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Quality and Price of Beans at the Market Node in Five Districts of Uganda

Immaculate Babirye[1,] *, **Michael Hilary Otim**[1], **Pamela Paparu**[1]

[1] National Crops Resources Research Institute, National Agricultural Research Organization.
*Corresponding author. imbabirye@gmail.com +256 778 939 332

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Abstract. We investigated the varieties of beans traded in five districts of Uganda and the factors affecting the quality and price of the beans at the market node. A semi-linear hedonic price model with 12 variables categorized as product and trader attributes was used to determine the factors influencing prices. Traders were found to be unmindful of the names of *new* bean varieties released by NARO. They used various names for both the *new* and local varieties. Brokers were identified as the leading suppliers of poor-quality beans. The respondents cited variations in the quality of beans received from different suppliers. Beans that were owned by traders exhibited slightly higher moisture content (17%) than is recommended. Storage insect infestation was identified as the primary cause of quality decline. Product attributes were associated with changes in the prices of beans. However, their effect was comparatively lower than the traders' characteristics. We recommend targeted sensitization about *new* bean varieties, emphasizing their benefits, post-harvest handling, and quality requirements at all value chain nodes. Monitoring trader traits and societal factors associated with price fluctuations is also crucial to price stability.

Keywords: Bean varieties, Price fluctuations, Trader characteristics.

Introduction

The common bean is the most consumed legume (Romero-Arenas et al., 2013), serving as a core traditional food for many low and middle-income countries worldwide (Rawal and Navarro, 2019). In Africa, Common bean production is concentrated in the eastern and central, mainly for domestic use, with limited export to other African countries (Rawal and Navarro, 2019). Over the years, Uganda has ranked well in Sub-Saharan Africa bean production. For example, it ranked third in bean production (volumes produced) after Tanzania and Kenya in the year 2021. In the same period, however, Uganda had the highest productivity in terms of yield (FAOSTAT 2022). Common bean contributes food for most farmers and institutions such as prisons and schools in Uganda. It is also a source of income and foreign exchange earnings. For instance, in 2023, Uganda exported common beans worth USD 70.01 Million

(BOU, 2024). Furthermore, the non-formal exports accounted for USD 32.2 Million in 2019 (UBOS, 2020). Although Ugandan farmers, traders, and the country stand to benefit from common bean (Kilimo Trust, 2012; Ugen et al., 2017; Ugen et al., 2021), the consumption, domestic sale, and export of common bean is affected by many factors, including varieties, quality and market prices (CASA, 2020).

To date, there have been several bean varieties released in Uganda by the Legumes Research Program of the National Agricultural Research Organization (NARO) and its partners (Mukayiranga et al., 2022), breeding for the most desirable bean traits, (Mukankusi et al., 2022; Smith, 2016). Targeted to address challenges affecting the communities such as malnutrition (Glahn et al., 2020), climate change as well as pest and disease susceptibility (Akpo et al., 2020; CASA, 2020). In collaboration with other organizations through development projects, efforts have been taken to empower farmers through direct pieces of trainings Ugen et al. (2017), demonstrations, and various awareness campaigns to enhance their productivity and ensure the quality of beans produced and supplied is of good standard (Akpo et al., 2020; Aseete et al., 2023; CASA, 2020; Ugen et al., 2021). Farmers are the primary producers of beans and would be the main suppliers to the markets. However, most farmers produce fewer quantities (Nakazi, et al., 2017), are in remote villages while some do not have knowledge of the right markets to sell to (Jjagwe et al., 2022). This implies that the beans reaching the market are not necessarily from the farmers directly and the prices charged and quality at the retail level might not be necessarily attributed to farmers.

Moreover, the quality of beans in Ugandan markets, particularly at the retail level, remains below standard and market prices fluctuate rapidly (CASA, 2020). Suppliers are believed to be among the factors contributing to poor quality and elevated prices (CASA, 2020; Nkalubo et al., 2020). Past research shows that whenever there is an upturn in food prices in Uganda, beans are among the major commodities affected (Benson et al., 2008), with their prices rising and never dropping (Shinyekwa and Ijjo, 2016). Changes in the prices of agricultural products are also associated with harmful interference from informal actors like middlemen (Da Cunha and Wander, 2014) and lack of price regulation for most agricultural commodities in many countries (Da Cunha and Wander, 2014; Shinyekwa and Ijjo, 2016).

The poor quality of beans at retail affects both the prices obtained by farmers and the overall satisfaction by consumers, prompting the need for a comprehensive investigation into the root causes of persistent poor quality and price variations in the market. Literature is rich with farm and consumption level information, for example several studies document variety preference for beans by consumers and farmers (Katungi et al., 2011; Mishili et al., 2011: Aseete et al., 2018; Berry et al., 2020;), farmer profitability and production as well as constraints faced (Nakazi, et al., 2017; PABRA, 2021). Nevertheless, literature about trader preferences, quality received from suppliers, and value-addition activities at the market level is limited. Moreover, the factors that influence bean prices charged by traders at the marketing node of the bean value chain are not well documented. In this study, we aimed to document common bean trade as well as quality challenges in Ugandan bean markets from selected districts and simultaneously identify the factors that influence the prices charged by traders to acquire knowledge for informed interventions toward optimizing the bean value chain and improving market flows.

Materials and Methods

Sampling and Data Collection

A market survey was conducted in five major districts from five regions of Uganda from May to July 2019. The districts included Arua in the West Nile region, Hoima in mid-western Uganda, Nakaseke in central Uganda, Oyam in northern Uganda, and Sironko in eastern Uganda. A total of 200 bean traders (36 to 44) were sampled from 12 major bean trading markets per district. The choice of markets inclined to the major bean trading markets with advice from district production officers. For each market, the market leaders helped to identify and provide the actual numbers of traders dealing in common beans. A random sample of four traders was selected and interviewed per market. Where bean traders were fewer than five, they were all interviewed.

Data were collected using a pretested semi-structured e-programmed questionnaire. The data collected included demographic characteristics, source of beans, postharvest activities carried out, varieties and volumes handled, prices of beans, other commodities sold among others. During data collection, the enumeration team used catalogues of released bean varieties to help traders identify the varieties traded. Two bean samples of half a kilogram each were picked from each interviewed trader for quality assessment. The determination of the quality was done by computing the percentage of varietal mixes, foreign matter, damaged beans and grain moisture content as suggested by (Araújo et al., 2015).

Data Analysis

Data were cleaned, and analysed using STATA 16. Descriptive statistics were employed in estimating traders' perceptions of the quality of bean grain sold. Tests of significance that included T-tests, chi-square, and ANOVA tests were carried out to assess relationships between variables. Test choices were made depending on the type of data and nature of samples that were being examined for example ANOVA test was used for age of the owner, age of the business and experience across districts. Chi-square testes were used for sex of the owner, type of the business and business form to test independence between the groups. A log linear Hedonic price model was used to determine the determinants of bean prices. Twelve characteristics classified into product, trader, and other attributes as independent variables were used in the model. Other attributes were external attributes that are neither inherent to the beans nor the traders. In particular, attributes like the suppliers and the customers may be controlled by the traders but they are not trader characteristics.

Determination of the Factors influencing the Price of Beans

The factors that influence the prices charged by traders were analysed using the hedonic price model, which is from the demand and supply conditions of the market. The hedonic price estimation helps to estimate the value of a composite good to the consumer and has been used and applied in several fields (Gilbert, 2013). In agriculture, it has mainly been employed in market valuations, consumer preference, and willingness to pay studies (Elepu, 2018; Mercier et al., 1994; Mishili et al., 2011; Mugisha et al., 2010). According to Gilbert, (2013), the primary purpose of a hedonic study is to determine how much each characteristic contributes to the final value of a composite good. The basic assumption of any hedonic pricing study is that a function, p, determines the price of all goods in the market.

Table 1. Measurement of Factors Influencing Bean Prices

Variable	Description	Measurement	Expected sign
Colour	Colour of the bean grain	Plain colour 1, Otherwise 0	+
Size	Size of the bean grain	Small beans 1, Otherwise 0	_
Variety	Local or improved	Local 1, Otherwise 0	_
Quality*	Bean quality at the time of purchase	High quality – base; medium and low-quality measurements	+
Supplier	Main suppliers of the beans	Aggregators 1, Otherwise 0	+
Customer	Major buyers of particular beans	Individuals 1, Otherwise 0	_
Sex	Sex of the individual trader	Male 1, Otherwise 0	+
Education	Trader's highest level of education	Primary base, Secondary, and University measurement	+
Region	Location of market	Central 1, Otherwise 0	+
Type	Type of business	Retail 1, Otherwise 0	+
Age	Age of trader in complete years	Continuous	+
Commodity	Commodities the traders sell	Grain only 1, Otherwise 0	+

*Quality attributes included moisture content, variety purity, absence of chaff, and grain damage

Conceptual Framework

The price set by the traders is affected by a number of things including the cost of production and perceived quality (Steffen and Yu, 2018). However, there are a number of other factors that influence the price of beans that were investigated (Figure 1).

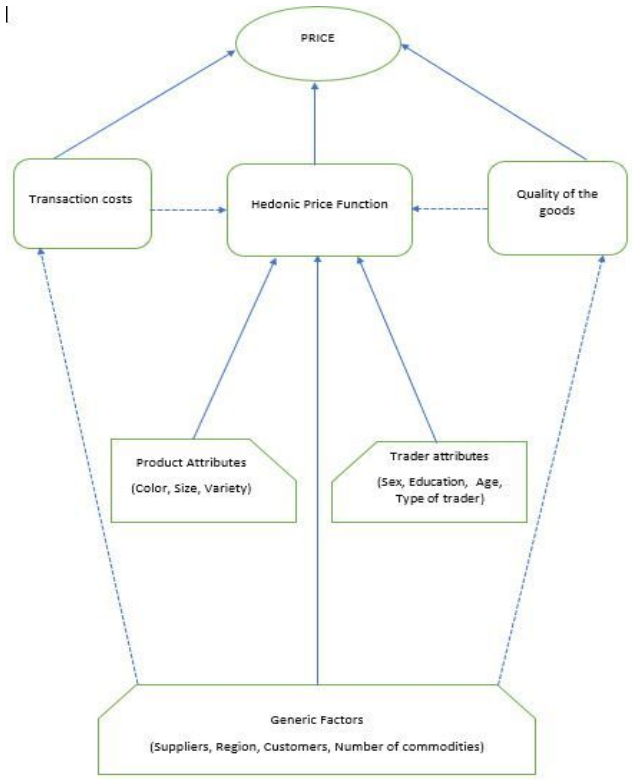

Figure 1. Conceptual Framework

We assumed that the products on the market being studied (beans) (i) are described by a bundle of characteristics (z_i) and they will sell for price (P_i). The assumption is that the price of the products (beans) is a function (y) of the beans' characteristics. The general equation for this assumption is;

$$P_i = y(z_i) \quad \ldots\ldots (i)$$

Since the (product) beans are to be consumed/purchased by rational consumers/ buyers who seek to maximize their utility (U_i) for the beans but have a fixed set of wealth (income) (M) from which they can use to purchase the product and many other products (c). Then the utility maximization equation for the consumers is;

$$\frac{MAX}{Z} U_i \ (M - P_i(i), Z_i; n) \quad \ldots\ldots (ii)$$

Where, U_i is utility derived from the consumption of the beans, *i* is the composite good (beans), Z_i is the bundle of bean attributes, and n the different consumers

Similarly, for the producers/suppliers, we have a cost function $C(Q, Z_i \ ; \varphi)$, where Q is the amount produced, $Z_i$is the bundle of bean attributes, and $\beta$is the vector of attributes that define the different producers (traders in this case). Therefore, the traders solve the problem of minimizing their cost structure given by;

$$\frac{MAX}{M,Z} QP(Z_i) - C(Q, Z_i, \varphi) \quad \ldots\ldots (iii)$$

Assuming a perfectly competitive market, the supply and demand must be equal for all values of Z_i. Specifically; $Q^D(P_i, Z_i)$ the number of consumers who choose to consume a specified amount of beans Z_i at a given price P_i, and $Q^S(P_i, Z_i)$ the amount of beans produced/supplied by traders $Z_i$at a given price P_i should be equal.

$$Q^D(P, Z_i) = \ Q^S(P, Z_i) \quad \ldots\ldots (iv)$$

Solving for the price in the equation (iv) will help us to determine the bundle of characteristics desired by the consumer (quality) and the trader (transaction costs). In practice, however, we usually do not have perfectly competitive markets, therefore equation (iv) might not hold in all cases and particularly this study where we are looking at the selling side.

So, we shall determine the price using equation (i), and considering the supply side (traders), we have to appreciate that there might be characteristics (beans and others) that affect the price but are not known or might not be included in the model. These characteristics can be denoted with ε, equation (*i*) then becomes:

$$P_i = y(Z_i, \varepsilon) \quad \ldots\ldots (v)$$

Considering a trader who wishes to minimize his/her costs equation (iii) and also make a profit, apart from the bean characteristics, his/her characteristics will greatly influence the price at which such a trader will sell. Keeping all other factors constant, the price that traders would sell is assumed to be a function of the bundles of known bean characteristics (Z_i), known trader characteristics (φ) and unknown characteristics (ε).

$$P_i = y(Z_i, \varphi, \varepsilon) \ldots\ldots (vi)$$

Characteristics and attributes are differentiated as, characteristics being objectively measured descriptors and attributes being subjective assessments of a product (Rao, 2014). However, this study will give an attribute the same functional meaning as a characteristic while referring to the traders.

This study assumed a semi-linear relationship between the price and the bundle of characteristics that affect it. Evidence suggests that the impact of price on the assumed characteristics diminishes for most characteristics (Bolton, 1989). Therefore, by expanding equation (vi) we get

$$InP_i = \beta_0 + \beta_1 Z_1 + \beta_2 Z_2 \ldots \ldots \beta_{12} Z_{12} + \varepsilon \ldots\ldots (vii)$$

Where: InP_i is the natural log of the price of 1 kg beans, β_0 is the intercept, $\beta_1 \ldots \ldots \beta_{12}$ parameters or marginal implicit values of the prices of beans, $Z_1 \ldots \ldots \ldots Z_{12}$ bean and trader characteristics, ε marginal error term (probability of all the characteristics that might have been left out). The factors that affect the price of beans being sold are therefore given as shown in equation $(viii)$

$$InP_i = \beta_0 + \beta_1 Color + \beta_2 Size + \beta_3 Variety + \beta_4 Quality + \beta_5 Supplier + \beta_6 Customer + \beta_7 Sex + \beta_8 Educ + \beta_9 Region + \beta_{10} Type + \beta_{11} Age + \beta_{12} Commodiy + \varepsilon \ldots \ldots \ldots \ldots (viii)$$

Because moisture content is embedded in the quality of the beans, quality was aggregated, and moisture content dropped as a variable to be added to the model. Additionally, the simultaneous determination of price and quantity was expected to affect the bean traders; it was assumed that those who handled huge volumes would sell at lower prices. Therefore, only the type of trader (retail or wholesale) was included, not the volumes they handled.

Results

Traders' Socio-Economic Characteristics

The age of bean traders differed significantly ($p<0.0001$) between the study districts, with means ranging from 35.6 years in Arua to 45.2 years in Sironko (Table 2). The average age of traders in Sironko (M=45.2, SD=12.01) and Hoima (M=43.9, SD=10.9) were significantly higher ($p<0.001$) than the average age of the traders in the other three districts combined ($F_{2,118} = 1.84$, $P=.163$). The age of the business and, experience in bean trade, and number of employees (averaging 7 years, 6 years and 3 persons, respectively) did not differ significantly between the districts.

Table 2. Socio-economic Characteristics of the Bean Traders

Characteristics		Districts combined (n=200)	Arua (n=40)	Oyam (n=37)	Sironko (n=36)	Hoima (n=43)	Nakaseke (n=44)	Statistic
Age of the owner (years)		40.53	35.58	40.22	45.17	43.91	38.20	5.94***
Company existence (years)		7.49	6.53	9.60	7.58	7.86	6.13	1.06
Years in Bean trade		6.89	6.13	8.78	6.61	7.42	5.73	1.02
Employees (persons)		3	2	2	3	2	2	1.82
Sex	Male	42.00	10.00	51.35	88.89	9.30	56.82	73.4722***
	Female	58.00	90.00	48.65	11.11	90.70	43.18	
Level of education	No formal education	7.00	10.00	8.10	0.00	6.90	9.13	
	Primary	45.00	35.00	51.36	66.67	37.20	38.60	
	Secondary	39.50	32.50	37.84	33.33	46.51	45.45	
	Tertiary	5.00	17.50	0.00	0.00	6.90	0.00	
	University	3.50	5.00	2.70	0.00	2.49	6.82	
Form of business	Sole proprietorship	94.50	97.50	100.00	91.67	90.70	93.18	4.7453
	Partnership	5.50	2.50	0.00	8.33	9.30	6.82	
Type of business	Wholesale	38.00	12.50	35.14	63.89	39.53	40.91	21.6111***
	Retail	62.00	87.50	64.86	36.11	60.47	59.09	
Main occupation	Private business	63.64	79.59	53.70	40.30	84.00	69.09	
	Crop farming	22.91	12.24	37.04	37.31	10.00	12.73	
	Livestock rearing	4.00	0.00	1.85	14.93	0.00	0.00	
	Mixed farming	5.82	4.08	5.56	7.46	0.00	10.90	
	Formal employment	1.82	4.08	1.85	0.00	0.00	3.64	
	Casual employment	1.82	0.00	0.00	0.00	6.00	3.64	
Products[1]	Bean seed	51.50	45.00	62.20	47.20	53.50	50.00	
	Bean grain	96.50	95.00	86.50	100.00	100.00	100.00	
	Fresh pod beans	0.50	0.00	0.00	0.00	2.30	0.00	

[1] Multiple response for products. Significance levels; *** for p<0.001, ** for p<0.001 and * for p<0.01.

There were significant differences ($p<0.0001$) in the number of female and male traders operating in and across the different districts (Table 2). Male traders dominated in Oyam, Sironko and Nakaseke, while female traders were more in Arua and Hoima. Over 45% of the respondents had attained at least primary education, which is basic for communication and numeracy. With the exception of Sironko, interviewed traders in the other districts operated retail stores, stocking beans and other food products. Largely, the traders conducted private business, followed by crop farming and mixed farming. Most (93%) traders sold beans as grain, and about 51.6% sold grain for seed. The beans sold as seeds were generally sorted by some traders and sold at higher prices to farmers during the planting season.

Bean Varieties Traded in the Sampled Districts

A total of 30 bean varieties were identified during this study; 16 of which were released varieties, 11 local bean varieties and 3 pre-releases but already in the market. Traders also sold mixed bean varieties. The traders were not fully aware of the names of released bean varieties and had a number of names for both the released and local varieties. There were, however, great differences in the top most traded bean varieties across all the surveyed districts. For each district, only the five major bean varieties traded were therefore explored and are listed (Table 3).

Table 3. Major Bean Varieties Traded

District	Varieties	% of traders selling*				
		Pooled	*Female*	*Male*	*Wholesalers*	*Retailers*
Arua N=40	Mixed varieties[1]	52.50	52.78	50.00	60.00	51.43
	Masindi yellow[2]	50.00	47.22	75.00	60.00	48.57
	Large white beans[2]	42.50	38.89	75.00	20.00	45.71
	Small white beans[3]	35.00	38.89	0.00	20.00	37.14
	NABE 4	22.50	19.44	50.00	0.00	25.71
Oyam N=37	Red mottled short (Kawula)[3]	54.05	44.44	63.16	69.23	45.83
	Mixed varieties	43.24	44.44	42.11	46.15	41.67
	Small black beans	35.14	22.22	47.37	53.85	25.00
	Masindi yellow	32.43	16.67	47.37	53.85	16.67
	Jewe[2]	29.73	16.67	42.11	23.08	8.33
Sironko N=36	NABE 15	91.67	100.00	90.63	95.65	84.62
	Grey (Mufumba chai)[2]	44.44	25.00	46.88	43.48	46.15
	Local varieties/landrace[2]	36.11	0.00	40.63	39.13	30.77
	Red mottled long (Tanzania)[3]	22.22	0.00	25.00	30.43	7.69
	Yellow large[2]	19.44	0.00	21.88	21.74	15.38

* Multiple responses/reporting % of responses hence >100

[1] Different varieties mixed and sold in a single batch

[2] Varieties that were tested but not released by the National Bean Research Program

[3] Varieties that were released but during society uptake were given local names

Hoima N=43	Small white beans	53.49	53.85	50.00	64.71	46.15
	Red mottled short	41.86	41.03	50.00	88.24	11.54
	Yellow short[3]	37.21	38.46	25.00	58.82	23.08
	Masindi yellow	25.58	20.51	75.00	29.41	23.08
	Yellow large	23.26	25.64	0.00	11.76	30.77
Nakaseke N=44	Red mottled short	72.73	73.68	72.00	72.22	73.08
	Yellow short	25.00	31.58	20.00	27.78	23.00
	Masindi yellow	22.73	31.58	16.00	27.78	19.23
	NABE 1	18.18	21.05	16.00	16.67	19.23
	Mixed varieties	18.18	15.79	20.00	22.22	15.38

No single bean variety emerged as dominant across all five districts surveyed. Traders in almost all districts preferred to trade in small-seeded beans of various colours; and pure colours such as white, yellow or black were the commonest. Preference for stocking particular market classes was mostly based on taste, ease of access, profitability, and low supply/purchase price (Table 4).

Table 4. Reasons for Selling Specific Market Classes

Variable	Pooled	Masindi Yellow	Red mottled short	NABE15	Small white beans	Mixed Varieties
Taste	65.53	71.54	55.78	58.89	54.45	60.96
Ease of access	28.44	18.56	33.82	15.55	18.89	45.65
Profitability	27.80	26.05	39.23	17.78	20.00	10.31
Cheap supply price	19.31	3.36	7.82	2.96	18.89	34.03
Short cooking time	15.63	7.67	5.54	20.37	29.44	2.86
Reliable supply	10.80	5.23	7.48	12.59	11.11	5.45
High yield	6.27	0.00	14.00	3.70	2.22	0.00
Long storage duration	2.61	1.82	0.00	2.22	0.00	0.00
Short growth period	1.69	0.00	2.74	2.96	0.00	0.00

[4]

Bean Sources and Quality

The bean sources for traders included farmers, aggregators, brokers, and farmer groups (Figure 2). Many traders (48.0%) indicated the beans received from the different sources as moderate, whilst about 30% indicated that they received high-quality beans, and 21.6% reported receiving low-quality beans. Thirty-six percent of traders reported that the beans received from individual farmers were of high (good) quality, while 24.3% said that brokers supplied the lowest quality beans (Figure. 2).

[4] Source: Survey data (July 2019)

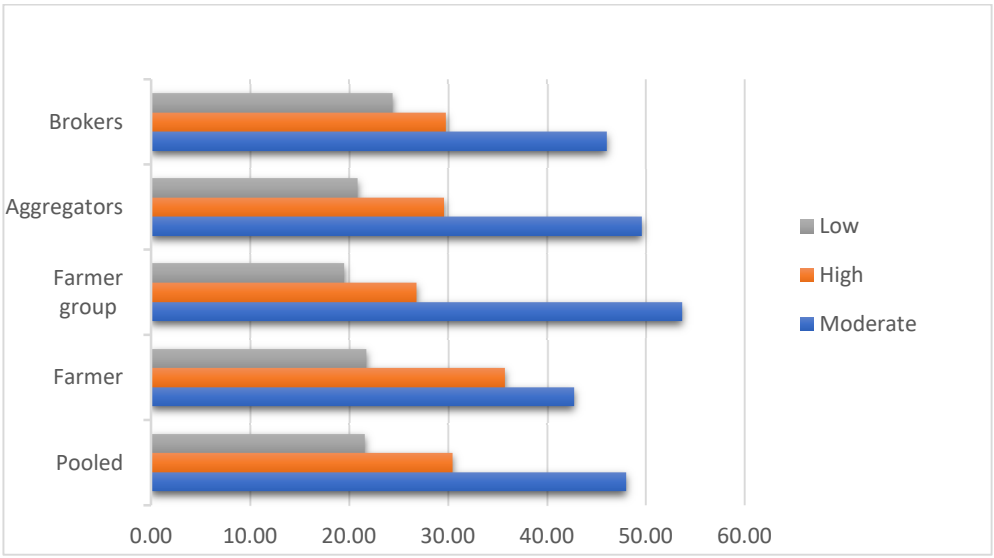

Figure 2. Traders' ranking of the quality of beans received from different suppliers

Variety uniformity, presence of impurities, grain size uniformity, and poor moisture content were the topmost factors affecting the quality of beans received from different suppliers (Figure. 3). Brokers supplied the highest percentage of beans of non-uniform variety, non-uniform grain size and with the highest rate of insect infestation. Although farmers supplied more uniform bean varieties, their beans had impurities and higher moisture content (Figure. 3).

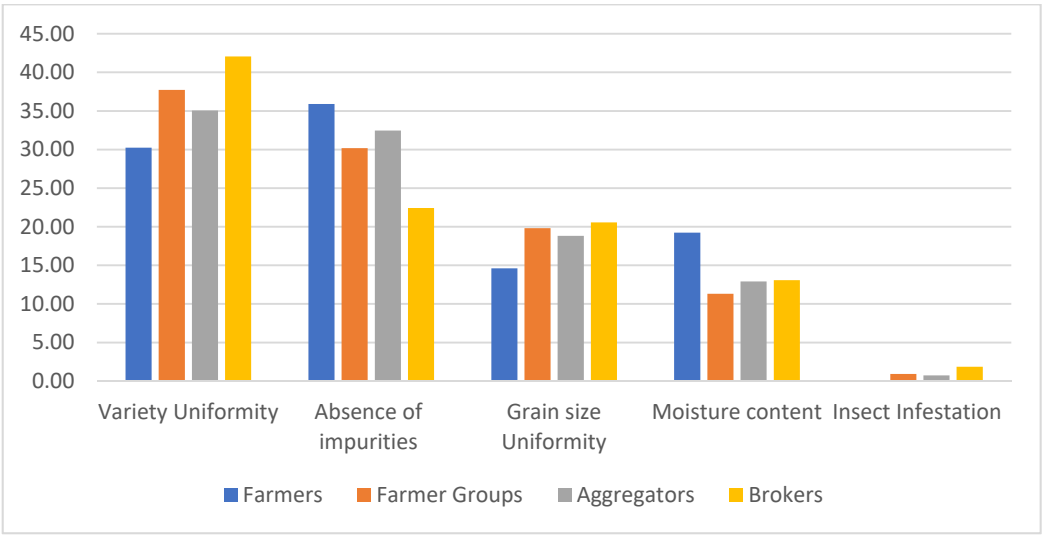

Figure 3. Attributes affecting the quality of beans received by traders from different suppliers

The traders reported storage pests (44% of respondents), mould (24%), discoloration (22%), physical damage and mixing of bean varieties as key contaminants of beans (Figure. 4).

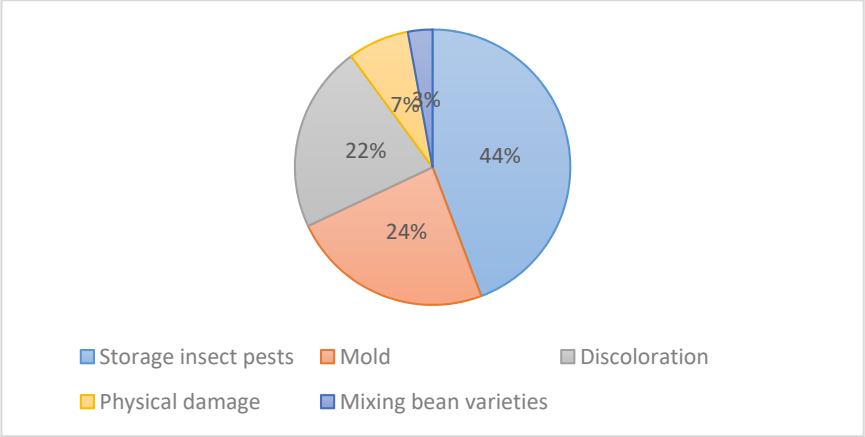

Figure 4. Causes of grain quality distortion at trade level

The mean moisture content of bean samples collected from the markets taken at the time of data collection was 17% (range, 10-31%) (Figure 5). A total of 124 bean samples of pure varieties collected from the surveyed markets taken to the laboratory had moisture content above 14%. More results on the quality are presented in Isout (2022).

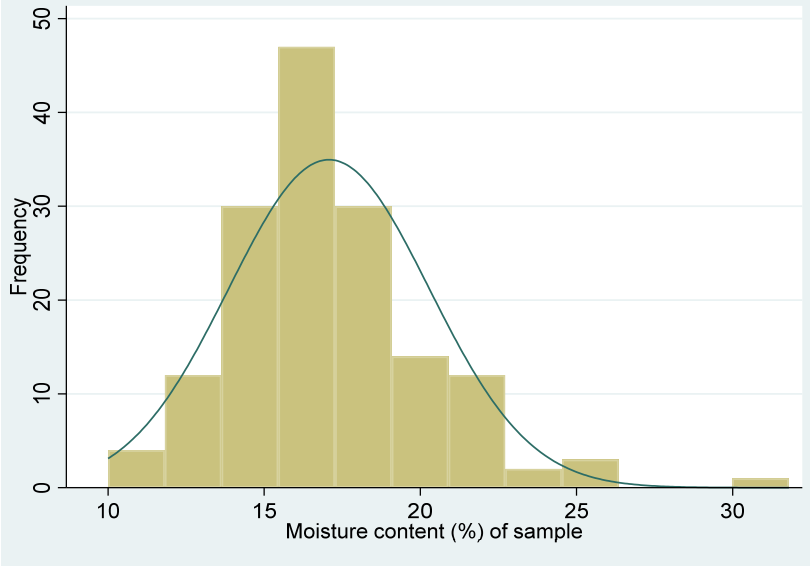

Figure 5. Average moisture content of common beans from selected markets

Traders used different methods to maintain or improve the quality of beans (Table 5). The three most reported methods were sorting, drying and application of insecticides. Other methods included buying only good quality beans, storing on raised platform, and use of triple bags. Almost 9% of the interviewed traders did nothing to improve or maintain the quality of beans they sell. Among the methods, there was a significant difference in the percentage of men and women carrying out drying ($p<0.0001$), with more men employing this method to improve the quality beans (Table 5).

Table 5. Methods Employed to Improve and Maintain the Quality of Beans

Method	Percentages of traders using the method			χ^2
	Combined	*Female*	*Male*	
Sort the beans	47.50	48.28	46.43	0.067
Dry the beans	46.50	34.48	63.10	16.033***
Apply pesticides/insecticides	30.50	35.34	23.81	3.058
Buy only good-quality beans	12.00	10.34	14.29	0.717
Clean beans with flour	4.50	6.90	1.19	3.691
Store on a raised platform	3.50	0.86	7.14	5.690
Use triple bags to store	1.50	2.59	0.00	2.205
Mix good and bad	1.00	1.72	0.00	1.463

[5] Significance levels; *** for p<0.001, ** for p<0.001 and * for p<0.05

Factors influencing the Price of Beans

Bean price at the trade level was significantly affected by the variety sold (improved or local), the source of beans (supplier), sex of the trader, market location, the age of the trader and the bean product (grain or seed) traded (Table 6). Local bean varieties were cheaper by 5% (p<0.05). Beans obtained from aggregators were sold at a significantly higher price compared to those received from individual farmers and farmer groups (Table 6). Female bean traders sold bean grain at significantly higher prices (more by 12%) (p<0.001).

Table 6. Factors Influencing Bean Prices

Independent variables	Coef.	Standard Error ±
Plain colour	0.0232	0.0212
Small Size	0.0058	0.0222
Local varieties	-0.0545**	0.0262
Quality		
Moderate quality	-0.0026	0.0239
Low quality	0.0494	0.0308
Aggregators	0.0873***	0.0209
Individual Consumers	0.0129	0.0349
Female	0.1282***	0.0247
Education		
Secondary	0.0310	0.0215
University	0.0716	0.0387
Region	0.0896***	0.0254
Retail	0.0194	0.0244
Owner's age	0.0020*	0.0010
Commodity assort	-0.1332**	0.0565
Constant	7.7156	0.0814
Number of observations	200	
Prob>F	0.000	
Adjusted R-squared	0.3493	

Significance levels; *** for p<0.001, ** for p<0.01 and * for p<0.05

[5] Source: Survey data July 2019

The price of beans received by traders in Nakaseke district was 8% ($p<0.001$) higher compared to the price received by traders in Sironko, Hoima, Arua and Oyam. Additionally, a 1% increase in the age (in complete years) of the traders was associated with a 0.2% ($p<0.05$) increase in the price of the beans. Dealing in only bean grain is associated with a 13% ($p<0.01$) decrease in the price of the beans. Traders who sold seed or both grain and seed along other grains such as maize, groundnuts (*Arachis hypogaea*), and field peas (*Pisum Sativum)* sold beans at a higher price compared to those who sold only bean grain.

Discussion

Socio-Economic Characteristics of the Traders

The traders were mainly youths who had obtained basic education and gained experience (7 years) in the enterprises. Having obtained the basic primary education is essential for conducting profitable business even in the agricultural sector of which bean trade is part, and education as well as experience contribute to the understanding of the required market quality by customers. Young entrepreneurs have been found to be ambitious, usually wishing to maximize profits in the shortest time possible (Murungaray and Ramirez-Urquidy, 2011), this can positively affect the quality of products. Nonetheless, the description of good quality products by the young traders was found to vary from that of the older traders whose choice of starting businesses goes beyond only economic survival (Scholtes et al., 2018), with the economic sense in mind, young traders may try to adhere to set quality standards.

The majority of the bean traders were sole entrepreneurs and employed a few helpers. Sole entrepreneurship ensures quick decision-making and flexibility. The business owners were thus fully involved in the purchase and setting prices for the different varieties they bought from different suppliers. Although good, sole entrepreneurship can limit capacity for large scale investment and increase workload. Research on entrepreneurship and small business management (Davidsson, 2015) highlights benefits of quick decision making associated with sole entrepreneurship, however, (Cassar, 2014), indicated the challenges that come along with it such as limited resources.

Many of the bean retailers were female, while most wholesalers were predominantly male, this might have negative implications on the supply chain with women being expected to take on the retailer role and men the wholesaler role. Traders as well as small business owners have been found to keep both the purchase and sales records in particular (Jjagwe et al., 2022; *National Small Business Survey of Uganda*, 2015). This pattern may reflect traditional gender roles and access to resources, with men potentially dominating roles that involve larger-scale trading and wholesale activities, while women are more prevalent in retail roles, which may involve smaller-scale operations

Bean Varieties Traded and Traders' Preferences

The predominance or preference to sell plain (single) coloured beans may reflect a strategic inclination towards trading in pure varieties, possibly due to the ease of distinguishing and maintaining pure varieties or a response to consumer preference for uniform beans. Comparable findings by Mishili et al., (2011) found that pure varieties were often associated with premium pricing compared to mixed varieties, as echoed in the present study.

The noticeable preference for certain bean varieties and market classes among traders may be closely linked to underlying market dynamics, such as institutional preferences, as suggested by previous research (Jjagwe et al., 2022). This highlights the pivotal role of consumer

preferences in shaping bean trade dynamics, as corroborated by findings from (Nchanji et al., 2023). Ease of accessing the beans, profitability of the variety and the cheap supply price were also major reasons for trading in particular varieties. Trade in mixed varieties and local landraces may be because of consumer demands. Indeed, many of the traders reported that mixed varieties are tasty, easy to access and have low supply price which makes them liked locally.

The influence of consumer preference on traded bean varieties was also reported by Kilimo Trust, (2012) for beans traded in Northern and Central Uganda. The yellow market class beans are relatively cheaper and demanded by institutions such as schools Birachi et al, (2021) and are thus traded as pure grain. Among the reasons for trading, profitability ranked higher for the beans in the market classes (Table 4) that comprised higher numbers of released varieties (Short red mottled, small white and NABE 15).

Quality of Beans

Approximately 70% of traders reported receiving beans of low to moderate quality, with only 30% obtaining high-quality beans. Predominant factors contributing to poor quality included insect infestation, molding, and discoloration. These issues may be stemming from inadequate storage practices, such as storing beans on damp floors, mixing different varieties of varying moisture content, and contaminating beans with other items. Poor storage at the marketing node may also compromise the nutritional quality of beans, emphasizing the need for improved storage practices.

According to Kilimo Trust (2012), majority of farmers sell their beans to brokers who unfortunately in the current study were found to be suppliers of poor quality beans at market level. This is evident from the brokers' supply of the highest percentages of non-uniform varieties, non-uniform grain sizes and most insect infested beans. Similar studies reported that brokers hike prices and slow down the delivery of farm produce to markets (FAO et al., 2019; CASA, 2020; Jjagwe et al., 2022). In this study, farmer groups were among those supplying good quality beans, previous research has shown farmer groups to build the capacity of farmers to produce good quality produce while also aggregating so as to enable them fetch better price for their produce (Ferris et al., 2014; Nakazi, Aseete, et al., 2017).

After the beans are received by the traders, storage insect infestation was identified as a major concern in trader stores (Figure. 4) even though they noted that beans received from farmers were free of insect pests. Freedom from insect pest infestation in beans supplied by farmers in Uganda has been attributed to the early sale before storing them for long (CASA, 2020; Nchanji et al., 2021; Ugen et al., 2021; Jjagwe et al., 2022). Poor storage causes seed hardening, moisture absorption, mold growth, discoloration and bad odour (Kaviyani et al., 2015). In a related study, Abebe and Zemedu, (2019) found that storage insect pests were a major challenge for bean traders in Ethiopia. This is an indication of poor post-harvest handling of beans and calls for building the capacity of the people involved in bean sale, including brokers and traders, to improve the quality of the beans for better prices, health and long storage duration. Another aspect is maintenance of variety purity and uniformity in grain size, samples collected from this market surveys were found to be on average 71.4% pure (Isout, 2022).

A critical factor determining bean quality is the moisture content (MC). Whereas the recommended moisture content for bean grain is 13% (EAS 46, 2011), mean MC of the grains was higher in our study (17%). Thus, the poor (low or high) MC also contributes to the low-quality factors including increased cooking time, proliferation of fungal infections due to optimum growth conditions offered by damp seed, rotting, and loss of viability. According to Aber et al., (2018) storage and postharvest drying are the key points at which bean quality is lost

and hygiene and sanitation by the traders during marketing significantly influence the quality of beans, and impact food safety.

There were cases of overly dry beans, which can also lower the quality of beans as they may easily result into physical damage during post-harvest handling procedures. According to Ferreira et al. (2017), higher moisture content of beans (≥17%) impacts the nutritional composition, including fatty acid content if they are stored at relatively high temperatures and for long duration. This implies that overly storage of beans by the traders may be avoided by consumers since they could have negative effects on the health and nutrition of the consumers of these beans.

Although traders used almost similar methods to improve the quality of beans they sold, there was a significantly higher percentage of men drying the beans than were the women, despite the equal proportions in sampling. This could be attributed to the few employees and owners having to carry out these activities by themselves hence women reluctantly carrying out this activity which needs man power. Some of the methods which help traders to improve the quality of beans and to sell more, such as mixing good and low-quality beans, cleaning the beans with other food staffs such as maize flour actually ends up compromising the quality of beans.

Factors influencing the Price of Beans

In our study, the significant factors associated with the prices charged by common bean traders are type of variety, bean supplier, sex of trader and region. Improved bean varieties (released by research organizations) fetched higher prices for traders in our study and earlier studies (Larochelle et al., 2015; Muthoni et al., 2008). In a literature review on improved beans, Muthoni et al. (2008) found improved beans to have both clinical and functional outcomes and this information has been passed to the communities with a general overview of being more nutritious as evidences in a number of other studies (Larochelle et al., 2015; Mishili et al., 2011; Muthoni et al., 2008; Mutwiri et al., 2020). With the increasing nutrition awareness, it is evident for improved varieties to be priced highly at all levels. This study found no significant observations among the bean grain characteristics (colour and the size) with the prices the beans are sold in the districts of study, which is similar to findings by Grisley and Mwesigwa (1994) who found that bean grain size and colour were not among the major factors influencing prices charged by common bean traders in Uganda at the time.

This study reveals that traders who purchase from aggregators sell beans at an average of 8.7% ($p<0.001$) higher than the usual selling price. Aggregators increase the prices of agricultural commodities by receiving commissions on each kilogram of beans sold (Babirye, 2019; Bonabana-Wabbi, 2013; Kilimo Trust, 2012). In a similar situation, the beans supplied by commission agents, aggregators and brokers were highly priced by the final selling agents, hence beans purchased expensively were priced highly. Therefore, in a bid to reduce the final price of beans in given districts, farmer linkages with the district wholesalers or community retailers are advised.

Unlike earlier studies where female traders have been portrayed as exposed to a number of challenges such as the lack of appropriate trade information (USAID, 2015), female bean grain traders interviewed in this study were more informed of the marketing of beans as evidenced by their familiarity with bean attributes such as nutrition, carried out better value addition (Table 5) hence selling their beans at higher prices. We believe that the female bean retailers charged higher prices because of the better marketing skills as well as the familiarity with the bean grain (food) attributes. Gonzalez-Igual et al. (2021) in "impact of education, age and gender on

investor's sentiments" discovered that female investors exhibited higher levels of optimism and confidence.

In this study, we also found that in the district closest to the capital Kampala, traders sold beans at relatively higher prices; Nakaseke district may have its bean prices slightly higher due to the enormously higher demand for beans in Uganda's capital city, Kampala. However, the cost of production cannot be undermined. In a related study, Steffen and Yu (2018) found that the distance to the capital Nairobi had a negative effect on transaction cost, with farther locations having increased prices of goods. Contrary to Steffen and Yu (2018), Rubalcaba et al. (2013) who argued that demand-oriented factors influence trade and hence being near the capital city might have caused the higher prices.

Consistent with prior studies, experience, increased with age, and the older the business persons, the easier for them to predict profitability from different entities Gonzalez-Igual et al. (2021), other factors could be the wealth status of the older traders and the goodwill built over the years with customers. Results of the current study are also consistent with earlier findings that profitability is linked to greater product diversity at retail and production levels (Alarcón and Sánchez, 2013; Oladimeji and Udosen, 2019).

Conclusion and Recommendations

The observed patterns in the bean trading preferences highlight the relationship between consumer demand, market dynamics, and varietal preferences. Thus, indicating the need for targeted market strategies and varietal selection for market classes to meet the evolving market demands and maximize trading efficiency. The study findings further indicate the need to prioritize awareness campaigns about the released improved bean varieties that fetch higher prices in the market, thereby enhancing profitability for farmers and traders. Fostering closer linkages between farmers/farmer groups, wholesalers/aggregators, and community retailers can help mitigate the impact of intermediaries, improving the quality of beans on the market while ensuring fairer prices for both producers and consumers. Additionally, the influence of gender on pricing dynamics highlights the need for gender-inclusive marketing policies and support programs to empower female bean traders. Overall, trader characteristics and societal factors that influence market dynamics need to be considered by breeders in the release of new improved varieties as well as policy makers and economists in developing policies and ensuring uptake by the society.

This study mainly focused at the trade level and found both local and released bean varieties on the market. However, comprehensive comparison of preference between the two was not done. Future research could explore preferences and prices of released versus local bean varieties along the value chain in Uganda to advisor breeders and policy makers. Additionally, research investigating bean quality from farm to consumer to identify major loss points is also recommended to establish the greatest quality deterioration points and address them.

Conflict of Interest

The authors declare that they have no conflicts of interest in relation to this article.

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