



## FARMERS' PREFERENCE OF BAMBARA GROUNDNUT VARIETIES AND THEIR BREEDING PRIORITY IN KANO STATE OF NIGERIA

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### ABSTRACT

*Bambara groundnut (Vigna subterranea [L.] Verdc.) is an age long crop grown in most parts of Kano State, Nigeria. Due to lack of sufficient research attention, the crop has not been improved through organized breeding programme. There is therefore the need to understand variety preference for improved field production of the crop. A baseline survey, using Participatory Rural Appraisal (PRA) was carried out among seven Local Government Areas (LGAs) in Kano State of Northern Nigeria to assess Farmers' Variety Preferences of Bambara groundnut. Structured interviews through the use of questionnaires were conducted among 150 Bambara groundnut farmers. All respondents interviewed are currently growing Bambara groundnut using landraces, but their choice of variety heightened with preference to oval, large and pure seeds at 54.0%, 59.3% and 80.0%, respectively. Cream coat coloured seed with good taste quality are most preferred by the farmers. The incorporation of the farmer's preferred traits into improved varieties would be a requirement for breeding goal of this crop to boost its production at both small and commercial scale levels.*

### INTRODUCTION

Bambara groundnut (*Vigna subterranea* [L.] Verdcourt) is an indigenous African under-utilized legume crop cultivated long before groundnut (*Arachis hypogea* L.) (Goli et al., 1997) which is primarily grown for human consumption as a cheap source of plant protein. The seed of Bambara groundnut is rich in carbohydrates and oils (Brough et al., 1993). Its protein consist of essential and non-essential amino acids at 33% and 66%, respectively (Amarteifio et al., 2010). Essential amino acids include lysine, methionine and cysteine (Fetuga et al., 1975). The crop is superior to mungbean (*Vigna radiata* [L.] Wilczek) in vitamin B (Basu et al., 2007).

Fresh pods are boiled and eaten as snack, while dry seeds are processed into flour for the

preparation of relish, such as 'Moi-moi' (a form of steamed paste), a traditional food made from soaked dry seeds, and puddled thereafter (Okpuzor et al., 2009). In paste form, the product is fried in oil and served with porridge at breakfast in many parts of Nigeria. The flour can be mixed with dry baobab leaf powder into paste, which is wrapped in maize leaves, and further steamed to make a traditional food, 'Tubani': a common food in northern Nigeria. Brough et al. (1993) and Massawe et al. (2005), and Fetuga et al. (1975) reported the use of Bambara groundnut seeds in making bread and vegetable milk, respectively.

These attributes and Bambara groundnut a valuable contributor to a balanced diet, thereby alleviating food insecurity thereby contributing to reducing protein malnutrition, which is common in rural communities in Africa (Ouedraogo *et al.*, 2008; Shegro *et al.*, 2013).

The crop is tolerant to drought, and like other legumes, the roots develop nodules which possess the ability to fix atmospheric nitrogen through the activity of symbiotic soil bacteria (*Bradyrhizobium* species), thereby increasing the fertility level of the soil (Linnemann and Azam-Ali, 1993). This attribute may be useful in intercropping systems or sequential cropping especially with cereals.

Despite the aforementioned importance of Bambara groundnut, the crop remains under-utilized for not receiving adequate research attention (Amadou *et al.*, 2001) for genetic improvement in contrast to other legumes including groundnut (*Arachis hypogea* L.), cowpea (*Vigna unguiculata* [L.] Walp.) and mungbean (*Vigna radiata* [L.] Wilczek) (Drabo *et al.*, 1995). Currently, there are no improved and released varieties of the crop with better agronomic traits and seed quality for both small-scale and commercial production (Akpalu *et al.*, 2013) when compared with cowpea and groundnut which are popular in Nigeria like Bambara groundnut. Therefore farmers are compelled to planting unimproved landraces made up of heterogeneous mixtures of various seed morpho-types (Mohammed *et al.*, 2016). It is therefore, a prerequisite for breeders to understand farmers' preferences for the choice of variety that suit their production requirements. This can be effectively achieved through methods or approaches where farmers who are the end users of any developed technologies, are adequately involved. Participatory rural appraisal (PRA) was found useful by both government and non-governmental organizations in developing an understanding of social and infrastructural need and problems (Cornwall *et al.*, 2001).

Few PRA studies conducted to understand the production status, constraints and utilization of Bambara groundnut include those reported by

Berchie *et al.* (2010) and Akpalu *et al.* (2013) in Ghana, while Alhassan and Egbe (2013) conducted a similar PRA in Benue and Kogi States, Nigeria. Bambara groundnut is a locally important grain legume in Kano State, alongside groundnut and cowpea, despite the absence of any improved variety. Therefore, this study was conducted to determine farmers' variety preference of Bambara groundnut through the use of PRA among seven Local Government Areas in Kano State of Northern Nigeria.

#### **Materials and methods**

##### **Study area and sampling procedure**

The PRA study was conducted among seven selected local government areas (LGAs) based on their status to Bambara groundnut production in the state. Kano State is in the Sudan Savannah located at 12°37' N, 9°29' E and 7°43' W with a mean rainfall of 600 to 650 mm per annum. Mean temperature is between 30 to 35°C in the main (rain) season, and drops to 10 to 15°C in coolest dry season, which is between September and March each year. The entire geographic area of Kano falls in Sudan Savannah Zone. Across the entire state, production of legumes is important, including Bambara groundnut.

Kano State comprise of three agricultural zones (i.e. Zone I, II and III) managed by the Kano State Agricultural and Rural Development Authority (KNARDA) with their administrative headquarters located in Rano, Dambatta and Gaya, in that order. In this study, two LGAs each from Zones I and III, and three LGAs from Zone II were purposefully selected based on their importance to Bambara groundnut production in the State. The selected LGAs and their zonal headquarters from which the farmers were interviewed are listed in Table 1. Twenty questionnaires were issued in each LGA to twenty farmers, except for the Gwarzo LGA, where 30 questionnaires were issued to 30 farmers. Pictures of Bambara groundnut seeds morpho-types with respect to seed coat colour and eye pattern were displayed to the farmers to aid perfection of farmers' responses at certain instances. The farmers were also encouraged to provide their own views, to enhance the quality of information in the survey.

**Table 1** List of Local Government Areas (LGAs) and their Zonal Headquarters used for the PRA

Zonal Headquarter	LGAs	Zonal Headquarter	LGAs	Zonal Headquarter	LGAs
Zone I (Rano)	Bebeji	Zone II (Dambatta)	Bambatta,	Zone III (Gaya)	Gabasawa
	and Gwarzo		Dawakin-Tofa		And
			Rimin-Gado		Gaya

**Data analysis**

Cross-tabulation was employed to perform chi-square analyses on discrete data. Analysis of variance (ANOVA) was performed on quantitative data using Agrobase statistical package (Agrobase, 2005) and SPSS (SPSS, 2011). In the ANOVA, treatment means were separated by the least significant differences (LSD) test at the 5% probability level.

**RESULTS AND DISCUSSION**

**Choice of Bambara groundnut variety, based on seed shape and seed size by the Bambara groundnut farmers**

The Bambara groundnut farmers’ preferences on seed shape differed significantly ( $P < 0.05$ ) (Table 2). A majority of the farmers (54%) in the study area preferred oval to round seeds. Round shaped seeds were the choice of Bambara

groundnut landraces among most farmers in Dawakin-Tofa and Rimin-Gado LGAs. Differences of choice based on seed shape may be related to mode of consumption pattern in the localities, since the findings in this study showed that most farmers grow Bambara groundnut both for home consumption and to sell their surplus.

Distribution of Bambara groundnut farmers on seed size preference did not vary in the study area (Table 3). However, large seeded landraces were preferred by most of the farmers in all the seven LGAs studied. This could be related to preferences for home utilization and how large seeds appeal to vendors in the markets. Typically, large, medium and small seed have 100-seed weight measures of  $>120g$ ,  $70$  to  $<100g$  and  $<70g$ , respectively (Ouedraogo *et al.*, 2008; Berchie *et al.*, 2010).

**Table 2** Summary of Chi-square tests on the choice of Bambara groundnut variety based on seed shape by the Bambara groundnut farmers from seven selected LGAs in Kano State, Nigeria

Local Government Areas	Class	Choice of variety by seed shape			df	X <sup>2</sup>	P-value	Number of valid cases
		Round	Oval	No preference				
Bebeji	Actual Count	7	13	0	12	26.637	0.009	20
	Expected Count	8.9	10.8	0.3				
Gwarzo	Actual Count	9	19	2				
	Expected Count	13.4	16.2	0.4				
Dambatta	Actual Count	10	10	0				
	Expected Count	8.9	10.8	0.3				
Dawakin-Tofa	Actual Count	15	5	0				
	Expected Count	8.9	10.8	0.3				
Rimin-Gado	Actual Count	13	7	0				
	Expected Count	8.9	10.8	0.3				
Gabasawa	Actual Count	9	11	0				
	Expected Count	8.9	10.8	0.3				
Gaya	Actual Count	4	16	0				
	Expected Count	8.9	10.8	0.3				

Legend: **df**=degrees of freedom

**Table 3** Summary of Chi-square tests on the choice of Bambara groundnut variety based on seed size by the Bambara groundnut farmers from seven selected LGAs in Kano State, Nigeria

Local Government Areas	Class	Choice of variety by seed size				df	X <sup>2</sup>	P-value	Number of valid cases
		Small	Medium	Large	No preference				
Bebeji	Actual Count	3	6	11	0	18	23.065	0.188	20
	Expected Count	2.1	5.2	11.9	0.8				
Gwarzo	Actual Count	4	6	16	4				
	Expected Count	3.2	7.8	17.8	1.2				
Dambatta	Actual Count	1	7	12	0				
	Expected Count	2.1	5.2	11.9	0.8				
Dawakin-Tofa	Actual Count	4	4	12	0				
	Expected Count	2.1	5.2	11.9	0.8				
Rimin-Gado	Actual Count	2	4	14	0				
	Expected Count	2.1	5.2	11.9	0.8				
Gabasawa	Actual Count	1	9	10	0				
	Expected Count	2.1	5.2	11.9	0.8				
Gaya	Actual Count	1	3	14	2				
	Expected Count	2.1	5.2	11.9	0.8				

Legend: **df**=degrees of freedom

**Choice of Bambara groundnut variety based on seed feature and seed coat colour by the Bambara groundnut farmers**

Selection of Bambara groundnut landraces based on seed features among the respondents differed significantly higher ( $P < 0.001$ ) (Table 4). The result revealed that most farmers preferred pure seed than seed mixtures. Uniform planting material may be more appealing to the eye as obtained with other improved crop species. Bambara groundnut farmers' preference with respect to seed coat colour was highly significant ( $P < 0.001$ ) (Table 5). Large percentage of the farmers (65.3%) in the study area preferred cream coat coloured seed to black eye colour, followed by cream seeds with red eye. Berchie *et al.* (2010) reported that farmers in Ghana preferred seeds that were white and large.

Farmers' preference for seed quality (taste and cooking time) differed significantly ( $P < 0.05$ ) (Table 6). Good taste was preferred than cooking time. It was observed that the Bambara groundnut farmers grow the crop for both home consumption and for sale, and that most farmers consumed fresh pods. It is suggested that these habits may impact farmers' preference for good taste than fast cooking. Abu and Buah (2011) observed in their study that Bambara groundnut farmers dislike seeds that require a longer cooking period.

Generally, specific choices of seed traits by farmers have research implications so that the breeders should breed for varieties that meet the requirements of the farmers.

**Table 4** Summary of Chi-square tests on the choice of the Bambara groundnut variety based on seed feature by the Bambara groundnut farmers from seven selected LGAs in Kano State, Nigeria

Local Government Areas	Class	Choice of variety by seed feature			df	$X^2$	P-value	Number of valid cases
		Pure seed	Seed mixture	No preference				
Bebeji	Actual Count	18	2	0	12	29.079	0.004	20
	Expected Count	16.1	2.9	0.9				
Gwarzo	Actual Count	22	4	4				
	Expected Count	24.2	4.4	1.4				
Dambatta	Actual Count	17	1	2				
	Expected Count	16.1	2.9	0.9				
Dawakin-Tofa	Actual Count	17	3	0				
	Expected Count	16.1	2.9	0.9				
Rimin-Gado	Actual Count	19	1	0				
	Expected Count	16.1	2.9	0.9				
Gabasawa	Actual Count	10	9	1				
	Expected Count	16.1	2.9	0.9				
Gaya	Actual Count	18	2	0				
	Expected Count	16.1	2.9	0.9				

Legend: df=degrees of freedom

**Table 5** Summary of Chi-square tests on the choice of Bambara groundnut variety based on seed coat and eye colour by the Bambara groundnut farmers from seven selected LGAs in Kano State, Nigeria

Local Government Areas	Class	Choice of variety by seed coat and eye colour							df	X <sup>2</sup>	P-value	Number of valid cases
		Cream black eye	Cream red eye	Brown seed coat	Speckle seed coat	Red seed coat	Seed mixture	No preference				
Bebeji	Actual Count	16	1	0	3	0	0	0	36	74.056	0.000	20
	Expected Count	13.1	2	2.9	1.3	0.1	0.4	0.1				
Gwarzo	Actual Count	20	5	5	0	0	0	0				
	Expected Count	19.6	3	4.4	2	0.2	0.6	0.2				
Dambatta	Actual Count	15	3	0	2	0	0	0				
	Expected Count	13.1	2	2.9	1.3	0.1	0.4	0.1				
Dawakin-Tofa	Actual Count	17	0	0	3	0	0	0				
	Expected Count	13.1	2	2.9	1.3	0.1	0.4	0.1				
Rimin-Gado	Actual Count	10	4	5	1	0	0	0				
	Expected Count	13.1	2	2.9	1.3	0.1	0.4	0.1				
Gabasawa	Actual Count	6	1	8	0	1	3	1				
	Expected Count	13.1	2	2.9	1.3	0.1	0.4	0.1				
Gaya	Actual Count	14	1	4	1	0	0	0				
	Expected Count	13.1	2	2.9	1.3	0.1	0.4	0.1				

Legend: df=degrees of freedom

**Table 6** Summary of Chi-square tests on the choice of variety based on seed quality traits by the Bambara groundnut farmers from seven selected LGAs in Kano State, Nigeria

Local Government Areas	Class	Choice of variety by seed quality			Df	X <sup>2</sup>	P-value	Number of valid cases
		Taste	Fast cooking	No preference				
Bebeji	Actual Count	20	0	0	12	31.31	0.002	20
	Expected Count	16.7	2.1	1.2				
Gwarzo	Actual Count	27	0	3				
	Expected Count	25	3.2	1.8				
Dambatta	Actual Count	17	3	0				
	Expected Count	16.7	2.1	1.2				
Dawakin-Tofa	Actual Count	13	7	0				
	Expected Count	16.7	2.1	1.2				
Rimin-Gado	Actual Count	14	3	3				
	Expected Count	16.7	2.1	1.2				
Gabasawa	Actual Count	15	2	3				
	Expected Count	16.7	2.1	1.2				
Gaya	Actual Count	19	1	0				
	Expected Count	16.7	2.1	1.2				

Legend: **df**=degrees of freedom



## Conclusion

The present study is the first baseline survey of its kind conducted among the Bambara groundnut farmers in Kano State, Nigeria. During the survey, only farmers actively growing Bambara groundnut were chosen for the interview. Varietal preference differed significantly among farmers in the study area where most farmers preferred oval and large pure seeds with a cream-

yellow seed coat colour and possessing desirable quality in terms of taste and fast to cook. Preferred varieties of Bambara groundnut have breeding implication improved production and productivity of the crop. This would also improve the livelihood, food security and income status of the growers as well as utilization, marketing and industrialization of Bambara groundnut in Kano State.

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