Tropentag 2016, Vienna, Austria
September 18-21, 2016

Conference on International Research on Food Security, Natural Resource Management and Rural Development
organised by the University of Natural Resources and Life Sciences (BOKU Vienna), Austria

# Consumer Preferences and Market Segmentation for Differentiated Beef with Less Environmental Impact

Karen Enciso[b], Stefan Burkart[b], Andres Charry[a\b], Cristhian David Puerta Rodriguez[b], Jhon Jairo Muñoz Quiceno[c], Lisbeth Rocio Ruiz[c], Jhon Freddy Gutierrez Solis[b], Nelson José Vivas Quila[c], Noé Albán Lopez[c], Sandra Morales Velasco[c], Michael Peters[b]

**[a] University of Hohenheim, Stuttgart, Germany**
**[b] International Center for Tropical Agriculture (CIAT), Tropical Forages Program, Colombia**
**[c] University of Cauca, Department of Agricultural Sciences, Colombia**

## Abstract

Environmental awareness is increasing globally and this leads to a segment of consumers willing to pay a higher price for products developed under more environmentally friendly conditions. In Colombia, beef production is specifically characterised by extensive management, with low levels of productivity and a significant negative environmental impact. Taking into account this problem, the International Centre for Tropical Agriculture (CIAT) and the University of Cauca in Colombia have worked during the last decade on the development of new alternatives for livestock production, such as improved forages, farming practices and silvo-pastoral systems, which generate significant benefits for the environment (e.g., reduction of greenhouse gas emissions, protection and maintenance of soil fertility, biodiversity conservation) while also improving productivity levels (carrying capacity and animal live weight gain). However, the implementation of these new technologies often requires high levels of initial investment, which detains producers from adoption. Thus, identifying a segment of consumers willing to pay for beef produced with less environmental impact would create an incentive for producers to invest in new technologies and result in higher levels of adoption.

This study aims to determine the relevant consumer segment for beef produced with less environmental impact. For this purpose, a consumer characterisation will be performed in order to know the preferences, buying habits and consumption of beef and its main substitutes (chicken, fish, pork). As a result, a market segmentation based on variables of socio-economic and demographic character will be conducted. The methodology consists of a descriptive analysis using contingency tables and relative frequencies, and an analysis of market segmentation using a CHAID algorithm and association tests (X2). Information was collected in April 2016 through personal interviews, with a pre-structured questionnaire for consumers directly responsible for buying meat. Research areas are the cities of Cali and Popayan, and the municipalities of El Patía and El Bordo, all in the Colombia Cauca and Cauca Valley Departments. Data analysis will take place in May 2016 testing the hypothesis that level of income, education, age and gender are significant determinants for identifying the segment of potential consumers of differentiated beef with less environmental impact.

**Keywords:** Beef, CHAID algorithm, Colombia, consumer preferences, market segmentation

## Introduction

In Colombia, cattle production is characterized by extensive production systems under native/naturalized or degraded pastures with low productivity levels, low soil use efficiency, low investment levels and a considerable environmental impact (e.g., deforestation, soil degradation, greenhouse gas (GHG) emissions, loss of biodiversity). Nevertheless, cattle is one of the major economic activities in the country and the most widespread in the rural sector (FEDEGAN, 2014). Thus, it is necessary that technologies and production practices are being promoted and adopted that boost the cattle sector in a more competitive way, while at the same time aiming at efficiency increases and climate change adaptation and mitigation (sustainable intensification; Rao et al., 2015)

Improved forages and silvo-pastoral systems are alternatives for sustainable intensification, and can contribute to the generation of benefits for the environment (e.g., reducing GHG emissions, protecting and conserving soil fertility, conserving of biodiversity) while at the same time increasing productivity levels and farm profitability (Peters et al., 2012). However, the implementation of such technologies requires investments (for establishment and management), resulting to be a major constraint for adoption (Chi & Yamada, 2002).

One of the major drivers for the transformation towards more sustainable production systems is the increasing demand for products with positive environmental attributes as a means of product differentiation, which is a result of higher consumer sensitization (Acuña, 2015). The growing concern about environmental and health issues has led to emerging consumer segments composed of buyers who are, in many cases, willing to pay a price premiums for such products. This behavior has been further strengthened by increasing incomes and the demand for higher value products (Salgado, Subirá, & Beltrán, 2009).

In that sense, the objective of this study is to identify the consumer segment for beef produced in systems with less environmental impact. The identification of this consumer segment will allow for a development of sector business plans and a design of incentive schemes for cattle producers adopting sustainable technologies and practices.

## Material and Methods

This study was part of the research program *"Development and implementation of forage resources for sustainable bovine production systems in the Cauca department, Colombia"* between the International Center for Tropical Agriculture (CIAT) and the Cauca University.

Data was obtained through a personal survey with a pre-structured questionnaire applied to 354 meat consumers in the cities of Cali (Valle del Cauca Department) and Popayán (Cauca Department), and in the municipalities of Mercaderes and Patía (both Cauca Department) in Colombia. A stratified sampling method by socioeconomic status was applied. The survey was applied randomly at meat sales points according to the following criteria: the interviewee must i) directly be involved in meat purchase, and ii) be a beef consumer.

Data analysis was descriptive using contingency tables, correlations and mean differences, to identify the sociodemographic characteristics of potential consumers. In addition to that a market segmentation analysis was conducted using a CHAID (Chi-squared Automatic Interaction Detection) algorithm in the statistical software SPSS version 23 (Escobar, 1998).

As dependent variable for consumer segmentation the variable "price premium" was applied and categorized according to its distribution into quartiles: 0=USD0, 1=USD0.035-USD0.17, 2=USD0.21-USD0.34, 3=> USD0.34. This variable was expressed as a function of the following variables which, in previous studies (Magnusson, Arvola, Hursti, Åberg, & Sjödén, 2001; Shafie & Rennie, 2012; Tsakiridou, Boutsouki, Zotos, & Mattas, 2008), have been identified to be

determinants for the consumption of a product with environmental characteristics: sex, age, income, education level, presence of children in a household, health concerns, and knowledge of environmentally friendly food. Quantitative variables such as age, income, price premium were transformed into ordinal variables in function of their quartiles as for a CHAID algorithm contingency tables are being applied using merely categorical variables (Escobar, 1998).

## Results and Discussion

About 70% of the interviewed beef consumers express a willingness to pay a price premium for beef produced with less environmental impact (Table 1). This price premium was on average US$ 0.31 per pound (with a standard deviation of US$ 0.42, confidence level of 90% and an estimation error of 4%), considering an average price paid per pound of US$ 2.23. This means an average price increase of 13.9%. However, a high variability of the mean value for the willingness to pay can be observed when considering the standard deviation. The values show a positive asymmetry and tend to group more on the left side of the mean value.

**Table 1** Willingness to pay for meat with less environmental impact according to location

| % of consumers willing to pay | Average beef price (US$/lb)[1] | Standard deviation | Willingness to pay Mean[2] (US$/lb) | Standard deviation | Asym metry | Kurtosis |
|---|---|---|---|---|---|---|
| 70 | 2.23 | 1.02 | 0.31 (13.9) | 0.42 | 2.65 | 11.3 |

[1]Prices in US$ – /US$/COP XRT: 08/22/2016; [2]The first value corresponds to the mean value for the willingness to pay and the second one to the % price increase.

Through statistic analysis, the variables education level, socioeconomic status, income and knowledge of environmental impacts in beef production were identified as most important for determining the profile of a potential consumer for beef with less environmental impact. This results in a positive relation between the mentioned variables and the price premium the consumers would be willing to pay for beef with less environmental impact.

The CHAID algorithm starts selecting the criteria which best discriminates the dependent variable. Through an iterative process, education level resulted to be the major predictor (presenting the lowest p-value: X2= 37, df=2, p=0.000). In the second stage, knowledge level of environmental impacts in beef production was segmented (X2= 13.051, df=1, p=0.004): a segment with no knowledge and a segment with little knowledge. With regard to the final results, the sample could be segmented into four parts related to education level and knowledge, being the first the major predictor.

The four identified segments are significantly different regarding their willingness to pay for bees with less environmental impact:

- *Segment 1:* (N=106; 29.9%) Consumers with a maximum level of incomplete secondary studies - Price Premium willing to pay: US$ 0 per pound (45.3%)
- *Segment 2:* (N=90; 25.4%) Consumers with completed secondary studies up to senior technician level, not knowing about the environmental impacts of beef production – Price Premium willing to pay: US$ 0 per pound (36.7%)
- *Segment 3:* (N= 75; 21.2%) Consumers with completed secondary studies up to senior technician level, knowing about the environmental impacts of beef production – Price Premium willing to pay: US$ 0.21-0.35 per pound (36%)
- *Segment 4:* (N=83; 23.4%) Consumers with education level superior to senior technician – Price Premium willing to pay: US$ >0.35 per pound (42.2%)

## Conclusions and Outlook

This study proves the existence of a potential market for beef with less environmental impact in the studied area. On the one hand, this represents an opportunity for the cattle sector for moving towards the development of differentiated products. On the other hand, it can serve as reference for decision makers in the formulation of policies and incentives that aim at promoting the adoption of new forage technologies (e.g., investment strategies) and at linking cattle producers to such markets.

For the development of such a differentiated market however, more research is necessary in the areas of consumers' willingness to pay (in-depth analysis) or consumer characteristics (e.g., behavior) and acceptance (e.g., certifications) that contribute to the development of differentiated products.

## Acknowledgements

This work was funded by the Sistema General de Regalías (SGR), Colombia. We acknowledge the support of the Cauca Regional Government, and the local producer associations COAGROUSUARIOS and ASOGAMER.

## References

1. ACUÑA, D. (2015). Agricultura sostenible : antecedentes e iniciativas. Oficina de estudios y políticas agrarias, Ministerio de Agricultura, Gobierno de Chile.
2. CHI, T., & YAMADA, R. (2002). Factors affecting farmers' adoption of technologies in farming system: A case study in Omon district, Can Tho province, Mekong Delta. Omonrice 10:94-100.
3. ESCOBAR, M. (1998). Las aplicaciones del análisis de segmentación : El procedimiento Chaid. Metodología de Ciencias Sociales 1:13–49.
4. FEDEGAN. 2014. Plan de desarrollo ganadero 2014-2019: Por una ganadería moderna, sostenible y solidaria. Federación Colombiana de Ganaderos. Retrieved from: https://goo.gl/9dq1qS
5. MAGNUSSON, M.K., ARVOLA, A., HURSTI, U.K., ÅBERG, L., & SJÖDÉN, P. (2001). Attitudes towards organic foods among Swedish consumers. British Food Journal 103(3):209-227.
6. PETERS, M., RAO, I., FISHER, M., SUBBARAO, G., MARTENS, S., HERRERO, M., … HYMAN, G. (2012). Tropical Forage-based Systems to Mitigate Greenhouse Gas Emissions. In Eco-Efficiency: From Vision to Reality. Cali, Colombia: Centro Internacional de Agricultura Tropical (CIAT). Retrieved from: http://hdl.handle.net/10568/55611
7. RAO, I., PETERS, M., CASTRO, A., SCHULTZE-KRAFT, R., WHITE, D., FISHER, M., MILES, J.,...RUDEL, T. (2015). LivestockPlus – The sustainable intensification of forage-based agricultural systems to improve livelihoods and ecosystem services in the tropics. Tropical Grasslands-Forrajes Tropicales 3(2):59-82. doi: 10.17138/TGFT(3)59-82
8. SALGADO, L., SUBIRÁ, M. E., & BELTRÁN, L. F. (2009). Consumo orgánico y conciencia ambiental de los consumidores. Revista Latinoamericana de Economia 140(157):190-199.
9. SHAFIE, F. A., & RENNIE, D. (2012). Consumer Perceptions Towards Organic Food. Procedia - Social and Behavioral Sciences, 49:360-367. doi: 10.1016/j.sbspro.2012.07.034
10. TSAKIRIDOU, E., BOUTSOUKI, C., ZOTOS, Y., & MATTAS, K. (2008). Attitudes and behaviour towards organic products: An exploratory study. International Journal of Retail and Distribution Management 36(2):158-175. doi: 10.1108/09590550810853093