Assessing rural consumers' WTP for orange, biofortified maize in Ghana with experimental auctions and a simulated radio message

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De Groote, Hugo; Tomlins, Keith; Haleegoah, Joyce; Awool, Manfred; Frimpong, Benedicta; Banerji, Abijit; Chowdury, Shyamal; and Meenakshi, J. V.

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Hugo De Groote[1], Keith Tomlins, Joyce Haleegoah, Manfred Awool, Benedicta Frimpong, Abijit Banerji , Shyamal Chowdury, J. V. Meenakshi

[1] International Maize and Wheat Improvement Centre, CIMMYT, PO Box 1041-00621 Nairobi, Kenya, h.degroote@cgiar.org

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Submission to Prof. Nick Vink, nv@sun.ac.za

Abstract

Deficiencies of micronutrients such as vitamin A are widespread, expecially in Africa. Biofortified crops such as maize, bred for high levels of provitamin A might offer a solution, but these crops are often bright orange, and African maize consumers prefer white. To estimate the consumers interest in orange biofortified maize, sensory evaluations were organized in rural Ghana with white, yellow and orange maize. The effect of information on willingness to pay for biofortification was estimated using a simulated radio message. Results indicate that color preferences are highly regional, wide variation exist within regions, and the provision of information is able to change these preferences. The color of biofortified maize should therefore not be seen as major impediment, but proper information messages should be targeted at the right channels such as rural radio.

Keywords: maize, biofortification, consumers, experimental auction, sensory evaluation

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1. Introduction

Malnutrition remains a serious problem in Sub-saharan Africa (SSA), the only region in the world where both the number and the proportion of malnourished children is on the rise. One of the major nutritional problems facing developing countries is micronutrient deficiency, in particular of vitamin A (West and Darnton-Hill, 2001) and predominantly affects low-income groups (Ruel, 2001).

Biofortification is a new public health intervention that seeks to improve the nutritional quality of staple foods consumed by poor people. The oldest biofortified crop is quality protein maize, bred for much higher levels of lysine and tryptophan, the limiting amino acids in maize, which substantially increases the quality of the maize protein (Krivanek et al., 2007). The second biofortified crop was orange flesh sweet potato, biofortified for provitamin A (Low et al., 2007). Recently, plant breeders have developed new maize varieties high in provitamin A. If these varieties are widely consumed, this could have a significant impact on the prevalence of vitamin A deficiency in maize consuming areas. Most provitamin A in maize is, however, beta-carotene, so high levels of provitamin A turns the maize orange, and African consumers, the main target, often prefer white maize.

The success of such biofortified maize depends on whether it is accepted and consumed in significant quantities by target populations. With maize, consumer acceptance may pose a particular problem because most maize varieties in Africa are white, especially the improved varieties (Smale and Jayne, 2003). Yellow maize varieties are therefore often perceived as old or old fashioned, are associated with animal feed or food aid, and often believed to have inferior organoleptic properties. The question is whether such perceptions will carry over to orange maize, which is distinct from yellow maize.

Consumer preferences for white maize have been studied previously. In Southern Africa, prices of yellow maize are generally lower than for white maize, as observed in Zambia (Diskin and Kipola, 1994), Mozambique (Tschirley et al., 1996) and South Africa (FAO and CIMMYT, 1997). During surveys, consumers have frequently stated their preference for white maize, as documented in Mozambique (Tschirley and Santos, 1995) and Zimbabwe (Rubey and Lupi, 1997). In both countries, consumers were willing to switch to yellow maize given a price discount. Moreover, consumers of low-income groups are more likely to make that switch (Dorosh et al., 1995; Tschirley et al., 1996; Rubey et al., 1997). In East-Africa, consumer

acceptance has only been studied in Nairobi, where consumers also stated strong preference for white. A recent study in Kenya, however, used experimental auctions (De Groote et al., forthcoming) to study rural consumer preference for white and yellow maize and concluded that preferences differed by region. In West Africa, no such studies have been conducted.

Therefore, to check consumer acceptance of newly developed biofortified maize, released in Ghana, a study was conducted there, using the most common maize product, kenkey. Kenkey was made from white, yellow and orange varieties, and consumers were invited to evaluate them and to make bids to reveal their WTP in an experimental setting.

2. Methodology

2.1. Studying consumers' preferences

Most rural households in Africa are both producers and consumers. For these households to accept a new variety, they have to be interesting in the field as well as in the kitchen and on the plate. Consumer perceptions therefore matter to the rural households, since they are consumers themselves, and they often like to sell their surplus to other consumers in the local market. To increase adoption and impact of new varieties, it is therefore important to study their appreciation by consumers. For the social scientists, two methods are avaible to study consumer evaluation of new food products: sensory evaluation and elicitation of consumers willingness to pay (WTP).

In sensory evaluation, consumers are typically asked to evaluate a product for different characteristics, and these characteristics are evaluated on a discrete scale, for example from 1 (very poor) to 5 (very good). WTP can be measured through stated preference method, basically contingent valuation of CV methods, or through revealed preferences. Since stated preferences have their problems, mostly stated preferences were used for this study. Another technique to measure WTP are choice experiments, which can be either about revealed preferences, if they are hypothetical, or stated, if they are binding.

Several methods exist, mostly individual or group auctions. The individual auctions or Becker-DeGroot-Marschak (BDM) procedure is actually a simulated auction: consumers are asked to make a bid for a new product, which is then compared to a random price, randomly drawn from a distribution with a mean equal or close to the current price for the product, and a reasonable standard deviation. If the consumer's bid is higher than the random price, she buys the product at the random price (Becker et al., 1964).

At group auctions, all participants bid for a product, but the procedure of selecting the binding bid differs. At the Vickrey or second price auction, participants simultaneously submit sealed bids for the product, and the individual with the highest bid wins the auction and pays the second

highest bid amount for the good (Vickrey, 1961; Lusk et al., 2004). At the nth price auction, the binding price is randomly drawn from the different bids made, and all participants who bid higher win and execute the transaction at the binding price (Shogren et al., 2001). In the choice experiments, consumers are offered a choice of products with different attributes such as price, color, nutritional value, and they are asked to make their choice, while provided with the option to choose none of the above. Participants are shown different sets of options, so the procedure allows for more options and combinations than in the auction method. To avoid bias between hypothetical and non-hypothetical settings, one of the sets is made binding, and the product chosen is bought at the stated price (Lusk and Schroeder, 2004), (Chowdhury et al., 2008). Choice sets vary in terms of attributes and prices, which enables the estimation of the demand for attributes including the value that consumers attach to each of the attributes.

2.2. Experimental design - overview

The main interest of this study was consumer acceptance and WTP for maize biofortified with vitamin A. For that purpose, consumer interest in three maize varieties was measured, used in the most common preparation, kenkey, a fermented maize product, popular in most of Ghana. Most households buy their kenkey, in balls of a few 100 g.

Because of the limited budget, a stratified three-stage sampling design was used. The three strata were the major maize regions in Ghana: Ashanti, Central, and Eastern Region. In each region, one district was randomly selected from the major maize producing and consuming districts, villages were then selected in the second stage and households in the third stage.

For consumer acceptance, participants were asked to evaluate the samples for appearance, aroma, texture, taste and overall appreciation, using a simple 5-points scale. For WTP, three elicitation methods were used: BDM, choice experiments and group auctions. Only the results of the BDM method are presented here. To analyze clearly analyze the effect of other factors on consumer acceptance and WTP, the design also included the factors of gender, participation fee, and information, all three randomly assigned over the participants.

2.3. Selection of sites and household

Budgetary constraints did not allow for a nationally representative sample survey, so the study focused on those areas with a high potential for vitamin A biofortified maize. These maize varieties are likely to have the highest impact in areas with high maize consumption and high vitamin A deficiencies. No statistics on maize consumptions were available for Ghana, and vitamin A deficiency was only available at the regional level.

However, maize production and poverty statistics were available per district. Taking maize production per capita as a proxy for consumption, and poverty as a proxy for vitamin A deficiency. Superimposing these two layers provides a map with high potential impact areas, and cover mostly Ashanti, Eastern and Central regions, and part of Brong Ahafo (see map in Figure 1). While there are large number of poor people in other regions, particularly the North, the Upper West and Upper East, Volta and Central Accra regions, not much maize is produced there and, assumingly, consumed.

Next, all districts with maize production above 50 kg/person and a density of poor people above 40/km2 were selected as high potential districts, 20 in total (map in Figure 1). Since only one of these was found in Brong Ahafo, and only one in Volta region, these regions were further dropped and one district was randomly selected of the high potential districts in each of the three other regions: Ahafo Ano South (Ashanti), West Akim (Eastern Region) and Abura/Asebu/Kwamankese (Central region) (Figure 2).

For the last census, in 2000, the Ghana Statistical Service had organized the country's villages and hamlets in enumeration areas (EA), mostly constituted of a village with related hamlets, or a cluster of small villages. EAs have about 100-150 households, and about 500-1000 people (Ghana Statistical Service, 2005). These EAs were graciously provided to us in electronic format by the GSS office in Kumasi. In each selected district, 10 EAs were selected proportionate to size, with size measured as number of households. The first seven EAs in Ashanti and the first eight EAs in the other regions EAs were visited and a list of households established with the local authorities, with the exclusion of small and distant hamlets. In each EA, further called village, 16 households were randomly selected. In each household, the husband or the wife were alternately selected. In polygamous households, one of the wives was randomly selected.

2.4. Randomization of treatments and factors

The villages and households were organized to take into account the different main factors in the design of the study: elicitation method, participation fee, information, gender. First, three elication methods were included, and villages were distributed over the different methods: six for the group auctions, and nine each for the BDM mechanism and for the choice experiment (Table 1). Initially, 32 people per village were selected, but after the first group auction it was realized that only 4 group exercises (with 8 people each) could comfortably executed in one day, so the number was reduced to 24.

Secondly, to study the effect of the participation fee, the participants were three levels of fees (40, 80, 200 Pesewas) always the same fee for a whole village to avoid tension. Since the number of villages did not allow for an even distribution among the fee levels, it was decided to keep all group auctions at the same medium level participation fee (80 Pesewas). For the other elicitation methods, 2 villages in each district were given one of the three levels, 6 in total (Table 1). Again

to avoid tenstion, in each district, the survey started with the lowest participation fee in the first village or villages, and ended with the hightest fee in the last village.

In one village one person too many was interviewed, and in two villages there was a problem with one of the respondents, leading to 703 respondents. In total, the survey was executed in with 7 villages with 224 people in Ashanti, in 8 villages with 239 people in Central Region, and in 8 villages with 240 people in Eastern Region. Because of the design, less people participated in the group auctions (121) then in the BDM mechanism (288) and choice experiments (287). To include equal number of men and women, in each alternate household a man and a woman was chosen. The man was usually the head of the household. If the household to provide a woman was polygamous, one of the wives was randomly selected.

In each site, the second half of the participants received nutritional information about the benefits of eating orange maize. The information was presented in the form of a five minute radio message and delivered with an MP3 player and headphones. The message was be developed in collaboration with Ghana Broadcasting Corporation (GBC) and translated into the local languages (see appendix I). In the form of a dialogue, it mentioned that a new type of orange maize has been developed with increased vitamin A levels, but also that one has to it regularly, over a period of weeks, for benefits to occur.

To avoid a bias from the order in which products are presented for evaluation, the three products were systematically rotated over the six possible orders. The study was designed to reveal consumers' sensory appreciation of the new varieties, as well as their WTP for them.

2.5. Data collection

The survey took place from November 25 to December 12, 2008. Three groups of data were collected. The first section included general characteristics of the households (composition, income, wealth indicators, and so forth), the respondents (age, gender, education), and their farm (maize production, other crops, livestock and so forth).

In the second section, the participants were asked to evaluate kenkey, made from three different maize varieties: a white, a yellow and an orange variety. Kenkey is the main maize preparation in Ghana, and is made by boiling a fermented maize dought, typically in balls of a few 100 g and boiled in a maize husk. A piece of each of the three products was presented on a plate, and marked with a three-digit code, randomly assigned. However, since the three products were readily identifiable by color, this coding was not used further, but the color. Each participant was asked to evaluate the three products, one by one, in a randomly assigned order, for four characteristics: appearance, aroma, texture, and taste, and also for overall acceptance. Participants in the main survey used a 5-point Likert scale for each of the five evaluations (from

1= very poor, to 5=very good). In each village, 3-4 more people were asked to evaluate the products on an experimental hybrid scale.

In the third section, consumers were asked for their willingness to pay (WTP), using three different elicitation mechanisms. The first mechanism was the individual auction, usually called Becker-DeGroot-Marschak or BDM. In the BDM mechanism, consumers are asked to offer a bid for a new product, which is then compared to a randomly drawn price (with mean similar to the current price for the product or a similar one). If the consumer's bid is higher than the random price, the transaction is executed at the latter (Becker et al., 1964). For this particular survey, a uniform distribution of 1-40, with mean 20, was used. Each number was written on a slip of paper and put in a bag. The participant made a bid for each of the three products, which were written down by the enumerator. To reduce costs and avoid making differences in endowment, only one of the products was randomly selected as binding. The participant drew a random number from the bag and if her number was higher or equal than the random number, she bought the product at the random price.

In a third of the villages, group auctions were organized to elicit WTP, and in another third choice experiment. In this paper, for the WTP only the results of the BDM will be presented. For the other variables, the full sample will be used.

3. Results

3.1. Respondents' characteristics

In total, 703 people people were interviewed, 49% of which were women (Table 2). A broad range of the population was reached, with an age ranging from 18 to 90, and an average of 43 years. About two thirds of the respondents had gone to school, on average 8 years. Almost all respondents were either the head of the household or the spouse of the head (Table 2). Of the women interviewed, about a third (29%) were head of the household, from which the number of female headed households can be derived at 15%.

Most respondents (three quarters) came from monogamous households, very few from polygamous households, and about a third were single, widowed, separated or divorced. On average, households had six members, mostly monogamous couples with, on average, three children and one other dependent. The large majority of participating households stated farming as their main activity and their main source of income, in the three regions. It is the main occupation and the main source of income of a large majority of household heads. A third of households engages in other commercial activities, especially small business and artisanal production like carpentry or brick laying

Most households have a metal roof on their main building, but that is clearly less for Central region (Figure 3). For the wall, most households in Ashanti and Eastern regions use mud, while households in the Central region use more clay bricks. Most households (84%) own a radio, in

the three regions. Half of the households in Eastern region own a phone, but less than 30% in the other regions. Very few households own any a transport vehicle like motorcycle, bicycle or car.

3.2. Agriculture and maize

The average farm size of the interviewed households was 2.7 ha, with a large majority of farms (90%) smaller than 6 ha (15 acres). About half of the farm area (1.3 ha on average) is used for producing food crops. Households own little livestock except for chicken (81% of households) and goats (48%), with a few sheep (27%) and almost no cattle.

Maize is the most important crop grown by most farmers in all regions (93%). The other two food crops of major importance in the three regions are cassava and plantain. Cocoyam, on the other hand, is popular in Eastern region (grown by almost all farmers) and Ashanti (half of the farmers), but not in Central region. Cowpea and rice were limited to the Eastern region, where most farmers grew them. Only few households grew groundnuts.

The most important cash crop by far is cocoa, grown by all farmers in Eastern, a majority in Ashanti, but relatively few in Central region. The farmers interviewed can no longer be considered subsistence farmers: they sell more than half of their agricultural production, of all crops. Almost all of cocoa, the major cash crop, is sold, but on average farmers also three quarters of their cowpea, rice and cassava, and two thirds of their maize and plantain.

The average maize production was 259 kg per household, and this for six people. Farmers usually grew either one or two varieties, but found it hard to name them, except for “improved” or “local”. In the Ashanti region, most farmers (87%) grow improved varieties, with 58% specifying the improved varieties as Obatampa (no other was named), while 28% could not name them. In the other regions, less than 13% grew improved varieties, and only half of those would name one: Obatampa. In Ashanti, only a quarter of farmers grew local maize varieties, compared to three quarters in Central and two thirds in Eastern region. Few farmers could specify the name of the local variety, but many were yellow.

3.3. Consumption patterns and dietary diversity

Maize was the major staple food, mentioned a such by almost all households. Others mentioned were mostly starchy staples like cassava, plantain and yam. The only other cereal mentioned, at the fifth place, was rice. No other cereal and no legumes were mentioned by more than 10% of the respondents. Food staples important in the children’s diet followed the same pattern, except that rice came in the 2nd place and beans at the 8th place.

Half of respondents, in all zones, ate maize every day, and another 30% a few times a week. Five maize preparations are mentioned as important by more that 10% of respondents. The most important are banku (mentioned by 85% of respondents) and kenkey (65%), both fermented products , followed by porridge (50%). Kenkey is more popular in Central, Banku in the other regions. The other two preparations are regional: Akple is popular in Eastern and Ashanti region, Etew in Central region.

There are also major regional differences in consumption preferences for varieties. Most respondents from Ashanti prefer improved varieties (67%), with half of them specifying Obatampa, while respondents in the other two regions prefer the local variety. Similarly, the favorite variety – for consumption -- of almost all Ashanti respondents is white ((98%). Only a quarter of respondents in the other regions prefer to consume a white variety, but two thirds prefer yellow varieties, with preferring orange or a mixture.

Based on the 24 hour recall method, the diversity in respondents' diets was estimated at a high 60% in all regions: respondent on average consumed 60% of the 17 food groups distinguished in the survey during the last 24 hoursL. In particular, there were high levels of respondents who had consumed cereals, vegetables, and fruits with VA content (90% of respondents for each category.

Vegetables high in VA scored a bit lower in the central region (70%), but still high in the other regions (90%). Even though legumes did not come out as important crop in the production part, most respondents had consumed it in the last 24 h (60%). Also, many reported consuming animal products, in particular fish (by more than half of respondents), eggs or meat (both by one third).

3.4. Sources and levels of information

Radio was by far the main source of information, in all the three regions. It was mentioned as major source of agricultural information (by 75% of respondents) and for information on vitamin A (50%). For VA, other major sources mentioned were the hospital (40%) and the schools (30%), followed by neighbors (20%), TV and drug stores. For agriculture, neighbors are much more important (48%), followed by extension (36) and, at a much lower level, TV.

Information levels on VA were, however, low. Only a third of respondents (from those who did not receive extra information) mention fruit as a source of VA, and only a quarter green leafy vegetables (Figure 4). Similarly, a third of respondents mentioned that VA improves immunity against diseases 20% that it is good for eyesight.

3.5. Sensory evaluation

All participants were offered three samples of fresh kenkey, made the same morning, from white, yellow or orange maize. They were invited to look at them, smell them, feel them, and taste them, and give them an evaluation for those traits as well as an overall evaluation, all on a scale from 1 (very poor) to 5 (very good).,

No participants, scored any kenkey sample below 3 (average) on the overall evaluation, but strong regional differences still emerged (Figure 5). The Ashanti consumers gave higher overall scores to white kenkey, followed by yellow, and then orange keneky. Only the difference between white and orange kenkey where, however, significant ($p<0.01$, pair-wise t-test). The central consumers prefer yellow over either orange or white, and both were significant ($p<0.001$). The consumers in Eastern region, finally, prefer both yellow and orange over white and both are, again, significant ($p<0.001$).

The scores for the individual attributes follow a remarkably similar patter. If a variety is better appreciated for appearance in one region, it will also be appreciated more for its taste in that region. Similarly, if a variety is less appreciated for aroma, it will also be less appreciated for texture. The only exeption in this pattern is the evaluation for appearance in Ashanti. While yellow and especially orange kenkey received lower scores for all attributes in this region, the differences in evaluation for appearance are much larger than the difference in the overall score and as well as in the differences of the score for other attributes.

3.6. Estimation of WTP

People interviewed in the morning did not receive any information on the nutritional benefit of orange maize. They were asked to bid on balls of kenkey made from the same three varieties as the samples they had just tasted and evaluated. Their bids were therefore judged to be a reflection of their WTP for the product based on its sensory characteristics, regardless of nutritional value.

The distribution of the bids also showed a particular pattern, likely reflecting the situation observed in the markets. Although people could bid in single pesewas, and these were provided for change to the enumerators, bidding reflected common prices in the market, which arse typically multiples of 5 or 10. A large majority of bids (80%) were multiples of 10P, with most of the rest multiples of 5P and only two that were not (one bid for 3P and one for 12P). Given the resulting distribution of WTP for different products, it would be hard to detect fine differences in consumers' WTP for different product or in different regions. Moreover, the distribution of WTP for a particular product differed widely, even within a same site. The variability within sites is much higher than between sites. As a result, WTP estimated have high standard errors.

Generally, WTP by product and region reflect the preferences established in the sensory evaluation (Figure 6). In Ashanti regions, consumers' WTP is higher for white kenkey than for yellow, and higher of yellow than for orange. In the Central region, WTP is higher for yellow maize than for white or orange, while in the Eastern region, WTP for yellow and orange maize is

higher than for white. Unfortunately, the only difference that is significant is that between yellow and white kenkey in the East.

To test the effect of different products in the different regions, a linear regression model was estimated, with main effects for products and regions, as well as cross effects (Table 3). The estimation confirms that the only significant effect is the higher WTP for yellow kenkey, as compared to white, in the Eastern region, while the effect of orange maize is marginally significant (p=0.15).

3.7. Effect of information

Half of the participants were provided with information on the benefits of orange maize. When interviewed about their knowledge at the end of the whole exercise, half would mention fruit as a source of VA (compared to one third in the other group), and 40% green leafy vegetables (up from a quarter) (Figure 4). Half would also recall that orange maize has some general benefits to health, although only 20% would mention its higher content of VA.Information was only provided to participants in the afternoon, to avoid that they would pass it on to those assigned to the no information group. Unfortunately, information was thus also linked to the time of the interview. Research in Senegal has since suggested that consumers WTP is lower before lunch than afterwards (REF), which does stand to reason.

The effect of the information clearly increases the WTP for orange maize relative to that for white maize. It also had the effect of reducing the WTP for white and yellow maize, which was unexpected because the information provided only concerned yellow maize. Therefore we interpret the effect on white maize as a time-of-the-day effect, while the change in the difference between white and orange can be interpreted as an effect from the information. These effects are best studied in the extended regression model.

The full model still shows a significant difference of WTP for yellow maize in Eastern region, and a marginal effect of WTP for orange in Central and Eastern region ($p < 0.2$). The effect of information is only marginally significant, although consistent with the expectation. The main effect on WTP is negative and amounts to 1.18P (p=0.14). We interpret this as the time-of-the day effect: WTP in the afternoon is expected to be reduced by this amount. The cross effect of information and orange maize, on the other hand, is postitive and amounts to 1.04 (p=0.16), which we interpret is the increase WTP for orange maize induced by consumers appreciation of its nutritional quality, brought on through the information provided.

Finally, participants from different villages were been offered different participation fees (40P, 80P and 200P). These fees did not differ within villages to avoid feelings of unfairness. Our concern was to find the right incentive, which would best reveal consumers' WTP. The effect of

the participation fee is very clear, with a WTP increasing by 2P for in increase of the partipation fee of 1 Cedi.

4. Conclusion

The main objectives of this study were to analyze the preference of rural consumers for different colors of maize products, to measure the possible effect of a preference for white on the adoption of orange biofortified maize, and the possible mitigation of that effect through provision of information.

We conclude that the orange color of biofortified should not be a major obstacle to its development and dissemination in the major maize areas of Ghana. Sensory evaluaton as well as estimation of WTP indicate that consumer preference for white maize is highly regional and that there are large variations within the regions. While consumers in the Ashanti region prefer white over yellow, and yellow over white, those in the Central region prefer yellow over white, and those in the Eastern region prefer both yellow and orange over white.

Clearly, people who are used to local varieties often prefer these varieties, as well as their color, often different from white. Still, even within the different zones and within the different villages, there are high differences in appreciation of different color, which can be exploited.

Consumer preferences for biofortified maize can clearly be influenced by providing nutritional information. Our survey also provided other important information to improve future information campaigns. Information on VA is low, but clearly increased by our simulated radio message, although not by that much. Still, most households own a radio, and they consider this radio as the most important source of information, both for agriculture and for health. Therefore, a good information campaign based on radio message is likely to have effect.

People also clearly distinguish between yellow and orange, which can be used to the advantage of branding a biofortified, orange maize.

Further, this studies provides good insights to the feasibility of the BDM method in rural Africa. BDM nin this particular setting lead to highly discrete bids in multiples of 5 and 10, making the estimation of a 20P product rather imprecise. Further, participation fees have a clear effect of WTP. Future work attention should be paid to providing different participants with equal benefits of participation. Another important factor, but unfortunately overlooked in this study, was the effect of time of the day. This factor needs to be studied further, in particular if the effect is discrete effect (maybe before or after lunch) or more of a continuum (changing also over time within morning or afternoon sessions).

Finally, the likely impact of orange maize biofortified with provitamin A maize needs, however, to be analyzed based on the current diets of the target populations. Our results show high levels of consumption of maize, but also of alternative sources of VA. VA deficiencies need to be measured more accurately, as well as the current levels of maize consumption and the contribution biofortified maize can make.

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Figure 1. Maize production and poverty in Ghana

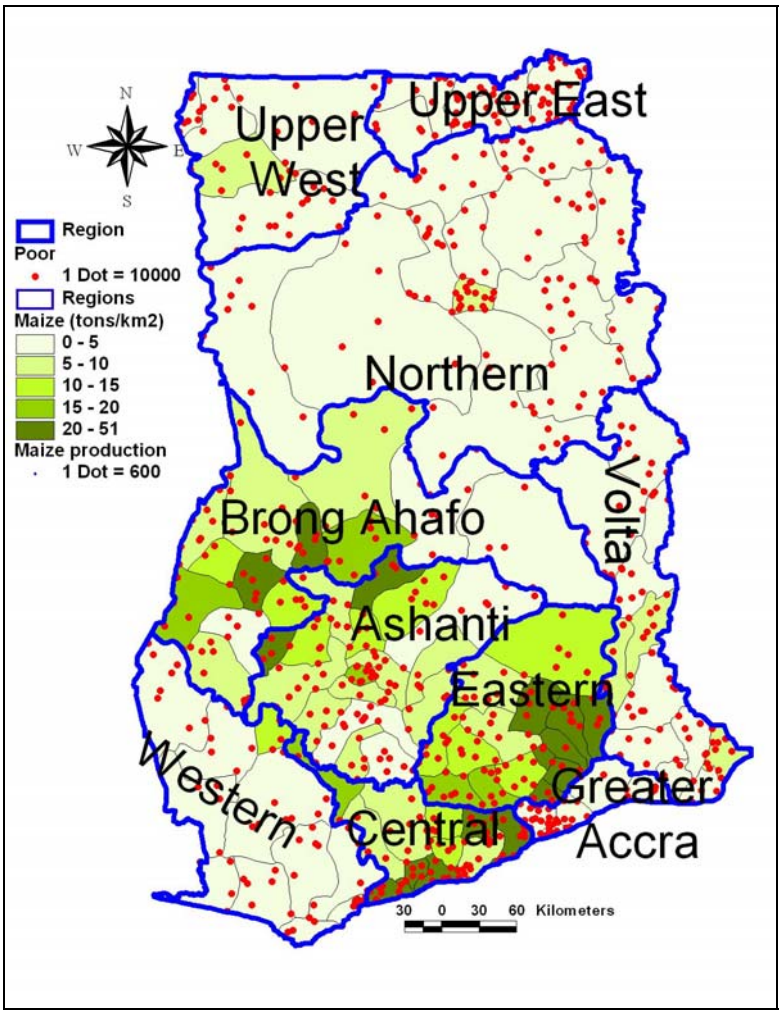

Figure 2. Selected districts and communities

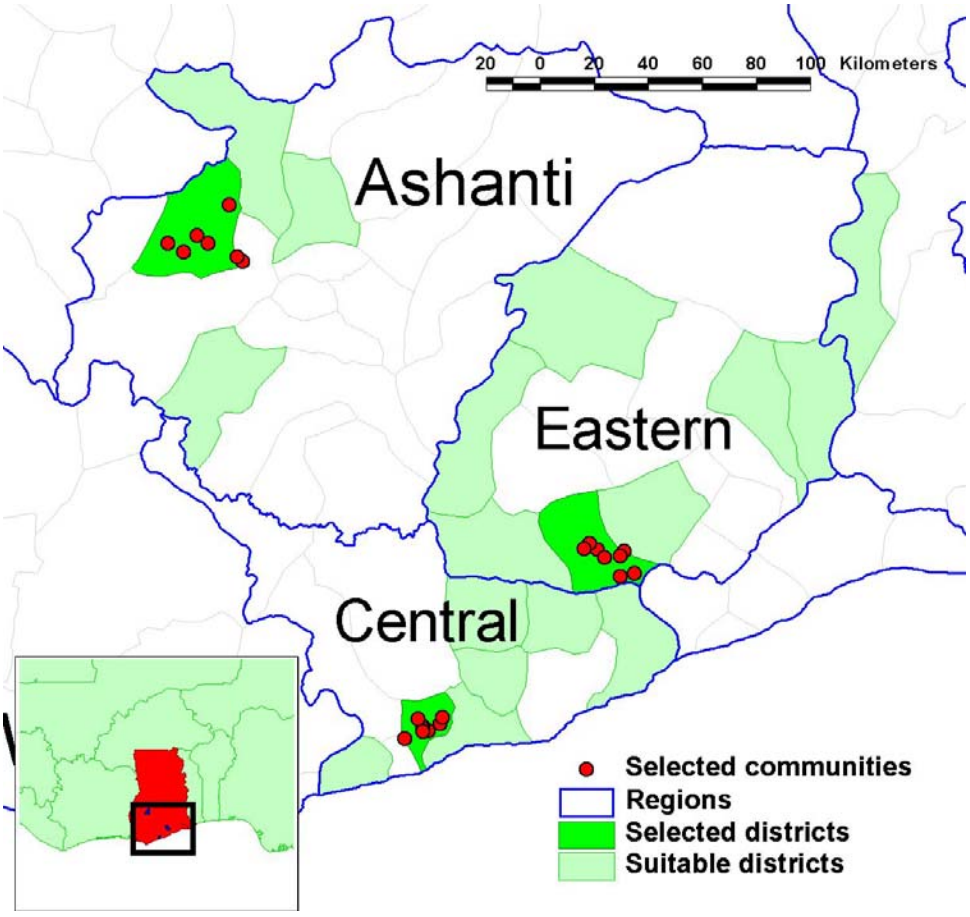

Figure 3. Housing and other assets (in % of participants).

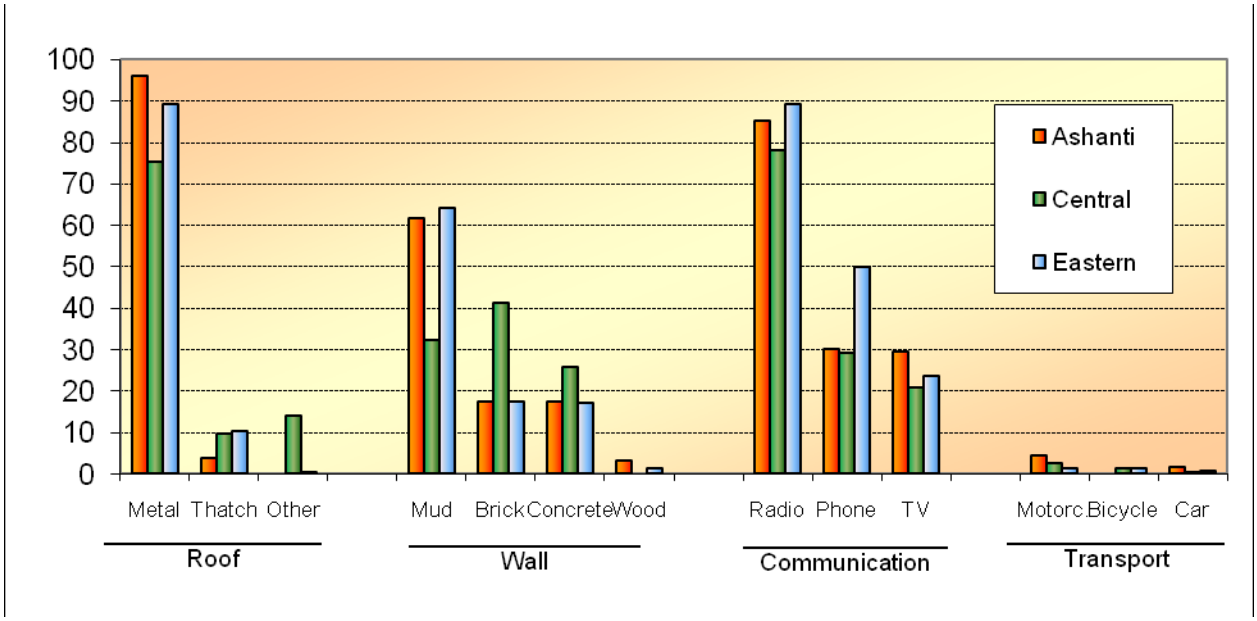

Figure 4. Sources of information

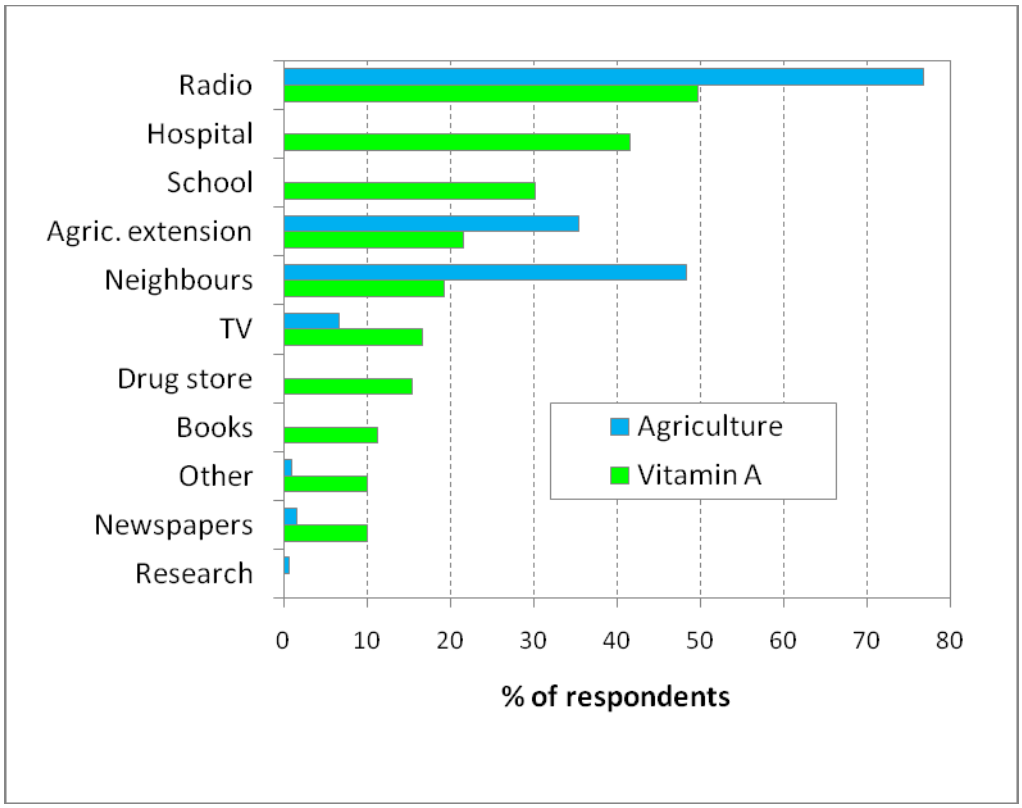

Figure 5. Consumers sensory evaluation (overall score on a scale of 1=very poor to 5=very good)

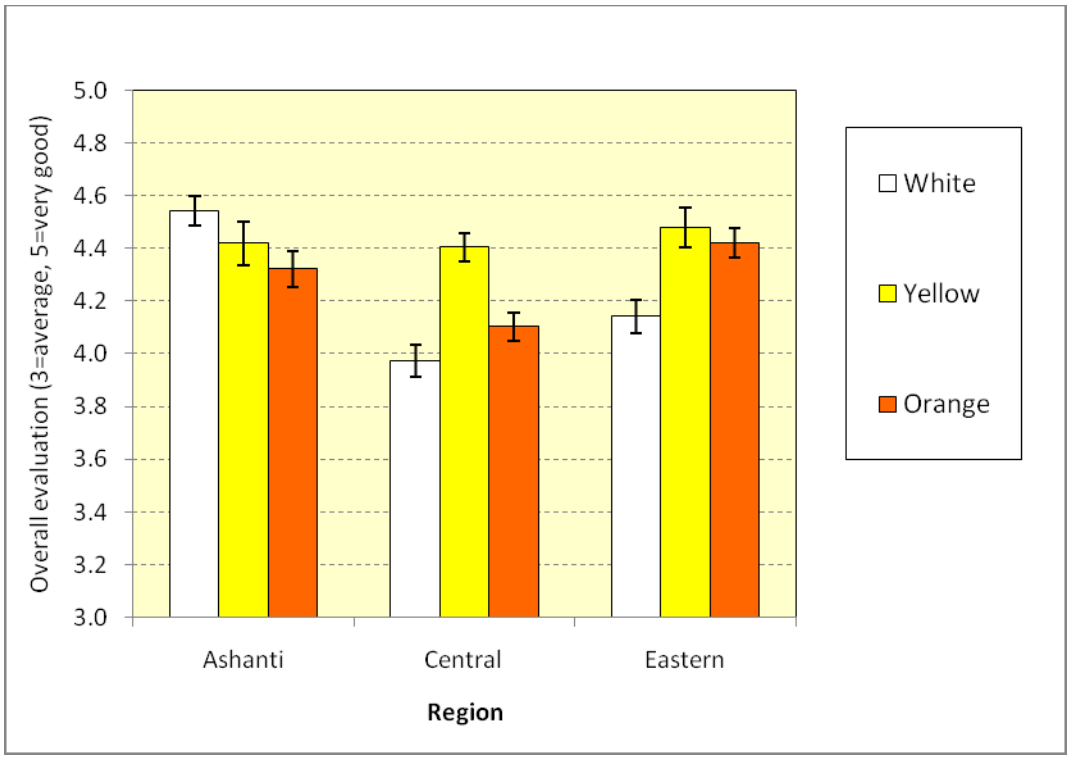

Figure 6. Consumer WTP for differently colored kenkey, by region

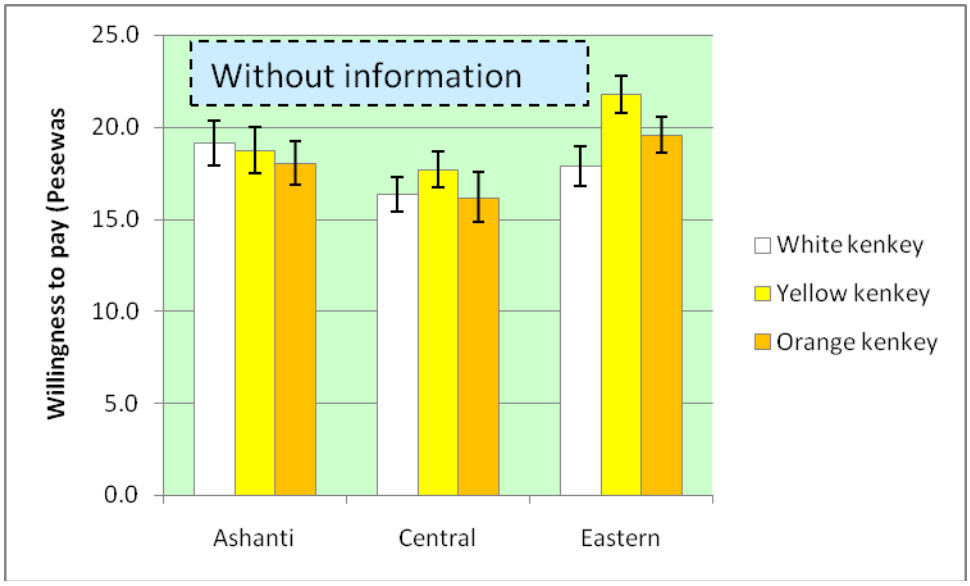

Table 1. Sampling design, by region, elication mechanism, and participation fee (with secon half of each village receiving information, every other participants female, tasting order of products systematically rotating)

Elicitation mechanism		Ashanti		Central		Eastern		Total	
	Participation fee (Pesawas)	Villages	People /village	Villages	People /village	Villages	People /village	Villages	People
Group auction	80	1	32	2	24	2	24	6	128
Individual auction	40	1	32	1	32	1	32	3	96
	80	1	32	1	32	1	32	3	96
	200	1	32	1	32	1	32	3	96
Choice experiment	40	1	32	1	32	1	32	3	96
	80	1	32	1	32	1	32	3	96
	200	1	32	1	32	1	32	3	96
Total		7	224	8	240	8	240	24	704

Table 2. Socioeconomic characteristics of respondents (n=703)

Type	Variable/group	Ashanti (n=224)	Central (n=239)	Eastern (n=240)
Head of household	Female (%)	14.7	15.1	13.3
Respondent	Female (%)	53.6	51	43.8
Age	Age (years)	41.5	45.7	41.5
	(st. dev.)	(14.060)	(14.060)	(14.060)
Relationship with head	Head	57.6	63.2	65.4
	Spouse	34.8	33.1	26.7
	Parent, brother or sister	4	0.8	2.9
	Other	0	0.8	1.3
Marital Status	Married Monogamous	70.5	77.4	75.8
	Married Polygamous	4.5	3.8	2.1
	Widowed, separated, divorced	18.3	16.6	17.5
	Single	6.7	2.1	4.2
Schooling	No formal schooling (%)	30	43	21
	Mean (years), of those who had eduction	8.03	8.03	8.03
			(2.613)	(2.613)
Household composition	Number of Wives	1.18	1.14	1.05
	(st. dev.)	0.98	0.42	0.22
	Children 0-4	0.75	0.52	0.58
	(st. dev.)	0.95	0.78	0.88
	Children 5-15	2.59	2.13	1.86
	(st. dev.)	2.29	2.17	1.99
	Other Dependants	1.06	1.28	1.54
	(st. dev.)	1.72	1.94	1.99
	Children and other dependents	4.40	3.92	3.98
	(st. dev.)	2.61	2.73	2.55

Table 3. Regression of the WTP, basic model, BDM mechanism, no information

Group	Variable	Coefficient	Standard error	p-value	
Main effects	Constant	19.12	1.058	0.000	***
	Central Region	-2.23	1.525	0.144	
	Eastern Region	-0.87	1.525	0.567	
	Yellow kenkey	-0.01	0.989	0.994	
	Orange kenkey	-0.71	0.989	0.474	
Cross effects	Central Region x yellow	0.82	1.420	0.561	
	Central Region x orange	1.65	1.443	0.252	
	Eastern Region x yellow	3.53	1.420	0.013	*
	Eastern Region x orange	2.05	1.420	0.150	
Model	Rsquare	0.04			
	sigma_u	5.70			
	sigma_e	4.95			
	rho (fraction of variance due to u_i)	0.57			
	Number of observations	433			
	Number of participants	147			

Table 4. Regression of WTP bids in BDM procedure (in Pesewas), full model

Group	Variable	Coefficient	Standard error	p-value	
Main effects	Constant	15.78	1.04	0.000	***
	Central Region	0.24	1.10	0.828	
	Eastern Region	1.01	1.10	0.355	
	Yellow kenkey	0.13	0.73	0.860	
	Orange kenkey	-0.52	0.81	0.518	
Cross effects	Central Region x yellow	0.48	1.04	0.644	
	Central Region x orange	1.38	1.05	0.187	
	Eastern Region x yellow	2.62	1.03	0.011	*
	Eastern Region x orange	1.31	1.03	0.206	
Information and fees	Information provided	-1.18	0.79	0.137	
	Information x orange	1.04	0.74	0.160	
	Participation fee	0.02	0.01	0.001	**
Model	Rsquare	0.034			
	sigma_u	5.70487			
	sigma_e	5.03044			
	rho (fraction of variance due to u_i	0.56258			
	Number of observations	844.000			
	Number of participants	288			