A Hedonic Price Analysis of Quality Characteristics of Chickpea in India[*]

Frank W. Agbola, Timothy G. Kelley, Martin J. Bent and Partha P. Rao[†]

Abstract

This paper examines consumer attitudes to quality characteristics of chickpea in India. A linear hedonic price functional form was estimated using price and quality data of 52 kabuli chickpea and 128 desi-type chickpea samples obtained from major chickpea markets in India. Empirical results indicate that physical quality characteristics and purity standards are important factors influencing consumption decisions in the Indian chickpea market. The chemical quality characteristics have been found to be unimportant in influencing consumption decisions due to their cryptic nature. The implicit values of the physical quality characteristics and purity standards are reported. The results demonstrate that there is an incentive for breeders, producers and exporters to improve the quality characteristics of chickpea export because consumers in India discriminate between chickpea varieties based on their physical characteristics and purity standards.

Key words: India, Chickpea, Hedonic Price Analysis, Quality Characteristics

JEL: D12, Q13

[†] Frank Agbola is Lecturer, Monash University - South Africa, Roodepoort, South Africa. Timothy Kelley is Senior Agricultural Officer, TAC, FAO, Rome, Italy. Martin Bent is Senior Lecturer, Muresk, Curtin University of Technology, Northam, Australia. Partha Rao is Senior Scientist (Economics), SEPP, ICRISAT, Hyderabad, India.

A Hedonic Price Analysis of Quality Characteristics of Chickpea in India

1.   Introduction

The Indian chickpea industry is undergoing dramatic structural shift following the implementation of market-oriented policies by the Government of India in the early 1990s. Before 1990, access to India's chickpea market was restricted by trade restriction that has been in place for almost forty years for balance of payment reasons. Tariff rates on agricultural imports varied from 40 to 100 percent. Coupled with this was the complex licensing system for chickpea imports (Kelley, 1999). These policies had reduced the importance of the price mechanism in the chickpea market. In the last two decades, the Government of India (GOI) embarked on a policy of economic liberalisation, backed by the International Monetary Fund. The stringent controls on imports and industrial licensing were gradually relaxed, stimulating industrial growth and reduction in the level of unemployment. In addition, the GOI expanded antipoverty schemes, especially rural employment schemes. Consequently, this led to a dramatic growth in demand for food. As Kelley (1999) notes, the change in tastes and preferences engendered by urbanisation and economic growth has given consumers greater freedom and alternatives in their consumption decisions.

Chickpea, along with rice, wheat and other pulses are important ingredients in the Indian diet. Approximately 25 percent of the Indian population are vegetarians, making India the world's largest consumer and producer of chickpea. Demand for chickpea (and pulses generally) began to weaken relative to the demand for cereals and dairy products due to changing relative price of food items, the changing tastes and preferences and the changing economic conditions (Kelley, 1999). The gradual decline in per capita chickpea consumption in India in recent times has been of major concern to chickpea exporting countries such as Australia. A number of groups associated with the pulse industry have discussed quite extensively the issue of improving the quality characteristics of chickpea (Kelley, 1999; Siddique, 1998; AGLC, 1991). Each of these issues could be discussed in much great detail. However, the common thread of the debate centres on the impact of quality characteristics on the price paid for chickpea and on whether market participants in India discriminate between chickpea varieties by offering price premium or discounts for chickpea with specific quality characteristics. Consequently, the pulse industry has been actively responding to consumer demand in major importing countries by developing new chickpea varieties.

Understanding the influence of quality characteristics on chickpea price is of critical importance to the Australian pulse industry. This is because if relevant chickpea grain quality characteristics can be identified and the contribution to price quantified, breeders could more accurately assess trade-offs between yield and quality characteristics and/or between characteristics and therefore anticipate future market changes. Further, knowledge about the value placed on quality characteristics of chickpea by consumers in India could provide useful information for developing agronomical practices and marketing programs. It is the burgeoning interest of producers, breeders, exporters and policy makers in Australia to understand consumer attitudes to quality characteristics of chickpea in India that motivated the research discussed in this article. This study was the outcome of a collaborative research project between Muresk Institute of Agriculture, Curtin University of Technology, Australia and Socioeconomic Policy Program of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and funded by Grains Research Committee of Western Australia.

The main purpose of this article is to estimate the marginal values of quality characteristics of chickpea and to test the hypothesis that there are no premiums/discounts associated with quality characteristics of chickpea in India. This study is based on the hedonic pricing theory developed by Rosen (1974), which postulates that the price of a good is a function of the quality characteristics of that good. That is, consumers' demand is derived from the levels of characteristics that the good possesses.

The remainder of this article is organised as follows: the next section presents the hedonic price model and associated variables. The following section discusses briefly the data employed in the analyses. The forth section discusses the empirical results of application of hedonic price model to auction price and quality characteristics and purity standards of chickpea. The final section notes some policy implication of the results and concluding remarks.

2.   The Model

In this section, the hedonic price function is derived. A number of studies have examined the impact of quality characteristics on the price of agricultural products (see for example, Samikwa *et al.*, 1998; Wahl *et al.* 1995; Ahmadi-Estafani and Stanmore, 1994; Espinosa and Godwin, 1982). However, to-date, no empirical work has been conducted to quantify the relationship between price and quality characteristics and purity standards in one of the most lucrative markets, the Indian chickpea market.

To analyse the links between the price and quality characteristics of chickpea, we develop an econometric model in which the price of chickpea is a function of the characteristics or attributes. This approach, referred to in the econometric literature as the hedonic pricing model, is based on the assumption that consumers obtain utility from consuming the characteristics of the chickpea.

Consider a profit maximising and competitive firm that uses a vector of inputs *z* with specific characteristics to produce an output *y*. Following Veeman (1987), the production function of the firm can be expressed as

$$q_y = f(z_{iy}, ..., z_{jy})$$ (1)

where q_y is the quantity of output produced *y*, and z_{jy} is the quantity of input characteristics *j* (j=1,...,n).

The firm's profit function is given by

$$\Pi = \sum_{y=1}^{Y} p_y \ f(z_{1y}, ..., z_{jy}) - \sum_{y=1}^{Y} \sum_{i=1}^{m} p_{xi} \ x_{iy}$$ (2)

where x_{iy} is the quantity of market input *i* (*i*=1, ...,*m*) used in producing output *y*, p_y is the price of output *y* and p_{xi} is the price of input x_i.

The first order conditions for profit maximisation is given by

$$\partial \Pi / \partial x_i = p_y \sum_{j=1}^{n} (\partial f / \partial z_{jy})(\partial z_{jy} / \partial x_{iy}) - p_{xi} = 0 \quad for \ i = 1, ..., m$$ (3)

Solving for p_{xi} in Equation (3) gives:

$$p_{xi} = p_y \sum_{j=1}^{n} (\partial f / \partial z_{jy})(\partial z_{jy} / \partial x_{iy}) \qquad (4)$$

where $\partial z_{jy} / \partial x_{iy}$ is the marginal yield of characteristic j from the i-th input for producing y, and $\partial f / \partial z_{jy}$ is the marginal physical productivity of one unit of characteristic j for producing output y.

From Equation (4), the hedonic price function can be specified as

$$p_{xi} = \sum_{j=1}^{n} \beta_j Z_{ij} \qquad (5)$$

where $\beta_j = p_y (\partial f / \partial z_{jy})$ and $Z_{ij} = \partial z_{jy} / \partial x_{iy}$

There is no theoretical basis for selecting a functional form of the hedonic pricing model. A test of functional form based on McKinnon and Davidson's (1981) P-test led to the rejection of semi-log and double log functional forms in favour of the linear functional form. Hence, in this article, a linear functional form is used to estimate the hedonic price function. The empirical hedonic price model for chickpea in India is specified as:

$$P_k = \alpha_{0k} + \alpha_{1k} \text{SWT} + \alpha_{2k} \text{FORE} + \alpha_{3k} \text{DHAL} + \alpha_{4ki} \Sigma_i \text{CID}_i + \alpha_{5k} \text{SID}$$
$$+ \alpha_{6kj} \Sigma_j \text{LID}_j + \alpha_{7k} \text{TID} + \alpha_{8k} \text{PROT} + \alpha_{9k} \text{ASH} + \alpha_{10k} \text{MOIS} + \varepsilon_k \qquad (6)$$

where P_k is the price in Australian dollars per tonne of the k-th type of chickpea, and where k=1, 2 is for desi-type chickpea and kabuli chickpea, respectively; SWT is the seed weight of chickpea types; FORE is the foreign matter content; DHAL is the splitting recovery rate; CID_i is color, with a base color of brown, and where i=1, 2, 3 is for greyish-brown color, orange-brown color and orange color, respectively; SID is the shape of seed; LID_j is chickpea market surveyed with a base-location Mumbai (Bombay), and where j=1,...,5 is for Aurangabad, Delhi, Indore, Jalgoan and Bhopal, respectively; TID is texture of seed; PROT is the dry weight basis percentage protein content of chickpea type; ASH is the dry weight basis percentage ash content of chickpea type; MOIS is the moisture content of seed; α is the parameters to be estimated; ε_k is the error term.

With inverse demand models, such as the hedonic price model used in this study, sensitivities are typically measured by flexibilities. The price flexibility measures how the market price responds to a finite (percentage or unit) change in the product characteristic. Following Wahl et al. (1995), price flexibility with respect to a continuous characteristic is defined as the percentage change in the price with respect to a 1% increase in the characteristic. For a 0-1 discrete characteristic, the price flexibility is defined as the percentage change in the price due to the presence of the characteristic relative to its absence.

3.   The Data

The empirical analysis employs data on price and quality characteristics and purity standards of chickpea samples collected at auction in major chickpea markets in India. Four terminal markets where chickpea traded are mainly from major chickpea growing regions in India and

from exporting countries were selected; Calcatta, Chennai (Madras), Delhi, and Mumbai (Bombay). Other chickpea markers surveyed were primary/secondary markets where the main source of chickpea supply is from domestic producing regions; Aurangabad, Bhopal, Indore, and Jalgaon. A random sample of 180 chickpea seed lot (consisting of 128 desi-type chickpea and 52 kabuli chickpea) was collected from the markets surveyed in May of 1999. The prices of chickpea samples are auction prices determined by open outcry in the market. The corresponding quality characteristics and purity standards were determined at ICRISAT laboratory in Hyderabad, India (for more details on description of markets surveyed and procedure used in determining quality characteristics and purity standards see Agbola *et al*. 2000). It is important to define some terms used in this study. The term desi refers to desi chickpea and Kantewala, other chickpea refers to chickpea other than desi and kabuli chickpea, and the term desi-type refers to both desi and other chickpea.

The analysis of data indicate that, in terms of variability, the price of kabuli chickpea exhibit the highest variability, followed by desi and other chickpea, in that order. The mean price is $974.04 for kabuli chickpea, $591.56 for other chickpea and $483.33 for desi. Except for seed weight of kabuli chickpea that exhibited a variability of 15.64, the variability of quality characteristics of chickpea in India is less than 4.3. The splitting recovery rate for other chickpea is greater than that of desi. The seed coat thickness for desi and other chickpea is about twice that of kabuli chickpea. The moisture content of seed appears to be the same for desi, kabuli chickpea and other chickpea. Dummy variables were generated for the data, where a value of one was assigned for the locations for which market surveys were conducted and for desi to differentiate it from the other chickpea. The binary variables were included in the final model.

4.   Results and Discussion

Regression equations explaining the relationship between the price of chickpea and the quality characteristics and purity standards, based on Equation (6), were estimated using the SHAZAM procedure of Ordinary Least Squares. The results are presented in Table 1. The adjusted R^2 (goodness-of-fit measure) is estimated to be 0.89 for desi-type chickpea equation and 0.82 for kabuli chickpea equation. The goodness-of-fit measure of the estimated equations reported in Table 1 indicates that the amount of variation in the price of chickpea explained by the estimated model range from 80 percent for kabuli chickpea to 87 percent for desi-type chickpea. These values are good considering the type of data (market survey data) used in the analyses.

Using Breusch-Pagan-Godfrey test, the null hypothesis that the error terms are homoskedastic could not be rejected at a 5 percent level. Calculated Chi-square statistics are 20.17 for desi-type chickpea equation and 5.31 for the kabuli chickpea equation and the critical values are 23.68 and 12.59, respectively (Table 1).

To test the null hypothesis that there are no premiums or discounts associated with quality characteristics of chickpea against the alternative that premiums or discounts exists in the Indian market, a likelihood ratio test was performed. This test compared the results of the estimated equation (6) with a restricted model in which the parameters of the quality characteristics and purity standards were equated to zero. The null hypotheses were rejected given that the calculated Chi-square statistic of 42.51 and 55.56 for the estimated kabuli chickpea and desi-type chickpea equations, respectively, are greater than the critical values of 11.1 for 5 degrees of freedom and 26.3 for 16 degrees of freedom, respectively. The results demonstrate that the quality characteristics of chickpea are important factors influencing the

price paid by consumers for chickpea in India. The test results suggest that the specified models perform significantly better than the restricted model in characterising the relationship between price and quality characteristics and purity standards of chickpea in India.

Table 1: Parameter estimates of the hedonic price equation

Explanatory variable	Parameter	Desi		Other Chickpeas		Kabuli chickpea	
		Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio
SWT	α_{1k}	7.23	8.40	7.23	8.40	9.13	7.09
FORE	α_{2k}	-7.56	1.89	-7.56	1.89	-16.61	-3.39
FORE*D4	α_{2k1}	6.73	2.84	-	-	-	-
DHAL	α_{3k}	-3.344	-1.15	-3.344	-1.15	-	-
DHAL*D4	α_{3k1}	6.87	1.85	-	-	-	-
CID	α_{4k}	3.19	1.08	3.19	1.08	-	-
CID*D1	α_{41k}	-13.73	7.01	-13.73	7.01	-	-
CID*D2	α_{42k}	21.59	2.27	21.59	2.27	-	-
CID*D3	α_{43k}	12.40	3.24	12.40	3.24	-	-
SID	α_{5k}	57.58	12.58	57.58	12.58	-	-
LID1	α_{61k}	-135.76	-8.96	-135.76	-8.96	-	-
LID2	α_{62k}	-84.79	-7.40	-84.79	-7.40	-124.54	-3.04
LID3	α_{63k}	-151.87	-15.18	-151.87	-15.18	-284.24	-6.72
LID4	α_{64k}	-132.94	-10.36	-132.94	-10.36	-246.78	-2.09
LID5	α_{65k}	-143.93	-11.14	-143.93	-11.14	-	-
D4	α_{0k1}	-565.87	-1.96	-	-	-	-
CONST	α_{0k}	676.97	3.10	676.97	3.10	789.13	11.49
R^2-adj.		-		0.87		0.80	
D-W		-		1.99		2.31	
Chi-square		-		55.56		42.51	

Notes: D1 denotes dummy variable for Greyish Brown Colour
   D2 denotes dummy variable for Orange Colour
   D3 denotes dummy variable for Orange Brown Colour
   LID denotes location dummy and where LID1 is Aurangabad, LID2 is Delhi, LID3 is Indore, LID4 is Jalgoan and LID5 is Bhopal
   D4 denotes dummy variable for desi.

Effects of quality characteristics on the price of chickpea in India

The marginal implicit values and price flexibilities with respect to quality characteristics of chickpea are reported in Tables 2 and 3, respectively. For kabuli and desi-type chickpea, the seed weight variable, SWT, coefficients are statistically significant, suggesting that price of chickpea responds to size of the seed. The positive sign of the coefficient of the seed weight variable indicates that an increase in seed weight will lead to an increase in the price paid for

chickpea. The results reported in Table 2 indicate that, for a 50-kernel weight, every extra gram per 50-kernel is worth an extra $9.13 per tonne for kabuli chickpea and $7.23 per tonne for desi-type chickpea. Holding all else constant, if the seed weight is increased by 1%, the price of desi-type chickpea and kabuli chickpea would increase by 0.26% and 0.35%, respectively (Table 3). Considering that that the mean price observed is $974.04 per tonne for kabuli chickpea, $483.33 per tonne for desi and $591.56 per tonne for other chickpea, the price premium associated with increasing the seed weight of chickpea appears substantial.

Table 2: Implicit marginal value of quality characteristics of chickpea in India

Explanatory variable	Desi	Other chickpeas	Kabuli chickpea
Seed weight	7.23	7.23	9.13
Foreign matter	-0.83	-7.56	-16.61
Greyish Brown colour	-10.54	-10.54	-
Orange Colour	24.78	24.78	-
Orange Brown Colour	15.59	15.59	-
Shape	57.58	57.58	-
Splitting recovery (Dhal)	6.87	0.00	-

Notes: A positive implicit price denotes a price premium.
A negative implicit price denotes a price discount.

Table 3: Price flexibility estimates of quality characteristics of chickpea in India, evaluated at the mean

Explanatory variable	Desi	Other chickpeas	Kabuli chickpea
Seed weight	0.264	0.264	0.347
Foreign matter	-0.006	-0.053	-0.052
Greyish Brown colour	-0.020	-0.020	-
Orange Colour	0.046	0.046	-
Orange Brown Colour	0.029	0.029	-
Shape	0.113	0.113	-
Splitting recovery (Dhal)	1.096	0 .000	-
Aurangabad	-0.016	-0.016	-
Delhi	-0.021	-0.021	-0.044
Indore	-0.073	-0.073	-0.056
Jalgoan	-0.023	-0.023	-0.005
Bhopal	-0.025	-0.025	

The foreign matter content of seed is negative and significant indicating that seed lot with higher foreign matter content receives lower prices. Table 2 indicates that, for a 50-kernel seed, every extra reduction in foreign matter content is worth an extra $7.56 per tonne for desi-type chickpea and $16.61 per tonne for kabuli chickpea. The results presented in Table 3 indicate that, holding all else constant, a 1% decrease in foreign matter content of seed would lead to a 0.01%, 0.05% and 0.05% increase in the price of desi, other chickpea and kabuli chickpea, respectively. The relatively small impact of foreign matter content on the price of desi can be explained by the fact that processors clean seed lot used for making split chickpea (dhal). As a result, the foreign matter content of desi is not valued heavily by processors in their decision making process. The negative sign of the coefficient of the foreign matter content in the estimated desi-type and kabuli chickpea equations indicates that consumers are willing to pay a price premium for chickpea with lower foreign matter content and to discount one with a higher foreign matter content.

The estimated coefficients of the splitting recovery rate is positive and significant in influencing the price of desi, as expected, but not significant in influencing the price of other chickpea at a 10% level (Table 1). Table 2 indicates that, for a 50-kernel seed, consumers are willing to pay a price premium of $6.87 per tonne for a unit increase in splitting recovery rate. The results reported in Table 3 indicate that if the splitting recovery should increase by 1%, the price of desi would increase by 1.1%. The elastic response in price to a unit change in splitting recovery is consistent with the findings of Agbola *et al*. (2000) and Siddique (1998), who found that producers value heavily the splitting recovery rate of desi used for making split chickpea (dhal). Consequently, processors prefer Australian desi to domestically produced and other imported ones because of its high splitting recovery rate, estimated to be between 3-5%.

The shape of seed coefficient is positive and significant in the estimated desi-type chickpea equations. The marginal implicit value of shape of seed variable in the estimated desi-type chickpea equation is significant and positive. This implies that, for a 50-kernel seed, consumers are willing to pay a price premium of $57.58 per tonne for a unit improvement in the shape of desi-type chickpea towards a round shape (Table 2). Table 3 indicates that a 1% improvement towards a round shape would increase the price of desi chickpea by 0.11%.

The estimated coefficient for the colour variable in the estimated desi chickpea equations is significant, as expected. The marginal implicit value of a greyish-brown colored desi chickpea is negative, while positive for an orange-brown and orange colored desi chickpea (Table 1). The results reported in Table 2 indicate that, relative to a brown coloured desi-type chickpea, consumers discount the price of a greyish-brown colored desi-type chickpea, but pay a price premium for an orange-brown and orange colored desi chickpea. Table 2 shows that a greyish-brown colored desi chickpea is worth $10.54 per tonne lower than the price of a brown colored desi chickpea, while the prices of an orange-brown and orange colored desi chickpea are higher than the price of a brown colored desi chickpea by $15.59 and $24.78 per tonne, respectively (Table 3). The results demonstrate that consumers are willing to pay a price premium for light colored desi-type chickpea and to discount dark colored ones. These findings are consistent with earlier studies by Siddique and Sykes (1997) and Siddique (1998).

The location variables are negative for terminal and primary/secondary markets relative to that of Mumbai at a ten percent level (Table 1). Table 1 shows that the price of chickpea in terminal and primary/secondary markets differ greatly. In terminal markets, the location variable for Chennai and Calcutta were excluded from the final model because the

coefficients were statistically non-significant at a 10% level. This suggests that the price of chickpea in Chennai and Calcutta and the base-location Mumbai are similar. It is interesting to note that the price of chickpea in Delhi is found to be lower than that in the base location Mumbai. The price flexibility of location variable for Delhi reported in Table 3 is negative, implying that consumers discount the price of desi chickpea and kabuli chickpea relative to that in Mumbai by 2.1% and 4.4%, respectively. For primary/secondary markets, the price of desi chickpea in Aurangabad, Indore, Jalgoan and Bhopal is discounted relative to the price in Mumbai by 1.6%, 7.3%, 2.3% and 2.5%, respectively. The price of kabuli chickpea in Indore and Jalgoan is also discounted relative to the price in Mumbai by 5.6% and 0.5%, respectively.

An important feature of the results is that the chemical quality characteristics of chickpea captured by the ash and protein content, are statistically non-significant at a 10% level. A possible reason is that there is inefficiency in the Indian chickpea market, a consequence of government regulation (Agbola *et al*., 2000). Another possible reason is the cryptic nature of the chemical quality characteristics. It is important to note however that as exporting countries compete with each other in the recently deregulated Indian chickpea market, they may begin to differentiate their products by promoting it as one with high chemical quality characteristics or as branded products. They may even resort to reputation selling based on chemical quality characteristics of seed. This suggests that the chemical quality characteristics of chickpea may become important in influencing the price of chickpea under recent changing economic conditions.

5.   Policy Implications and Concluding Remarks

To keep up with recent trend s in consumer demand for chickpea, an understanding of the associated consumer attitudes to quality characteristics of chickpea is needed. This study developed a hedonic pricing model to ascertain whether consumers in India differentiate between varieties of chickpea based on quality characteristics. The results of this study provide strong empirical evidence to suggest that consumers differentiate between varieties of chickpea based on their quality characteristics. The policy implication of the findings is that there is an incentive for breeders, producers, exporters and policymakers to improve the physical quality characteristics and purity standards of chickpea exports to India. Given that Australia has a reputation for producing desi chickpea with high splitting recovery rate and low impurities, exports from Australia can be promoted as one with high quality characteristics in India. Despite this, improving the physical quality characteristics and purity standards could be at the expense of other quality characteristics. Further, this reputation for Australian desi chickpea does not its ability of Australia to set prices because the scope of this differentiation could be constrained by other factors such as regulated environment and the cryptic nature of chemical quality characteristics of chickpea in India.

The results of this study suggest that the liberalisation of the chickpea import market is going to have a significant impact on chickpea trade in India. Given the explanatory power of quality characteristics in explaining chickpea price, this suggests that the focus of breeders, producers, exporters and policymakers should be on improving the physical quality characteristics and purity standards of chickpea. In terms of importance, the results indicate that for desi, the most important factor influencing price variability is shape of seed, followed by colour, seed weight, splitting recovery and foreign matter content, in that order. For other chickpeas, the shape of seed, followed by colour, foreign matter content and seed weight, in that order, are the factors influencing price variability. For kabuli chickpea, the most important factor influencing price variability is foreign matter content of seed followed by

seed weight. The importance of foreign matter content in influencing the consumption of kabuli chickpea can be explained by the fact kabuli chickpea is consumed whole and one expects it to be clean. In making split chickpea (dhal), however, desi is cleaned as part of the processing. Consequently, market participants do not value heavily the foreign matter content of seed lot compared to other quality characteristics. Interestingly, market participants were found to value heavily the foreign matter content of other chickpea because most of the other chickpea are consumed whole or processed for direct consumption.

It is important that Australia anticipates the potential reaction of market participants to changes in quality characteristics of chickpea before developing new chickpea varieties and agronomical practices and marketing programs to make sure that it will not have to back-track on its breeding programs and agronomical practices. By adopting such a strategy, they can better position itself in the Indian market and be able to compete with other chickpea exporting countries. While other factors may be able to explain the variability in the price of chickpea, the fact remains that the physical quality characteristics and purity standards play an important role in determining the price of chickpea in India. This suggests that while the focus of breeders should be on improving the physical quality characteristics and purity standards, recent changes in economic policy, the increased awareness of nutritional values of chickpea and the technological advances are likely to reduce the price premium associated with these quality characteristics.

References

Agbola, F.W., Bent, M.J.M., Rao, P.P. and Kelley, T.G. (2000), Factors influencing the demand for chickpea in India: Implications for Marketing and Promotion in the Indian chickpea market. Proceedings of the 43rd Conference of Australian Agricultural and Resource Economics Society, Sydney, Australia, January 23-25.

AGLC (1991), *Market Research Visit to India, Bahrain, Dubai, Iran, Turkey, Italy, Sri Lanka and the United States in September/October*. Australian Grains Legumes Committee.

Ahmadi-Estafani, F.Z. and Stanmore, R.G. (1994), "Values of Australian Wheat and Flour Quality Characteristics." *Agribusiness*, 10(6): 529-536.

Espinosa, J.A. and Goodwin, B.K. (1982), "Hedonic price Estimation for Kansas Wheat Characteristics", *Western Journal of Agricultural Economics*, 7(4): 293-299

Kelley, T.G. (1999), *The Fundamentals of the Indian Sub-Continent Pulse Economy: Long-Term Implications of the Australian Pulse Industry*. GRDC Project No. VF35 A.

Rosen, S. (1974), "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition." *Journal of Political Economy*, 82(1): 34-55.

Samikwa, D.D., Brorsen, B.W., Sanders, L.D. (1998), "Hedonic Prices of Malawi Burley Tobacco." *International Food and Agribusiness Management Review*, 1(1): 107-117.

Siddique, K.H.M. and Sykes (1997), "Pulse Production in Australia: Past, Present and Future." *Australian Journal of Experimental Agriculture*, 37: 103-111.

Siddique, K.H.M. (1998), *Summary of Overseas Travel to New Delhi, India*, 29 August to 4 September 1998, Unpublished.

Veeman, M.M. (1987), "Hedonic Price Functions for Wheat in the World Market: Implications for Canadian Wheat Export Strategy." *Canadian Journal of Agricultural Economics*, 35: 535-552.

Wahl, T.I., Shi, H. and Mittelhammer, R.C. (1995), "A Hedonic Price Analysis of Quality Characteristics of Japanese Wagyu Beef." *Agribusiness*, 11(1): 35-44.