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Signaling quality in informal markets. Evidence from an experimental auction in the Sahel

Jacob Ricker-Gilbert [a,*], Bokar Moussa [b], Tahirou Abdoulaye [c]

[a] Department of Agricultural Economics at Purdue University, United States
[b] Institut National de la Recherche Agronomique du Niger (INRAN), Niger
[c] International Institute for Tropical Agriculture (IITA), Nigeria

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ABSTRACT

This study estimates the extent to which rural consumers in sub-Saharan Africa value quality signals about their food. We tested this by implementing an incentive-compatible Becker-Degroot Marschak auction among consumers in Niger and Northern Nigeria to estimate their willingness to pay (WTP) for cowpea (blackeyed pea) that was stored and sold in an improved grain storage bag that signaled unobservable quality in the form of insecticide-free grain. The improved bag had two inner layers of high-density plastic that created an airtight seal around the grain stored in it. The seal killed insects through suffocation rather than insecticide. The bag also had a branded label from its manufacturer on its outer layer to help distinguish it from a generic single-layer, woven storage bag. We estimated the size of the price differential (premium) that the average consumer placed on unobservable grain quality, as measured through the WTP premium for grain sold in the improved bag with a label. We also estimated the effect that consumers' previous awareness of the improved bag had on their valuation of observable and unobservable quality. Our results indicated that on average consumers in Niger were willing to pay a 10% premium for cowpea stored and sold in the improved storage bag compared to cowpea of the same observable quality that was sold in a generic woven bag. The same unobservable quality premium was 17% in Nigeria. The results from this study provide evidence that there may be a latent demand for quality proxied by food safety among limited resource people in sub-Saharan Africa and that improved products with branded labels can potentially provide a quality signal to the market.

1. Introduction

Quality signals can reduce asymmetric information between buyers and sellers. This is important for market development in SSA and elsewhere around the world. It is also crucial in the context of food safety (Bai 2021). Food is not nutritious if it is not safe to eat, and households cannot be food secure if their food supply is not safe. Furthermore, the production of food that is not safe to eat constitutes a waste of scarce resources and poses a threat to human health. As a result, many developed countries have testing, inspection, and standards in place to mitigate food safety and quality threats, but these controls do not exist or do not function well in many developing countries. This is a critical issue because successful markets depend on a consistent supply of quality products (Hodges, Buzby, and Bennett 2011). Lack of quality food in many developing countries has been associated with poorly integrated value chains (Fafchamps, Hill, and Minten 2008), and with pushing smallholder farmers towards subsistence food production (Hoffmann and Gotabu 2014). This has implications for the health, safety, income, and livelihoods of millions of people in developing countries.

Food quality can be divided into observable quality and unobservable quality. Examples of observable quality in grain include size, color, and texture of kernels, along with visible signs of mold and/or insect damage. A consumer can inspect a product to check for observable quality attributes that affect the grain that he or she is considering for purchase. There is evidence to suggest that observable attributes are built into the price of grain in rural markets, at least at harvest when high-quality grain is plentiful (Kadjo, Ricker-Gilbert, and Alexander 2016). As such, consumers can differentiate observable quality grain and discount the price that they pay when low-quality grain is sold in the market.

Contrary to observable characteristics, identifying unobservable quality attributes is much more difficult in rural markets of developing

* Corresponding author.
E-mail address: jrickerg@purdue.edu (J. Ricker-Gilbert).

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countries. Examples of unobservable (or partly observable) quality attributes in grain include food safety contaminants such as pesticide residues and levels of aflatoxin, a harmful liver toxin that causes stunting and cancer.[1] Testing methods for pesticide residues and aflatoxins can make these threats observable, but no affordable or accessible testing mechanisms for aflatoxin or chemical residues are readily available in informal rural markets of SSA to our knowledge (Hoffmann and Gatobu 2014; Kadjo et al. 2020; Nindi et al. 2023).

With no straightforward way for consumers to identify unobservable quality, sellers may have incentives to maintain or improve observable quality, but not unobservable quality. Sellers may even have incentives to take steps to improve observable quality at the expense of unobservable quality and safety. For example, a seller of grain may apply chemical insecticides to kill insect pests. Thus, they will be rewarded with a price premium for improving observable quality, by preventing insects from damaging grain kernels. At the same time, they will not be penalized for reducing unobservable quality by making grain less safe to eat due to applying insecticides. This problem creates asymmetric information between buyers and sellers and leads to the classic lemons market problem identified by Akerlof (1970), where low unobservable quality dominates rural markets.

With these considerations in mind, the objective of the present study is to estimate the value that rural consumers in Southern Niger and Northern Nigeria placed on food that was sold to them in an improved grain storage bag that signaled unobservable quality in the form of insecticide-free grain. We estimated the size of the price differential that the average consumer placed on unobservable grain quality (measured through the improved bag) and observable grain quality (measured through insect damage, color, and mold) that participants assessed through visual inspection. We also estimated the effect that a consumer's previous awareness of the improved storage bag and its branded label had on their valuation for observable and unobservable quality. The effect that awareness of a product has on demand is important because awareness converts the quality attribute from a credence good that the consumer has not observed to an experience good that they have some knowledge of. The results of our study have implications for incentivizing producers and consumers to invest in technologies and products that improve food safety in rural markets.

Specifically, we conducted an experimental Becker-Degroot-Marshak auction for cowpea (also called black-eyed pea) stored in an improved storage bag, with a label. The improved bag created a hermetic (airtight) seal that protected grain from threats to both observable quality (i.e. insect damage, color, mold), and unobservable quality (i.e. pesticide residues and aflatoxins). As such, the "brand" in this experiment was the hermetic bag itself along with the label on it.

The auction took place roughly ten months after harvest when threats to food quality were very prevalent in the market. Consumers were asked to bid on and purchase cowpea that were stored and sold three separate ways. The first bag of cowpea was stored in the hermetic bag for 10 months and was sold to consumers in the hermetic bag with that bag's branded label on it. Thus, the cowpea from the first bag had elevated levels of both unobservable quality (signaled through the hermetic bag and its label) and observable quality (signaled through visual inspection of grain in the bag). The second bag of cowpea was stored in the same hermetic bag for 10 months, but the grain was transferred to a standard woven bag immediately before being sold to consumers.[2] Therefore, the second bag had the same level of observable quality as the first bag, but it lacked the unobservable quality signal from the hermetic bag and its label that the first bag had. The third bag of cowpea was stored in a traditional woven bag and preserved with the certified storage chemical phostoxin. It lacked the observable quality in the first and second bags along with the unobservable quality signal of the first bag (see Fig. 1).[3] As such, the difference in consumers' willingness to pay (WTP) for cowpea between the first and second bag measured the value they placed on unobservable quality, while the difference in WTP between the second and third bag measured the value they placed on observable quality.

The present article contributes to the limited evidence on branding and how consumers value food safety in developing countries. Two recent studies estimated how introducing new food products with enhanced quality into developing country markets caused market actors to respond (Bai 2021; Kariuki and Hoffmann 2022). Bai found that urban consumers in China were willing to pay a price premium for watermelon that included a new laser-generated label indicating its level of sweetness. However, the study revealed that the price premium for the labeled watermelon was not high enough to cover the overall cost of buying the laser labeling machine. As a result, none of the sellers in the intervention continued with the laser-generated label after the intervention ended. Kariuki and Hoffmann offered Kenyan consumers information about aflatoxin in maize flour and about which brands in the market were known to have the lowest levels of aflatoxin. They offered another group the same information and the opportunity to have their maize flour tested for aflatoxin. They found that those offered information and a test were 76 percent more likely to consume a safer brand two months later. In a related study, Hoffmann, and Moser (2017) found that in the formal market for maize flour in Kenya, higher-priced brands were significantly more likely to have lower levels of aflatoxin, thus signaling their quality to consumers.

In addition, several studies have used BDM auctions to estimate how providing food safety training and a label indicating that food had safe levels of aflatoxin affected rural consumers' WTP for that food (De Groote et al. 2016; Nindi et al. 2023). Another notable study by Fafchamps, Vargas-Hill, and Minton (2008) based in India found that in the absence of branding and vertical market integration, food safety attributes for horticultural crops were not reflected in their price. The present article adds to this literature because the design of our experiment allows us to estimate how an improved technology with a branded label can or cannot induce consumers to pay for both observable and unobservable food safety attributes. We also estimate how past awareness of the technology and the brand affects demand for observable and unobservable quality in this context. Given the fact that it is prohibitively expensive to test grain for unobservable threats to food safety like pesticide residues in rural markets of developing countries, it is important to understand if consumers will pay a premium for food sold in the improved technology. If they are, then this type of quality upgrade can potentially provide a signal to the market that may help break its low

[1] Some aspects of food safety could be considered experience goods because they become observable after the food is consumed and the consumer gets sick. However, in the case of pesticide residues or aflatoxins, it can take a long time for symptoms to be revealed unless the contaminants are consumed in high doses.

[2] Many farmers in the region store cowpea in a hermetic bag and then sell it in a woven bag. As such, they treat the hermetic bag as a granary and preserve grain in it. Then they transfer grain to a woven bag to transport it to the market, because they do not want to damage the hermetic bag during transport. This practice is logical and makes sense if a cowpea seller does not believe that they would get a premium for the grain that they stored in hermetic bags.

[3] People in the study area were aware of phostoxin, and its potential benefits and drawbacks as these have been available for a long time in the study area. Phostoxin was the main method people used to preserve grain before hermetic bags were disseminated. We told participants that the cowpea was stored using phostoxin so they were aware of what they were buying.

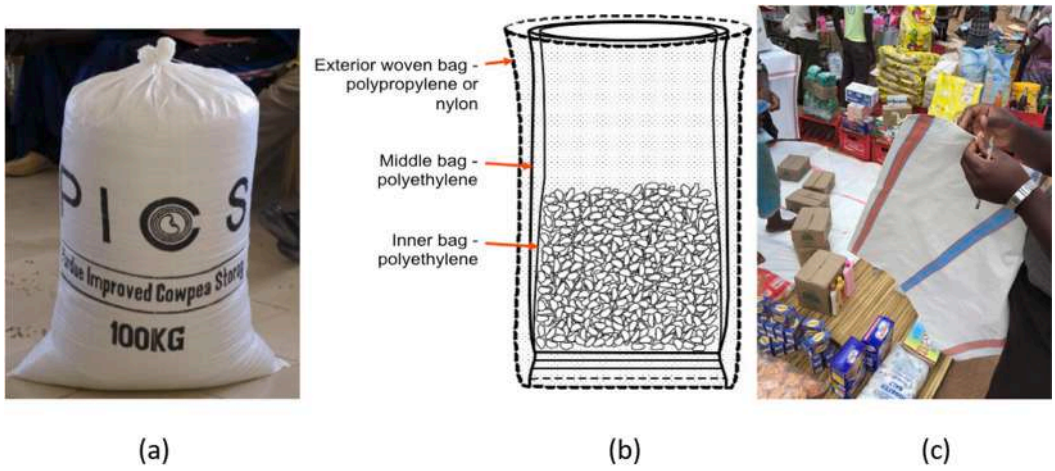

Fig. 1. (a) Outside of PICS hermetic storage bag with the brand logo; (b) Interior design of PICS hermetic storage bag; (c) Generic, traditional woven storage bag with no branding.

food safety equilibrium.

2. Background information

2.1. Cowpeas in Niger and Nigeria

Cowpea plays a strategic role in the food security of rural communities in both Niger and Nigeria because it is the earliest crop to be harvested in each season. Thus, it complements low-protein staples, such as millet, sorghum, and maize. Cowpea is also a high-value commodity in West and Central Africa, and demand for its grain is often higher than the supply. This provides farmers an opportunity to earn additional income by storing cowpea at harvest for sale in the lean season. However, cowpea productivity in Niger and Nigeria is challenged by many abiotic and biotic constraints. The abiotic stresses include drought, heat, and low soil fertility. The biotic stresses include insect pests (aphids, flower thrips, pod-sucking bugs, Maruca, and bruchids), diseases (fungal, bacterial and viral), root-knot nematodes, and parasitic weeds (Horn, and Shimelis 2020). Bruchids (*Callosobruchus maculatus*) cause substantial losses during postharvest storage. Near-certainty of loss to insects causes many farmers to sell their cowpea at harvest when prices are at their lowest point of the year. This occurs even though they know that if they can store their cowpea for four to six months the market price may increase as much as three-fold.

2.2. Hermetic storage technology

The brand of hermetic storage bag used in this study was the Purdue Improved Crop Storage (PICS) bagging system. PICS bags were developed during the 1980′s and 1990′s in response to the post-harvest challenges that smallholder farmers and small-scale traders in West Africa faced. PICS bags are chemical-free bags composed of one outer polypropylene (PP) woven bag, and two liners of high-density polyethylene (HDPE), each 80 μm thick (See Fig. 1). These bags limit oxygen availability leading to insect inactivity, cessation of population growth, desiccation, and eventual death (Baoua et al. 2012). Since its inception, the dissemination of PICS bags has been coupled with efforts to develop a supply chain to ensure the availability of bags in markets to improve access for smallholder farmers and small-scale traders (Moussa et al. 2014).

The use of hermetic bags to store grain in Niger, Nigeria, and the rest of SSA has significantly increased in the past 15 years. A recent study in Niger found that 22 % of respondents used PICS bags during the previous season, with adoption rates ranging from 4 % in Zinder to 49 % in Dosso (Aker, Dillon and Welch 2023). The adoption of hermetic bags has been affected by several factors. These include (i) the severity of storage losses at the farm level; (ii) the ineffectiveness of chemical storage insecticides, (iii) the availability of quality bags, and (iv) other benefits such as being chemical-free, cost-effective, easy to use, and durable as the bags last three seasons on average.

As mentioned above, when farmers use hermetic storage bags like PICS for their grains they eliminate the need to apply chemical insecticides to protect them from insect pests. Thus, hermetic bags significantly reduce food safety risks posed by the conventional method of treating stored grains with insecticides. Additionally, when the stored grain is dried properly to below 13.5 % moisture content, the airtight environment prevents fungi that cause Aflatoxins from developing (Bauchet et al. 2021; Walker et al. 2018).[4] Many farmers in West and Central Africa are aware of the quality improvement offered by hermetic bags. Aker, Dillon, and Welch (2023) reported that 69 % of farmers and 98 % of traders were aware of PICS bags in Niger. They found that the constraints to PICS adoption included a lack of available supply and a relatively high price of between US $2.00–2.50 for one bag that held 100 kg of cowpeas and had an expected life of three seasons.

Though hermetic technology and the hermetic bag brand were well known to many farmers and consumers in our study region, the question of whether grains stored with hermetic bags receive any price premiums compared to grains stored in traditional woven bags and/or treated with insecticide has not been investigated to date. Previous cowpea price and quality studies in West and Central Africa have shown that consumers are very conscious of observable quantity and quality losses from insect damage, and they have a negative effect on cowpea prices (Faye et al. 2004; Langyintuo et al. 2004). Thus, our study provides an excellent context to test the effect of brand value on unobservable quality premiums in rural markets.

3. Data Collection

In both Niger and Nigeria, we randomly selected participants in the most important cowpea production and consumption areas. In each area, villages were selected randomly from villages where hermetic bag

[4] When grain is stored in hermetic bags at a moisture content that is above 17% the grain can ferment. Practically speaking grain moisture content causing Aflatoxins is less of a problem in northern Nigeria and Niger than are insects due to the hot, dry Sahelian climate.

demonstrations had occurred and villages where the demonstrations had not occurred. Ten people were selected randomly from a village list and enumerators approached them, explained the purpose of the study, and asked if they wanted to participate. If they said yes, then they answered a short set of demographic questions before the auction was conducted. The auction took place during the cowpea marketing season, which occurred 10 months after the cowpea harvest. To avoid heterogeneity in the quality of the grains being used for the auction, the sample of cowpea was bought at the beginning of the storage period, in November 2017, and stored for about ten months to allow a significant amount of insect damage, in the non-hermetic bags to accumulate. The grains that we used for the auction in both countries were bought from the main market of Kano in Nigeria.[5] In total, six 100-kilogram bags for Nigeria and six 100-kilogram bags for Niger were stored in a safe storage facility during the whole storage period in preparation for the auction. One set of cowpea was stored in hermetic bags and was sold to consumers in the hermetic bags with the PICS bag brand name on it. The second set of cowpea was also stored in PICS bags, but the grain was transferred to a traditional woven bag immediately before being sold to consumers. The third set of cowpea was stored and sold to consumers in traditional woven bags, with the certified insecticide phostoxin applied to it to protect it from insect pests as effectively as possible.

Ten enumerators were involved in the surveys in both countries. Enumerators were trained to follow the entire auction procedure and collect the required data from participants. The survey covered the period of September 6 to September 29 in Nigeria and the period of 26 October to 24 November 2018 in Niger.[6] In each country, 600 participants were recruited, so the study sample covered 1,200 farmers in six different states in Nigeria and three main zones in Niger.

4. Auction procedure

As mentioned in the introduction, we used the standard incentive-compatible Becker-Degroot-Marschak (BDM) auction mechanism following Becker, Degroot and Marschak (1964). The BDM auction is widely used to assess consumers' revealed preferences and has been used in similar contexts in recent studies across SSA (Hoffmann and Gatobou 2014; Berry et al., 2020; Prieto et al. 2021; Aker, Dillon, and Welch 2023). As with the standard BDM auction procedure, participants were instructed that they should bid their true valuation for the three different bags of cowpea with varying quality, and that it was not in their interest to bid strategically. Participants had a practice round of auction bidding on three different types of kola nuts to familiarize themselves with the BDM procedure before the auctions for the three cowpea bags took place.

When the true auction began, people were told that the cowpea in one of the bags was preserved using phostoxin (a certified storage chemical mentioned earlier), and that the cowpea in the other two bags were stored in hermetics. Surveys and auctions were conducted on tablets, and we randomized the order of the bags of cowpea that respondents bid on. Before the auction respondents were instructed that they would bid on all three bags, but that only one of the bids would actually be binding and would be randomly picked by the respondent based on a corresponding number that they chose out of a paper bag. For the binding auction, respondents selected a price from a bag with values ranging from 100 to 500 CFA or Naira in increments of 50. If the random number that was picked was lower than the respondent's bid for that grade of cowpea, then they "won" the auction. That person could purchase the cowpea for the price he or she drew from the bag. If the randomly drawn number was higher than the respondent's bid, then he or she "lost" the auction and was not able to purchase the cowpea.[7] Participants were given a small participation fee of 500 CFA or Naira to alleviate any liquidity constraints they may have faced at that time.[8]

After completing the auction, we asked respondents to complete a short demographic survey. This included some questions about their cowpea production and consumption along with questions about how important attributes such as taste, price, variety, and color of the cowpea are to them when they purchase it (See Appendix B for the survey and auction instrument). To keep the auction short and to alleviate the burden on participants, we did not ask them questions about their perceptions of the attributes of the cowpea they bid on specifically in the auction. Thus, we could not analyze how perceptions affected WTP for cowpeas in the different bags that were part of the auction.

5. Empirical model

We seek to estimate how buyers in rural grain markets value both observable and unobservable quality as it relates to food safety, and how awareness of a brand affects willingness to pay. First, we estimated the following equation separately for consumers in both Niger and Nigeria. The willingness to pay (WTP) of consumer (i) for product (j) was modeled as follows:

$$WTP_{ij} = \beta_0 + \beta_1 H_{ij} + \beta_2 W_{ij} + \beta_3 A_i + \beta_4 X_i + \varepsilon_i \quad (1)$$

Where WTP was the consumer's valuation of cowpea sold in different containers with different branding. The units were in CFA/kilogram for consumers from Niger, and in Naira/kilogram for Nigerian consumers. The variable H represented the cowpea that was stored in hermetic bags and sold in hermetic bags. This grade of cowpea represented the highest level of unobservable, and observable quality available to participants in our auction. The variable W represented the cowpea that was stored in hermetic bags and sold in woven bags.

Other variables in Eq. (1) included A, which was equal to one if the consumer had previous awareness of the hermetic bag, and its branded label. The variable vector X represented the other household characteristics that were controlled for in the model. The variables in X included the respondent's age, the number of members in the respondent's household, a binary variable = 1 if the respondent was female, a binary variable = 1 if the respondent's main occupation was farming, and a binary variable = 1 if the respondent was a trader or processor (the latter two variables = 0 if the respondent was engaged in another occupation). It was important to consider the occupation of the respondent in the model because it may have had an impact on how that person valued grain quality. For example, in the lean season, farming households would have been more likely to purchase cowpeas for household consumption after their own food supply ran out. Conversely, traders would have likely been more interested in purchasing the cowpea to resell it later. Prieto et al. (2021) found that traders and consumers in southern Senegal both valued dry maize that had been tested for moisture content with a grain moisture meter. Thus, in our context, we needed to control for the possibility that farmers and traders valued observable and unobservable quality differently. Other control

[5] The varieties of cowpea are generally the same in both countries. It is also possible that the cowpea purchased in Kano was grown on a farm in Niger.

[6] the surveys were conducted at slightly different times in Niger and Nigeria because of logistics. The team started in Nigeria and then moved on to Niger when they completed the first country.

[7] Since respondents bid their true WTP as part of the BDM, and the quantities of cowpea they purchased were relatively small, we were not aware of any issues of people bidding and then reneging on their purchases after winning the auction. For the most part, people were happy when they won the cowpea auctions.

[8] The enumerators were supervised throughout the survey and auction process. We put in two levels of control. The enumerators were supervised by IITA staff. Second, the auction was conducted in a central place in the village to simulate a market where the cowpeas could have been purchased. We recruited the participants to come to the central location where the bags were located and the auction occurred.

variables included in X were a binary variable = 1 if cowpea was very important to a household's diet, a binary variable = 1 if the household mainly purchased cowpea grain from the market rather than consuming cowpea from home production, a binary variable = 1 if the respondent intended to use the cowpea from the auction for consumption or seed, rather than to sell it; land owned in hectares to proxy for household wealth, and a binary variable = 1 if the respondent won the practice round for kola nuts. This controlled for how well the respondent understood the BDM auction. The individual-specific error term in Eq. (1) was denoted by ε_i. Given the experimental design of the auction, we expected the error terms to be uncorrelated with any of the covariates in the model. Standard errors were clustered at the individual participant level.

In Eq. (1), the coefficient estimate on $\widehat{\beta_1}$ tested the hypothesis of whether or not consumers placed a premium on cowpea with high observable and unobservable quality compared to the control bag that had low observable and low unobservable quality (ie: cowpea that was stored and sold in a traditional woven bag with certified insecticides applied to it). The coefficient estimate on $\widehat{\beta_2}$ tested whether or not consumers placed a price premium on W compared to the control bag. The cowpea in W had the same level of observable quality as the cowpea in H as both were stored securely in PICS bags for 10 months, so they were free of insects and chemical insecticides. However, W was presented and sold to consumers in a traditional woven bag, so it lacked the quality signal of the hermetic bag with branded label. Therefore, the F-statistic on the test of $\widehat{\beta_1} = \widehat{\beta_2}$ tested the unobservable quality premium represented by the hermetic bag and its label.

Second, we wanted to understand how previous awareness of the hermetic bag brand affected demand for cowpeas sold in that bag relative to cowpeas sold in the other bags. Therefore, we estimated the following equation via linear regression:

$$WTP_{ij} = \alpha_0 + \alpha_1 H_{ij} + \alpha_2 W_{ij} + \alpha_3 A_i + \alpha_4 H_{ij}{}^{*} A_i + \alpha_5 W_{ij}{}^{*} A_i + \alpha_6 X_i + \mu_i \quad (2)$$

Where the variables in Eq. (2) were the same as in Eq. (1), except that μ_i represented the respondent-specific error term. It was again assumed to be uncorrelated with the covariates given the experimental nature of the auction. The other difference between Eqs. (1) and (2) was that the latter equation included an interaction between H * A and W * A. The F-test of coefficients $\widehat{\alpha_1} = \widehat{\alpha_2}$ told us if participants who were previously *unaware* of the PICS bag brand placed a premium on the unobservable quality that it provided. The F-statistic on the test of $\widehat{\alpha_1} + \widehat{\alpha_4} = \widehat{\alpha_2} + \widehat{\alpha_5}$ told us if participants who were previously *aware* of the hermetic bag brand placed a premium on the unobservable quality it provided.

Standard errors were clustered at the individual participant level in Eq. (2).

6. Results

6.1. Main results

Table 1 presents the descriptive statistics for the covariates used to estimate Eqs. (1) and (2). Means and standard deviations were presented for the variables in both Niger and Nigeria. The average respondent's age was 46 years old in Niger, and 47 years old in Nigeria. The average household size in Niger was close to 10, and in Nigeria it was just over 8. Thirty percent of respondents were female in Niger to 29 % in Nigeria. In terms of occupation, 61 % of respondents in Niger were farmers, 38 % were traders or processors and just 1 % were engaged in something else. In Nigeria 64 % were farmers, 28 % were traders or processors, and 8 % were engaged in something else. Interestingly, 88 % of respondents in Niger had previous awareness of the hermetic bag brand, while only 40 % of respondents in Nigeria did. This could be because the bags had been available for sale for a longer time in Niger compared to Nigeria. It could also be because more of the sample in Niger happened to be traders, which would be consistent with Aker, Dillon, and Welch (2023) who found that traders in Niger were more familiar with PICS bags than farmers. As such, the traders in Niger may have been more aware of the types of storage bags that were available on the market.

Table 1
Descriptive statistics of covariates used in the model.

	Niger		Nigeria	
Variable	Mean	Std Dev	Mean	Std Dev
Respondent age	46.07	14.71	46.57	13.78
Household size	9.86	5.46	8.28	4.31
Female Respondent (%)	0.30	0.46	0.29	0.46
Respondent's main occupation was farming (%)	0.61	0.49	0.64	0.48
Respondent was employed as a trader or processor (%)	0.38	0.49	0.28	0.45
Respondent was employed in other activity (%)	0.01	0.11	0.08	0.27
Respondent was aware of hermetic bags (%)	0.88	0.33	0.40	0.49
Respondent was employed in other activity	0.61	0.49	0.47	0.50
Cowpea was very important to household diet	0.49	0.50	0.82	0.38
Mainly purchase cowpea grain from the market	5.48	0.42	3.64	0.38
Respondent intended to use cowpeas for cons. or seed	0.77	7.73	0.82	3.37
Land owned in hectares	0.58	0.49	0.49	0.50
Respondent won practice round for kola nuts	46.07	14.71	46.57	13.78

Note: N = 596 in Niger and 599 in Nigeria.

Fig. 2 and Fig. 3 present the sample means and standard errors of respondents' WTP for cowpea that were offered to them in the three different bags. Fig. 2 showed results from Niger and indicated that on average consumers were willing to pay CFA 342 per kilogram for cowpea stored and sold in hermetic bags (CFA 550 = USD 1.00 at the

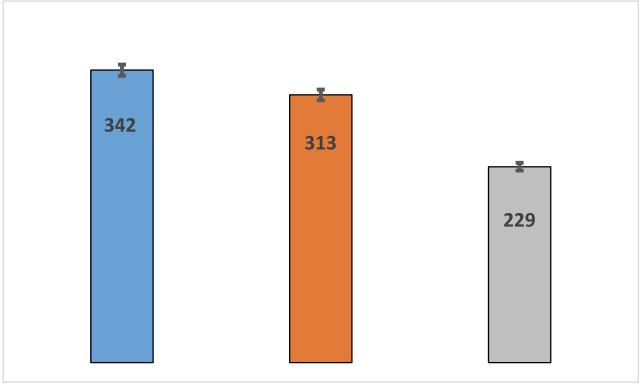

Fig. 2. Mean willingness to pay for cowpea by storage and presentation method in Niger in CFA/kg. (i) Cowpea stored & sold in hermetic bag; (ii) Cowpea stored in hermetic bag, sold in woven bag; (iii) Cowpea stored in woven bag with insecticide, sold in woven bag; Standard Error bars included; CFA 550 = USD 1.00; N = 1,791.

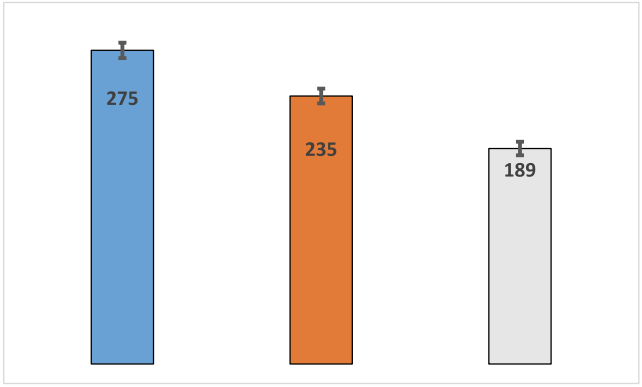

Fig. 3. Mean Willingness to pay for cowpea by storage and presentation method in Nigeria in Naira/kg. (i) Cowpea stored & sold in hermetic bag; (ii) Cowpea stored in hermetic bag, sold in woven bag; (iii) Cowpea stored in woven bag with insecticide, sold in woven bag; Standard Error bars included; NAIRA 365 = USD 1.00; N = 1,797.

time of the study). This was 29 CFA per kilogram more than the price that the average consumer was willing to pay for cowpea stored in a hermetic bag and sold in a woven bag. The latter fetched an average price of 313 CFA per kilogram. This was equivalent to roughly a 10 % premium and can be thought of as the unconditional premium that people placed on the hermetic bag and its branded label. In addition, the average respondent was willing to pay just 229 CFA per kilogram for cowpea stored in a traditional woven bag and sold in that bag. The difference between the cowpea stored in hermetic bags and sold in woven bags and the cowpea stored and sold in woven bags was equivalent to a 37 % premium. It can be thought of as the unconditional observable quality premium that people place on undamaged cowpea over damaged cowpea during the lean season.

The unconditional average WTP for cowpea stored and sold in different bags in Nigeria shown in Fig. 3 revealed a similar relationship to that in Niger. The average respondent was willing to pay 275 Naira per kilogram for cowpea stored in a hermetic bag and sold in a hermetic bag (Naira 365 = USD 1.00 at the time of the study). This difference was 39 Naira per kilogram, equivalent to a 17 % unobservable quality premium. Additionally, the average WTP for cowpea stored in a hermetic bag and sold in a woven bag was 47 Naira/kilogram higher than for cowpea sold and stored in a woven bag (189 Naira/kilogram average). This was equivalent to a 25 % average premium for observable quality.

Table 2 presents the linear regression results for the factors that were associated with WTP for cowpea in Niger, measured in CFA per kilogram. The first two columns showed the results for the model in Eq. (1). These results tested the hypothesis about the extent to which respondents were willing to pay a premium for observable and unobservable quality in their cowpea. Column 1 showed the parsimonious model with just the different quality grades based on the different bags of cowpea and a constant, while column 2 showed the results with a full set of controls. The results for columns 1 and 2 were consistent. They indicated that the average respondent was willing to pay 84 CFA per kilogram more for cowpea stored in a hermetic bag and sold in a traditional woven bag than they were for cowpea stored and sold in a traditional woven bag ($p < 0.01$). This was equivalent to a 37 % observable quality premium for cowpea that consumers could see was not damaged by insects (84 CFA per kilogram / 229 CFA per kilogram average for cowpea stored and sold in a woven bag). Furthermore, the average respondent was willing to pay 114 CFA per kilogram more for cowpea stored and sold in a hermetic bag, compared to cowpea stored and sold in a woven bag ($p < 0.01$). Furthermore, The F-tests at the bottom of columns 1 and 2 indicated that the 30 CFA per kilogram premium on cowpea stored and sold in hermetic bags and cowpea stored

Table 2
Willingness to pay for cowpea of different quality in Niger.

Dependent Variable: WTP in CFA/kg of Cowpea	(1)	(2)	(3)	(4)
(i) Cowpea stored & sold in hermetic bag	114***	114***	99***	99***
	(0.00)	(0.00)	(0.00)	(0.00)
(ii) Cowpea stored in hermetic bag, sold in woven bag	84***	84***	88***	88***
	(0.00)	(0.00)	(0.00)	(0.00)
(iii) Cowpea stored & sold in hermetic bag			17**	17**
*Respondent was aware of hermetic bag			(0.03)	(0.03)
(iv) Cowpea stored in the hermetic bag, sold in woven bag			−4	−4
* Respondent was aware of hermetic bag			(0.60)	(0.58)
Respondent was aware of the hermetic bag and its branded label	−8	−7	−12	−11
	(0.39)	(0.44)	(0.15)	(0.20)
Respondent age*10		−0		−0
		(0.15)		(0.15)
Household size		1**		1**
		(0.01)		(0.01)
Female respondent		−5		−5
		(0.56)		(0.56)
Respondent is employed as a trader or processor		5		5
		(0.47)		(0.47)
Respondent is employed in other activity		27		27
		(0.26)		(0.26)
Cowpea is very important to household diet		14**		14**
		(0.01)		(0.01)
Mainly purchase cowpea grain from the market		9		9
		(0.11)		(0.11)
Respondent intended to use cowpeas for consumption or seed		9		9
		(0.32)		(0.32)
Land owned in hectares		−1**		−1**
		(0.02)		(0.02)
Respondent won practice round for kola nuts		4		4
		(0.43)		(0.43)
F-Test of unobservable quality premium for cowpea sold in the hermetic bag with branded label				
Full sample: (i) – (ii) = 0	30***	30***		
	(0.00)	(0.00)		
If *unaware* of the hermetic bag: (i) – (ii) = 0			10***	10***
			(0.00)	(0.00)
If *aware* of the hermetic bag: {(i) + (iii)} – {(ii) + (iv)} = 0			32***	32***
			(0.00)	(0.00)
R^2	0.30	0.32	0.30	0.32

Note: N = 1,788; ***, **, *, indicates that the corresponding coefficients are statistically significant at the 1 %, 5 % and 10 % levels respectively; standard errors clustered at the individual participant level; p-values in parentheses; models include a constant term that is not shown; CFA 550 = US $1.00 at time of study.

in hermetic bags and sold in traditional woven bags was statistically significant at the 1 % level. This was equivalent to a 10 % unobservable quality premium (30 CFA per kilogram / 313 CFA per kilogram average for cowpea stored in a hermetic bag and sold in a woven bag). It can be thought of as the unobservable quality premium that consumers place on the hermetic bag and its branded label.

Columns 3 and 4 of Table 2 estimated the model presented in Eq. (2) to test the hypothesis of how prior awareness of the hermetic bag and its branded label "PICS" was associated with WTP for cowpea stored and sold in it. Column 3 showed the parsimonious specification, while column 4 showed the fully specified model with a full set of control variables. Focusing on the results in column 4, we found that being previously *unaware* of the hermetic bag and its label was associated with being willing to pay 88 CFA per kilogram more on average for cowpea that was stored in a hermetic bag and sold in a woven bag than it was for cowpea that was stored and sold in a woven bag ($p < 0.01$) (i.e. the observable quality premium). In addition, being previously unaware of the hermetic bag and its label was associated with being willing to pay 99 CFA per kilogram more on average for cowpea stored and sold in that bag ($p < 0.01$) compared to a traditional woven bag.

In column 4, the interaction between the bags of cowpea and prior awareness of the hermetic bag and its branded label generated some interesting results. The first F-test at the bottom of column 4 indicated that the unobservable quality premium for those who were previously *unaware* of the hermetic bag and its branded label was 10 CFA per kilogram on average ($p < 0.01$). This was equivalent to a 3 % average unobservable quality premium. However, the unobservable quality premium more than tripled to 32 CFA per kilogram for those who were previously *aware* of the hermetic bag and its label, equivalent to a 10 % unobservable quality premium. These results indicated that the high level of awareness among the sample of participants in Niger, 38 % of whom were traders or processors, may have induced them to pay a significant premium on cowpea that was sold in the hermetic bag with its branded label. Though our study was limited by a lack of data on respondents' beliefs about the quality of the cowpea in hermetic bags, these results may suggest that people in this market valued the information about unobservable quality that the hermetic bag and its label signaled. Namely, that the cowpea was stored without chemical insecticides.

The Nigeria results in Table 3 were presented in the same way as the Niger results in Table 2. The results for columns 1 and 2 indicated that the average respondent was willing to pay 45 Naira per kilogram more for cowpea stored in a hermetic bag and sold in a woven bag than they were for cowpea stored and sold in a traditional woven bag ($p < 0.01$). This indicated that there was a 24 % average observable quality premium for cowpea that were not visibly damaged from insects (45 Naira per kilogram / 189 Naira per kilogram average for cowpea stored and sold in a woven bag). In addition, the average respondent was willing to pay 86 Naira per kilogram more for cowpea stored and sold in a hermetic bag, than they were for cowpea stored and sold in a traditional woven bag ($p < 0.01$). The F-test at the bottom of columns 1 and 2 indicated that the 41 Naira per kilogram unobservable quality premium was statistically significant at the 1 % level. It was equivalent to a 17 % average price premium for cowpea presented to respondents for sale in the hermetic bag with a branded label (41 Naira per kilogram / 236 Naira per kilogram average for cowpea stored in a hermetic bag and sold in a woven bag).

The results in column 4 indicated that being previously *unaware* of the hermetic bag brand in Nigeria was associated with a 49 Naira per kilogram higher average premium for cowpea that was stored in a hermetic bag and sold in a woven bag compared to cowpea that was stored and sold in a traditional woven bag ($p < 0.01$) (i.e. the observable quality premium). In addition, being previously *unaware* of the hermetic bag and its label was associated with being willing to pay 92 Naira more per kilogram on average for cowpea stored in that bag compared to cowpea stored and sold in a woven bag ($p < 0.01$).

The F-test at the bottom of column 4 suggested that being previously *unaware* of the hermetic bag was associated with a 43 Naira per kilogram unobservable quality premium on average ($p < 0.01$). This was equivalent to an 18 % price premium. In addition, being previously *aware* of the hermetic bag was associated with a 39 Naira per kilogram unobservable quality premium on average ($p < 0.01$). This was equivalent to a 17 % price premium. These results suggested that there was a positive relationship between unobservable quality signaled by the hermetic bag and its branded label regardless of a respondent's previous level of awareness.

Table 3
Willingness to pay for cowpea of different quality in Nigeria.

Dependent Variable: WTP in Nira/kg of Cowpea	(1)	(2)	(3)	(4)
(i) Cowpea stored & sold in hermetic bag	86***	86***	92***	92***
	(0.00)	(0.00)	(0.00)	(0.00)
(ii) Cowpea stored in hermetic bag, sold in woven bag	45***	45***	49***	49***
	(0.00)	(0.00)	(0.00)	(0.00)
(iii) Cowpea stored & sold in hermetic bag *Respondent was aware of hermetic bag			−14**	−14**
			(0.02)	(0.02)
(iv) Cowpea stored in the hermetic bag, sold in woven bag * Respondent was aware of hermetic bag			−10*	−10*
			(0.06)	(0.06)
Respondent was aware of the hermetic bag and its branded label	3	0	11*	8
	(0.57)	(0.94)	(0.07)	(0.18)
Respondent age		−0		−0
		(0.36)		(0.36)
Household size		0		0
		(0.77)		(0.77)
Female respondent		15*		15*
		(0.10)		(0.10)
Respondent is employed as a trader or processor		−15*		−15*
		(0.09)		(0.09)
Respondent is employed in other activity		0		0
		(0.97)		(0.97)
Cowpea is very important to household diet		21***		21***
		(0.00)		(0.00)
Mainly purchase cowpea grain from the market		−10		−10
		(0.21)		(0.21)
Respondent intended to use cowpeas for consumption or seed		10		10
		(0.33)		(0.33)
Land owned in hectares		−1		−1
		(0.20)		(0.20)
Respondent won practice round for kola nuts		4		4
		(0.54)		(0.54)
F-Test of unobservable quality premium for cowpea sold in the hermetic bag with branded label				
Full sample: (i) – (ii) = 0	41***	41***		
	(0.00)	(0.00)		
If *unaware* of the hermetic bag: (i) – (ii) = 0			43***	43***
			(0.00)	(0.00)
If *aware* of the hermetic bag: {(i) + (iii)} – {(ii) + (iv)} = 0			39***	39***
			(0.00)	(0.00)
R^2	0.16	0.19	0.17	0.19

Note: N = 1,797; ***, **, *, indicates that the corresponding coefficients are statistically significant at the 1 %, 5 % and 10 % levels respectively; standard errors clustered at the individual participant level; p-values in parentheses; models include a constant term that is not shown; Naira 365 = US $1.00 at time of study.

6.2. Heterogeneity analysis

Appendix A shows the results from an additional heterogeneity analysis where WTP for cowpea in the different bags was interacted with the amount of land owned by respondents. The purpose was to see if observable and unobservable quality premiums for cowpea in the different bags varied by wealth, proxied by land ownership. We used two measures of land owned, first a continuous measure of land owned in hectares, and second, a binary variable = 1 if the respondent owned above the median landholding in the sample. The median amount of land owned was 3.25 ha in Niger and 2.5 ha in Nigeria. The only statistically significant premium in the table was in the Nigeria model when landholding was treated as a continuous variable. The coefficient estimate suggested that an extra hectare of land was associated with the average household being willing to pay three Nira less per kilogram of cowpea that was stored in a hermetic bag and sold in a woven bag compared to people with less land. Given the overall lack of statistical significance on the interaction between the WTP for the different cowpea bags and land owned and the small coefficient on the one coefficient that was statistically significant, it seems that landholding did not have an economically meaningful impact on WTP for observable and unobservable quality in our context.

7. Conclusions

The present study's objective was to test whether rural consumers in sub-Saharan Africa were willing to pay a premium for food that was stored in an improved storage bag with a branded label that signaled unobservable quality in the form of insecticide-free grain. We implemented an incentive-compatible Becker-Degroot Marschak auction among consumers in Niger and Nigeria to test their willingness to pay for cowpea that was stored and sold in three distinct types of bags, that each signaled different levels of quality. The auction let us estimate the price differential that the average consumer placed on unobservable grain quality (i.e. food safety) for cowpea that were stored and sold in the improved hermetic (airtight) storage bag with a branded label. We also estimated the association between a consumer's previous awareness of the hermetic bag and its branded label on their valuation for observable and unobservable quality for the cowpea that was stored and sold in that bag. In doing so, this was one of the first studies to test the extent to which consumers are willing to pay for signals of quality upgrades in rural markets of developing countries.

Our results indicated that on average consumers in Niger were willing to pay a 10 % price premium for cowpea stored and sold in the hermetic bag with a branded label compared to cowpea of the same observable quality that was not sold in the hermetic bag. The same quality premium was 17 % in Nigeria. Interestingly, in Niger being previously *unaware* of the hermetic bag and its label was associated with a 3 % average unobservable quality premium for cowpea sold from it. The same unobservable premium associated with being *aware* of the hermetic bag and its label was 10 % on average. In Nigeria, being *unaware* was associated with an 18 % average quality premium, while being *aware* was associated with a 17 % average unobservable quality premium. Taken together, these results suggested that consumers in both Niger and Nigeria were willing to pay a statistically and economically meaningful premium on unobservable cowpea quality. Our results indicated that there was a latent demand for quality in the form of food safety among rural people in sub-Saharan Africa. Our findings were consistent with Hoffmann and Moser (2017), Kariuki and Hoffmann (2023) and Nindi et al. (2023). In our context, people were willing to pay a premium for cowpea that were stored in an improved bag with a branded label that signaled the food was safe for them. Though our study did not have data on respondents' beliefs about the quality of cowpea that they bought from the hermetic bags, they may have offered a higher willingness to pay because of the signal that the hermetic bag eliminated the need for chemicals to kill insects that are known attack cowpea during storage.

Our results have important implications for rural markets in developing countries. It is prohibitively expensive to test grain for unobservable threats to food safety like pesticide residues in these markets. Therefore, it is important to understand if consumers will pay a premium for food sold in a product that signals food safety. Previous studies that measured consumer demand for safe food in developing countries offered food safety information along with food that had been tested and labeled as safe to eat (De Groote et al. 2016; Kariuki and Hoffmann 2022; Nindi, Ricker-Gilbert, and Bauchet 2023). The present study contributed to this literature because we did not offer food safety training or testing to consumers. We only offered them the opportunity to purchase grain in a bag that signaled a quality upgrade (i.e. that the grain in it was safe from chemical insecticides). In doing so, we provided experimental evidence that even in a limited resource environment consumers respond to quality signals about their food. Such signals can potentially help these markets break out of their current low-quality equilibrium.

CRediT authorship contribution statement

Jacob Ricker-Gilbert: Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis, Conceptualization. **Bokar Moussa:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Tahirou Abdoulaye:** Writing – review & editing, Methodology, Investigation, Funding acquisition, Conceptualization.

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Appendix A. . Heterogeneity Analysis, willingness to pay for cowpea of different quality based on landholding in Niger and Nigeria

	(1)	(2)	(3)	(4)
Dependent Variable: WTP in (CFA) Nira / kg of Cowpea	Niger	Niger	Nigeria	Nigeria
(i) Cowpea stored & sold in hermetic bag	115***	118***	91***	88***
	(0.00)	(0.00)	(0.00)	(0.00)
(ii) Cowpea stored in hermetic bag, sold in woven bag	86***	88***	56***	49***
	(0.00)	(0.00)	(0.00)	(0.00)
(iii) Cowpea stored & sold in hermetic bag * land owned	−0		−1	
	(0.48)		−0.18	
(iv) Cowpea stored in the hermetic bag, sold in woven bag * land owned	−0		−3***	
	(0.13)		(0.00)	
(v) Cowpea stored & sold in hermetic bag *Respondent had		−7		−3
above median landholding		(0.18)		(0.64)
(vi) Cowpea stored in the hermetic bag, sold in woven bag *		−7		−8
Respondent had above median landholding		(0.15)		(0.12)
Land owned in hectares	−0		0	
	(0.15)		(0.82)	
Respondent owns more than the median landholding in the sample		−4		5
		(0.42)		(0.45)
Respondent was aware of the hermetic bag and its branded label	−7	−7	0	−0
	(0.46)	(0.47)	(0.94)	(0.97)
Respondent age*10	−0	−0	−0	−0
	(0.17)	(0.21)	(0.36)	(0.37)
Household size	1**	1**	0	0
	(0.03)	(0.03)	(0.77)	(0.92)
Female respondent	−6	−7	15*	17*
	(0.54)	(0.44)	(0.10)	(0.07)
Respondent is employed as a trader or processor	5	4	−15*	−15*
	(0.45)	(0.54)	(0.09)	(0.10)
Respondent is employed in other activity	27	26	0	1
	(0.27)	(0.28)	(0.97)	(0.90)
Cowpea is very important to household diet	13**	13**	21***	21***
	(0.01)	(0.01)	(0.00)	(0.00)
Mainly purchase cowpea grain from the market	9*	9*	−10	−8
	(0.08)	(0.10)	(0.21)	(0.31)
Respondent intended to use cowpeas for consumption or seed	9	8	10	9
	(0.35)	(0.40)	(0.33)	(0.36)
Whether respondent has won the test auction	4	4	4	3
	(0.40)	(0.40)	(0.54)	(0.59)
R-squared	0.321	0.321	0.189	0.186

Note: N = 1,788 in Niger and N = 1,797 in Nigeria; ***, **, *, indicates that the corresponding coefficients are statistically significant at the 1 %, 5 % and 10 % levels respectively; standard errors clustered at the individual respondent level; p-values in parentheses; models include a constant term that is not shown; The median amount of land owned was 3.25 ha in Niger and 2.5 ha in Nigeria; CFA 550 = US $1.00 at time of study; Naira 365 = US $1.00 at time of study.

Appendix B: Survey and Auction Instrument

QUESTIONNAIRE
UNDERSTANDING PRODUCER AND CONSUMERS' VALUATION FOR STORED COWPEA IN NIGER AND NIGERIA

Village_____ Date_____ Time_____

LGA/commune_____ State/Region_____

Questionnaire number_____

Enumerator's name_____

Introduction

(*Appropriate greetings*) My name is _____ and I am carrying out a survey on behalf of INRAN along with IITA and Purdue University in the USA to understand how people think about cowpea that has been stored using various storage methods. I would like to ask you some questions that will take about 20 minutes of your time.

Part I. Experimental Auction

In this section I want to know how you value different bags of cowpea that have been stored for 6 months. They will each be presented to you. You will undertake an auction and for this purpose, I will give you money for you to be able to participate. The money is yours and is to help you buy the product if you choose, in case you win the auction. This is how the auction will be operated (*Explain the BDM auction as below)*

- I will show you 4 products, one at a time and ask you how much you can pay to have each product,
- I will write all your bids,
- I will then ask you to pick a random number to determine the bag of cowpea that you will actually have the opportunity to purchase one kg of.
- You will then pick another random number from a distribution to determine the winning price (for the product in the binding round),
- If the bid you set is higher than the randomly picked winning price, you win the auction and you have to buy the product at the price you pick randomly (remember money will have been provided to you to facilitate this exchange),
- If the bid you set is lower than the winning price, you have not won the auction, hence you just keep the money and get no product.
- Remember it is in your best interest to bid your true valuation for the cowpea in each bag.
- We will start with Kolanuts before we come to the cowpea auction so that you can get familiar with the method.

.

- Do you have any questions?
- Would you like to participate in the auction? *(if he/she says yes than start reading the instructions starting with **1.Description of Procedure** on page 3 of the instruction sheet. This includes doing the practice auction with pencils and real auction with cowpea)*

a) Test Round with Kolanuts

Bid 1: _____ (CFA)

Bid 2: _____ (CFA)

Bid 3: _____ (CFA)

Bidding round: _____

Winning price: _____ (CFA)

Whether has won the test auction _____ (Y/N)

b) Cowpea Auction

Order of auction products _____ ***(To be drawn randomly for each participant. See instruction sheet table 1.)***

Bid 1: _____ (CFA)

Bid 2: _____ (CFA)

Bid 3: _____ (CFA)

Bid 4: _____ (CFA)

Bidding round: _____

Winning price: _____ (CFA)

Whether has won the cowpea auction _____ (Y/N)

Part II: Cowpea Production and Consumption

1.What do you want to do with the cowpea you acquire today?

1. Use for consumption 2. Use for sale 3. Use for seed 4.Processing _____

.

2. How important is cowpea in your daily diet? _____

1. Not important 2. Slightly Important 3. Medium 4. Important 5. Very important

3a. Where do you usually obtain your cowpea (for food) from?

(1) From own farm (2) Buying (3) Not applicable_____

3b. Where do you usually obtain your cowpea (for seed) from?

(1) From own farm (2) Buying (3) Not applicable _____

3c. Where do you usually obtain your cowpea (for processing) from?

(1) From own farm (2) Buying (3) Not applicable _____

4. How many acres of land do you own? _____

5. Which form of tenure is your land ownership?

1. Freehold with certificate/title deed 2. Freehold without certificate/title deed

3. Rented from another individual 4. Informal and not paying rent (e.g. roadside/public land held informally 5. Communal 6= 1&2 7=3&5 8=(2&3)

6a. what was the total area that you cultivated for all crops in the past season _____ha?

6b. What area of your farm is allocated to cowpea in the past season _____ ha?

7. Which cowpea variety did you plant the most area to in the past season? _____

8. Why do you prefer this variety?

(a) High yielding. (b) Early maturing. (c) Pest and disease resistant (d) Cheap

(e) Readily available (f) Drought resistant (g) Further Production (*Circle the response*)

If more than one rank from the most preferred to least preferred.

1…… 2…….

.

9. How important to you are the following in choosing cowpea to buy?

	Not important	Slightly Important	Medium Important	Important	Very Important
Taste	O	O	O	O	O
Price	O	O	O	O	O
Variety	O	O	O	O	O
Color	O	O	O	O	O
Smell	O	O	O	O	O
Freshness	O	O	O	O	O
Texture	O	O	O	O	O
Nutritional Value	O	O	O	O	O
Packaging	O	O	O	O	O
Level of damage	O	O	O	O	O
Other Important traits					

10. Were you aware of PICS bags before today? Yes (go to next question), No (Skip to part III).

11. If Yes, did you attend a PICS demonstration? Yes (go to next question), No (Skip to part III).

12. have you ever stored any grain in PICS bags? Yes No

Part III: Demographic/Socio-economic information

1. Gender: (1) Male (2) Female *(circle the gender but do not ask this)*

2. *Marital Status 1. single 2. Married 3. Seperated 4. Divorced 5. Widow(er)*

3. Age in years/Date of birth_____

4. Highest level of education attained: (No. of years in school)

1. None (0yrs) 2. Primary (7/8yrs) 3. Secondary (12yrs) 4.University (17yrs)

.

5. Number of people in the household you are living in _____

6. Do any children below 18 years at home living with you 1. Yes 2. No

7. What is your employment status:

1. Formally employed 2. Self employed 3. Unemployed 4. Student 5. Other ___

8. Number of people in the household you are living in_____

9. How many children are under 5 live with you?_____

10.What is the main Profession_____

1. Farmer 2. Processor 3. Traders 4. Civil Servant 5. Retiree

Thank you for your time. It is greatly appreciated. Do you have any questions for us?

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