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Practices and Constraints in Bambara Groundnuts Production, Marketing and Consumption in the Brong Ahafo and Upper-East Regions of Ghana

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Abstract: A study was undertaken to understand the practices and major constraints in bambara groundnut production, marketing and consumption in the Brong Ahafo (Transition) and Upper East (Guinea Savannah) Regions of Ghana. A total of 200 bambara producers, 33 marketers and 68 consumers were randomly chosen and interviewed from the Brong Ahafo and the Upper East Regions of Ghana. Three bambara groundnut growing districts in the Transition agro-ecology; Nkoranza, Wenchi East and Wenchi West and four districts in the Guinea Savannah agro-ecology; Bawku West, Kasena Nankana, Talensi Nabdam and Builsa were studied between August 2006 and January, 2007. Three separate questionnaires were developed to target producers, marketers and consumers in this study. The study confirmed more females (63%) produced bambara than males (37%). More farmers produced bambara solely for cash in the Transition (73%) whereas in the Guinea Savannah most farmers produced for cash and subsistence (78%). Most farmers (65%) depend on farmer saved seeds for planting. Sellers and consumers preferred white or cream seeds with large sizes. The major problem with bambara is the long cooking time of mature seeds.

Key words: Bambara groundnut, transition, guinea-savannah, production, marketing, consumption

INTRODUCTION

Bambara groundnut is a traditional or indigenous crop, which is mainly grown as a subsistence crop by farmers and to some degree for income generation. The crop is found in the wild from Central Nigeria eastwards to southern Sudan. It is however, cultivated throughout tropical Africa (Brink and Belay, 2006). The crop has the potential to contribute to food security in view of its ability to withstand drought. This becomes more important especially in sub-Saharan Africa and some regions of the continent where rainfall is low to support most leguminous crops. Doku and Karikari (1971) described bambara groundnut as the most resistant pulse crop producing under conditions of high temperature and low rainfall where other pulses fail to survive. In Ghana, Bambara groundnut is mostly grown in the Coastal Savannah, Transition and Guinea Savannah agro-ecologies. These areas are relatively low in rainfall compared to the high rainfall areas in the country. Rainfall pattern in the Northern and Upper Regions as well as the Transition of Ghana is erratic. In the Northern and Upper Regions rainfall is unimodal with a long season of drought. Bambara groundnut therefore becomes a food security crop in these areas. The crop plays an important role in traditional ceremonies (funeral rites) and gift exchanges (Anchirinah *et al*., 2001; Haleegoah *et al*., 2005). Dried seeds are mixed with maize or plantains and then boiled. The seeds may also be ground into flour and added to maize to enrich traditional preparations (Brink and Belay, 2006). In Senegal leaf preparations are applied to abscesses and the roots are sometimes taken, as aphrodisiac (Brink and Belay, 2006). The mature seeds of the crop are rich source of protein (16-25%), carbohydrate (42-60%) and relative to groundnut low in lipids (5-6%) (Poulter and Caygill, 1980; Ankroyed and Doughty, 1982; Brough and Azam-Ali, 1992). This gives the crop a distinct food value. Coudert (1984) concluded that the demand for bambara groundnut in West Africa exceeds the present supply. Anyika *et al.* (2009) reported that when legumes and cereals are appropriately combined their protein quality may be as good as casein or other animal protein sources or better than them. Aremu *et al.* (2008) also observed that the seed flour of bambara groundnut seeds could be useful replacement in viscous food formulation such as soups and baked goods due to high values of water absorption and oil and emulsion capacities.

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Improved agronomic practices are lacking in bambara production. This needs urgent attention if farmers are to reap some greater benefits from cultivating the crop. Another problem is related to soil fertility. There might be the need to examine the soil fertility status in relation to bambara production. One of the major constraints to bambara consumption relates to cooking. The ease of cooking will greatly save farmers, processors and consumers a lot of time, money and energy and will enhance the consumption of bambara in Ghana.

The objectives of the study were (1) to understand the practices and major constraints in bambara groundnut production, marketing and consumption and (2) provide some baseline information on production, marketing and consumption of bambara in the selected areas in Ghana.

MATERIALS AND METHODS

The survey involved producers, marketers and consumers of bambara groundnut. A total of 200 bambara producers, 33 marketers and 68 consumers were randomly chosen and interviewed from the Brong Ahafo and the Upper East Regions of Ghana. Three separate questionnaires were developed for producers, marketers and consumers in this study. Semi structured interviews were utilized to elicit further information. The study was undertaken between August 2007 and January, 2008. To capture the ecological effect, the districts and villages chosen were from the Transition zone of the Brong Ahafo Region (Nkoranza, Wenchi East and Wenchi West districts) and the Guinea Savannah of the Upper East Region (Bawku West, Kasena Nankana, Talensi-Nabdam and Bulsa districts). In the text, Guinea Savannah or Upper East Region and Brong Ahafo Region or Transition would be used interchangeably.

Data analysis: Descriptive statistical values mainly percentages were used to determine differences among the various parameters investigated in the study.

Producers: Four bambara growing districts in the Upper East Region and three in the Transition zones of the Brong Ahafo Region were randomly chosen from all the districts producing bambara. Villages were also chosen at random from all villages cultivating bambara. Since it was difficult getting the list of all bambara farmers in the villages, houses were rather chosen at random and the first farmer seen was interviewed. Depending on the concentration of bambara growers, the sample was skewed towards villages having more producers. Table 1 gives the lists of districts sampled in the two agroecological zones, number of respondents interviewed and the total number of persons interviewed.

Table 1: Distribution of Producers' sample among Districts in the Transition and Guinea Savannah zones, Ghana

	Sample size		
District	Transition zone (B/A Region)	Guinea savannah zone (Upper East Region)	Total
Nkoranza	46	0	46
Wenchi East	12	0	12
Wenchi West	52	0	52
Bawku West	0	29	29
Kasena Nankana	0	20	20
Talensi-Nabdam	0	31	31
Bulsa	0	10	10
Total	110	90	200

Table 2: Sample distribution of bambara sellers

	Sample size		
District	Transition zone (Brong Ahafo Region)	Guinea savannah zone (Upper East Region)	Total
Nkoranza	10	0	10
Wenchi East	5	0	5
Wenchi West	5	0	5
Bawku West	0	3	3
Kasena Nankana	0	8	8
Talensi-nabdam	0	0	0
Bulsa	0	2	2
Total	20	13	33

Table 3: Distribution of sample of consumers within the districts of the bambara survey

	Sample size		
District	Transition zone (Brong Ahafo Region)	Guinea savannah zone (Upper East Region)	Total
Nkoranza	9	0	9
Wenchi East		0	0
Wenchi West	29	0	29
Bawku West	0	5	5
Kasena Nankana	0	11	11
Talensi-nabdam	0	12	12
Bulsa	0	2	2
Total	38	30	68

Bambara sellers (Marketing agents): Within the districts and villages where bambara producers were selected, bambara sellers were sampled. The sample distribution for bambara sellers for the various districts in the two agroecological zones is given in Table 2.

Consumers and processors: Similarly, from the selected villages, bambara consumers were sampled randomly and interviewed (Table 3), thirty-eight consumers from the Transition zone and 30 consumers from the Guinea Savannah zone were interviewed making the total sample size of consumers 68.

RESULTS

Characteristics of the sample: Females (63%) dominated the production of bambara compared to males (37%). More than half of the bambara farmers had no formal education.

Land tenure: The land tenure system of the bambara farmers in the study areas are presented in Table 4, a higher percentage of bambara farmers (83%) planted on their family or own land in the Guinea Savannah than their counterparts in the Transition zone (63%). On the contrary, a higher percentage of farmers in the Transition zone tended to rent land, which they pay for with cash than those in the Guinea Savannah (Table 4).

Reasons for growing bambara: Farmers may have their reasons for growing bambara. It is interesting to note that while none of the farmers in the Guinea Savanna planted bambara solely for cash, 73% of their counterparts in the transition planted the crop mainly for cash (Table 5). Twenty four percent of respondents however, produced bambara groundnut for cash and subsistence in the Transition agroecology with 78% in the Guinea savannah.

Months of high and low supply of bambara: The months in which bambara is in high supply are the same in both the Transition and the Guinea Savannah. These months are October to early December as indicated by 84 and 83% of the farmers in the Transition and Guinea Savannah, respectively. There are low supplies of bambara in January, July and August in the Transition as shown by 59% of the farmers. In the Guinea savannah, low supplies are in May and August and similarly, 59% of the farmers indicated so. This has implication for planting time for bambara and it seems that they are about the same time in both ecological zones. In both zones bambara groundnut planting is done mostly between the end of June and July.

Bambara production trend: Over the past three years, farmers were asked to indicate the trend of their bambara production. While production was said to have increased in the Transition, production had decreased in the Guinea Savannah.

Reasons for increase in bambara production: For farmers who indicated increased bambara production, the reasons attributed by them to the increase are summarized in Table 6. Weather is critical for farmers in the Guinea Savannah if they are to get good yields (Table 6). More farmers (70%) in the Transition regarded higher income as motivating their increase in bambara production with 53% in the Guinea Savannah saying good weather.

Reasons for decrease in production: The reasons assigned to decrease in bambara production in the past 3 years were poor weather and decreased income for the Guinea Savannah and decreased capital for farmers in the Transition.

Most important constraints to Bambara production: Farmers listed a number of constraints to their bambara production. The common problems centred on climate, labour and inputs. Another issue was access to credit. While, none of the farmers in the Transition made mention of money as the most important constraint to bambara production, 17% of the farmers in the Guinea Savannah indicated money as their first major constraint.

Source of seed: The major sources of bambara seeds are farmers' own and the local market. This seems to suggest that the formal sector of seed source is lacking. Fifty three percent of farmers from the Transition and 77% from the Guinea Savannah used their own seeds for cultivation (Table 7). This is because all the bambara groundnut produced in the country presently are landraces.

Table 4: Land tenure system of bambara farmers in the Transition and Guinea Savannah Zones, Ghana

	Percent in the ecological zone		
Type of tenure	Transition	Guinea Savannah	All farmers
Family/own	63	82	72.5
Rented	29	7	18.0
Leased	4	3	3.5
Sharecropped	1	6	3.5
Communal	0	1	0.5
Other	3	1	2.0
N	110	90	200

Table 5: Reasons for growing bambara

	Percent in the ecological zone		
Type of tenure	Transition	Guinea savannah	All farmers
Cash	73	0	40
Subsistence	3	22	12
Both cash and subsistence	24	78	48
N	108	90	198

Table 6: Reasons for increase in bambara production within ecological zones

	Percentage of farmers within ecological zone		
Reason	Transition	Guinea Savannah	All farmers
Good weather	20	53	36.5
Increased capital	7	9	8.0
Higher income	70	15	42.0
Bigger land acquisition	2	18	10.0
Others	1	6	3.5
Total	100	100	100
N	59	34	93

Table 7: Sources of Bambara seeds

	Percentage of farmers in the ecological zone		
Source	Transition	Guinea Savannah	All farmers
Own	53	77	65.0
Other farmers	9	2	5.5
Market	38	21	29.5
N	110	90	200

Table 8: Use of some inputs in bambara production

	Percentage of farmers using inputs		
Input	Transition	Guinea Savannah	All farmers
Fertilizer	0	8	4.0
Field insecticide	1	2	1.5
Storage insecticide	42	32	37.0
Weedicide	14	2	8.0
N	110	90	200

*Percentage total less than 100%

Table 9: Acreage and yield of bambara

	Mean		
Acreage/yield	Transition	Guinea Savannah	All farmers
Size of field (acres)	1.1	1.2	1.1
Yield ha^{-1}	1 t	600 kg	800 kg
N	110	90	200

Use of inputs: Table 8 gives a summary of the use of some inputs in the production of bambara. Insects seem to be a problem during storage. Most farmers (42% from the Transition and from both the Transition and 32% from the Guinea Savannah use storage insecticides. Very little fertilizer is used in the Guinea Savannah whilst no fertilizer is used by farmers in the Transition (Table 8).

Acreage and yield of bambara: The acreage put under bambara and the yield normally obtained in a growing season is presented in Table 9. The mean acreage under bambara groundnut cultivation in the Transition is 1.1 acres and in the Guinea Savannah 1.2 acres. Yields in the Transition is however higher (1.0 tonne) relative to the Guinea savannah (600 kg) (Table 9).

Accessibility to resources: Ninety percent of farmers from the Transition and 80% from the Guinea Savannah mentioned land to be easily accessible (Table 10). Labour was also said to be easily accessible as reported by 87% of farmers from the Transition and 74% from the Guinea Savannah. Extension services and irrigation however, were less accessible. The low yield of the crop can also be attributed to poor access to extension.

Traditional pre-storage treatment: Farmers had their own traditional ways they used to store bambara. Some farmers used ashes or herbs to store bambara. Ninety percent of the farmers in the Guinea Savannah store their bambara in jute bags and the rest store them using polythene bags, drums and baskets. In the Transition, 55% of the farmers used jute bags 12% stored in polythene bags. The rest used similar packages as those of the Guinea savannah.

Marketing: Most of the bambara sellers were females. About half of the sellers in the Transition had some education. In the Guinea Savannah, most sellers did not have formal education. The main occupation of most sellers in the Guinea Savannah were not only trading but also farming. Bambara is sold mostly in the open market in both the transition and Guinea Savannah. The rest sold them through middlemen. The main problem of marketing was low price particularly in the Guinea Savannah where 69% identified this as a problem. In the Transition, 85% did not have problem selling bambara.

Table 10: Accessibility of resources

	Percentage of farmers indicating accessibility		
Resources	Transition	Guinea savannah	All farmers
Land	90	80	85
Labour	87	74	82
Extension services	15	36	22
Irrigation	6	9	7
N	110	90	200

*Percentage total more than 100% due to multiple responses

Special periods for bambara demand: Bambara may have high demand in special periods or months. August and November are those months that bambara is demanded in the Transition. In the Transition this period coincides with some few months after planting (August) and during harvesting (November). It is possible most people will look for bambara in November because they know it is available at that time. In the Guinea Savannah the demand is in April, June and July and during funerals. This seems to coincide with the planting season in the Guinea Savannah. Cultural differences in the two regions studied might account for bambara not being demanded for funerals in the Transition since that may not form part of their culture.

Seed preference by sellers: Colour and seed size are important attributes of bambara. In both ecological zones sellers preferred white and big sized seeds. This was not surprising because consumers who normally would purchase from farmers also preferred white and big seeds. These have implications for research.

Consumers and processors: Most of the respondents were females. Majority of the consumers had some education particularly in the transition zone. The traditional bambara meal are tubani (bambara flour, made into a paste, wrapped in leaves and steamed) and aboboi (boiled bambara groundnut usually eaten with fried plantain) as indicated by respondents. Bambara was said to be hard to cook by 76% of consumers in the transition zone and 87% of consumers in Guinea Savannah. The consumers overcame this by soaking the seeds overnight, boiling with bicarbonate, putting more fire or by

Table 11: Colour preference by consumers

	Percentage of farmers preferring	
Colour of testa	Transition	Guinea Savannah
White	48	38
Black	11	14
Brown	8	17
Red	4	17
Cream	18	0
Indifferent	11	14
N	38	30

combining any of the methods. It is apparent that cooking bambara is difficult and ways of easing this drudgery should be found.

Medicinal value of bambara consumption: Some consumers in Guinea Savannah mentioned that there were medicinal values with bambara consumption. For example, 23% of the consumers said bambara had a medicinal property of curing diarrhoea while 10% mentioned stomach ache. These issues might need further investigation.

Important grain characteristics in the consumption of bambara: Consumers were asked to rank some characteristics of bambara in terms of importance in consumption. Clean, tasty and stoneless grains were preferred. Another important attribute was price. As consumers, they might want an appropriate and affordable price for bambara. These are all important issues to consider in the development of improved technologies on bambara for farmers.

Colour of bambara testa preferred by consumers: Colour is another criterion used by consumers to buy some grains such as bambara. The colour preferences for consumers are given in Table 11. The preferred colour seems to be white for both agro-ecological zones. Cream colour is also preferred in the Transition zone. The use of the bambara seed would also determine the colour consumers would prefer. In terms of grain size, 82% of consumers preferred bigger size in transition and 79% from Guinea Savannah.

DISCUSSION

Characteristics of the sample: Anchirinah *et al.* (2001) observed that in the Upper West Region of Ghana 64% female and 36% male are involved in the production of bambara groundnut. This result agrees with the findings of this study where females (63%) dominated in Bambara groundnut production relative to males (37%) in the two agroecologies studied. Adu-Dapaah *et al.* (2006) observed that in the Northern Region of Ghana, more females are involved in bambara production whereas in Southern Ghana more males are involved in bambara production. They attributed the reasons to the fact that bambara groundnut being a subsistence crop in the North is considered as a women's crop. This has implications in gender consideration for any technology aimed at improving bambara groundnut cultivation, processing and utilization in these parts of Ghana.

Land tenure system: A higher percentage of farmers (83%) from the Guinea Savannah planted on their family or own land than in the Transition (63%). This is because more farmers in bambara production in the Transition zone are migrant farmers from the Northern and Upper Regions of Ghana. However, in both zones, farmers could have rights to the land since most of the farmers either owned or rented their bambara fields and could take decisions on production just as owner-occupier. The type of ownership of land is likely to have effect on the production decisions of farmers and their ability to adopt improved technologies especially, if the technology involves purchasing of inputs. It is thus, important to examine the land tenure system of bambara farmers.

Reasons for growing bambara: The study brought into the fore the fact that there is more subsistence in the Guinea Savannah than the Transition zone and that more farmers consumed bambara in the Guinea Savannah than in the Transition. This is also in agreement of the fact that the Guinea Savanna is seen as a low rainfall area with a unimodal rainfall season. Any crop that is able to resist drought becomes a food security crop for the area. These findings have implications for more work on varietal development as well as development and diffusion of improved production and utilisation technologies in bambara groundnut for farmers, processors and consumers. Such technologies when adopted would improve the income and food security of bambara farmers. These results are in consonance with similar studies in Ghana by Anchirinah *et al.* (2001) and Haleegoah *et al.* (2005).

It is thus not surprising that while 57% of bambara farmers in the Transition indicated that they obtained more income from bambara than other legumes, 50% indicated so in the Guinea Savannah. Other legumes that seemed to compete with bambara are groundnut, cowpea and soybean.

Months of high and low supply of bambara: The period of high and low supply of the crop has implication for planting time for bambara and it seems that they are about the same time in both ecological zones. This confirms pressure on demand for labour at both planting

and harvesting. In both zones bambara groundnut planting is done mostly between the end of June and July. Harvesting of the crop coincides with the dry season to ensure good quality grain (Haleegoah *et al*., 2005).

Bambara production trends: The trend of the crops production was increasing in the Transition and reducing in the Guinea Savannah as expressed by respondents. This result has implications for research on issues of soil fertility, development of high yielding and early maturing varieties and other production practices. It should be noted that for the one rainy season in the Guinea Savannah, other crops like maize, cassava, millet, sorghum, groundnut and cowpea are competing with bambara for space. Extra early drought tolerant maize varieties developed by research institutions in the country have been introduced to farmers especially in the Northern and Upper Regions (Adu-Dapaah *et al*., 2007).

Reasons for increase in bambara production: As pointed out earlier in Table 5, the driving force for farmers to increase their bambara production in the Transition zone seemed to be higher income because most of them planted the bambara as a cash crop. Table 6 also showed that while 18% of farmers in Guinea Savannah mentioned increase in land area as accounting for increase in bambara production only 2% of farmers in the Transition zone said so. There was probably intensification of land use in the Transition. Clearly, these present contrasting factors for consideration in the development of improved bambara groundnut technologies for farmers in the two agro-ecologies.

Reasons for decrease in bambara production: It is interesting to note how farmers perceive weather effect considering the percentage of farmers who also mentioned good weather as accounting for the increase production in bambara in both agroecologies. This perception can however be understood since within these periods there can be years of good rainfall and others of poor rainfall. Even though bambara is said to be a drought tolerant crop a certain amount of rainfall is required for the development and yield of the crop. In the Guinea Savannah with a unimodal and erratic rainfall, weather is very crucial in the production of the crop.

Most important constraint in bambara production: Farmers in the Transition depend on migrant labour as a means of labour force. During this period the demand for this labour is high because most of the labourers would be cultivating their own farms. Even though farmers in the Guinea Savannah (17%) saw money as a constraint to bambara production, those in the Transition did not see money as a problem to the production of the crop. It is possible farmers in the Transition are able to generate some income from bambara production since it is seen as a cash crop and not a subsistent crop. Labour constraint however, is related more to the high cost of labour at certain times than its actual availability.

Source of seed: Most farmers from both agroecological zones used their own seeds for cultivation. These materials are landraces since no varieties have been developed in the country presently. This findings is in agreement with observations by Haleegoah *et al. (*2005) who reported that no improved bambara variety has been released compared to other food crops.

Use of inputs: Even though bambara groundnut has been regarded to be relatively resistant to pests attack relative to cowpea, long storage affects seed quality. This confirms observations by Adu-Dapaah *et al*. (2004) who reported that all the 40 Bambara accessions screened were susceptible to bruchid attack. Very little fertilizer is used in bambara production. While some fertilizer is used in the Guinea Savannah, none is used in the Transition. Relatively soils in the Transition are more productive than those in the Guinea Savannah of Ghana. This could be due to farmers inability to purchase fertilizer or lack of knowledge on the use of fertilizer on bambara among others. Generally most farmers would not use fertilizer on bambara. A good number of farmers from both agro-ecological zones however, use a certain amount of storage insecticide. This result is in agreement with findings by Anchirinah and Bennet-Lartey (2002) who observed that farmers did not apply fertilizer to bambara groundnut in the Upper West Region of Ghana. They also reported that 70% of farmers treat their grain with only wood ash before storage with 11% of them using the recommended chemical, Actellic.

Acreage and yield of bambara groundnut: Yields are much lower in the Guinea Savannah than in the Transition zone. This might relate to poor fertility of soils in the Guinea Savannah, low rainfall or poor agronomic practices. This also calls for the development of high yielding drought resistant varieties and better extension education on the cultivation of the crop. Adu-Dapaah and Sangwan (2004) observed that the poor storage of bambara seeds by farmers results in poor plant establishment resulting in low yield.

Colour of bambara seeds preferred by consumers: Consumers preferred cream and white seeded bambara seeds. This finding is in agreement with work done by Amarteifio *et al.* (1998) who reported of the lowest tannin level in the cream, intermediate in red and highest in black coloured bambara seeds. They mentioned that cream coloured seeds are often preferred to red and black seeds because they are less bitter (sweeter) and take less time to cook.

CONCLUSIONS

Bambara seems to be one of the forgotten grain legumes in Ghana. Farmers had lived with what they had for years. Little research and extension has taken place on bambara but farmers continue to grow them showing the resilience these farmers are. It is thus important to provide some research and extension activities in areas of production processing and consumption. Variety development is necessary to satisfy the different requests of farmers and to boost their yields. The yields from farmers' fields are quite low and may affect their cost of production.

Improved agronomic practices are lacking in bambara production. This needs urgent attention if farmers are to reap some greater benefits from cultivating the crop. Another problem is related to soil fertility. There might be the need to examine the soil fertility status in relation to bambara production.

One of the major constraints to bambara consumption relates to cooking. The ease of cooking will greatly save farmers, processors and consumers a lot of time, money and energy and will enhance the consumption of bambara in Ghana.

Finally, the survey has unearthed some issues on bambara production, marketing and consumption in Ghana. When these issues are given the attention they deserve, bambara production, processing, marketing and consumption will increase in Ghana. This will enhance food security, improved nutrition and livelihood with the resultant effect of poverty reduction.

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