes indicates they were imported, followed by “grown in a neighboring state” (67%) compared to “grown in the USA”. Other studies have been pointing out the importance of state branding programs in advertising agricultural products (e.g., Naasz, Jablonski and Thilmany, 2018) but also highlighted that a foreign indication of origin tends to dissuade buyers (e.g., Campbell et al., 2014).

Beyond the indication of preferences, clearly a substantial variation in the values of the partworths across individual respondents needs to be underscored. In looking at patterns in the respondents' choices we can see important variation among respondents and the inconsistency in choosing the same production label (table 5).

Table 5. Categorization of the sample based on their choice pattern

% of respondents	Selected alternative within choice survey
2.7%	100% Organic
7.6%	100% CNG
1.4%	100% UPP
0.3%	100% Opted out
45.5%	Mainly chose Organic or CNG
42.5%	Choice varied between Organic, CNG, UPP and opt out.

These variations seem to indicate three buyers' profiles. For nearly half of our sample (45.5%), substitution between options mainly occurs between Organic and CNG. For 42.5% of our respondents, we found a great variation among their choices between the different production practices and the opt out. Lastly, 12% always chose the same option with a higher response rate for CNG (7.6%) compared to organic (2.7%) and UPP (1.4%). The pattern of choice for our first profile seems to align with the substitution among production labels highlighted in the literature (McFadden & Huffman, 2017; Ditlevsen et al., 2020; Land and Rodrigues, 2022) where consumers' perceptions of benefits are similar for organic and "naturally grown". We corroborate these conclusions about organic and CNG. Our second profile of respondents who had a greater variation of their choices among the four options were clearly influenced by price or origin attributes. These results may support Lee and Yun (2015) studies

explaining a substitution effect involving organic by consumers' misperceptions or lack of awareness. Buyers who consistently chose the same production practice (100% organic, 100% CNG or 100% UPP) pertain to our third profile. As mentioned before, they represent a much smaller sample which we interpret as an evidence of how multi-factorial the purchase of fresh produce can be.

While the considerable variation in the partworths precludes unambiguous statements of preferences, it does permit analysis at the individual level. Since the mean partworths of each respondent are calculated, we can associate them with individual level characteristics. The attraction of this approach stems from the fact that individuals' observed patterns of choices shape their partworths—not a survey or some other elicitation method to infer their valuations of the attributes. The following (table 6) are regressions with the mean of the respondent-specific posterior distribution of the partworth associated with location and production practice as the dependent variable and demographic measures as the explanatory variables (all self-explanatory except for $F&V which measures the average amount of dollars spent for all fruits and vegetables on a weekly basis).

Table 6. Regressions of partworths on demographic variables

	ORGANIC PW			CNG			IMPORTS			NEARBY-STATE		
	COEFF	StdErr	T VALUE	COEFF	StdErr	T VALUE	COEFF	StdErr	T VALUE	COEFF	StdErr	T VALUE
Const	1.94719	0.21994	8.85323	2.21481	0.16810	13.17579	-0.78821	0.08007	-9.84360	-0.12332	0.00668	-18.45568
Age	-0.02202	0.00330	-6.67628	-0.00537	0.00252	-2.12829	-0.00526	0.00120	-4.37699	-0.00020	0.00010	-1.95926
Male	-0.03767	0.10553	-0.35695	-0.10421	0.08065	-1.29210	0.02656	0.03842	0.69135	0.00138	0.00321	0.42927
$F&V	0.30939	0.04419	7.00096	0.14278	0.03378	4.22734	0.04181	0.01609	2.59857	0.00088	0.00134	0.65267
Rural	-0.14579	0.12138	-1.20117	-0.20842	0.09277	-2.24669	-0.04968	0.04419	-1.12430	0.00156	0.00369	0.42280
Urban	0.29394	0.13715	2.14326	-0.07921	0.10482	-0.75568	0.05365	0.04993	1.07448	0.00267	0.00417	0.64072
Educ	-0.00440	0.03334	-0.13191	-0.05017	0.02548	-1.96885	-0.01592	0.01214	-1.31104	-0.00096	0.00101	-0.94637

	MY STATE			NEARBY-AREA			MY AREA		
	COEFF	StdErr	T VALUE	COEFF	StdErr	T VALUE	COEFF	StdErr	T VALUE
Const	0.24252	0.01193	20.32300	0.34123	0.00880	38.78586	0.19186	0.02222	8.63303
Age	0.00037	0.00018	2.05165	0.00020	0.00013	1.55226	0.00108	0.00033	3.24371
Male	-0.01345	0.00573	-2.34934	-0.00819	0.00422	-1.94011	0.00729	0.01066	0.68328
$F&V	-0.00009	0.00240	-0.03796	-0.00635	0.00177	-3.59174	-0.00224	0.00447	-0.50062
Rural	0.00054	0.00659	0.08256	-0.00393	0.00486	-0.81043	0.00524	0.01226	0.42710
Urban	-0.00764	0.00744	-1.02733	-0.00279	0.00549	-0.50836	0.01043	0.01386	0.75230
Educ	0.00078	0.00181	0.42961	0.00358	0.00133	2.68740	0.00352	0.00337	1.04447

Adding socio-demographic variables such as age, gender, location of residence, education degree and average amount spent weekly on fresh produce, we identify significant results based on age, level of education and amount spent. Older generations put more value on cherry tomatoes that were grown within their county or their state. They tend to put less value if the product comes from a neighboring state or if it is imported. Respondents with a higher level of education generally put more value on cherry tomatoes grown at the county or neighboring county level and less if the product is imported. Interestingly, imported products appear to be more attractive than the locally grown version (more specifically neighboring county) for buyers with a higher average amount of fruit and vegetable expenditures.

The value of USDA organic cherry tomatoes is strongly associated with higher amounts of purchase and an urban location of residence. Older respondents tend to value organic cherry tomatoes much less than younger respondents. This pattern carries over to CNG tomatoes but with a muted effect since the coefficient on age is about one fourth the magnitude of that for organic. Residents in rural areas and respondents with a higher level of education seem to put value on CNG cherry tomatoes, even more so than for organic types.

Conclusion

Many growers have seen their direct to consumer sales increase since 2020. They need to compete for local markets as many traditional retail operations have expanded their produce offerings. As a consequence, growers widely use labels indicating the origin of the production (e.g., locally-grown or state brand) or their production practice (e.g., USDA organic or CNG). Numerous studies have demonstrated that growers can expect premiums from such strategies. However, these studies also underscore the ambiguity that surrounds buyers' interpretation of the different production practices

labels and between production practice and origin. As noted by Hasselbach & Roosen (2015), the potential to get a higher premium might also emerge from the combination of a local origin and the indication of production practice.

Our study is the first, to our knowledge, to show that respondents value Certified Naturally Grown at a slight premium over organic. Evidence from our choice experiment analysis suggests three buyers' profiles related to preferences of production practice. Nearly half of our sample seem to substitute organic and CNG while a much smaller sample consistently choose one or the other. The last profile is characterized by buyers whose choices are mainly influenced by price and origin. Our results also suggest that the purchase of organic cherry tomatoes is associated with younger generations and those living in urban areas. If cherry tomatoes are grown in a close geographic location such as county, nearby county or state, older respondents valued them more than when they are from a neighboring state or imported.

These results contribute to the on-going discussion about the role of information through labeling. There are several components of the strategy that should be considered.in order to increase buyers' patronage and expenditure. A combination of indication of "local" origin and a well-known production practice certification such as CNG or USDA Organic seem to translate into higher premiums. More specifically, younger generations living in an urban area with a higher disposable income favor an origin within their state borders combined primarily with CNG followed by USDA Organic. This represents an opportunity for local producers to build on in order to retain their young buyers. Higher quality of information on production practices is also recommended to increase the buyers' knowledge and trust of these practices.

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