International Journal of Agricultural Management and Development (IJAMAD)
Available online on: www.ijamad.com
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Consumers' Preference for Cowpea in Nigeria

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Received: 15 September 2012,
Accepted: 10 October 2013

Abstract

The study investigates consumers' preference for cowpea reflected in the Nigerian markets through price discounts and premiums that consumers pay for different cowpea characteristics. The price data used for this study were obtained through a market survey. A common data collection protocol was employed. Every month, between October 2009 to December 2010, five cowpea samples per seller were bought from randomly selected sellers in six markets and the prices noted. In the laboratory, the non-price data, such as, 100 grain weight, number of bruchid holes per 100 grains, eye colour and texture of the testa were obtained. A hedonic pricing regression model was used to analyze data collected. Hedonic pricing methods provide a statistical estimate of premiums and discounts. Results indicate that eye colour is the most important determinant of cowpea market prices. Cowpeas with brown colour commands a clear premium in all but one market. The consumers discount prices for insect damage in most markets. In general, this study signals the need for cowpea breeders to identify cost effective ways of breeding for brown coloured cowpea (Ife-brown specie) which was noted to attract price premium.

Keywords:
Consumers, Hedonic Pricing, Cowpeas, Nigeria

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INTRODUCTION

Like other citizens in sub-Sahara African countries, cowpea (*Vigna unguiculata* L. walp.) commonly referred to as 'beans' in Nigeria has been a major food legume for several decades. Nigeria is the largest producer of cowpea in the world with an annual yield of about 2million metric tons on 4.4 million hectares or 0.45mt/ha (Pereira *et al.*, 2001). Several factors account for the leading position of Nigeria in cowpea production, among which are the significant advances made by the International Institute of Tropical Agriculture (IITA) over the last two decades in improving production in sub-Saharan Africa (Singh *et al.,* 1999). As a relatively inexpensive source of food, cowpea fits the needs of the rural-urban poor. Cowpea is highly nutritive. Its nutritive value lies in its high protein content of about 23%, which is double that of cereals with a protein content of about 23%, fat content of 1.3%, fibre content of 1.8%, carbohydrate content of 67%, and water content of 8-9% (Bressami,1985). It therefore has a tremendous potential to contribute to the alleviation of malnutrition among poor families (Mcfarlene, 1983). Cowpea seed is a nutritious component in livestock feed. Its forage contributes significantly to animal feed mainly during the dry season when the demand for feed reaches its peak. Epidemiological studies in over 40 countries of the world show a direct link between consumption of dry beans and reduced incidences of chronic diseases including cancer, and it is also used to enhance child survival (USAID, 2003). Furthermore, cowpea is an important legume in Nigeria which serves as a source of farm income (Afolami, 2002).

Despite the economic and nutritional importance of cowpea to consumers and producers, a major problem of cowpea production is the mismatch between improved varieties of cowpea and consumers preference (Faye *et al.*, 2002). According to Faye *et al.* (2002) the characteristics of improved varieties of cowpea are not necessarily those priced by consumers. For example, the white cowpeas with dark eyes are the type widely accepted internationally but not necessarily the type West African consumers want. Another example of this mismatch between the improved varieties of cowpeas and consumers preference relates to size. While most West African consumers prefer larger grain size, some of the improved varieties are quite small. Consumers prefer large seeds for their sauce or rice and processors also prefer large seeds, since they yield larger amounts of flour. Cowpea varieties with smooth skin are difficult to cook, and given that time and energy have costs and can be scarce, especially in a pressurized urban environment, consumers prefer cowpeas which are quick to cook, to save time and fuel. (Faye *et al.*, 2002) The most important preference for testa colour in West Africa is white, but in some areas consumers prefer red, brown or mottled grains (Langyintuo *et al*., 2003).

The main objective of this study therefore is to provide information on consumers' preference of cowpea reflected in the market through price discounts and premiums that consumers pay for visible cowpea characteristics in Nigeria. This information is useful in guiding producers, marketers, policy makers and other role players in the cowpea value chain. This is important because the financial benefits are much higher when farmers understand the cowpea characteristics that attract price premium from consumers and increase their production and supply of the commodity to the market. On the other hand, if farmers fail to take into account the characteristics preferred by consumers; they face financial losses because they have already invested capital and time. The knowledge of consumer preferences is essential to developing cowpea markets in Nigeria. There will be efficient marketing of farmers produce, whereby producers and marketers will realize fair income and consumers' utilities optimized. This will also lower the transaction costs of intermediaries in the cowpea value chain (Langyintuo *et al.,* 2002). Producers and merchants will be more likely to adopt storage and post harvest technologies that improve the characteristics that cowpea consumers value. Researchers will achieve cost effectiveness by targeting research at characteristics that meet consumers' tastes and preference. By providing such information, a significant contribution can be made to the growing importance of cowpea as a means to improve and sustain the livelihood of people in the study area.

The specific objectives of the study therefore are to (i) analyze cowpea grain characteristics

across selected markets and (ii) estimate the hedonic prices paid by consumers for cowpea characteristics. To guide research, the following hypotheses were stated: (i) the characteristics of cowpea grains do not vary across markets and (ii) there is no significant relationship between cowpea price and cowpea characteristics. The rest of the paper is organized as follows. Section 2 discusses the materials and methods employed to estimate price differences. Section 3 describes the data used for the study. Section 4 presents the results of the Hedonic Pricing Regression. Finally, Section 5 concludes.

MATERIALS AND METHODS

The conceptual basis for estimating consumer demand for a good's quality is Lancaster's model of consumption theory (Lancaster, 1971). The model regards the characteristics of the good and not the good itself as the direct object of utility. Thus, price differences across different units of transaction are due mainly to quality differences that can be measured in terms of the characteristics. Using this concept, Ladd and Suvannut (1976), developed the consumer goods model which describes the price of a good as a linear summation of the implicit value of its attributes. They showed that:

$$P_i = \sum_{j=1}^{M} \left(\frac{dX_{oj}}{d_{qi}} \right) \left(\frac{du / dX_{oj}}{du / dE} \right) \quad (1)$$

Where, p_i = market price of product i

X_{oj} = total amount of the mth product charaterristics provided by consumption of all goods.

q_i = amount consumed of product i, E = total expenditure, dX_{oj}/d_{qi} = the marginal yield of the jth product characteristic by the ith product du/dX_{oj} = marginal utility of the jth product characteristic, du/dE = marginal utility of income.

If we assume that expenditure equals income [$du/dX_{oj}/du/dE$] can be regarded as the marginal implicit price. Given that most product characteristics are constant, the marginal yield ($dX_{oj}/d_{qi}=X_{oj}=X_{ij}$) may be constant. In terms of the current cowpea demand analysis, this can be expressed as:

$$P_i = \sum_{j=1}^{m} X_{ij} \beta_{ij} + \mu \quad (2)$$

Where, P_i price of cowpea, X_{ij} = the quantity of cowpea grain caharacterisics j such as grain size, skin colour and insect damage. β_{ij} = the implicit price of characterstic j,

μ = stochastic error term.

Based on the economic principle that products demand stems from the utility provided as a function of its quality characteristics (Brent, 1991) utility theory has been used to analyze consumer choice of a good or a service based on price and a budget constraint. In the case of food products, the price a consumer is willing to pay may be a function of the marginal implicit prices that an individual is willing to pay for each nutrient. A good way to understanding the hedonic analysis framework is to view each good in terms of the set of characteristics it possesses (Ladd and Suvannut, (1976).

For any given good say cowpea, let the set of characteristics be ordered and denoted as:

$$X = (x_i \ldots\ldots\ldots\ldots x_k) \quad (3)$$

It is assumed that the preference of consumers in the market for a particular good is solely determined by its corresponding characteristics vector. In addition, it is assumed that there is a functional relationship between the good's price P, and the characteristic vector X, in the form of the equation:

$$P = f(x) \quad (4)$$

This functional relationship specifies the hedonic relationship or hedonic regression typical for the good in the market (Hans, 2003). Using this concept, Faye *et al.* (2002) and Langyintuo *et al.* (2003) employed a profit maximization framework and a hedonic pricing model to asses the impact of cowpea characteristics on market price. They showed the importance of grain size and seasonal variations on cowpea prices. This study follows the framework outlined in the Faye *et al.* (2002) and Langyintuo *et al.* (2003). Cowpeas are agricultural commodities; therefore the effect of weather in a given year and other seasonal effects are likely to have related effects on the disturbances, for the different demand equations in different markets. These disturbances are not always related to the characteristics of the cowpea, hence the necessity to test for contemporaneous correlation (Judge *et al.*, 1988) When contemporaneous correlation exists, it may be more efficient to estimate all equations jointly with the seemingly unrelated estimator (SUR), rather to estimate each one separately using least squares

(Greene,1993). The data did not include seasonal variable for constraints of time and therefore were not tested for contemporaneous correlation. The problem of autocorrelation associated with time series data does not arise. The cross sectional units are randomized individuals (cowpea sellers) hence the disturbances of the cross sectional units were assumed mutually independent, but heteroscedastic. But by randomizing across sellers the presence of heteroscedasticity is ruled out (Langyintuo *et al.,* 2003) consequently, the use of the linear model of hedonic pricing for parameter estimation was justified.

Data and variables

The study used a self-administered questionaire directed at cowpea sellers to generate primary data through a market survey between October 2009 to December 2010. The questionaire was translated into the local language to facilitate understanding of questions asked. A common data collection protocol was employed. Every month, between October 2010 and December 2011, five cowpea samples per seller were bought from eight randomly selected sellers. Six markets were purposively selected. They include Ede, Ife, Ilesha, Ikirun, Iwo and Oshogbo markets. A typical Nigerian market is systematically segmented with cowpea sellers displaying their products according to particular visible characteristics. In the markets, survey began with a randomly chosen seller and every 8th seller was selected from whom the five available cowpea types were purchased. Thus, adding up to 40 samples per market and 240 samples for the six markets. Cowpea grains are sold in bowl weights and one kongo is equivalent to 1.64kg and price is expressed in naira per kilogramme (CEPO, 2007). Price data were generated from current retail prices of purchased cowpea samples. While non-price data such as the 100 grain weight (Grain size), number of bruchid holes per 100 grains, (Insect damage level) eye colour, and texture of the testa were obtained in the laboratory. These were supplemented with secondary data from the Central Economic Panning Office (CEPO) of Osun State Ministry of Finance and Economic Development,Osogbo. Faostat data base and National Bureau of Statistics (NBS) Annual abstracts.The study area, Osun state is largely urban and has an estimated population of about 3,423,535 people (NBS, 2006). It is delineated into six geopolitical zones. They include Ede, Ife, Ilesha, Ikirun, Iwo and Oshogbo. Ikirun is the gateway through which cowpea is moved to the study area from the Northern part of Nigeria, where the commodity under study is largely produced.

Following Faye *et al.* (2002), the hedonic price function is stated as:

$$P_i = \alpha_0 + \beta_{ik} \sum_{i=1}^{j=1} Z_{ik} + \mu \quad (5)$$

Where P_i = per unit price of cowpea α = intercept β_{ik} implicit price of characteristic k in good i, Z_{ik} = amount of characteristic k in good i, μ = error term

For each of the six markets studied, the Hedonic price function in (5) was expressed in the following form:

$$Pi=\alpha_0+\alpha 1Z_i1+\alpha 2Z_i2+\alpha 3Z_i3+\alpha 4Z_i4+\ \alpha 5Z_i5+\mu \quad (6)$$

Where, P_i = Price in Nigerian Naira per kilogramme (₦/kg) is the dependent variable, Z_1 = Grain size (weight of 100 grains), Z_2 =Number of holes per 100 grain Z_3 = eye colour, Z_4 = testa texture μ = error term

The eye colour and testa texture are independent variables. The approach used to create dummies for eye colour was to assign a value of one for the brown coloured grains and zero otherwise. A value of one was assigned to rough testa texture and zero otherwise. This is because the prices for white cowpea were generally lower than the brown variety in the study area and so also was the smooth testa variety over the rough. The choice of these classes of dummy variables as base variables was important because it allowed for positive values of the regression coefficients for ease of interpretation of the results. A typical Nigerian market is systematically segmented with cowpea sellers displaying their products according to particular visible characteristics. By comparing the visible cowpea characteristics across six spatially separated markets, Ikirun was not included in the final analysis due to its close similarity to Osogbo. The data generated were thereafter, pooled cross section with 180 observations. For the expected signs for estimated parameters, the number of holes is expected to have a negative sign. The signs for

brown skin colour and rough skin texture and grain size are expected to be positive.

RESULTS AND DISCUSSION

Comparisons Between the selected Cowpea Markets

A Comparison between the cowpea markets was made in the six selected markets. Cowpea prices showed relatively high variation in the markets. Table 1 indicates that on the average, cowpea prices observed in Ikirun were consistently lower relative to Ede, Ife, Ilesa, Iwo and Osogbo. The average cowpea price in the Ikirun market was ₦75.45 per kilogramme. The minimum and maximum prices for Ikirun market ranged from ₦70 to ₦85 per kilogramme. While the highest cowpea prices were observed in Ife with an average price of ₦108.37. The minimum and maximum prices ranged from ₦90 to ₦150 per kilogramme depending on variety. The variation in prices between Ikirun and Ife markets could be due to the fact that Ikirun is the gateway through which cowpea is moved to the study area form the north where the commodity is produced. While the higher prices observed in Ife could be as a result of the large presence of high income buyers from the university community. Average cowpea price for Ede market was ₦86.06 with a range of ₦80 to ₦95 per kilograme. For Ilesa market, the average cowpea price was ₦91.56 and the minimum and maximum prices ranged from ₦85 to ₦110 per kilogramme. In Iwo, average cowpea price was ₦98.87 with a range of ₦86 to ₦120. While the average cowpea price for Osogbo was ₦76.93 with a range of ₦70 to ₦80. The average price for all the six markets was ₦89.54 with a range of ₦70 to ₦150.

Although, the average price of cowpea was lower in Ikirun than in Osogbo, the low standard deviation of price in Osogbo compared to the other markets of Ife, Iwo, Ilesa and Ede suggests price stability in Osogbo market. On the other hand, cowpea prices were on the average most unstable in Ife as depicted by the high standard deviation of price.

Across the major markets in Osun state, it was observed that, on the average, cowpea grains sold in Ikirun market were slightly larger than those of the other markets studied, with an average of 20.1grammes (Table 1). The average weight of 100 cowpea grains in Ife and in Osogbo markets were 19.6g and 19.8g respectively. The average weight of 100 cowpea grains for Ede was 18.9 grammes with a range of 14.1 to 28.3g. In Ilesa market, the average weight of 100 grains was 19.5g while for Iwo market, the average weight of 100 cowpea grains was 19.0g with a range of 14.1 to 29.3g. Across the markets, the average weight was 19.5g per 100 grains. This is consistent with an earlier study by (Faye *et al.*, 2002). The results indicate that in all markets the average grain size varied between 18.9 to 20.1g with a mean of 19.5g, suggesting that cowpea grains sold in the various markets were on the average uniformly distributed. The low standard deviation indicates that grain size distribution was largely uniform in the

Table 1: Average Cowpea Grain Characteristics in the selected markets (2009-2010)

Market	Price(N) per kg		Mean Wt/ 100grains		No.of holes/100grain	
	Mean	S.D	Mean	S.D.	Mean	S.D.
Ede	86.06 (80-95)	3.91	18.9 (14.1-28.3)	4.2	6.97 (1-20)	4.87
Ife	108.37(90-150)	18.71	19.6 (14.4-29.3)	3.4	8.95 (3-20)	4.04
Ikirun	75.45 (70-85)	4.08	20.1 (14.2-29.4)	3.7	8.20 (3-18)	3.40
Ilesa	91.56 (85-110)	5.62	19.5 (14.1-25.8)	3.3	5.60 (3-10)	2.07
Iwo	98.87 (86-120)	9.34	19.0 (14.1-29.3)	3.5	4.83 (2-17)	3.04
Osogbo	76.93 (70-80)	2.91	19.8 (14.5-29.9)	4.4	6.70 (3-15)	2.79
All mkts-space out	89.54 (70-150)	14.82	19.5 (14.1-29.9)	3.8	6.87 (1-20)	3.73

Source: Market survey (2010)
Note: In parenthesis are the minimum and maximum prices, prices are in Naira, and S.D. stands for the standard deviation.

different markets. However Ilesa market had the highest uniformity of grain sizes as indicated by the low standard deviation. The highest disparity in grain sizes was recorded in Osogbo as shown by the high standard deviation. This may be due to influx of many cowpea sellers from neighbouring towns and villages to Osogbo, being the state capital.

In terms of grain susceptibility to stored pests, cowpeas sampled were minimally vulnerable. Table 1, shows that the average infestation levels observed based on the number of bruchid holes per 100 grains in Ede was 6.97. In Ife it was 8.95. Iwo had the lowest infestation level with 4.83 holes per 100 grains by Ilesa with an average infestation level of 5.60 per 100 grains. Ikirun and Osogbo recorded averages of 8.20 and 6.70 holes per 100 grains respectively. The highest level of average insect damage was observed in Ife with an infestation level of 8.95 and the lowest average infestation level was recorded in Iwo with 4.83 holes per 100 grains. The minimum and highest numbers of 1 and 20 were observed for all markets. While the average infestation level for all markets was approximately 7. This is consistent with the findings of Faye *et al*. (2004) who reported an average number of bruchid holes per 100 grains of between 6 and 9. It is however contrary to the results of Langyintuo *et al*. (2002) who reported an average infestation level of 13 and 14 holes. The low levels of insect damage may probably be as a result of the practice of picking out of damaged grains before sale by the sellers or as they are displayed. The sellers appeared to know the implications of a low quality produce in terms of low demand. Three distinct colours of cowpea were on sales in the markets surveyed. These are white, brown and mixed colours. However, only the white and brown colours were sampled. Brown coloured cowpea is more predominant than white. In terms of testa texture, two types were observed namely smooth and rough textures. The study showed that cowpea with rough texture dominates in all the markets.

Hedonic prices for cowpea characteristics in the selected markets

The estimated models fitted the data reasonably well given the variables used, with an overall value of the coefficient of determination of 92% (Table 2). The coefficient of Grain size measured as the weight of 100 grains had the expected positive sign and was statistically significant at the 5% level in all the selected markets, but not significantly different from zero in Osogbo market. Consumers in Ife market pay a premium of ₦3.35 for grain size per kg increase in hundred grain weight,, While consumers in Ilesha pay a premium ₦2. 53 and Iwo markets consumers are willing to pay ₦2.47 per kg increase in hundred grain weight respectively. Coefficients for grain damage, as measured by the number of bruchid holes per

100 grains were statistically significant at 5% level for the Ede and Osogbo, and not significantly different from zero elsewhere. For Ede, the price dropped by ₦0.33 per bruchid hole and for Osogbo the price dropped by ₦0.81 per hole. The relatively small number of markets with statistically significant coefficients for bruchid damage is consistent with previous studies (i.e. Langyintuo *et al*., 2005; Faye *et al*., 2006). Evidence suggests that cowpea merchants sort cowpeas to remove damaged grains. In Nigerian markets it is common to see retailers sorting grains in between customers. Cowpea grain colour coefficients had the expected positive sign, and statistically significant at 5% level in all the selected market, but not significantly different from zero in Ilesha market. For Ede market brown grain colour attracts a premium price of ₦1.65. Consumers in Ife market are willing to pay a premuim of ₦13.39 for brown coloured grain. while for Ilesa consumers discount price of ₦0.69 for the brown coloured cowpea. For Osogbo market, consumers are willing to pay a premium of ₦1.21 for brown coloured cowpea. The coefficients of skin texture had the expected positive sign in three markets and statistically significant at the 5% level. But in Iwo and Osogbo, in all the selected markets, it is not statistically different from zero. For Ife market, consumers pay a premium of ₦19.54 for testa texture. For Ilesa, consumers pay a premium of ₦3.67 per kg for the rough testa texture.

CONCLUSION

This study used samples from six major markets in Osun state, Nigeria to estimate the value of cowpea characteristics for consumers. In the state, most consumers prefer brown coloured

Table 2: Estimated model coefficients for selected markets

Variable	Ede	Ife	Ilesa	Iwo	Osogbo
Grain size	0.39 (5.47)*	3.35 (4.41)*	2.53 (8.43)*	2.47 (8.43)*	- 0.01(0.10)
No of holes	-0.33 (-5.18)*	-0.14 (0.27)	0.23 (0.49)	-0.02 (0.60)	- 0.81(5.23)*
Colour	1.65 (2.50)*	13.39 (3.22)*	-0.69 (4.37)*	0.44 (0.22)	1.21(1.51)*
texture	-1.69 (–3.72)*	19.54 (7.03)*	3.67 (3.35)*	-1.54 (0.88)	0.44 (0.73)
Constant	80.38 (44.86)*	46.07 (2.70)*	48.30 (5.73)*	53.12 (8.44)*	81.12 (27.99)*
R^2	0.96	0.92	0.90	0.90	0.87
Adj R^2	0.95	0.91	0.89	0.89	0.86
Std Error	1.79	17.07	8.42	6.30	2.90

Source: Market Survey, (2010).
Note: t-statistics are in parenthesis
* Significant at 5% level

cowpea. The only exception was at Ilesha market where local preference for white coloured cowpea varieties is particularly strong. Although consumers are willing to pay a premium for large grain size, the coefficient is not statistically different from zero in Osogbo markets. The impact of bruchid holes on cowpea prices was negative as expected, except in Ilesha. In spite of the fact that sellers sort out damaged grains, five of the six markets show statistically significant discounts for bruchid holes from the very first hole. Cowpea testa texture is significant in explaining price variation across the markets, as consumers pay a premium for rough textured grainsin Ife,Ilesha and Osogbo. However, rough skin is discounted in the other markets. These results suggest that efforts to improve upon grain colour and grain size will be worthwhile in Osun state. Consumer sensitivity to grain damage by storage insects indicates that cowpea storage research and technology transfer will have substantial pay- off in the state markets and should be emphasized. In general, this study indicates that quality characteristics are very important in Osun state markets. Even low income consumers are willing to pay a premium for products that match their preferences and they are vigilant in identifying products that do not meet their standards. Price level differ from market to market, hence comparisons are facilitated by expressing the hedonic coefficients as a percentage of the average price in the market for a given period.

ACKNOWLEDGEMENT

The initial paper was presented at the Biennial Conference of the Economic Society of South Africa (ESSA) held at Stellenbosch University on September 7, 2011. I am indebted to the conference participants for their time, patience and invaluable comments. I am grateful to the anonymous referees for helpful comments which are reflected in the revised manuscript. Thanks are also extended to Mohammed Sadegh Allahyari (Islamic Azad University) for his constructive suggestions on this subject. I am however, solely responsible for all the remaining errors and shortcomings.

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