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Publisher: Taylor & Francis

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## International Journal of Vegetable Science

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/wijv20>

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Available online: 03 Oct 2011

To cite this article: O. Coulibaly, T. Nouhoeflin, C. C. Aitchedji, A. J. Cherry & P. Adegbola (2011): Consumers' Perceptions and Willingness to Pay for Organically Grown Vegetables, *International Journal of Vegetable Science*, 17:4, 349-362

To link to this article: <http://dx.doi.org/10.1080/19315260.2011.563276>

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# Consumers' Perceptions and Willingness to Pay for Organically Grown Vegetables

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Vegetable production plays an important role in food security and provides food and raw materials for industries, income from sales, and employment for small households in urban and peri-urban areas in West Africa. However, some significant health hazards may occur due to misuse of chemicals pesticides applied during vegetable production. Reducing health risks by developing alternatives to synthetic pesticides may be beneficial for consumers and producers. This study assesses the potential market for organically grown vegetables and analyzes consumer awareness and perceptions of synthetic pesticide residues in vegetables. Price levels that consumers are willing to pay for chemical-free vegetable products were evaluated. A hedonic-pricing model (preferences choice) was used to identify determinants of consumer willingness to pay for organically grown vegetables. Data were collected with a questionnaire on consumer perceptions of produce quality problems, awareness of pesticide use on vegetables, and willingness to pay for synthetic pesticide free vegetables. Consumers were aware of heavy use of synthetic pesticides on vegetables. Consumer preferences for quality vegetables included damage free, freshness, size, color, and firmness. Consumers were willing to pay a premium of more than 50% for synthetic pesticide-free vegetables. The most likely factors affecting consumer willingness to pay for organically grown vegetables were awareness of chemical residues and health risks, damage free,

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The authors thank Alphonse Singbo, F. Adigoun, and John Baptist Jatoe for their assistance. This study was undertaken within the framework of the research project “Public–Private Partnerships for Development and Implementation of Entomopathogenic Viruses as Bioinsecticides for Key Lepidopteran Pests in Ghana and Benin, West Africa,” implemented by the International Institute of Tropical Agriculture and funded by the Department for International Development (DfID) of the United Kingdom. The views expressed are not necessarily those of DfID (R7960, Crop Protection Programme).

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reliable availability of products, taste, and income level. There is a potential demand for synthetic pesticide-free vegetables.

**Keywords** *Brassica oleracea*, *Solanum lycopersicum*, Organically based pesticides, Synthetic pesticides, Residue, West Africa.

Agricultural production in the vicinity of towns, defined as peri-urban, is important for local and national economies of Ghana and Benin because of significant contributions to food security, supply of raw materials for local industries, and improved income and employment. However, concerns about health and environmental hazards associated with misuse of pesticides have increased (Marquez, 1999). Agricultural pests cause significant reductions in crop yields, product quality, and income. Synthetic pesticides are used in attempts to increase yield and improve product quality. There may be negative effects to human health and the environment caused by overapplication of synthetic pesticides. Producers, pesticide applicators, and field workers are at greatest risk of exposure. Breast milk samples from women in cotton-producing regions in Guatemala and Nicaragua have some of the highest levels of DDT recorded in humans (World Bank, 1992). Illness and mortality rates from synthetic pesticide poisoning are close to those due to major diseases (World Bank, 1992). There were 4031 cases of acute pesticide poisoning and 603 deaths over the period 1980–1987 in the Philippines (Castaneda and Rola, 1990). This number is likely to be underestimated because most cases do not reach hospitals, and rural health official records may not always mention poisoning from synthetic pesticides (International Development Research Centre [IDRC], 1990). Prolonged exposure to pesticides has been associated with non-Hodgkin's lymphoma, leukemia, cardiopulmonary disorders, neurological and hematological symptoms, and skin diseases (Antle and Capalbo, 1995; Crissman et al., 1994; Pingali et al., 1994; Wigle et al., 1990). The risk to consumers due to consumption of vegetables to which high levels of synthetic pesticides have been applied is high because they are not aware of the health hazards linked to chemical residues in vegetables (Coulibaly et al., 2002).

Rising concerns regarding safety aspects of synthetic pesticides are driving public awareness and desire for information on misuse of synthetic pesticides and for assessment of alternative pest control methods. Nongovernmental organizations are supporting implementation of integrated pest management (IPM) strategies in Ghana. Changes in production conditions (growing plot sizes, expanding monocropping, reduction in fallow periods) need to be compensated for with appropriate changes in cropping techniques such as effective crop rotation and use of inputs including IPM (Hendrik and Recke, 2000).

The World Bank supports pest control strategies that promote the use of biological or environmental control methods (Youdeowei, 2000). The European Union (EU) has undertaken a program for norms and standards and setting

the maximum residual levels for chemicals suitable for use on agricultural products. All imports originating from non-EU member countries must comply with these new regulatory standards. All horticultural products originating from non-EU member countries and exported to the EU have to meet the zero tolerance regarding pesticide residues containing substances for which EU approval has been revoked (COLEACP Pesticides Initiative Program, Pesticides File). This is a significant challenge for exporters of products to the EU, the major destination for Ghana horticultural exports. The West African vegetable export sector to the EU is limited by lack of appropriate safer options for pest management or it must find alternative markets. Despite measures to harmonize a single market, the European fresh produce market is diverse in terms of consumer preferences, structural dynamics, and attention to and enforcement of food safety and other standards.

## CONCEPTUAL FRAMEWORK

### Approaches in Measuring Willingness to Pay for Products

There are many approaches used today to assess consumer willingness to pay (WTP) for a new product (Braidert, 2005). The classification framework for methods to measure WTP includes stated and revealed preferences. *Revealed preferences*, according to Samuelson (1948), is a method by which it is possible to discern the best possible option on the basis of consumer behavior. This method consists of observing the price that people pay for goods in various markets or observing individual expenditures to obtain goods or to avoid their loss. The stated preferences method is based on asking consumers to directly state their values, rather than inferring values from actual choices, as revealed preference methods do (King et al., 2000). The stated preferences method use direct and indirect surveys; revealed preferences use market data and experiments. Direct surveys consist of asking for expert points of view or judgments or conducting customer surveys. The indirect survey consists of conducting a discrete choice analysis or a conjoint analysis.

The stated preferences approach (direct survey-based approach) was used to estimate consumer WTP or accept organically produced vegetables. To analyze this, the contingent valuation methodology, which consists of simulating a market for a nonmarketed good and obtaining a value for that good contingent on the hypothetical market described during the survey, was used (Wedgwood and Sansom, 2003). A questionnaire was used for the contingent valuation for estimating individual values of nonmarket goods or services (Richard, 1998). The contingent valuation method is a useful tool in measuring consumer WTP. Cummings et al. (1986) found that when the contingent method is used for goods that consumers are familiar with it leads to accurate and useful information of consumers' preferences. The method was applied to cabbage

(*Brassica oleracea* L.) and tomato (*Solanum lycopersicum* var. *cerasiforme* L.), two widely grown and consumed vegetables. However, this approach has been subject to criticism (Diamond and Hausman, 1994).

### Estimating Consumer Willingness to Pay for Nonmarket Goods

The contingent valuation (CV) method, which is based on interviewing respondents, is used to approach consumer WTP. Although at one time it was common to pose open-ended questions—that is, “How much would you be willing to pay for . . .”—researchers increasingly prefer a dichotomous choice approach. The good is described and consumers are asked whether they would be willing to pay to obtain that good at a specified price. This response may seem to be limited in its informational content because one does not know the value of the payment at which they are indifferent; that is, the maximum value they would be willing to pay. A contingent valuation survey was conducted to estimate prices (WTP estimates) for various physical aspects of vegetables produced with organically based pesticides. Techniques were used to control biases that are inherent to a hypothetical survey and tests were used to determine whether they remain.

### Contingent Valuation and Willingness to Pay

The CV uses survey questions to elicit respondent preferences for public goods by determining what respondents would be willing to pay for specified improvements in the goods. The method is aimed at eliciting their WTP or willingness to accept compensation in monetary units or in health guarantee. It circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the targeted good. Specifically, CV devices involve asking individuals to reveal personal valuations of increments (decrements) in goods being evaluated by using contingent markets. These markets define the good or amenity of interest, the status quo, the level of provision and the offered increment or decrement therein, the institutional structure under which the good is to be provided, the method of payment, and (implicitly or explicitly) the decision rule that determines whether to implement the offered program. Contingent markets are highly structured to confront respondents with a well-defined situation and to elicit a circumstantial choice contingent upon the occurrence of the posited situation (Cummings et al., 1986).

The purpose of this study was to assess the potential for developing an organically based pesticide market in Ghana and Benin. Specific objectives were to analyze consumer awareness and perceptions concerning synthetic chemical residues in vegetables, to assess consumer WTP for organically grown vegetables, and to determine key factors affecting consumer decision making in paying for organically grown vegetables.

## MATERIALS AND METHODS

Surveys were conducted in vegetable markets in urban and peri-urban areas of Ghana and Benin, two coastal countries located in West Africa situated about 200 miles apart. Data collected were cross-sectional data from vegetable buyers in the markets. Several steps were followed to minimize biases while determining the CV. A survey questionnaire included a) a set of questions on respondents characteristics; b) a detailed description of goods being valued (organically grown tomatoes and cabbage vs. those grown with synthetic materials) and the hypothetical circumstances under which it is made available to the respondents; c) the respondents' preferences relevant to goods; and d) questions on their WTP for the organically grown vegetables.

Subjects were those consumers who mainly bought cabbage and tomato. Face-to-face interviews with respondents were conducted using questionnaires. A sample of 100 consumers was interviewed in markets in each country. In Ghana, surveys were carried out in Accra and Tema, two major cities in the southern part of the country. In Benin, surveys were conducted in Cotonou and Grand-Popo, two cities located in the southeast and southwest of the country. Consumers were interviewed about perceptions of product quality, awareness of synthetic pesticide used on vegetables, and willingness to pay for a chemical free head of cabbage or tomato at a given price. Consumers were asked to choose from a list of the main characteristics or preferences they evaluated in assessing quality of tomato and cabbage. In order to place these characteristics in the context of product quality, attributes that consumers associate with a quality of tomato or cabbage were assessed. Key factors most likely to influence willingness of consumers to pay for organically grown vegetables were identified and assessed (Table 1).

### Theoretical Model

The starting point for the analysis is a consideration of the change in utility induced by the prescribed change and the level of payment with which it is associated. The change in utility for an individual was based on the models of McFadden (1981). Given the assumption that utility is strictly increasing in the unobserved attribute for all products and for all consumers, Bajari and Benkard (2005) reported that for any two goods with strictly positive demand the response is positive. An individual is willing to accept change if the utility is positive. A probabilistic model depends on assumptions about the nature of the error term. If it is assumed to be normally distributed, then the model follows a probit functional form.

The WTP measurements are based on utility theory. Hanemann (1991) outlined the theoretical underpinnings as a utility maximization problem subject to a budget constraint. The consumer chooses the level of the good



**Table 1:** Names and description of factors affecting consumer decision making for purchase of organically grown vegetables.

Variable	Criterion
Dependent: WTP	Willingness to pay higher premium price for organically grown vegetables (1 = yes, 0 = no)
Independent:	
Household	Size
Education	Education level
Occupation	Head of household
Income	Income level (<US\$100; US\$100–US\$200; >US\$200)
Chemical	Chemical free
Damage	Damage free
Cleanliness	No dirt on product
Freshness	Degree of freshness
Health	Awareness of health risks
Residue	Awareness of chemical residues
Label	Presence of label to guarantee grown organically
Appearance	Physical appearance of organically grown vegetable
Taste	Expected taste of organically grown vegetable
Availability	When available
Distance	Distance to market

that maximizes utility, producing the traditional Marshallian demand curve (Hanemann, 1991), resulting in an indirect utility function. Identifying a change in a good's quality is the amount the consumer would be willing to pay for the improved quality, maintaining constant utility. The estimate is shown more directly using the dual problem of expenditure minimization constrained by a given utility level (Lusk and Hudson, 2004). The dual problem produces a Hicksian demand curve and indirect expenditure function (Lusk and Hudson, 2004).

### The Empirical Model

The empirical specification of the logit model (Herman, 2004) was employed to identify determinants affecting consumer willingness to purchase an organically grown vegetable in Ghana and Benin. The model identifies key factors that influence consumer willingness to pay for organically grown vegetables for each country. In determining variables, affecting the purchase of organically grown WTP is the dependent variable. A value of 1 is assigned for consumers willing to pay a premium for organically grown vegetables and a value of 0 for those who would not pay more than for vegetables treated with synthetic pesticide. Data from the responses for participants in Benin and Ghana were analyzed separately because the countries are characterized by different market environments, which may influence consumer preferences.

## RESULTS

### Consumer Perceptions of Vegetable Product Quality

The demand for tomatoes in daily vegetable purchases is higher than cabbage; tomato is used as an ingredient for soups, stews, or salads by almost all households, whereas cabbage is used for special meals and it is purchased twice a week by only 20% and 14% of consumers in Ghana and Benin, respectively. These proportions are not statistically different (Table 2). In both countries, characteristics that consumers are looking for in assessing quality of cabbage and tomato are damage free, freshness, size, and color. In Ghana, firmness is also important but it is not in Benin. In Ghana, consumers do not foresee risks of health hazards due to heavy chemical residues as a major determinant to buying vegetables. In Benin, more than 50% of consumers reported that the risk is important in their purchase decision (Tables 3 and 4). Freshness is also important.

### Consumer Awareness of Heavy Synthetic Pesticide Use and Alternatives in Vegetable Production

Consumers in both countries are aware of intensive use of chemicals on vegetables and its associated health risk. About 80% of consumers in Ghana are aware of the heavy usage of synthetic pesticides on vegetables compared to 60% in Benin (Table 5). About 85% of respondents in Ghana and 67% in

**Table 2:** Proportion of consumers purchasing cabbage twice a week in Benin and Ghana.

	Benin (N = 100)	Ghana (N = 100)	$\chi^2$	DI	P
Purchase of cabbage	14	20	0.752	1	0.386

DI = degré de liberté (degree of freedom).

**Table 3:** Characteristics used by consumers (%) in assessing quality of cabbage in Benin and Ghana.

	Benin (N = 100)	Ghana (N = 100)
Color	69	74
Freshness	80	69
Size	83	51
Firmness	6	37
Undamaged	87	33
Cleanliness	86	5



**Table 4:** Characteristics used by consumers (%) in assessing quality of tomato in Benin and Ghana.

	Benin ( <i>N</i> = 100)	Ghana ( <i>N</i> = 100)
Color	92	24
Freshness	90	75
Size	93	32
Firmness	2	23
Undamaged	86	67
Cleanliness	9	9

**Table 5:** Consumer awareness (%) of synthetic pesticides and organically based pesticides.

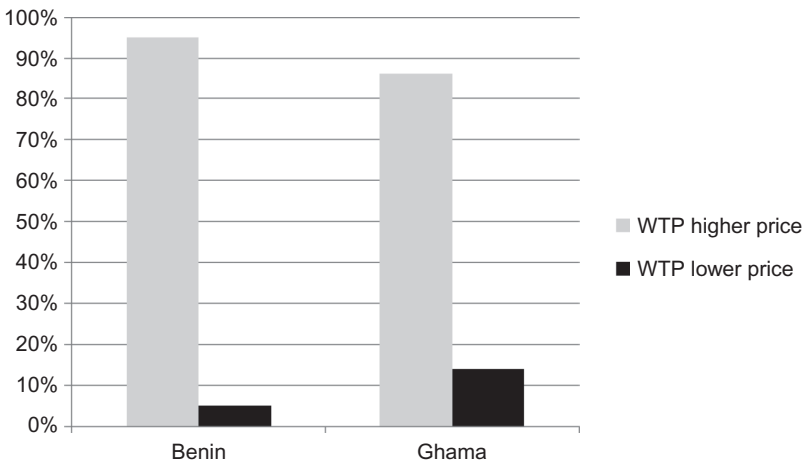
Country	Use of synthetic pesticides	Awareness of chemical residues	Awareness of possible health risk due to synthetic pesticides	Use of organically based pesticides
Benin	60	67	71	24
Ghana	80	85	88	19

Benin are aware of chemical residues on vegetables. The level of awareness of the health risk associated with chemical residues is high in both countries. Almost 90% of the sampled respondents in Ghana and 70% in Benin reported being aware of health hazards linked to synthetic pesticides. However, most consumers in both countries do not have an informed opinion about organically based pesticides and their use in vegetable production. Only 19% of consumers in Ghana and 24% in Benin reported being aware of the existence of organically based pesticides.

### Consumer Willingness to Pay for Organically Grown Vegetables

Eighty-six percent of consumers in Ghana and 95% in Benin were willing to pay a premium for organically grown vegetables (Fig. 1). Given a standard price of \$0.25 for an average size head of cabbage or a pack of tomatoes treated with synthetic pesticides, consumers were willing to pay up to 57% and 50% more for organic cabbage and tomatoes, respectively, above that of synthetic pesticide-treated cabbage or tomatoes in Ghana (Tables 6 and 7). The high standard deviations are explained by mixed perceptions and the range of prices consumers are willing to pay for organically grown vegetables.

Premiums for organically grown crops are slightly higher in Benin and have been estimated to reach up to 66% for cabbage and 56% for tomato (Tables 8 and 9). The high premium may be explained by an increasing rate



**Figure 1:** Proportion of consumers willing to pay (WTP) a higher price for organically grown vegetables.

**Table 6:** Minimum and maximum price premium for organically grown cabbage or tomato in Ghana.

Value	WTP <sup>a</sup> chemical free	
	Cabbage	Tomato
Minimum (US\$) <sup>b</sup>	0.06	0.06
Maximum (US\$)	0.6	0.6
Mean (US\$)	0.36	0.36
Standard deviation (US\$)	0.1	0.1

<sup>a</sup>WTP = Willingness to pay higher premium price for organically grown cabbage or tomato in Ghana.

<sup>b</sup>US\$1 = FCFA 464 (Benin) or GHC 9400 (Ghana).

**Table 7:** Price premium estimates for organically grown cabbage and tomato in Ghana.

Value	Price premium	
	Cabbage	Tomato
Mean WTP (US\$) <sup>a</sup>	0.39	0.37
Standard deviation (US\$)	0.08	0.08
Premium (%)	57	50

<sup>a</sup>US\$1 = FCFA 464 (Benin) or GHC 9400 (Ghana).

of chemical poisoning caused by the misuse of synthetic pesticides such as endosulfan in Benin (Vodouhe et al., 2000). In both countries, consumers are becoming concerned about the types of pesticides used on vegetables as the awareness of health risks is increasing.

**Table 8:** Minimum and maximum price premium for organically grown cabbage or tomato in Benin.

Value	WTP <sup>a</sup> chemical free	
	Cabbage	Tomato
Minimum (US\$) <sup>b</sup>	0.2	0.1
Maximum (US\$)	1.5	1.5
Mean (US\$)	0.4	0.4
Standard deviation (US\$)	0.1	0.1

<sup>a</sup>WTP = Willingness to pay higher premium price for organically grown cabbage or tomato in Benin.

<sup>b</sup>US\$1 = FCFA 464 (Benin) or GHC 9400 (Ghana).

**Table 9:** Price premium estimates for organically grown cabbage and tomato in Benin.

Value	Price premium	
	Cabbage	Tomato
Mean WTP (US\$) <sup>a</sup>	0.45	0.39
Standard deviation (US\$)	0.2	0.2
Premium (%)	66	56

<sup>a</sup>US\$1 = FCFA 464 (Benin) or GHC 9400 (Ghana).

## Determinants of Consumer Willingness to Pay for Organically Grown Cabbages

In Ghana, three factors were found to significantly affect consumer choices for cabbage: level of education, awareness of synthetic pesticide residues on vegetables, and expected taste of the vegetables treated with organically based pesticides (Table 10). In Benin, factors affecting consumer WTP for organically

**Table 10:** Factors likely affecting the decision to choose organically grown cabbage in Ghana (dependent variable: WTP<sup>a</sup>).

Variables	B	Standard error	Wald	Significance
Household	0.141	0.178	0.626	0.429
Education	-1.023	0.324	9.975	0.002**
Occupation	0.360	0.339	1.123	0.289
Distance	-0.979	0.814	1.446	0.229
Fresh	0.846	1.088	0.605	0.437
Taste	-2.795	0.884	9.999	0.002**
Residue	1.161	0.682	2.899	0.089*
Label	-1.437	1.341	1.148	0.284

<sup>a</sup>WTP = Willingness to pay a higher price premium for organically grown cabbage in Ghana. Chi-square = 50.737; *df* = 8; prediction = 87.5%.

\*, \*\*Significant at  $P < 0.1$  and  $P < 0.01$ .

**Table 11:** Factors likely affecting the decision to choose organically grown cabbage in Benin (dependent variable: WTP<sup>a</sup>).

Variable	B	Standard error	Wald	Significance
Education	2.982	1.736	2.952	0.086*
Income level	-11.060	6.516	2.881	0.090*
Residue	-9.119	4.545	4.025	0.045**
Health	12.537	6.627	3.579	0.059*
Label	-4.967	3.490	2.025	0.155
Size	0.179	0.770	0.054	0.816
Taste	1.740	1.596	1.188	0.276
Appearance	1.422	1.524	0.870	0.351
Availability	-10.057	5.851	2.955	0.086*

<sup>a</sup> = WTP = Willingness to pay a higher price premium for organically grown cabbage in Benin). Chi-square = 105.021; *df* = 9; prediction = 95.4%.

\*. \*\*Significant at  $P < 0.1$  and  $P < 0.05$ .

grown cabbages are level of education, awareness of health risks, availability of organically grown vegetables throughout the year, and level of residue on cabbage (Table 11).

## Determinants of Consumer Willingness to Pay for Organically Grown Tomatoes

Several factors affected consumer WTP for organic tomatoes (Tables 12 and 13). In Ghana, consumers are sensitive to the taste and appearance of

**Table 12:** Factors likely affecting the decision to choose organically grown tomato in Ghana (dependent variable: WTP<sup>a</sup>).

Variable	B	Standard Error	Wald	Significance
Availability	0.090	0.774	0.013	0.908
Chemical	-15.602	18,849.584	0.000	0.999
Damage	4.167	2.054	4.116	0.042**
Cleanliness	-12.799	19,589.448	0.000	0.999
Distance	-1.191	1.664	0.512	0.474
Freshness	-0.098	1.682	0.003	0.953
Household	-0.231	0.415	0.309	0.578
Label	-0.716	2.264	0.100	0.752
Occupation	1.011	0.833	1.474	0.225
Residue	2.473	1.352	3.347	0.067*
Taste	-3.821	1.902	4.035	0.045**
Education	-0.624	0.538	1.349	0.245
Level of income	-0.624	0.538	1.349	0.245

<sup>a</sup>WTP = Willingness to pay a higher price premium for organically grown tomato in Ghana. Chi-square = 51.601; *df* = 13; prediction = 94.2%.

\*Significant at  $p < 0.1$ .

\*\*Significant at  $p < 0.05$ .

**Table 13:** Factors likely affecting the decision to choose organically grown tomato in Benin (dependent variable: WTP<sup>a</sup>).

	<i>B</i>	Standard Error	Wald	Significance
Education	1.930	1.340	2.075	0.150
Level of income	-6.699	3.304	4.112	0.043**
Residue	-6.891	3.129	4.850	0.028**
Health	7.782	3.411	5.203	0.023**
Label	-3.792	2.632	2.075	0.150
Size	0.280	0.994	0.079	0.778
Taste	0.828	0.951	0.757	0.384
Appearance	1.320	1.205	1.199	0.274
Availability	-5.945	3.023	3.866	0.049**

<sup>a</sup> = WTP = Willingness to pay a higher price premium for organically grown tomato in Benin. Chi-square = 107.982; *df* = 9; prediction = 95.7%.

\*\*Significant at  $P < 0.05$ .

tomatoes. Organically grown tomatoes should have a taste similar to or better than crops grown using synthetic materials and should be free from damage. In Benin, awareness of synthetic pesticides residues in vegetables, awareness of health risks due to chemical residues, level of income, and the availability of tomato treated with organically based pesticides were important for consumer decisions (Table 13).

## DISCUSSION

Daily purchases of vegetable products are common in Ghana and Benin. Consumers in these two countries value external and visible characteristics, including free from damage, freshness, size, and color, for assessing vegetable quality. Red color is desired for tomato, but consumers may suspect that it might indicate artificial maturation from chemicals; fertilizers may induce early maturing. In the same way, a tomato that is too large may mean that the producer used growth-stimulating chemicals. Based on these perceptions, more consumers may choose pink and smaller tomato fruit (CIRAD, 2003). Size and color of tomato fruit are attributes that may positively and negatively affect decisions to choose a product.

In both countries there is a potential demand for organically produced cabbage and tomato. The majority of consumers were informed about the use of synthetic pesticides in vegetable production, but almost all consumers in Ghana do not consider pesticide-linked health hazards a major issue in purchasing vegetables. The establishment of a separate market for organic vegetables may induce changes in consumer attitudes.

In Benin, consumers are more aware of potential risks from overuse of synthetic pesticides. Urban consumers travel to peri-urban areas surrounding

cities to purchase products that have a lesser chance of being treated with synthetic pesticides. Developing, packaging, and labeling organically grown vegetables will help guide consumers who are willing to pay for organically grown vegetables and related premium prices. In both countries, consumers were willing to pay higher price premiums for organically grown vegetables if available due to increasing awareness of health risks linked to synthetic pesticides. In addition to information diffusion and rising awareness regarding health risks associated with excessive use of synthetic pesticide, the sustainable supply of labeled organically grown vegetables (all-time availability) and related information packaging to consumers are important key factors in consumer decision making for purchasing vegetables in Benin and Ghana.

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