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Assessing Farmers' Knowledge, Perceptions, Varietal Preferences and Constraints to Groundnut Production, the Pra Approach

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Abstract
Groundnut is cultivated in all tropical and sub-tropical regions of the world due to its adaptability to a varied range of soil and climatic conditions. Information about farmers' knowledge, perceptions, varietal preferences and production constraints in groundnuts are limited. The current study generally sought to exploit groundnut varieties, both landraces and improved to assess farmers' knowledge and perceptions of the main constraints to groundnut production and determine their varietal preferences, based on PRA. A participatory rural appraisal (PRA) aimed at identifying and assessing farmers' knowledge and perception of the main production constraints and their preferred groundnut varieties, ranked drought (4.43), yield potential (3.53) and pests (3.50) and diseases (3.23) as the major and most important production constraints. Majority (41.00%) of the farmers who were aged between 40 and 49, had no form of education (74.67%), and maintained an average farm size of 1-4 acres, out of which groundnut farm size was about 1 to 2 acres preferred 'Chinese', 'Agric-Manipinta' and 'Obolo' groundnut varieties based on the traits; high yield potential (pod and seed size), ease of harvesting, drought-tolerance, earliness and high market value. More males (75.17%) were involved in groundnut production than females and farmers' main sources of information were colleague farmers and the Ministry of Food and Agriculture (MoFA).

Keywords: *Constraints, farmers, groundnut, perceptions, PRA, production, knowledge, varieties.*

INTRODUCTION

Involving farmers in any breeding programme towards the improvement of existing landraces or cultivars, and the selection of new varieties, in what is normally and simply called Participatory Plant Breeding, is very crucial to ensuring greater success and adoption. Information is limited in Ghana generally, and the Northern Regions specifically, on the numerous production constraints as well as the farmers' preferred varieties and their reasons for the preference, pertaining to groundnuts. Therefore, a research study in this area is most timely. Involving farmers in a breeding programme is to guarantee the easy adoption of the breeder's improved products as it

would meet the preferences, needs and expectations of farmers and consumers alike.

Participatory Rural Appraisal (PRA) enables communities to share, develop and analyze their own knowledge of life and conditions (Chambers, 1994 and 1996). PRA that is well done empowers local farmers to conduct their own modes of investigation; communities are able to plan and act on their own outcomes and develop more community based solutions.

Alhassan and Egbe (2013) used PRA technique, focus group discussions as well as simple ranking technique to identify farmers' production constraints in Bambara beans in Nigeria. A participatory varietal selection of okra (*Abelmoschus esculentus*) genotypes for adaptation to the semi-arid agro-ecology of Northern Ghana was undertaken by Sugri *et al*. (2015). Nkongolo *et al*. (2008) conducted a PRA to identify the major characteristics of sorghum landraces in Malawi by using PRA tools such as focus group discussion, matrix ranking and individual interviews. Joshi and Witcombe (1996) used Farmer Participatory varietal selection to identify farmer-acceptable cultivars of rice and chickpea in India. Odendo *et al*. (2001) undertook an assessment of farmers' preferences and constraints to maize production in moist mid-altitude zone of Western Kenya. A similar PRA study was conducted by the same researchers on farmers' criteria for selection of maize varieties and constraints to maize production in moist-mid-altitude zone of Western Kenya (Butere-Mumias, Busia and Homa Bay Districts), Nairobi (Odendo *et al*., 2002). Lastly, Ellis-jones *et al*. (2004) researched into the participatory research and extension approaches used in *Striga* and *Imperata* weed control in Kaduna, Benue, Cross-River, and Kogi States, Nigeria. Similar PRA approaches were adopted in this study to assess production constraints to groundnut in the Northern, Upper East and West Regions of Ghana.

Incorporating the opinion of farmers in the selection criteria of research Scientists is almost always crucial; therefore, the appropriate selection criteria must have a link with that of farmers, in a bid to transferring the appropriate, preferred varieties and technology to farmers; yet, this link is most of the time weak (Efisue *et al*., 2008).

The objectives of this study were to assess farmers' knowledge, perceptions, varietal preferences, reasons for the varietal preferences and the main production constraints to groundnut in the three Northern Regions of Ghana.

This would serve as important background information to improving the crop in future.

METHODOLOGY

i. Study Area, Location and Sampling Procedures for PRA

A total of thirty (30) districts (Figure 1) were chosen, by the simple random sampling procedure, from the three

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Northern Regions of Ghana (Upper West, Upper East and Northern), by employing the PRA procedure. Ten (10) randomly selected, predominant groundnut growing districts were sampled in each case (Tables 3, 4 and 5); interviews and focus group discussions were held which involved about 600 individual key informants in all with 20 from each district/community, and thirty (30) focus group discussions. Interviews were conducted using both close and open-ended questionnaires. Selection of districts/communities was based on the information of quantity of groundnuts produced (MoFA-Statistics, Research and Information Directorate, SRID, 2014) (Figure 1).

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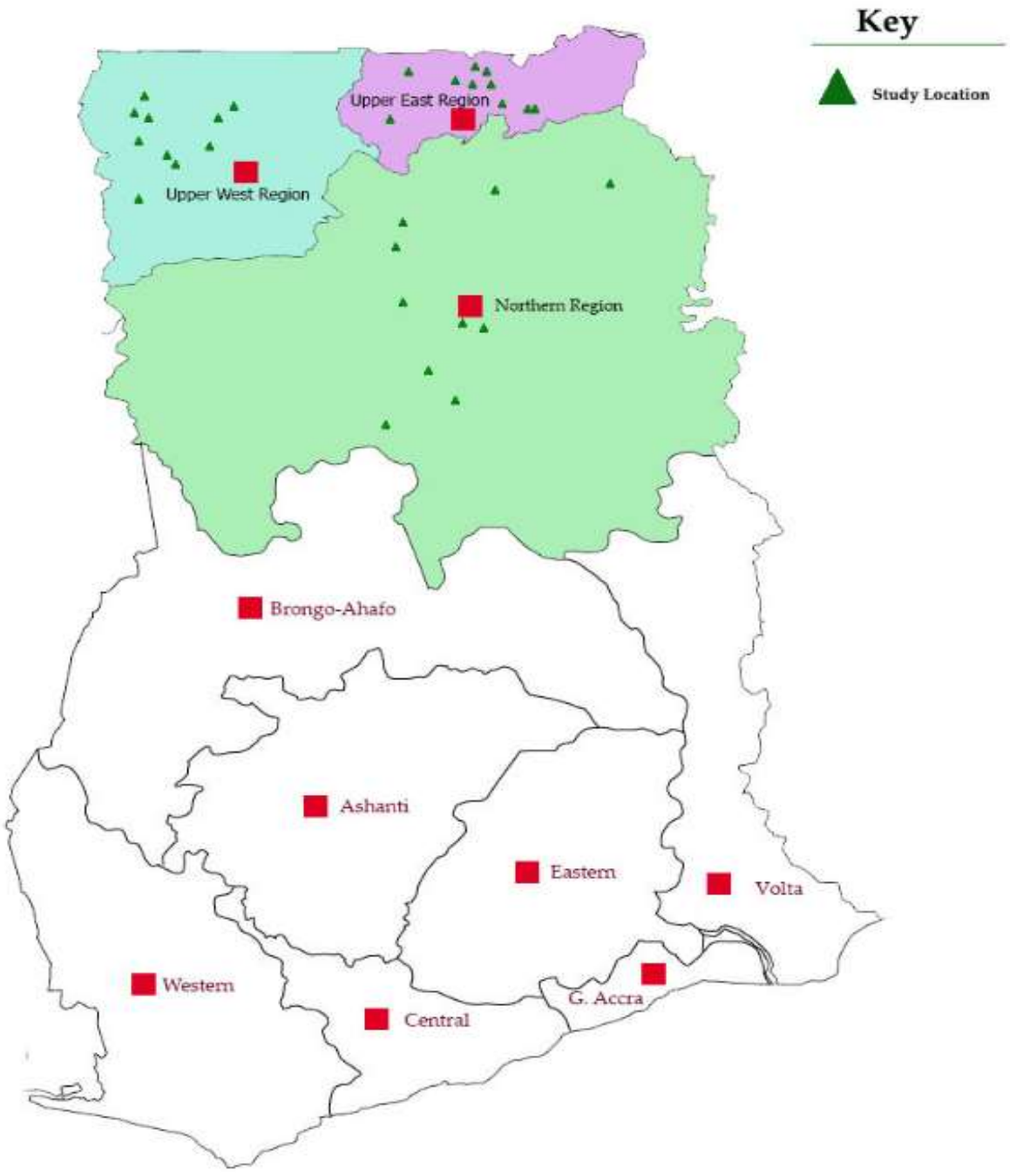

Figures 1: Map of Ghana Showing the Study Locations in the Three Northern Regions

ii. Field Visits to Districts and Communities:

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Group Discussions and Data Collection

Preliminary visits were made to the chosen districts and/or communities by the researcher and staff of the Ministry of Food and Agriculture (MoFA) in the respective selected districts, with the objective to familiarize themselves with the key sites, establish a good relationship with the local people and have a first-hand experience of the study areas. The community heads and the extension officers were tasked to mobilize farmers (both male and female) for focus group discussions; Dates, time and venue were agreed on. Checklists were developed with input from field officers and used to guide discussions with farmers' groups and individual key informants (opinion leaders, farmer-group/based organizations (FBOs), Agricultural Extension Agents and Chiefs from the study areas).

A discussion was initiated between the researcher, farmers and extension officers, to explain the objectives of the research and also outline the role and communication processes of the various actors in the study. The most common and familiar language of communication was employed by farmers, and where necessary, the services of an interpreter was used. Farmers formed discussion groups to ensure focus and consensus building, taking into consideration, gender and age of each group (Plate 1).

Farmers were asked to list in order of importance the main constraints to groundnut production using a scale of 1-5 as indicated below: 1 = Low (not important), 2 = Fair (fairly important), 3 = Average (important), 4 = Above average (very important), 5 = High (most important).

Plate 1: PRA Interaction with some farmers in Northern Ghana

iii. Analysis of Data

Statistical Package for Social Scientists (SPSS version 22.0), STATA software version 12.0 and Microsoft Excel were used to analyze data collected from the questionnaire, and same summarized into percentages and means; while standard errors were used to separate means where necessary. Mode was employed in analyzing and interpreting some of the data. Scoring and ranking techniques were used to assess farmers' production constraints (Odendo *et al.*, 2002). The Kendall's coefficient of concordance was employed to test the level of agreement among the ranked constraints and preferences.

RESULTS

Demography of Respondents

i. Gender of Farmers

According to results of the study in Table 1, more males (75.17%) were involved in groundnut production in the three Northern regions than females (24.00%). However, among the regions, Upper West region recorded the highest (79.50%) in terms of male farmers in groundnut production.

ii. Age of Farmers

From Table 1, most of the groundnut farmers were aged between 40 and 49 years (41.00%). More youths (30-39; 34%, 20-29; 26.50%) engaged in groundnut production in Northern region, than in Upper West and Upper East Regions. Across the three Regions, an appreciable proportion of the aged (50 year and above; 19.17%) engaged in groundnut cultivation.

iii. Educational Level

From the study (Table 1), more than two-thirds (74.67%) of the farmers had no form of education at all. The greatest (77.00%) of this observation was recorded for Upper West Region. Generally, less than ten percent of the farmers had received non-formal education (6.67%), basic education (8.83%) or secondary education (7.50%). Only 2.00% of the farmers interviewed had obtained tertiary education, a figure which runs through in all the three regions.

Table 1: Demographic data

	UER *n* (%)	UWR *n* (%)	NR *n* (%)	Total *n* (%)
Gender				
Male	141 (70.50)	159 (79.50)	151 (75.50)	451 **(75.17)**
Female	59 (29.50)	40 (20.00)	45 (22.50)	144 (24.00)
Missing		1 (0.50)	4 (2.00)	5 (0.83)
Age (years)				
Below 20	3 (1.50)	2 (1.00)	2 (1.00)	7 (1.17)
20 – 29	12 (6.00)	12 (6.00)	53 (26.50)	77 (12.83)
30 – 39	40 (20.00)	42 (21.00)	68 (34.00)	150 (25.00)
40 – 49	78 (39.00)	100 (50.00)	68 (34.00)	246 **(41.00)**
50 +	67 (33.50)	41 (20.50)	7 (3.50)	115 (19.17)
Missing		3 (1.50)	2 (1.00)	5 (0.83)
Level of Education				
Non-formal education	17 (8.50)	8 (4.00)	15 (7.50)	40 (6.67)
Basic Education	15 (7.50)	16 (8.00)	19 (9.50)	50 (8.33)
Secondary education	17 (8.50)	14 (7.00)	14 (7.00)	45 (7.50)
Tertiary	4 (2.00)	4 (2.00)	4 (2.00)	12 (2.00)
No Education	147 (73.50)	154 (77.00)	147 (73.50)	448 **(74.67)**
Missing		4 (2.00)	1 (0.50)	5 (0.83)

UER: Upper East Region, UWR: Upper West Region, NR: Northern Region

Farm size

Total Farm Size under Cultivation.

From the results in Figure 2; Table 2, majority (64.83%) of the groundnut farmers cultivated a total farm size of 1 to 4 acres. Out of this, farmers maintained a groundnut farm size of 1-2 acres (46.00%).

Only a small 3.67% of the farmers cultivated 7 acres or more of groundnut field based on the total acreages of land available to them for farming purposes.

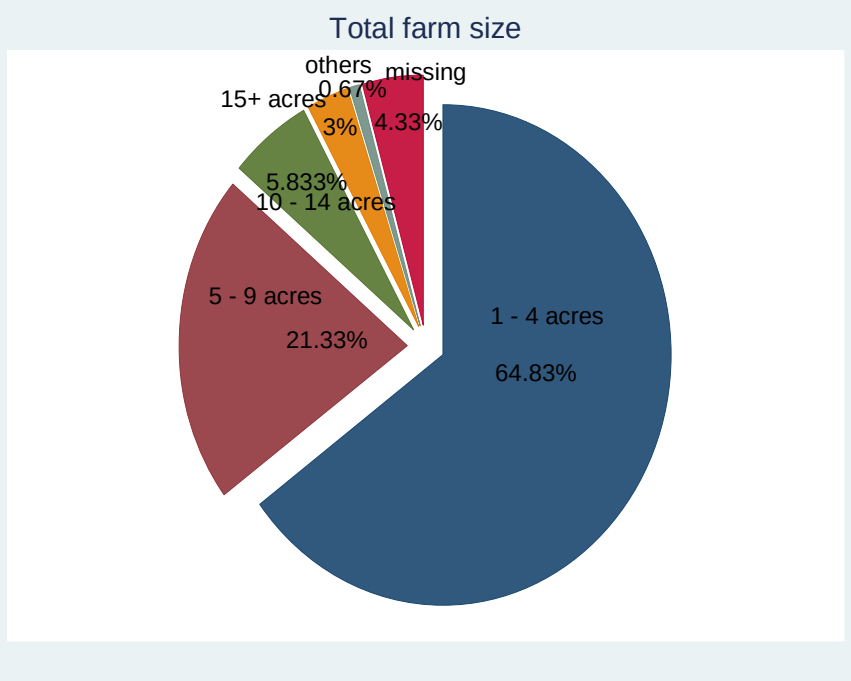

Figure 2: Total Farm Size under Cultivation

Table 2: Size of groundnut farm

Total land used for groundnut cultivation (acres)	Number (Percentage of farmers)
None	2 (0.33)
1 – 2	276 (46.00)
3 – 4	192 (32.00)
5 – 6	72 (12.00)
> 7	22 (3.67)
Missing	36 (6.00)

Farmers' Varietal Preferences

Figure 3 represents the percentage of farmers based on their preference for different varieties of groundnut per each region. Each bar represents the total number of responses (proportion out of a 100%) of farmers' preference for their varieties of choice. Across the three regions, China (Chinese) variety was the most popularly cultivated by farmers. This was followed by Agric-Manipinta and Obolo varieties, among others. Obooshie and Yenyawoso varieties were not found to be cultivated in the Northern region.

In Upper East Region, for instance, out of all the available varieties, 99.5 out 100% of the farmers preferred Chinese variety whereas 74 out of 100% liked Agric-Manipinta. Similarly, in the Northern Region, 76.5 out of 100% of the farmers preferred Chinese variety, while 20% out of 100% preferred Agric-Manipinta. Obolo was preferred by only 22 out of 100% of the farmers. In Upper West Region, 96.5 out of 1005 of the farmers preferred Chinese variety, while a small 0.5 and 4.5 out of a hundred percent liked Agric-Manipinta and Obolo varieties respectively.

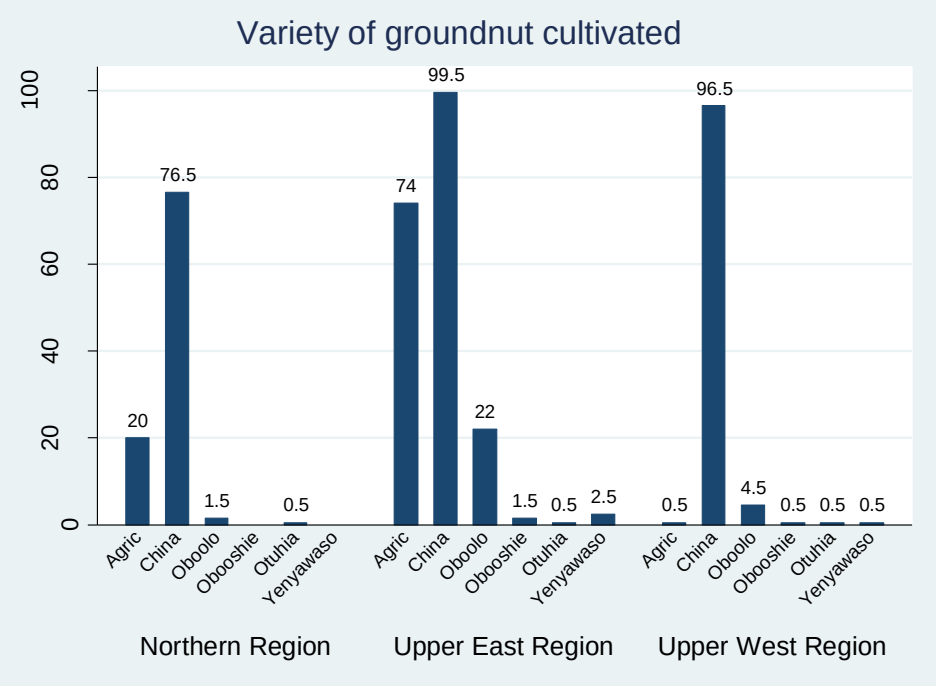

Figure 3: Variety of Groundnuts Preferred by Farmers

Reasons for Varietal Preference

In Figure 4, each bar represents the total number of responses (proportion out of a 100%) of the respondents who assigned reason(s) for their choice or preference for a particular variety (ies).

Majority of the farmers interviewed attributed 'high yield potential' (73.33%), 'ease of harvesting' (46.5%), drought tolerance (32.67%), high market value (23.33%), disease tolerance and high oil content (18.83%), among others, as the main reasons for choosing a particular type of groundnut variety (Figure 4).

A section (8.33%) of the farmers across the regions preferred varieties with bigger pods or seeds (e.g. Obolo, Oboshie, Agric-Manipinta) or smaller pods or seeds (e.g. Chinese, Sinkara, Ndogba) depending on the type of market available, demand, end-use (processed into groundnut paste, oil and snacks) and cost of such varieties (Figure 5). Farmers revealed in the PRA that the rainy seasons were becoming shorter from year to year; therefore they needed groundnut varieties that could mature early and escape the drought before they set in. According to farmers, shortage of food (groundnut) occurred almost every year from the middle of the season or onset of the dry season. Farmers who planted drought tolerant varieties could realize some harvest, thus, allowing them to stay on their farms and carry out remaining farm operations.

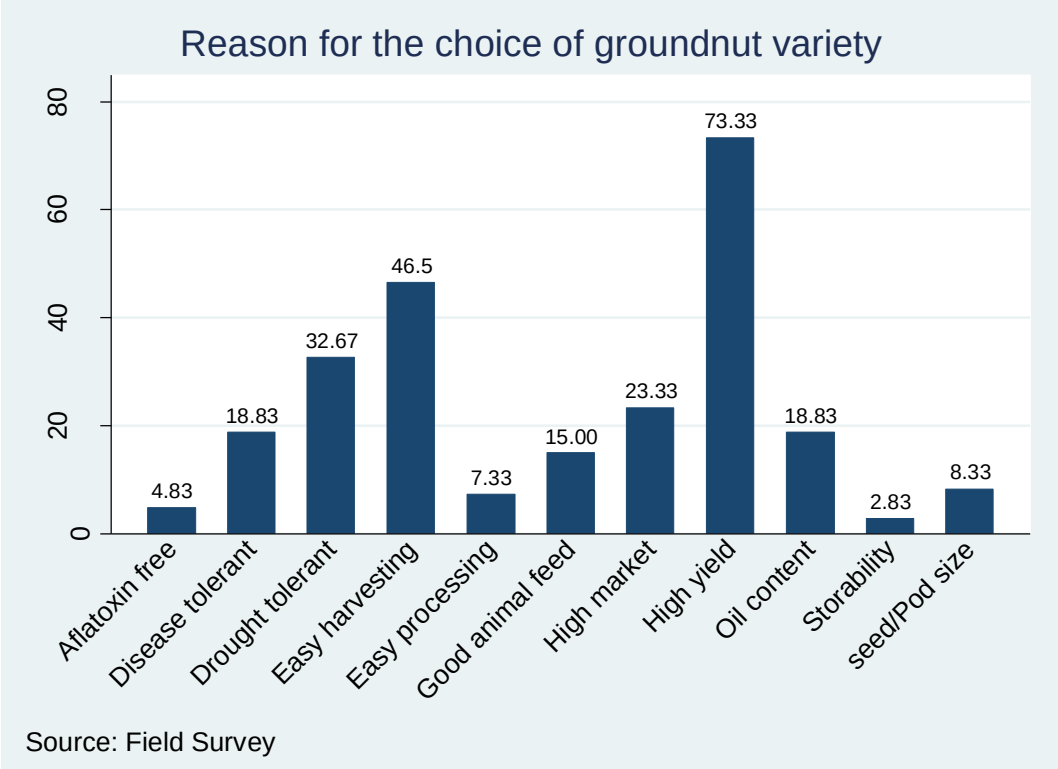

Figure 4: Reasons for Preference of Groundnut Varieties by Farmers

Preference of Groundnut Variety based on Market Value

The choice of groundnut variety based on market value was topical during the PRA interaction with farmers. Respondents in the regions therefore attributed several reasons to their preference.

The study revealed that, 81.5% of the farmers interviewed preferred 'China' (Chinese) groundnut variety followed by 'Agric-Manipinta' (11.67%) and 'Oboolo' variety (0.17%).

Different groundnut variety(ies) attract different market value based on the pod or seed size; bigger pods or seeds (e.g. Obolo, Oboshie, Agric-Manipinta) or smaller pods or seeds (e.g. Chinese, Sinkara, Ndogba), end-use (such as groundnut oil, paste and snacks when processed). This would determine the demand and market price. At the onset of the dry season (drought), the price of foodstuffs, particularly groundnut, is high on local markets; farmers therefore enjoy good prices from preferred groundnut varieties (Figure 5).

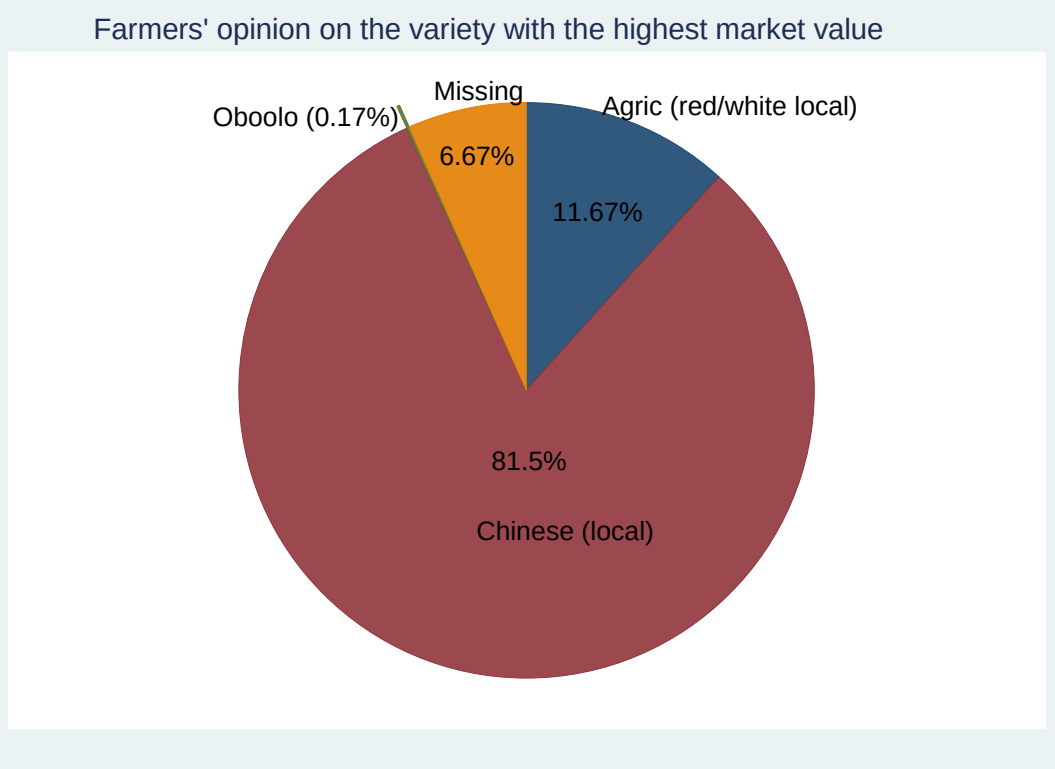

Figure 5: Farmers' varietal preference based on market value

Sources of information to farmers

among the departments or agencies that relayed information to groundnut farmers, colleague farmers were the majority (39.33%), followed by the ministry of food and agriculture (MOFA- through its extension services division) (31.33%), NGOs (13.83%) and retailers (11.33%) respectively. a little above 1 percent (1.17%) of the

farmers received meteorological information (figure 6).

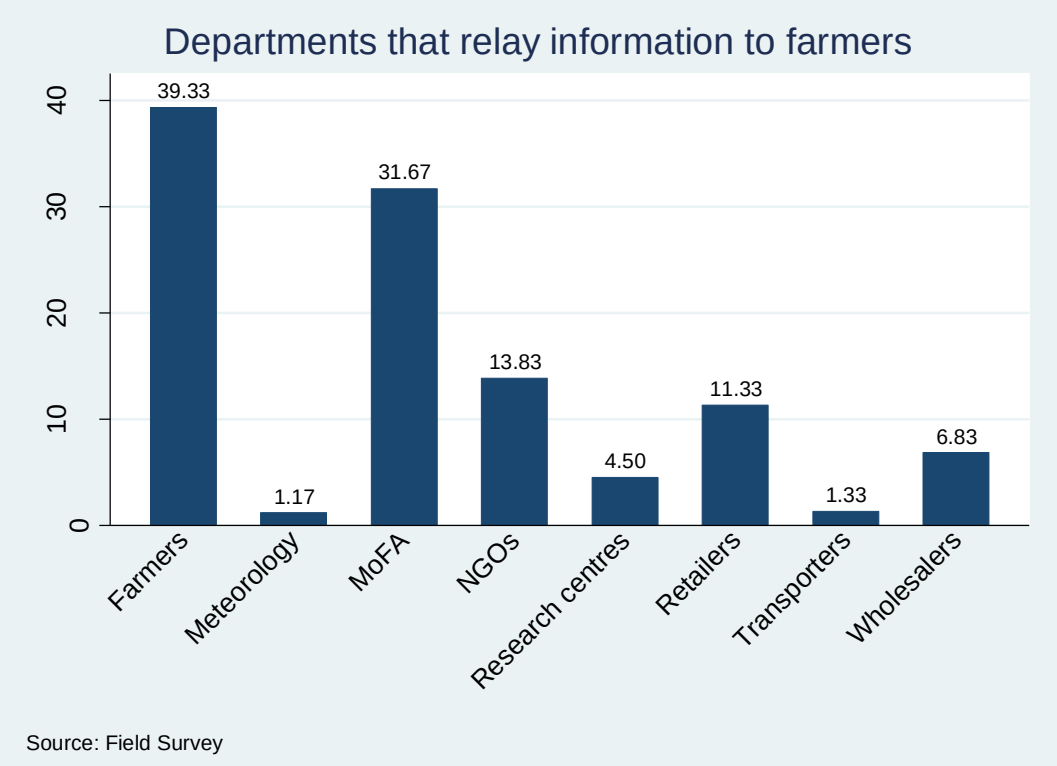

Figure 6: Department(s) Serving as Sources of Information to Farmers

Constraints to Groundnut Production in Northern Ghana

Tables 3, 4, and 5 describe the results of the constraints to groundnut production in each of the Upper East, Northern and Upper West Regions of Ghana respectively. Groundnut farmers in the Upper East Region mentioned *drought* as the most important constraint to their groundnut production with average rank sum score of 4.9; *Processing* recorded the lowest or least important rank with a score of 1.2 (Table 3). Farmers in the Northern Region ranked *pest* as the greatest constraint with an average rank score of 4.7, whereas *Labour* recorded the lowest rank of 1.2, meaning labour was least important to them (Table 4). In the Upper West Region, *Processing* was given the highest consideration by farmers with regard to the constraints to groundnut production with average rank scores of 4.5, while *disease and Aflatoxin* (mouldiness) were ranked lowest (least important) with a rank score of 1.1 in each case (Table 5).

According to the overall ranking of the groundnut production constraitns, *drought* was ranked the overall highest (most important) constraint to groundnut production in Northern Ghana with a total rank sum score of 4.43 (Table 6). *Yield potential* was considered second important followed by *Pests* and *diseases* with total rank

sum scores of 3.53, 3.50 and 3.23 respectively. *Marketing* (1.7) and '*Aflatoxin'* (Mouldiness) (1.7) were considered least important constraints among the list of constraints to the production of groundnuts in the Northern Regions of Ghana.

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Constraints to Groundnut Production in Each of the Three Northern Regions of Ghana

Table 3: Constraints to groundnut production in the Upper East Region of Ghana

Community	Adabinsa	Tiedema	Yepala	Tongo Beo II	Tongo beo I	Yikene	Sumbrungu Kolgo	Vea Gunga	Zorko Tarongo	Wiaga Yemonsa	Average rank
Disease	4	4	4	4	4	5	5	4	4	3	4.1
Pest	5	3	5	4	5	5	3	4	5	4	4.3
Drought	**5**	**5**	**5**	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**4.9**
Yield Pot'ial	3	4	3	3	3	3	3	3	3	4	3.2
Marketing	1	1	2	2	2	2	2	1	2	3	1.8
Processing	1	1	1	1	1	1	1	1	3	1	1.2
Storage	4	3	4	3	4	3	3	3	3	3	3.3
Labour	3	3	3	4	3	3	3	2	2	4	3.0
Aflatoxin (Mouldiness)	3	2	2	4	3	3	3	2	2	3	2.7

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Table 4: Constraints to groundnut production in the Northern Region of Ghana

Community	Kpandu	Jangyili	Bonyangshei	Kukuo	Dakpemyili	Yapei zogu	Nyengbalo	Kpalisogu	Sagnarigu	Diare	Average rank
Disease	5	5	5	4	5	4	4	4	4	5	4.5
Pest	**5**	**5**	**5**	**4**	**5**	**5**	**5**	**4**	**4**	**5**	**4.7**
Drought	4	5	4	4	5	4	5	4	4	5	4.4
Yield Potential	5	5	5	4	5	5	4	4	2	2	4.1
Marketing	1	1	1	1	1	1	5	1	1	1	1.4
Processing	2	2	3	2	3	2	1	3	3	2	2.3
Storage	3	3	4	3	4	4	2	3	4	4	3.4
Labour	1	1	1	2	1	1	1	2	1	1	1.2
Aflatoxin (Mouldiness)	1	1	1	2	1	1	2	1	2	1	1.3

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Table 5: Constraints to groundnut production in the Upper West Region of Ghana

Community	Saabalon	Kandayiiri	Moryiiri	Fian	Takpo	Sankana	Dapuori	Baazu	Saabolo I	Dapopare	Average rank
Disease	1	1	1	1	1	1	1	2	1	1	1.1
Pest	1	1	1	1	1	1	2	5	1	1	1.5
Drought	5	3	2	3	4	3	5	5	5	5	**4.0**
Yield Potential	4	3	3	3	3	2	4	4	4	3	3.3
Marketing	1	2	2	2	2	2	1	1	5	1	1.9
Processing	**5**	**5**	**5**	**5**	**5**	**4**	**5**	**5**	**1**	**5**	**4.5**
Storage	2	1	2	1	2	1	1	4	3	2	1.9
Labour	1	2	2	1	1	1	1	3	1	1	1.4
Aflatoxin (Mouldiness)	1	1	1	1	1	2	1	1	1	1	1.1

Overall Rank Sum of Constraints to Groundnut Production in all three Northern Regions of Ghana

Table 6: Mean ranking of groundnut constraints in all three Northern Regions of Ghana

Constraint	REGION			Overall Rank Sum
	Upper East	Northern	Upper West	
Disease	4.10	4.50	1.10	**3.23**
Pest	4.30	4.70	1.50	**3.50**
Drought	**4.90**	**4.40**	**4.00**	**4.43**
Yield Potential	3.20	4.10	3.30	**3.53**
Marketing	1.80	1.40	1.90	1.70
Processing	1.20	2.30	4.50	2.67
Storage	3.30	3.40	1.90	2.87
Labour	3.00	1.20	1.40	1.87
Aflatoxin (Mouldiness)	2.70	1.30	1.10	1.70
Mean	***3.17***	***3.03***	***2.30***	***2.83***
Standard error	***0.39***	***0.49***	***0.43***	***0.89***

The Kendall's Coefficient of Concordance to Test the Level of Agreement among the Ranked Constraints and Preferences of Groundnut Farmers in the Three Northern Regions of Ghana

According to the Kendall's Coefficient of Concordance run to test the level of agreement between the ranked constraints and preferences of farmers (Table 7), a significant but positive correlation was recorded between disease and pests (r = 0.6912), and storage method (r = 0.5469), but a negative but significant correlation was observed between same and processing (r = -0.4288). Positive but significant relationship was found between pest and drought (r = 0.3675), storage (r = 0.6762), but negative and significant with processing (r = -0.3629). The correlation revealed again a negative but significant association between drought and processing (r = -0.4226), and between yield and *Aflatoxin* contamination (r = -0.3389). Processing recorded negative but significant correlation with storage (r = -0.3422), labour (r = -0.4232) and *Aflatoxin* contamination (r = -0.6265). Labour correlated positively and significantly with *Aflatoxin* contamination (r = 0.6564) (Table 7). This positive and significant association between labour and Aflatoxin contamination (mouldiness) implies that *Aflatoxin* contamination or infection may be managed with availability of (trained) labour or manpower.

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Table 7: Coefficient of Concordance for all three Northern Regions of Ghana

	Disease	Pest	Drought	Yield	Marketing	Processing	Storage	Labour	*Aflatoxin*
Disease	-								
Pest	0.6912*	-							
Drought	0.1715	0.3675*	-						
Yield pot'al	0.2065	0.2577	0.1079	-					
Marketing	-0.2568	-0.2037	-0.0706	-0.2514	-				
Processing	-0.4288*	-0.3629*	-0.4226*	-0.0094	-0.2114	-			
Storage	0.5469*	0.6762*	0.2730	0.1376	-0.2966	-0.3422*	-		
Labour	0.1058	0.1486	0.2139	-0.1731	0.2432	-0.4232*	0.2198	-	
Aflatoxin	0.2313	0.1902	0.2465	-0.3389*	0.3285	-0.6265*	0.1721	0.6564*	-

(*): The traits are correlated (significant) at the 5% (P ≤ 0.05) level of significance

DISCUSSION

More than two-thirds (74.67%) of the farmers interviewed had no form of formal education. The low level of formal education among respondents corroborated with findings of Atuahene-Amankwa *et al*. (1990); MoFA-Statistics, Research and Information Directorate, SRID (2014) where high illiteracy rate among adults and the youth in rural areas was reported. Though governments and other Non-Governmental Organisations have come up with several policy interventions such as mass education to reduce the rate, the change has not been significant. Moreover, young men, particularly those with appreciable level of formal education do not have any interest in agriculture and have therefore migrated from the rural to urban areas in search for non-existent jobs.

The low level of formal education has made it increasingly difficult for farmers to make informed choices and decisions regarding assessment of drought.

Majority (41.00%) of the groundnut farmers were aged between 40 and 49 years. Generally, more youths (40-49; 41%), (30-39; 34%) and (20-29; 26.50%) were engaged in the production of groundnuts in the Northern Region than the Upper East and Upper West Regions. This might be linked with the campaign by government and her agencies, such as the Ministry of Food and Agriculture (MoFA)-Extension Directorate of Agriculture, research adoption programmes by research institutions such as CSIR-Crops Research Institute and CSIR-Savanna Agriculture Research Institute (SARI), various universities and Agricultural colleges,

Non-Governmental Organisation (NGOs), among others, encouraging youths to embrace farming in addition to the relatively improved rural infrastructure which is attracting youths to the local communities and villages. The opportunity for ready market of the groundnut produce could also be a contributory factor. Youths, who exude much exuberance and strength, if given the necessary support could go into large scale production of the crop given the labour intensive nature of its production (Akpalu *et al.*, 2014).

The study revealed that more males (75.17%) were involved in groundnut production in the three Northern Regions of Ghana than females. This corroborated the research work of Alhassan and Egbe (2013) in an investigation based on a Participatory Rural Appraisal of Bambara groundnut (*Vigna subterranea* (L.) Verdc.) production in Southern Guinea Savanna of Nigeria. Contrary to results found in the current study, Varshney *et al.* (2006) posited that groundnut is a popular commodity that is widely traded in local, regional and international markets, and can also be an important source of income, especially for women farmers, who are the main cultivators.

Majority (64.83%) of the farmers cultivated a total farm size of 1 to 4 acres, out of which farmers maintained average groundnut farm size of 1-2 acres (46.00%).

The type of land tenure and ownership system in the Northern parts of Ghana where land basically belongs to males (women do not own farm lands) and therefore may have to negotiate for a proportion of available land for agricultural use may also contribute to more men venturing into cultivation of the crop than women. This does not allow for commercial production of the

crop, hence farmers mostly cultivated groundnuts on subsistence basis.

'China' (Chinese), Agric-Manipinta, and Obolo groundnut varieties were most popularly planted by majority (76.5%) of the farmers and they attributed 'high yield potential' (73.33%), 'ease of harvesting' (46.5%), drought tolerance (32.67%), high market value (23.33%), disease tolerance and high oil content (18.83%), as some of the main reasons for the choice of those varieties. Before the deliberate introduction of crop research in the sub-Saharan African countries, farmers used to choose varieties through mass selection. In the selection of these cultivars (landraces), farmers use their own criteria that may not conform to those of formal plant breeders. Farmers usually select varieties that are adapted to their agro-ecological environments and to their socio-cultural needs as well as economic conditions. Chinese variety, for instance, was mentioned as an early-maturing variety (2 to 3 months, 65.67%). Others such as Agric-Manipinta, Obolo, Oboshie and Otuhia took an average of 4 to 5 months to mature. Chinese, Agric-Manipinta and Obolo from the study were highly accepted for their market value and ease of processing into groundnut paste and oil which also have high market value. Different prices were quoted because different market places had different prices for the produce. It was further observed that not all the landraces were sold at a higher price; the market women were interested in the Chinese, Agric-Manipinta and Obolo varieties because of their high demand and relatively higher prices at sales. Farmers indicated that these groundnut varieties have multiple uses across the country, such as use as groundnut butter

or paste, soup preparation, groundnut oil, groundnut cake, snacks and animal fodder. This might also be the reason why majority of the farmers in the community preferred to grow these varieties, hence their popularity in the Northern regions of Ghana (Akpalu *et al.*, 2013 and 2014). A section (8.33%) of the farmers across the regions preferred bigger pods or seeds (e.g. Obolo, Oboshie, Agric-Manipinta) or smaller pods or seeds (e.g. Chinese, Sinkara, Ndogba) depending on the type of market available, demand, end-use and cost of such varieties (Figure 5). Farmers revealed in the PRA that the rainy seasons were becoming shorter from year to year; therefore they needed groundnut varieties that could mature early (Chinese) and escape the drought before they set in. According to farmers, shortage of food (groundnut) occurred almost every year from the middle of the season or onset of the dry season. Farmers who planted drought tolerant varieties could realize some harvest, thus, allowing them to stay on their farms and carry out remaining farm operations through the proceeds from the sale of those harvests.

Result from the PRA revealed two very significant farmer-preferred traits of groundnut varieties; high yield potential and drought tolerance. Similar results were obtained by Orawu (2007) in Uganda, Ansah *et al.* (2014) in Ghana and Salifou *et al*. (2015) in Niger. Farmers indicated that, in order to avoid yield loss caused by end-of-season drought as a result of the rainy season becoming shorter due to the influence of climate change, they prefer drought-tolerant or early-maturing groundnut varieties. Rain distribution within the season, especially in the Northern regions is most often unpredictable; early maturity should therefore be complemented by tolerance to drought

tolerance in order to obtain good yield. Nautiyal *et al*. (2002) reported a strong association between seedling and end-of-season drought tolerance in groundnut, information that essential to breeders for the development of drought tolerant cultivars of groundnut.

The results of the study again give an indication that farmers in these communities were not adopting the new varieties of groundnut released by CSIR-Crops Research Institute, Savanna Agricultural Research Institute and MoFA. Moreover, it appears that most improved groundnut varieties were yet to be accepted and/or adopted by farmers (Dugje *et al*., 2009). From the study, farmers' main source of information was through colleague farmers and the extension services division of the Ministry of Food and Agriculture (MoFA). These results confirm those of CGIAR Research Program on Grain Legumes, (2012) which concluded that, 'depending on the country, farmer-to-farmer exchange and government extension are two major sources of information on agricultural technologies for farmers. This assertion partly accounts for the low adoption or acceptance of new improved varieties by farmers in Ghana and Africa at large. The grain-legume baseline research by CGIAR (2012) concluded that the 'use of improved, modern varieties was generally low across target countries. Unavailability of improved seeds and, in some cases, lack of access to credit had been identified as major bottlenecks for improved variety adoption (CGIAR, 2012). A little above one percent of farmers received meteorological information. This made it difficult for farmers to predict the weather and its variables, hence its potential adverse effect on their crop production.

Agriculture of these communities and the country as a whole must target large scale production of most staple crops in order to be able to feed the ever increasing population. Groundnut is one of the most important protein sources in the community since animal protein is expensive and not easily affordable by the rural people (Achieng *et al*., 1999).

Drought was ranked the overall highest and most important constraint to groundnut production in the three Northern regions of Ghana with a total rank sum score of 4.43. *Yield*, *Pests* and *diseases* were considered next most important with total rank sum scores of 3.53, 3.50 and 3.23 respectively.

A similar study in Bambara groundnut production in the Upper East Region by Akpalu *et al*. (2013) revealed that the most important constraints to Bambara groundnut production in the community were low yields, pests and diseases and lack of improved varieties. Pandey *et al.* (2012) observed that, cultivated peanut is mainly grown in the semi-arid tropics region by resource-poor farmers. The major biotic stress factors include early leaf spot (*Cercospora arachidicola*), late leaf spot (*Phaeoisariopsis personata*), rust (*Puccinia arachidis*), mottle virus (*Peanut mottle virus*), rosette virus (*Groundnut rosette virus*), aphids (*Aphis craccivora*), jassids (*Amrasca devastans*) and thrips (*Frankliniella* sp.) This result is also reiterated by CGIAR (2012).

Varshney *et al*. (2006), reported that *drought* is the major abiotic stress as over 70% of the crop is grown in the semi-arid tropics, which is characterized by low and erratic rainfall. Soil moisture during pod filling stages affects the aflatoxin

accumulation in seeds (Varshney *et al.*, 2006). According to a comprehensive grain legume research carried out by CGIAR, (CGIAR, 2012), key constraints to production over the decades included diseases, insect pests, drought, high and low temperatures, edaphic problems, salinity and aluminum toxicity, nitrogen fixation and weeds (CGIAR, 2012). Drought is a critically important constraint to crop production in all crops, because it can occur at any stage of crop development. In groundnut, end-of-season droughts not only reduce yield, but predispose the crop to infection by *Aspergillus flavus* and aflatoxin contamination (Abate *et al.*, 2012). Short-duration cultivars have been developed in legumes to overcome end-of-season drought (Abate *et al*., 2012).

The Kendal's test indicated a positive and significant level of relationship among the ranked constraints and preferences of farmers. This gives an indication that there exists a substantially reasonable association and a reason to believe the real existence and effects of farmers' most important constraints and preferences as ranked, hence the urgent need to consciously address them (Table 7).

The current study identified the major and most important constraints limiting the production of groundnut as drought, pests/diseases and poor yield potential. Therefore breeding interventions should aim at drought-tolerant, disease/pest-resistance and higher yield. The need for farmers to go into large-scale commercial production of groundnut is paramount. Hence, the land-tenure system should be reviewed to favour commercial production. District Assemblies should release agricultural lands to farmers for commercial

production. The most important farmer-preferred groundnut varieties such as 'China' (Chinese), 'Agric-Manipinta', 'Sinkara' and 'Obolo', among others, should form key part of any breeding programme. MoFA, Research Institutes, NGOs should intensify their adoption efforts by farmers regarding improved groundnut varieties.

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