CONSUMER ATTITUDES TOWARD FOOD PRODUCTION SYSTEMS AND ATTRIBUTES IN THE SOUTH-EASTERN STATES OF THE U.S.

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ABSTRACT
Extension activities towards rural and urban consumers are a tradition of the US Cooperative Extension Service. This study seeks to understand consumer food purchasing behaviors in order to suggest policy interventions to improve healthy eating habits. Data from a random sample of 252 consumers in three southern states show that consumers prefer organic over conventional and sustainable production systems. A follow-up study of consumer preferences for five attributes of fresh and vegetables, using a random sample of 412 consumers, shows that they prefer food attributes in the following order: freshness, taste, hygiene, nutritional value and affordable price. The study concludes that consumers should be educated to evaluate foods using all the information available on food attributes. The growing demand for organic products will also call for more extension activities for organic producers.

Keywords: Food Attributes, Analytic Hierarchy Process, Fuzzy Pair-wise Comparison, Multidimensional Scaling.

INTRODUCTION
Concerns regarding health, as well as the environmental impacts and sustainability of conventional agriculture have led to the development of more sustainable alternatives as described by Delind (2002), Lapping (2004), Lyson and Guptill (2004) and Flora (1990). Alternatives, variously described as organic food production systems, community supported agriculture (CSA), community-based agriculture, civic agriculture and farmers markets have begun to resonate and gather significant public
support. The advent of specialized stores offering organic produce and products and the allocation of supermarket self-space to organic produce and products attest the increasing demand for food and food products obtained under alternative production systems. The emergence of alternative food production systems and the discussion in the public domain concerning the health, environmental and social benefits they offer vis-a-vis conventional production systems may have, at the very least, sensitized the consumers about the opportunities that exist for food purchasing decisions based on the type of production system and its perceived benefits. Additionally, the promotion of healthy eating habits and the need for increased consumption of fruits and vegetables (Stewart and Harris, 2004; USDA, 2008; FAO, 2003) plus the well-publicized need for environmental conservation (WCED, 1987) amplifies the salience and relevance of differences between the food production systems in terms of their health, environmental and socio-economic impact. For the purpose of this study, conventional agriculture is operationalized as emphasizing the intensive use of land, water, synthetic fertilizers and inorganic chemical insecticides. It is generally agreed that the overall effect of these negative impacts is rendering conventional agriculture unsustainable. In general, sustainable systems use conventional practices more judiciously and integrate such practices with natural systems. For the purpose of this study a sustainable agricultural production system is operationalized as employing good agricultural practices (judicious use of synthetic fertilizers and pesticides), integrated pest management and emphasizing the use of natural cultural practices and fertilizers and insecticides from natural sources (WCED 1987; Ikerd 1993). Even though sustainable agricultural systems are more nature friendly and promote social equity, the popular belief is that true sustainability is captured best by organic production systems, which rely completely on natural systems and products to produce food and fiber. Based on this perspective, organic agriculture is operationalized as using only natural fertilizers and insecticides and emphasizes the use of natural cultural practices. In addition to studying food production systems, investigating consumers attitudes towards the attributes of food produced via these systems is the linchpin in designing extension education programs to promote increase consumption of fresh fruits and vegetables. The United States Department of Agriculture (USDA)-Nutrition Assistance Programs and Produce for Better Health Foundation
PBH have encouraged Americans to consume fruit and vegetables to reduce diet-related health problems such as stroke, cancer and diabetes (USDA 2008). These reports depict that the dietary recommendations for fruit and vegetable are taken into consideration by just 23% and 38% of all individuals, respectively (Stewart and Harris 2004). In 2009, per capita consumption of fresh fruits and vegetables was only 101.3 and 209.1 lb., whereas processed fruits and vegetables was 163.7 and 201.2 lb., respectively (USDA 2011). Increased consumption of fresh fruits and vegetables increases the demand for fresh fruits and vegetables (Moser et al. 2011) and provides opportunities for farmers, and the growing number of urban community gardens to meet this growing demand. Farmers' success in meeting this growing demand will be contingent on the capacity of extension to train farmers to produce and market fresh fruits and vegetables that match consumers' preferences.

Consequently, the objectives of this study were: (1) In the first stage, to assess consumer attitudes toward food produced under the following food production systems—conventional agriculture, sustainable alternatives and organic along five criteria—contribution to environmental conservation, food safety, food quality, contribution to wellness and contribution to community economic development by using Analytic Hierarchy Process (AHP). (2) In the second stage, to assess consumer preferences for fresh fruit and vegetables along five attributes: nutrition value, hygiene, taste, affordable price and freshness by using Fuzzy Pair-wise Comparison (FPC).

**METHODOLOGY**

For objective 1, the sample was designed following the protocol described by Dillman et al. (2009). It was drawn proportionate to population size by county in Georgia, North Carolina and South Carolina. Data were collected from a random sample of 252 respondents via a telephone survey. Enumerators asked consumers to compare three food production systems, conventional, sustainable and organic, in terms of which consumers would prefer farmers to use in producing the fresh fruits and vegetables that they purchase or consume; taking into consideration the following criteria: environmental, food safety, food quality, wellness, and community development issues. In the first stage of the study, the AHP model (Saaty 1980), illustrated in Figure 1, was employed to derive a measure of an individual consumer's preferences for production systems given the selected criteria following the approach of Moser et al. (2011).
For objective 2, the sample was designed using the same protocol (Dillman et al. 2009) described in the objective 1. It was drawn proportionate to population size by county in the same states. Data were collected from a random sample of 412 respondents. For achieving the objective 2, FPC was used to derive a measure of an individual consumer's preferences for fresh fruit and vegetable attributes in the second stage of the study. Researchers designed and formatted a FPC questionnaire to be compatible with the data collection protocol of Survey Monkey. In the questions, enumerators asked consumers to make pair-wise comparisons of five food attributes: nutritional value, hygiene, taste, affordable price and freshness, in order to determine their preference for one attribute over the other. The results obtained from FPC were evaluated using the Friedman and Kendall's W tests to establish the relative importance of attributes and the extent of agreement among consumers with respect to two or more rankings (Gunden et al. 2011). Finally, Multidimensional Scaling (MDS) was used to obtain “perceptual maps of consumer preferences” for both production systems and fresh fruit-vegetable attributes. In the analysis, the production systems, the criteria and the attributes that are perceived to be very similar to each other are placed near each other on the maps, and those systems, criteria and attributes that are perceived to be very different from each other are placed far away from each other on the maps.

**FINDINGS AND DISCUSSION**

In the AHP Model, consumers were asked to assess conventional, sustainable and organic production systems, taking into account the ability of each to generate benefits related to environmental conservation, food safety, food quality, wellness and community economic development. The AHP model for assessing the preference for production systems in terms of these criteria is defined in Figure 1. The goal is to determine consumers' preferences for food produced under three production systems using the following criteria: environmental conservation, food safety, food quality, wellness and community economic development. These criteria are the perceived benefits generated by each system. In the AHP model illustrated below, consumers are being asked to choose their preferred food production system from among the alternatives, conventional, sustainable and organic production systems, based on environmental conservation, food safety, food quality, wellness and community economic development criteria.
Figure 1 - AHP model for consumer attitudes toward food production systems

Table 1 shows the results obtained by applying the AHP model. The last column in Table 1 indicates the consumers' average priority ratings for each criterion. The results indicate that consumers accorded priority in the following order to food safety (0.281) followed by wellness (0.275), food quality (0.209), environmental concerns (0.144) and community development concerns (0.091). Consumers considered food safety and wellness to be more important attributes or features of a food production system than the other attributes such as food quality and the capacity of the food system to contribute to community development or environmental quality. In each row of Table 1, the preference scores for each type of production systems are presented. The third column of Table 1 shows that organic agriculture is preferred based on its perceived capacity to generate benefits associated with wellness, food quality and safety, environmental and community development with the highest ratings of 0.575, 0.533, 0.530, 0.515 and 0.514 respectively. The average preference degree of 0.544 shown in the last row of Table 1 and Figure 1 denotes that consumers preferred the organic production system over sustainable and conventional alternatives, which were assigned preference ratings of 0.274 and 0.182 respectively.
Table 1 - Consumers' attitudes toward food production systems by the criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Conventional</th>
<th>Sustainable</th>
<th>Organic</th>
<th>Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Concerns</td>
<td>0.203</td>
<td>0.282</td>
<td>0.515</td>
<td>0.144</td>
</tr>
<tr>
<td>Food Safety</td>
<td>0.186</td>
<td>0.284</td>
<td>0.530</td>
<td>0.281</td>
</tr>
<tr>
<td>Food Quality</td>
<td>0.195</td>
<td>0.272</td>
<td>0.533</td>
<td>0.209</td>
</tr>
<tr>
<td>Wellness</td>
<td>0.162</td>
<td>0.262</td>
<td>0.575</td>
<td>0.275</td>
</tr>
<tr>
<td>Community Development Concerns</td>
<td>0.209</td>
<td>0.278</td>
<td>0.514</td>
<td>0.091</td>
</tr>
<tr>
<td><strong>Final Decision</strong></td>
<td><strong>0.182</strong></td>
<td><strong>0.274</strong></td>
<td><strong>0.544</strong></td>
<td><strong>0.091</strong></td>
</tr>
</tbody>
</table>

Consumer preference scores are ranged between 0 and 1. The sum of each row, excluding the preference in the last column, is equal to 1.00.

Figure 2 shows consumers' perceptual map derived from multidimensional scaling. The map illustrates the pattern of proximities for food production systems and the criteria consumers used to assign preference ratings. Kruskal's stress value was used to measure goodness-of-fit. The stress value is a number on a scale from 0 (perfect fit) to 100 (the map captures nothing about the data). In general, researchers are looking for a stress value that is less than 20 (Johnson 2008). In the MDS results, Kruskal's stress value is 10 for this two dimensional model and $R^2 = 0.97$. The results indicate that consumers view the organic production system as quite dissimilar to the other production systems. Additionally, organic production is perceived as being associated with food safety and wellness, but not with environmental and community development benefits. On the other hand, consumers perceive a sustainable system of production to be associated with environmental and community development and food quality. Consumers see conventional as being dissimilar to organic and sustainable production systems and not associated with environment, community development, food quality, food safety and wellness. Consequently, the y axis is labeled as environmental/community development and the x axis as conventional production system. This means that moving from left to right along the x axis the production system becomes more conventional. And moving along the y axis from top to bottom indicates that environmental sensitivity of the production system decreases.
Descriptive statistics for consumers' pair-wise comparisons of the attributes of fresh fruit and vegetables obtained from the FPC model are presented in Table 2. The fresh fruit and vegetable attributes are ranked from most to least preferable using the reported degree of the consumer preferences. The results show that the fresh fruit and vegetable attribute most preferred by consumers is freshness with a preference rating of 0.579. Gao et al. (2011) reported a similar pattern of preference in their study on consumer preferences for fresh citrus. Consumers prefer the other food attributes in the following order: Taste (0.452), hygiene (0.449), nutritional value (0.428) and affordable price (0.411). In this sample, consumers seem to value freshness, taste and hygiene over price and nutritional value. The Friedman test was used to see if there was a difference in the rankings of the fresh fruit and vegetable attributes. The Friedman test, which is significant ($\chi^2=177.71; \ p<0.01$), confirms that some attributes are preferable to the others. Kendall's W test was used to measure the degree of agreement among consumers. The value of Kendall's W is 0.11, which indicates that the level of agreement among consumers in ranking the attributes is very low. A low level of agreement among consumers is an indication of the heterogeneity of consumers' preferences for the attributes of fresh fruits and vegetables.
Table 2 - Consumer preferences towards fresh fruits and vegetable attributes

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrition Value</td>
<td>0.428</td>
<td>0.122</td>
<td>0.024</td>
<td>0.929</td>
</tr>
<tr>
<td>Hygiene</td>
<td>0.449</td>
<td>0.142</td>
<td>0.049</td>
<td>1.000</td>
</tr>
<tr>
<td>Taste</td>
<td>0.452</td>
<td>0.128</td>
<td>0.049</td>
<td>0.868</td>
</tr>
<tr>
<td>Affordable Price</td>
<td>0.411</td>
<td>0.154</td>
<td>0.000</td>
<td>0.735</td>
</tr>
<tr>
<td>Freshness</td>
<td>0.579</td>
<td>0.159</td>
<td>0.150</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Significant by Friedman test for $p<0.01$; Kendall’s $W = 0.11$

Figure 3 shows consumers' perceptual map with attribute positioning derived from MDS analysis of consumers' preferences for the attributes of fresh fruits and vegetables. In the MDS results, Kruskal's STRESS measure is 0.03863. A satisfactory measure should be less than 0.05 for a two dimensional model (Mazzocchi, 2008). $R^2 = 0.99404$ shows that the model's goodness-of-fit is almost perfect. The analysis indicates that consumers perceive freshness as a distinct food attribute, which is quite separate from taste, hygiene, nutritional value and affordable price. On the other hand, consumers do not seem to perceive hygiene and nutritional value as distinct attributes, that is, consumers tend to accord the same level of priority to hygiene and nutritional value. Similarly, consumers tend to accord the same level of priority to taste and price.

Figure 3 - Perceptual mapping of preferences for fresh fruit and vegetable attributes
CONCLUSIONS AND RECOMMENDATIONS

Consumers accord the highest preference to organic production, followed by sustainable and conventional production systems respectively. Moreover, in according higher priority to food safety and wellness, consumers appear to be more concerned with criteria that are more tangible in terms of the consequence for consumers' personal and immediate well-being. Since our findings indicate that consumers do not associate organic food production with benefits for environmental and community development, there is a need to design education programs that will convince consumers that there are also socioeconomic and environmental benefits to be derived from organic production.

Consumers in making purchasing decisions pay more attention to freshness, taste and hygiene attributes of fresh fruits and vegetables than they do price and nutritional value, when these attributes are considered individually (Table 2). However, multidimensional scaling shows that consumers tend to associate taste and price when making purchasing decisions under conditions of low levels of nutritional value and freshness. Similarly, when only freshness is in question, consumers pay more attention to hygiene and nutritional value. This seems counter intuitive, but it may explain at least partially many consumers' predilection for inexpensive tasty fast food. These results indicate the need for extension to educate consumers on the connection among the food attributes and their relevance to healthy eating habits and a healthier lifestyle. That is, extension agencies should conduct hands-on education programs that use a holistic approach to in training consumers to use all the information available on all food attributes. For example, extension agencies could develop interactive workshops that engage a select number of participants from a target community in the selection and preparation of fresh fruits and vegetables. These workshops would involve participants in the development of menus and recipes, which would be codified and published for use by other members of the community. An interactive hands-on educational program that provides experiential learning is essential since classroom style teaching method tends to diminish the capacity to learn (Badrie, Ganpat and Cudjoe 2009). The results from multidimensional scaling also indicate that consumers tend to associate price and taste when making purchasing decisions, which may explain consumers love for inexpensive tasty fast food.
Extension marketing specialists should develop a program to train farmers in the selection, grading, packaging and presentation of fresh fruits and vegetables. Packaging should include information on likely health benefits and the nutritional value of fresh fruits and vegetables.

REFERENCES


