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Participatory Rural Appraisal of Constraints to Groundnut (*Arachis hypogaea* L.) Production in Northern Ghana

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A B S T R A C T

Participatory Rural Appraisal (P.R.A.) study of groundnut (*Arachis hypogaea* L.) production was conducted in a total of thirty (30) districts/communities sampled from the three Northern Regions of Ghana; Upper East, Upper West and Northern, involving ten (10) randomly selected, predominant groundnut growing districts in each case. Thirty (30) focal group discussions as well as 600 individual key informants (20 from each district/community), were interviewed using both open and close-ended questionnaires. The simple scoring and ranking technique was used to rank farmers' constraints to groundnut production.The overall goalof the project was to assess the main constraints to the production of groundnuts in Northern Ghana. Data obtained from the questionnaire was analyzed using Statistical Package for the Social Scientists (SPSS version 17.0) and Microsoft Excel, and summarized into percentages and means, while simple scoring and ranking techniques were used to assess farmers' production constraints. Standard errors were used to separate means where necessary.Results obtained from the study indicated that more males (451; 75.17%) were involved in groundnut production in the three Northern Regions. Majority (531; 88.50%) of the farmers was married with household size 5–9 (281; 46.83%) and did not have any formal education (448; 74.67%). Majority of the groundnut farmers have been in the farming business for 10 years and more (408; 68.00%), Inherited their farm lands (430; 71.67%), did not belong to any FBOs (498; 83.00%). Farmers waited for three rainfall events before land preparation (270; 45%) and planting on generally a sandy soil (345; 57.5%), that is about 1/3rd ploughing depth (390; 65.00%). Drought was the major weather condition that affected groundnut production (66.83%). Majority of the farmers used hoe as farm equipment (582; 97%). Land preparation began in April (585; 97.5%) and Period of Planting was June/July (347; 57.83). Average land cultivated by farmers was 1–2 acres (276; 46%) 'China' local groundnut variety was the most cultivated (76.5%, 99.5%, 96.5%) in all three regions (N/R, U/E and U/W respectively). Reason for choice of variety was high yielding (73.33%) and ease of harvesting and early maturing (46.5%). Average maturity of groundnut was 'China'; (2-3 months, 394; 65.67%), Late variety ('Agric'; 4-5 months). Majority had total farm size of 1–4 acres (64.83%) and weeding was done manually [559; 93.17% and majority (77.17%) did not apply fertilizer on their farms]. Most common disease reported on farmers' groundnut farms was Early Leaf Spot (Caused by *Cercospora arachidicola*) 240; 40.00%. Yield of groundnut was 2–3 bags/acre for Shelled (218; 36.33%) and 4–5bags/acre for Unshelled (252; 42.00%). Relay of information was mostly by colleague farmers (39.33%) and MoFA (31.33%), NGOs (13.83%). Constraints to the production of groundnuts were ranked by farmers as drought (4.43), yield (3.53), pests (3.50) and diseases (3.23). Scientific investigation into the suitability of some of the popular landraces of groundnut in Northern Ghana for higher yield might be necessary to ensure food security in the regions.

Introduction

Low agricultural productivity, malnutrition and poverty affect the majority of rural households in the Northern Regions of Ghana (MOFA, 1997, MOFA, 2014). Poor soil fertility, unavailability of quality, certified seeds, and unreliable rainfall are major factors limiting crop productivity (Abate *et al.*, 2011). Consequently, most households do not produce enough food to feed themselves for more than nine months of the year. Food shortfalls play a major role in malnutrition but a lack of protein, oil and vitamins in a largely cereal-based diet is also of major importance. More than half of the populations in the regions live below the poverty line. Thus, the purchase of additional food to supplement the family diet, or of external inputs to improve crop productivity, is not possible for the average household (MOFA, 1997, MOFA, 2014).

The Northern Regions (Northern, Upper East and West) of Ghana, considered as one of the breadbasket regions of the country, has over 40% of the agricultural land. However, these areas are plagued with high levels of food insecurity and poverty. This is a major concern to the government and its development partners. The main reason for the extreme poverty and high food insecurity is that the bulk of the population is small-scale resource-poor farmers who rely mainly on rainfed agriculture to improve their livelihoods under low farm input conditions (MOFA, 1997, MOFA, 2014). The soils of these areas are degraded and infertile (Tsigbey *et al*., 2001). An important step to addressing this problem is the need to increase the wide-scale use of improved seeds and its availability to farmers for adoption.

Numerous agricultural policy documents have been published and many relevant agricultural production and improved, certified planting materials as well as management technologies have been developed in Ghana but they are not achieving their full potential impact because of low levels of adoption and limited dissemination (MOFA, 1997).

Groundnuts (peanuts) fix atmospheric nitrogen and thrive under low nitrogen conditions. It also improves soil fertility for the subsequent crop.

Increased groundnut consumption will help families reduce problems of malnutrition, since they are nutritious [high protein (12–36%), high oil content (36-54%)], thrive under low rainfall and can be grown with low capital investment (Chenault *et al.*, 2008). Being a popular commodity that is widely traded in local, regional and international markets, groundnuts can also be an important source of income, especially for women farmers, who are the main cultivators (Varshney *et al*., 2006).

Participatory Rural Appraisal (P.R.A.) is a research approach that evolved from Rapid Rural Appraisal and it can be explained as a set of informal techniques used by development practitioners in rural areas to collect and analyze data (Chambers, 1994a,b; 1996). In PRA, data collection and analysis are undertaken by local people, with outsiders (researchers) facilitating rather than controlling the process.PRA is therefore aimed at enabling local communities to conduct their own analysis and to plan and take action (Abedi and Vahidi, 2011), so that, research would develop technologies that farmers could play a key role in the diffusion of such research findings (Ellis-Jones *et al*., 2004) resulting in more productive, stable, equitable and sustainable agricultural systems (Odendo *et al*., 2002).

In the light of the above, it became necessary to obtain information on the various challenges pertaining to the general crop production and management of groundnuts in the three Northern Regions of Ghana, which are the major producers.

Materials and Methods

Location and study area for PRA; sampling procedures

Participatory rural appraisal study was conducted in a total of thirty (30) districts/communities sampled from the three Northern regions of Ghana; Upper East, Northern, Upper West, involving ten (10) randomly selected, predominant groundnut growing districts in each case (Table 20, 21 and 22). It involved thirty focal group discussions as well as 600 individual key informants (20 from each district/community), who were interviewed using both open and close-ended questionnaires.

These districts were selected based on the information that they produced groundnut in large quantities than other areas (MOFA, Statistics, Research and Information Directorate, SRID, 2014). The simple scoring and ranking technique was used to rank farmers' constraints to the production of the groundnuts.

Field visits and group discussions

The researcher and staff of the Ministry of Food and Agriculture (MOFA) in the respective selected districts visited the chosen communities. The visits were aimed at familiarizing the researcher with the key sites, establish a good rapport with the local people and have a feeling of the study areas. After some discussions, the community heads and the extension workers were asked to mobilize farmers, both males and females for focus group discussions on agreed dates, time and venues. Checklists were developed 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).

The objectives of the study and contributions of various actors were explained and communication procedures established to ensure that farmers, extension staff and the researcher discussed the same issues. Farmers were encouraged to use a language they were most familiar with and where there could be a language barrier, an interpreter was engaged. For ease of focusing the discussions and reaching a consensus, the farmers were asked to form discussion groups depending on the farmers present at the centres. Sex and age were important criteria the farmers used in categorizing themselves into discussion groups. 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)

Data analysis

Data obtained from the questionnaire was analyzed using Statistical Package for the Social Scientists (SPSS version 17.0) and Microsoft Excel, and summarized into percentages and means, while simple scoring and ranking techniques were used to assess farmers' production constraints (Odendo *et al.,* 2002). Standard errors were used to separate means where necessary.

Results and Discussion

General crop management

Land acquisition and crop management

Number of years in business

From the results of the current study (Table 2), more than half, 408 (68.00%) of the farmers had been in the farming business for more than ten years (10 years +); the situation was highest for Upper West region, 178 (89.00%), followed closely by Upper East region with 151 (75.50%).

Mode of land acquisition

Majority of the farmers who were interviewed, 430 (71.67%) acquired their farm lands through inheritance whereas a small 5 (0.83%) purchased their lands. Among the regions, Upper West recorded the highest, 190 (95.00%) for inherited farm land followed closely by Northern region with 142 (71.00%) for the same parameter (Table 2).

3 member of FBO or not?

More than two-thirds, 498 (83.00%) of the farmers interviewed did not belong to any Farmer Based Organisation(s) (FBO). Only 84 (14.00%) said they belonged to FBOs. Among the regions, Upper West recorded the highest, 181 (90.50%), followed by Northern region 142 (71.00%), with figures over two-thirds in both situations.

Number of rainfall events before land preparation

Less than half of the groundnut farmers interviewed, 270 (45.00%) waited for three rainfall events before commencing preparation of their farm lands for groundnut cultivation. This was followed by 135 (22.50%) with only two rainfall events. Among the three regions, the highest figure of 118 (59.00%) was true for Upper East region for three rainfall events (Table 2).

Number of rainfall events before planting of groundnut

From table 2, a similar trend was observed with regard to number of rainfall events before groundnut cultivation (as with events before land preparation). The highest figure of 273 (45.50%) for three rainfall events was recorded. About three percent, 17 (2.83%) of the farmers did not wait for any rainfall events before planting their groundnuts.

Nature of soil

According to the study (Table 3), a greater percentage of groundnut farmers interviewed, 345 (57.50%) mentioned sandy soil as the soil type and nature of their farm lands, followed by loamy soil with 235 (39.17%). Less than one percent, 1 (0.17%) of the farmers planted their groundnuts on clayey soils. Among the regions, Upper East region recorded the highest, 191 (95.50%) for sandy soil. More than two-thirds, 149 (74.50%) of the groundnut farmers in the Upper West region planted on loamy soils followed by Northern region with 80 (40.00%). Both regions had none of the groundnut farmers planting on clayey soils.

Ploughing depth of soil (for 1/3, ½and 1 cutlass lengths)

More than half of the groundnut farmers, 390 (65.00%) planting their groundnut at a ploughing depth of their soil at about one-third a cutlass length, a figure that was overwhelmingly high, 185 (92.50%) in Upper West region. A planting depth of half (1/2) a cutlass length was recorded by 200

(33.33%) of the farmers, while more than fifty percent, 106 (53.00%) of the farmers in the Northern region observed same. Less than one percent, 2 (0.33%) of the groundnut farmers planted at a ploughing depth of 1 cutlass length.

Water-holding capacity of farmers' soil

From the study, majority of the groundnut farmers, 375 (62.50%) indicated that their soils dried gradually after rainfall, followed by 216 (36.00%) who indicated their soils dried quickly after rainfall. This was opposed to only 4 (0.67%) who said their soils remained waterlogged for long periods after rainfall. Among the regions, Northern region recorded highest with 155 (77.50%) in terms of the fact that their soils dried gradually after rainfall followed by Upper West region, 118 (59.00%).

From (Figure 1), a majority 66.25% of the groundnut farmers interviewed said their farm lands had a wet moisture condition during the time of land preparation as opposed to 13.5% who said otherwise.

In a similar vein, more than two-thirds (73.41%) of the respondents had the soil condition of their farm lands wet during the time of planting of their groundnut, while a small 3.68% observed dry soil moisture condition (Figure 2).

According to the length of time it took for farmers' groundnut plants to wilt and die out on their farms in the study, Figure 3; (a). Without rainfall, more than fifty percent, (56.47%) of the farmers said their groundnut plants survived for four (4) weeks and above during the flowering stage, 45.61% said their groundnut survived for about two (2) weeks during the maturity period, only one (1) week during the seeding stage (44.35%) and about two (2) weeks during the vegetative phase (37.93%) without rainfall.

With excess rainfall, farmers groundnut plants survived for over four (4) weeks (47.06%), three (3) weeks (32.98%), one (1) week (48.11%) and three (3) weeks (37.63%) for the flowering, maturity, seeding and vegetative stages of groundnut respectively.

Table 4 talks about the conditions of the weather that had effect on groundnut production. According to the farmers interviewed, more than half, 401 (66.83%) indicated drought adversely affected their production. Twenty five and half percent, 153 (25.50%) indicated both drought and excess rainfall conditions affected their groundnut production as well.

Table 5, describes groundnut farmers' ownership of farm implements. An overwhelming majority, 582 (97.00%), of the farmers owned and used hoe on their groundnut farms as the main farm implement. More than half of the farmers, 351 (58.50%) said they owned tractors. Among the regions, Upper East region recorded highest, 195 (97.50%) followed closely and insignificantly by Northern, 194 (97.00%) and Upper West regions, 193 (96.50%). For ownership of hoe as an implement, Northern region recorded the highest, 195 (97.50%) followed by Upper West region with more than fifty percent of the respondents, 118 (59.00%).

Beginning and end of land preparation for groundnut production

From table 6, more than two-thirds, 585 (97.50%) of the groundnut farmers interviewed, begun their land preparation between March and ended it around April, 480 (80.00%).

Total land (acres) for groundnut cultivation

Majority of the groundnut farmers, 276 (46.00%) cultivated an average of 1-2 acres of land, followed by 192 (32.00%) with 3-4 acres of land. A small 22 (3.67%) cultivated 7 acres of land and above (Table 6).

Period for planting groundnut

Most farmers in the study areas planted groundnut between June and July, 347 (57.83%), but by July, groundnut planting may have ended, according to 334 (55.67%) of the farmers. The period between June and July was adjudged the best period for groundnut cultivation, 307 (51.17%) (Table 6).

Variety of groundnuts

According to Figure 4, 'China' variety was the most cultivated by the farmers in the Northern region, being cultivated by more than two-thirds, (76.5%) of the farmers, followed by 'Agric' (20%), 'Oboolo' (1.5%) and 'Otuhia' (0.5%) varieties. Similar trend was observed in the Upper East region but generally with higher percentage figures; 'China' (99.5%), 'Agric' (74%) and 'Oboolo' (22%). For Upper West region, 'China' variety recorded the most cultivated groundnut variety (96.5%) followed rather by 'Oboolo' (4.5%) and 'Agric' varieties with a small (0.5%), which incidentally runs through all the other varieties. Varieties, 'Obooshie' and 'Yenyawoso' were not found to be cultivated in the Northern region.

Some popular groundnut varieties grown and reasons

Majority (73.33%) of groundnut farmers interviewed, mentioned 'high yield', followed by 'ease of harvesting', (46.5%) and drought tolerance (32.67%), among others, as their reasons for choosing a particular type of groundnut variety. 'Disease tolerance' and 'Oil content' recorded 18.83% respectively whereas 'Storability' came across as the least (2.83%) reason for choice of a variety (Figure 5).

Average maturity period of groundnut varieties

The average maturity period of 'China' variety was 2-3 months, as mentioned by 394 (65.67%) of groundnut farmers interviewed. All other varieties; 'Agric, Oboolo, Obooshie, Otuhia and Yenyawoso' fell within an average maturity period of 4 to 5 months (Table 7).

Total farm size under groundnut cultivation

From the study in Figure 6, majority of the groundnut farmers, (64.83%) cultivated a total farm size of 1 to 4 acres, followed by 5 to 9 acres with 21.33%. Only 3% of groundnut farmers cultivated 15 acres of land and above.

Fertilizer application to groundnut crops

Results from the study in figure 7 indicate that, more than two-thirds (77.17%) of the groundnut farmers in the study area did not apply fertilizer to their groundnut crops. While 19% applied organic fertilizer on their farms, only 0.83% of the farmers applied inorganic fertilizers on their groundnut farms.

Methods of weed control in groundnut farms

Weeding was done manually by a majority 559 (93.17%) of groundnut farmers while more than half of the farmers, 369 (66.01%)

did manual weeding only once during the growing season. This was followed by 139 (24.87%) who did manual weeding twice. Farmers also sprayed their groundnut crops only once using chemicals 12 (80.00%) (Table 8).

Table 9 describes the type of disease that attacked farmers' groundnut crops on the field. From the study, the highest field disease infection was recorded by Early Leaf Spot (caused by *Cercospora Arachidicola*), 240 (40.00%), followed by Peanut *Rosette*, 104 (17.33%). According to the farmers, Late Leaf Spot disease, 6 (1.00%), bacterial wilt, 9 (1.50%), rust, 6 (1.00) and other diseases (16; 2.67%) were not common or did not pose much problem on their groundnut fields. It must be indicated that most of the groundnut farmers, 192 (32.00%) said they did not record any disease incidences on their farms. Majority of the farmers, 192 (32.00%) did not apply any control measure(s) on their farms, but the 160 (26.67%) of farmers manually uprooted and buried the diseased groundnut plants. A small 19 (3.17%) employed chemical application as a control measure for groundnut disease incidence.

A majority, 358 (59.67%) of the farmers, indicated they did not receive services from MOFA extension officers, while a little 19 (3.17%) said they very often received services. Less than twenty percent of the farmers, 110 (18.33%) noted they received MOFA services once a month and 82 (13.67%) twice every month. Among the departments or agencies relaying information to groundnut farmers, colleague farmers recorded the highest figure of 39.33% followed by MOFA (31.33%), NGOs (13.83%) and retailers with 11.33% respectively. A little above 1 percent (1.17%) received meteorological information (Figure 13).

Constraints to groundnut production

Constraints to the production of groundnuts per region

Table 20, 21 and 22 describe the results to the constraints to groundnut production in the Upper East, Northern and Upper West Regions respectively.

Constraints to the production of groundnuts in the upper east region

According to the results of the study, groundnut farmers in the Upper East region mentioned drought as the most ranked constraint to their groundnut production with average rank sum score of 4.9 (Table 20).

Constraints to the production of groundnuts in the northern region

Farmers in the Northern region ranked **pest** as the highest constraint with an average rank score of 4.7 (Table 21).

Constraints to the production of groundnuts in upper west region

In the Upper West region, processing was ranked the highest consideration by farmers with regard to the constraints to groundnut production with average rank scores of 4.5 (Table 22).

Overall rank sum of constraints to groundnuts production in Northern Ghana

Drought was ranked the overall highest constraint to groundnut production in Northern Ghana with a total rank sum score of 4.43 (Table 23).

Yield was considered next followed by Pest and disease with total rank sum scores of 3.53, 3.50 and 3.23 respectively.

Marketing and *Aflatoxin* were considered least important constraints among the list of constraints to the production of groundnuts in the northern regions of Ghana, according to results of the current study.

General crop management

Majority of the farmers (68%) had been in groundnut farming business for more than 10 years, and most of them (71.67%) inherited their farm lands while only 0.83% purchased. That is, they farmed their own or family lands. This statistics shows that land is readily available and that farmers could get access to land easily, even to expand production of the crop (Akpalu *et al.*, 2014). According to Varshney *et al*. (2006), groundnut is a popular commodity that is widely traded in local, regional and international markets, and it is an important source of income, especially for women farmers, who are the main cultivators.

Majority, 83% did not belong to any Farmer-Based Organizations. Financial institution would normally advance financial support to farmers who are members of a vibrant Farmer-Based Organization. This goes to confirm why most farmers in the Northern regions do not attract financial support for their farming/production business. In a study by Achieng *et al*. (1999) in western Kenya, farmers ranked poor cash flows as a key challenge to production. This is also supported by a survey work by Braimah *et al.* (2013) in a gender and agricultural production study.

Majority (45%) of the farmers waited for at least 3 rainfall events before land preparation and planting (45.5%). Moreover, drought (66.83%) and a combination of both drought and excess rainfall (25.5%) were the major weather conditions that affected groundnut production. This confirms the research assertion that, 'drought is the major abiotic stress to groundnut production as over70% of the crop is under semi-arid tropics, which is characterized by low and erratic rainfall' (Pandey *et al.*, 2012).

From the results, majority of the farmers owned and used hoe (97%) and tractor (58.5%) as the main farm implements for groundnut production. Groundnut is a traditional crop cultivated by resource poor farmers, particularly women, who can barely afford sophisticated, expensive agricultural farm equipment. This result is confirmed by (MOFA, 1997; MOFA, 2014; Braimah *et al.*, 2013). Moreover, the current research corroborates a study by Twumasi in 2001, which confirmed the assertion that, the main reason for the extreme poverty and high food insecurity is that, the bulk of the population is small-scale resource-poor farmers who rely mainly on rainfed agriculture to improve their livelihoods under low farm input conditions (Twumasi, 2001).

According to majority of the farmers, they prepared their farm lands before April (97.5%) each year. Rainfall pattern in the Northern regions of Ghana is largely unimodal and starts around April/May every year. Perhaps farmers thought it necessary to monitor the pattern and prepare in earnest so as to take advantage of the erratic rainfall pattern and also not to miss the planting season (Braimah *et al.*, 2013).

From the study, total land area cultivated to groundnut by most groundnut farmers were 1 to 2 acres (46%), while a small 3.67% cultivated about 7acres and above, though total farm size owned by majority of the farmers was 1 to 4 acres (64.83%).

These results demonstrate that most of the farmers are subsistence farmers, producing the groundnut, perhaps in combination with other crops, mostly for household

consumption rather than for commercial purposes, though a small percentage are in large scale production. This has an implication for low groundnut production in the community or district and the region as a whole. But if these categories of farmers are supported in land acquisition and other farm inputs, there will be an increase in the general groundnut production (Twumasi, 2001). According to CGIAR (2012), grain legumes account for less than 20% of total cultivated area in the majority of target countries (exceptions are: Niger, Malawi, and Kenya) (CGIAR Research Program on Grain Legumes, 2012).

Results from the current study shows that planting time of groundnut in the Northern regions was June and July (57.83%).

In the Guinea Savannah zones of Ghana, rains start around March/April and peaks in June through to September. Most farmers in this region planted groundnut during this period.

In a similar study on 'monitoring the genetic diversity of Bambara groundnut in two districts of the Upper West Region', farmers concentrated on their major staples like millet, sorghum, cowpea and maize, during the early parts of the rainy season (March to May) and then turn their attention to groundnut, Bambara groundnut, and other legumes around June to July (Singh *et al.*, 2001; Twumasi, 2001; Braimah *et al.*, 2013).

China variety was mostly planted by majority (76.5%) of the groundnut farmers and attributed high yield (73.33%), ease of harvesting (46.5%) and drought tolerance (32.67%) as their reasons for the choice of variety. 'China' variety is an early-maturing groundnut variety (2 to 3 months (65.67%). All others; Agric, Oboolo, Obooshie, Otuhia and Yenyawoso took 4 to 5 months to mature], and it is highly accepted for its market value and ease of processing into groundnut paste, which also has high market value. These might be some of the reasons for the variety's popularity in the Northern regions (Akpalu *et al.*, 2014). The results again show that farmers in these communities were not adopting the new varieties of groundnut released by CSIR-Crops Research Institute and MOFA. Moreover, it appears that most improved groundnuts varieties were yet to be adopted by farmers (Hammond *et al*., 2002).

Today and future 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).

Majority of the farmers did not apply fertilizer on their groundnut farms (77.17%); organic fertilizer use was 19% and Inorganic fertilizer (0.83%) only.

This might be due to the traditional belief among farmers that groundnutcould give some reasonable yield without the application of synthetic fertilizer. It is common knowledge that groundnuts, like most legume crops has the ability to fix atmospheric nitrogen and thus could grow on poor soils (Mulila-Mitti, 1995). These results might also be due to the farmers' inability to procure fertilizers as a result of unavailability and limited financial resources (Rogers, 1983).

However, substantial number of farmers who applied fertilizer to their groundnuts resulted in high yields inagreement with the findings of Toungos *et al.* (2009) who reported higher yields in plots where

fertilizer was applied than in plots without fertilizer in Yola, Nigeria.

From the results of the current study, farmers manually weeded their groundnut farmsonce (66.01%) in the growing season of the groundnut, and 24.87% weeded twice a season. Chemical Spraying was done by 80% of the farmers.

Groundnut is a type of legume crop whose growth habit is largely of the bunch type, and after the first weeding in the early stages of its growth, do not encourage growth of weeds among the groundnut plants. Therefore most groundnut farmers did not have to increase their production cost by embarking on two or more weeding activities.

Early Leaf Spot was most common (40%)on farmers' groundnut farms followed by Peanut Rosette disease (17.33%); 32% did not apply any control measure while 26.67% manually uprooted and buried weeds, but 3.17% employed chemical application.

These results could be attributed to the fact that most of the groundnut farmers did not have knowledge of management practices of the crop, especially the diseases and pests that attacked the crop, and also the recommended chemical(s) for controlling such diseases and pests.

This finding is in line with those of CGIAR, (2001); Twumasi (2001), in a Bambara groundnut research, who stated that groundnut and Bambara groundnut alike, are resistant to pests and disease attack as compared to cowpea. In the same study, farmers, in contrast to the current study, stated that they adopted regular weeding to reduce the incidence of diseases and pests, while others stated they sprayed the crop with chemicals, results that corroborates those found in the current study.

In a groundnut study by Pandey *et al.* (2012), authors concluded that crop productivity has been adversely challenged by several abiotic and biotic stresses. In addition, aflatoxin contamination deteriorates product quality and greatly reduces grain value. 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* spp.) (Pandey *et al.*, 2012).

Yield

Majority (36%) of the groundnut farmers in the current study recorded yields for shelled groundnut at 2 to 3 bags per acre.Yield of unshelled groundnut was highest for 4 to 5 bags per acre.Moreover,worst yield (77.1%) for the past 5 years was highest for 1 to 2 bags per acre and least (1.5%) for 6 to 7 bags per acre.

These yields were obtained without any fertilizer application and under lowand erratic rainfall. Most farmers are generally of the erroneous view that groundnuts, like many other legumes, do no need fertilizer since it has the ability to fix atmospheric nitrogen, hence the results in the current study.The low yields obtained by farmers could account for the seasonal shortage of the crop since thefarmers do not get enough for their household use, as majority produce smaller acreages on subsistence basis rather than on commercial basis. Therefore only a small percentage is marketed.

Majority of the farmers interviewed did not have knowledge of management practices of the crop, especially the diseases and pests that attacked the crop, and also the recommended chemical(s) for controlling

such diseases and pests. All farmers interviewed complained of attack of pests and diseases that destroyed the crop in the field of which they had no control measures. Majority said that they did not adopt any management practices since they thought the crop is generally resistant to pests and diseases. These findings are in line with those ofCGIAR, in a cowpea-Bambara groundnut study (Cowpea (v.u). cgiaronline/ CGIAR Research, 2002; Twumasi, 2001; Hammond *et al*., 2002) who stated Bambara groundnut is resistant to pests and disease attack as compared to cowpea.

Weed control

Majority of the farmers weeded their farms once in the growing season. Singh *et al.* (2001) observed that Bambara groundnut monocultures, like other legumes, require less weed management than other crops and they speculated that weeds that germinate with the onset of the March-April rains would not have produced mature seeds that would have germinated in the June-July rains.

According to departments or agencies relaying information to groundnut farmers, colleague farmers recorded the highest figure of 39.33% followed by MOFA (31.33%). This results confirms those of CGIAR Research Program on Grain Legumes, 2012) that concluded that, 'depending on the country, farmer-to-farmer exchange and government extension are two major sources of information on agricultural technologies for farmers.

Constraints to groundnut production in northern Ghana

Drought was ranked the overall highest constraint to groundnut production in the Northern regions of Ghana with a total rank sum score of 4.43 (Table 23).

Yield, Pests and diseases were considered next 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 and colleagues, (2014) revealed that themost important constraints to Bambara groundnut production in the community were low yields, pests anddiseases and lack of improved varieties. According to Pandey *et al.* (2012), cultivated peanut is mainly grown in the semi-arid tropics region by resource-poor farmers. As a result, crop productivity has been adversely challenged by several abiotic and biotic stresses. 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* spp.) (Adu-Dapaah *et al*, 2004); (CGIAR, 2012).

Drought is the major abiotic stress as over 70% of the crop is under 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 Research Program on Grain Legumes, 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, phenology and weeds (CGIAR, 2012).

Table.2 Land acquisition and crop management

		UER	UWR	NR	Total
		n (%)	n (%)	n (%)	n (%)
Number of business years					
	1 - 5	17 (8.50)	13 (6.50)	53 (26.50)	83 (13.83)
	6 – 10	32 (16.00)	9 (4.50)	49 (24.40)	90 (15.00)
	10+	151 (75.50)	178 (89.00)	79 (39.50)	408 (68.00)
	Missing			19 (9.50)	19 (3.17)
Mode of land acquisition					
	Rent	5 (2.50)	-	3 (1.50)	8 (1.33)
	Purchase	4 (2.00)	-	1 (0.50)	5 (0.83)
	Lease	3 (1.50)	1 (0.50)	22 (11.00)	26 (4.33)
	Inherited	98 (49.00)	190 (95.00)	142 (71.00)	430 (71.67)
	Gift	10 (5.00)	7 (3.50)	23 (11.50)	40 (6.67)
	Kinship	79 (39.50)	1 (0.50)	-	80 (13.33)
	Missing	1 (0.50)	1 (0.50)	9 (4.50)	11 (1.83)
Member of FBO?					
	No	175 (87.50)	181 (90.50)	142 (71.00)	498 (83.00)
	Yes	22 (11.00)	6 (3.00)	56 (28.00)	84 (14.00)
	Missing	3 (1.50)	13 (6.50)	2 (1.00)	18 (3.00)
Number of rainfall events before land preparation					
	No event	24 (12.00)	35 (17.50)	9 (4.50)	68 (11.33)
	One event	10 (5.00)	20 (10.00)	45 (22.50)	75 (12.50)
	Two events	19 (9.50)	45 (22.50)	71 (35.50)	135 (22.50)
	Three events	118 (59.00)	86 (43.00)	66 (33.40)	270 (45.00)
	4+ events	23 (11.50)	12 (6.00)	-	35 (5.83)
	Missing	6 (3.00)	2 (1.00)	9 (4.50)	17 (2.83)
Number of rainfall events before planting of groundnut					
	No event	2 (1.00)	1 (0.50)	14 (7.00)	17 (2.83)
	One event	9 (4.50)	-	121 (60.50)	130 (21.67)
	Two events	15 (7.50)	52 (26.00)	49 (24.50)	116 (19.33)
	Three events	132 (66.00)	129 (64.50)	12 (6.00)	273 (45.50)
	4+ events	37 (18.50)	16 (8.00)	2 (1.00)	55 (9.17)
	Missing	5 (2.50)	2 (1.00)	2 (1.00)	9 (1.50)

Table.3 Nature of soil and land tilting

	UER n (%)	UWR n (%)	NR n (%)	Total n (%)
Nature of soil				
Sandy	191 (95.50)	38 (19.00)	116 (58.00)	345 (57.50)
Loamy	6 (3.00)	149 (74.50)	80 (40.00)	235 (39.17)
Clayed	1 (0.50)	-	-	1 (0.17)
Others	2 (1.00)	5 (2.50)	-	7 (1.17)
Missing	-	8 (4.50)	4 (2.00)	12 (2.00)
Ploughing depth of land				
$^1/_3$ of cutlass length	113 (56.50)	185 (92.50)	92 (46.00)	390 (65.00)
½ of a cutlass length	86 (43.00)	8 (4.00)	106 (53.00)	200 (33.33)
One cutlass length	-	1 (0.50)	1 (0.50)	2 (0.33)
Others	-	5 (2.50)	-	5 (0.83)
Missing	1 (0.50)	1 (0.50)	1 (0.50)	3 (0.50)
Water-holding capacity of the soil				
Dries quickly after rainfall				
Dries gradually after rainfall	95 (47.50)	82 (41.00)	39 (19.50)	216 (36.00)
Remains water logged for long periods	102 (51.50)	118 (59.00)	155 (77.50)	375 (62.50)
Missing	3 (1.50)	-	1 (0.50)	4 (0.67)
	-	-	5 (2.50)	5 (0.83)

Table.4 Weather conditions that affect groundnut production

	UER *n* (%)	UWR *n* (%)	NR *n* (%)	Total *n* (%)
Drought	150 (75.00)	167 (83.50)	84 (42.00)	401 (66.83)
Excess rainfall	2 (1.00)	4 (2.00)	12 (6.00)	18 (3.00)
Both	45 (22.50)	5 (2.50)	103 (51.50)	153 (25.50)
Missing	3 (1.50)	24 (12.00)	1 (0.50)	28 (4.67)

Table.5 Ownership of farm equipment

		UER	UWR	NR	Total
		n (%)	*n* (%)	*n* (%)	*n* (%)
Ox-plough					
	NO	26 (13.00)	193 (96.50)	113 (56.50)	332 (55.33)
	YES	173 (86.50)	6 (3.00)	85 (42.50)	264 (44.00)
	Missing	1 (0.50)	1 (0.50)	2 (1.00)	4 (0.67)
Tractor					
	NO	162 (81.00)	81 (40.50)	4 (2.00)	247 (41.17)
	YES	38 (19.00)	118 (59.00)	195 (97.50)	351 (58.50)
	Missing	-	1 (0.50)	1 (0.50)	2 (0.33)
Ox – Cultivator					
	NO	151 (75.50)	197 (98.50)	193 (96.50)	541 (90.17)
	YES	49 (24.50)	1 (0.50)	3 (1.50)	53 (8.83)
	Missing	-	2 (1.00)	4 (2.00)	6 (1.00)
Harrow					
	No	191 (95.50)	196 (98.00)	139 (69.50)	526 (87.67)
	Yes	9 (4.50)	-	57 (28.50)	66 (11.00)
	Missing	-	4 (2.00)	4 (2.00)	8 (1.33)
Hoe					
	No	3 (1.50)	5 (2.50)	3 (1.50)	11 (1.83)
	Yes	195 (97.50)	193 (96.50)	194 (97.00)	582 (97.00)
	Missing	2 (1.00)	2 (1.00)	3 (1.50)	7 (1.17)

Figure.1 Moisture condition of soil during land preparation

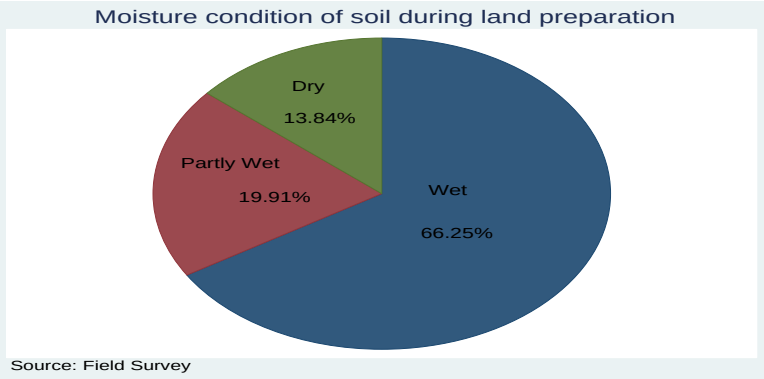


Table.6 Land preparation and groundnut cultivation

		Number of responses *n* (%)
Beginning of land preparation		
	September – October	2 (0.33)
	November – December	2 (0.33)
	January – February	3 (0.50)
	Others	585 (97.50)
	Missing	8 (1.33)
End of land preparation		
	October	8 (1.33)
	December	1 (0.17)
	March	15 (2.50)
	April	480 (80.00)
	Others	85 (14.17)
	Missing	11 (1.83)
Total land used for groundnut cultivation (acres)		
	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)
Period for sowing groundnut		
	April – May	204 (34.00)
	June – July	347 (57.83)
	August – September	12 (2.00)
	Others	28 (4.67)
	Missing	9 (1.50)
Beginning of groundnut planting		
	April – May	214 (35.67)
	June – July	332 (55.33)
	August – September	16 (2.67)
	Others	35 (5.83)
	Missing	3 (0.50)
End of groundnut planting		
	April	15 (2.50)
	May	116 (19.33)
	June	128 (21.33)
	July	334 (55.67)
	Missing	7 (1.17)
Best sowing period for groundnut		
	April – may	215 (35.83)
	June – July	307 (51.17)
	August – September	12 (2.00)
	Others	34 (5.67)
	Missing	32 (5.33)

Table.7 Average maturity period of groundnut varieties

Months	Agric *n* (%)	China *n* (%)	Oboolo *n* (%)	Obooshie *n* (%)	Otuhia *n* (%)	Yenyawoso *n* (%)
1 – 2	10 (1.67)	26 (4.33)	4 (0.67)	5 (0.83)	10 (1.67)	15 (2.50)
2 – 3	67 (11.17)	394 (65.67)	53 (8.83)	66 (11.00)	86 (14.33)	56 (9.33)
4 – 5	245 (40.83)	124 (20.67)	235 (39.17)	194 (32.33)	145 (24.17)	154 (25.67)
6 – 7	3 (0.50)	6 (1.00)	2 (0.33)	9 (1.50)	6 (1.00)	6 (1.00)
Others	6 (1.00)	13 (2.17)	7 (1.17)	3 (0.50)	9 (1.50)	16 (2.67)
Missing	269 (44.83)	37 (6.17)	299 (49.83)	323 (53.83)	344 (57.33)	353 (58.83)

Table.8 Weed control measures

Activity		Number of responses *n* (%)
Weed control measure		
	Manual weeding	559 (93.17)
	Biological	2 (0.33)
	Chemical	15 (2.50)
	Others	1 (0.17)
	Missing	23 (3.83)
Number of times crops are spayed using chemical		
	1 time	12 (80.00)
	2 times	3 (20.00)
Number of times that manual weeding is done		
	1 time	369 (66.01)
	2 times	139 (24.87)
	3 times	1 (0.18)
	Others	2 (0.36)
	Missing	48 (8.59)

Table.9 Type of field disease that attack groundnut crops and the mode of control

		Number of responses *n* (%)
Type of disease that attacks groundnut		
	None	192 (32.00)
	Peanut rosette	104 (17.33)
	Early leaf spot	240 (40.00)
	Late leaf spot	6 (1.00)
	Bacterial wilt	9 (1.50)
	Rust	6 (1.00)
	Others	16 (2.67)
	Missing	27 (4.50)
Mode of control		
	None	192 (32.00)
	Manually uproot and burn	69 (11.50)
	Manually uproot and burry	160 (26.67)
	Use chemical	19 (3.17)
	Others	101 (16.83)
	Missing	59 (9.83)

Table.18 Frequency of receipt of extension services from MOFA

		UER *n* (%)	UWR *n* (%)	NR *n* (%)	Total *n* (%)
Access to Extension Services					
	Once a month	53 (26.50)	4 (2.00)	53 (26.50)	110 (18.33)
	Twice a month	21 (10.50)	12 (6.00)	49 (24.50)	82 (13.67)
	Very often	10 (5.00)	1 (0.50)	8 (4.00)	19 (3.17)
	Not at all	106 (53.00)	176 (88.00)	76 (38.00)	358 (59.67)
	Others	3 (1.50)	-	2 (1.00)	5 (0.83)
	Missing	7 (3.50)	7 (3.50)	12 (6.00)	26 (4.33)

Figure.2 Moisture condition of soil during land preparation

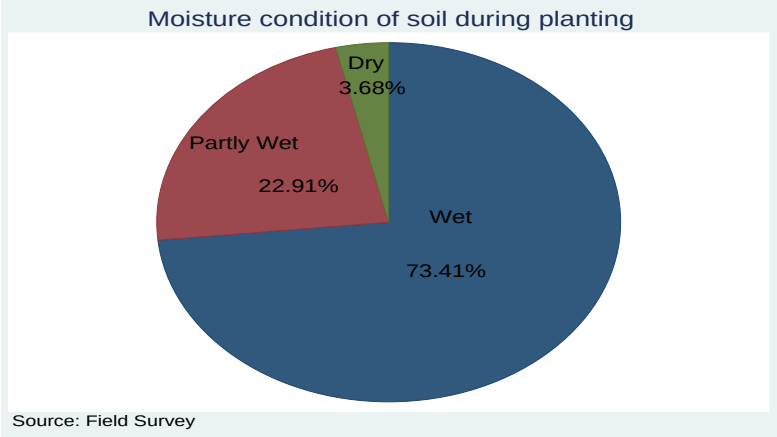


Figure.3 Wilting and death of groundnut plants

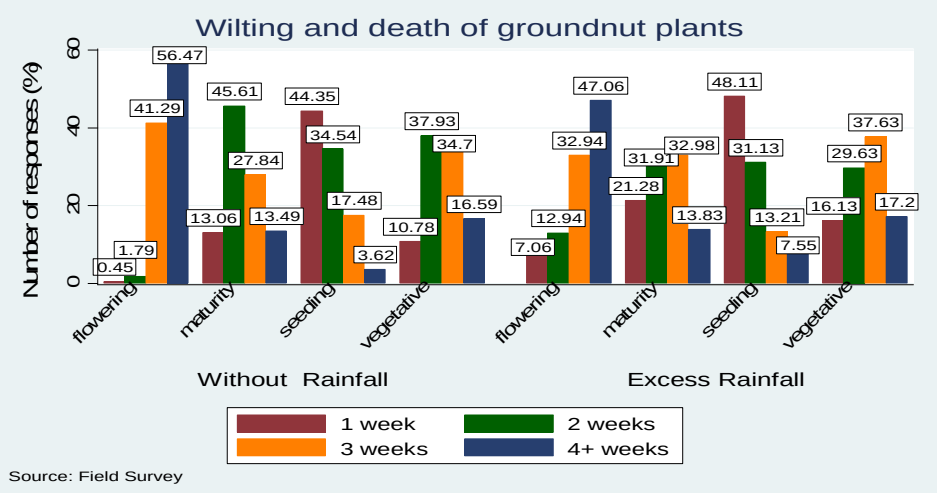


Table.20 Constraints to groundnut production in the Upper East Region

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	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
Process	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

Table.21 Constraints to groundnut production in the Northern Region

Community	Kpandu	Jan gyili	Bonya ngshei	Kukuo	Dakp emyili	Yapeiz ogu	Nyen gbalo	Kpali sogu	Sagnari gu	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	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
Process	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

Table.22 Constraints to groundnut production in the Upper West Region

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	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

Table.23 Mean (Overall) ranking of groundnut constraints by region (All three Northern Regions)

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	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
Average	3.17	3.03	2.30	2.83
Standard error	0.39	0.49	0.43	0.89

Figure.4 Variety of groundnut cultivated by farmers

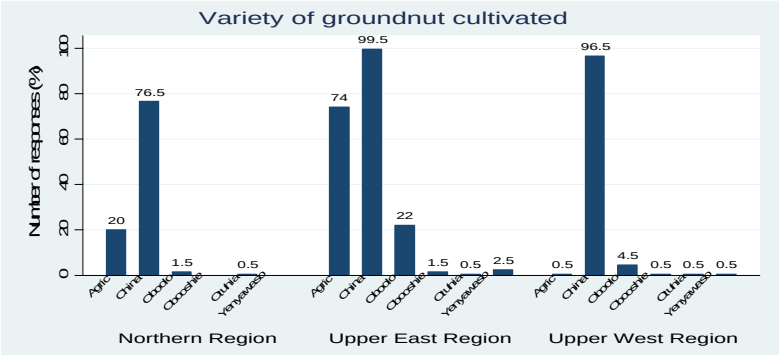


Figure.5 Reasons for the Choice of Groundnut Varieties by Farmers

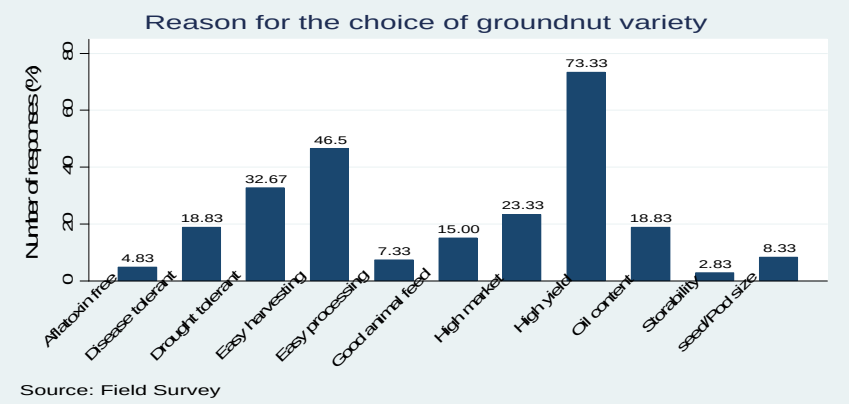


Figure.6 Total farm size under cultivation

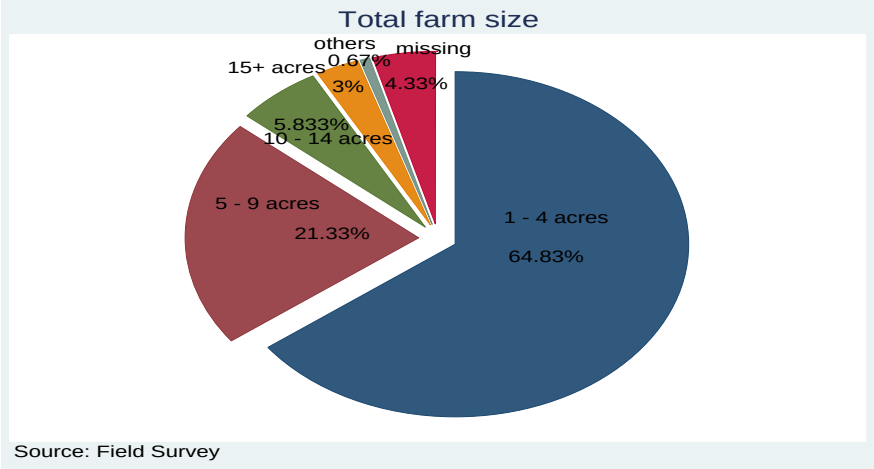


Figure.7 Type of fertilizer applied to groundnut crops by farmers

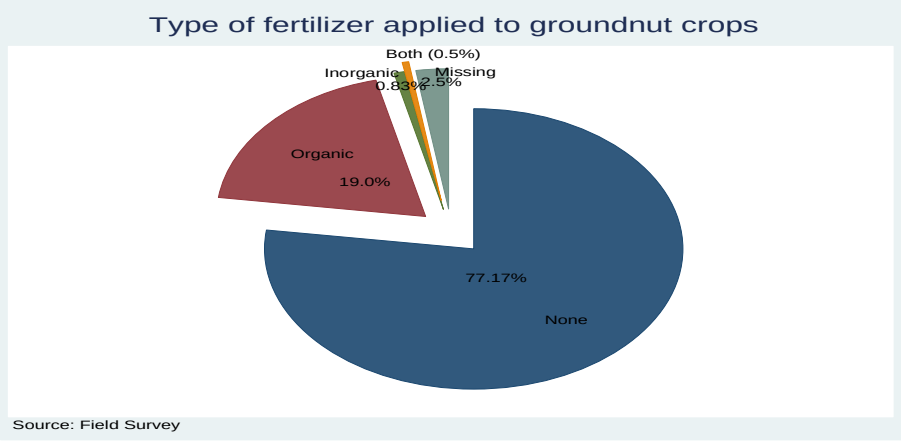
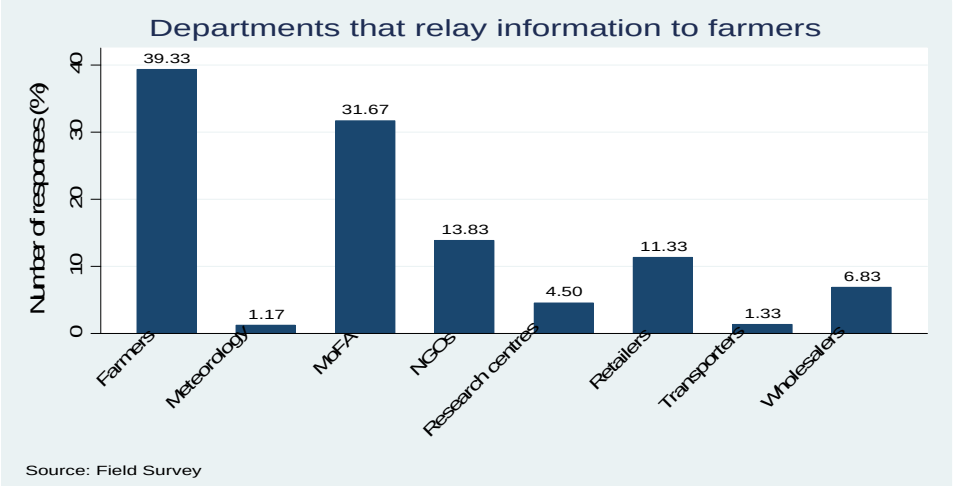


Figure.13 Department(s) Relaying Information to Farmers



Drought is one of the most important constraints to crop production in all crops, especially as drought can occur at any stage of crop development. Short-duration cultivars have been developed in legumes to overcome end-of-season drought. In groundnut, end-of-season droughts not only reduce yield, but predispose the crop to infection by *Aspergillus flavus* and aflatoxin contamination.

Drought tolerance has been dissected into its component traits such as root morphologies, specific leaf area, improved mobilization of photosynthate to grain, chlorophyll content, transpiration efficiency, carbon isotope discrimination and canopy temperature and sources of such traits used in developing drought tolerant cultivars. Many of these have been deployed and adopted by farmers in the rainfed dryland areas(CGIAR, 2012; Abate *et al*., 2012).

Molecular markers that lead to increased water use efficiency have been identified for key root traits such as lateral root number, maximum root length, root fresh weight, root dry weight and slow wilting related to increased drought tolerance in soybean, groundnut, chickpea and cowpea and are being used in marker-assisted selection to develop drought tolerant cultivars(CGIAR Research Program on Grain Legumes, 2012).

Diseases:Major disease constraints include early and late leaf spots, rust, peanut rosette, Root Rot, and southern stem rot. Other minor diseases include leaf blotch and lesion nematode infestation. No form of disease control is practiced by farmers, who most often link crop maturity to leaf defoliation as a result of diseases thus overlooks the adverse effects on their crop. Disease severities are so high so much so that at harvest more than 80% of the leaves on peanut plants are defoliated due to the combined attack of Cercospora leaf spots and rust (Tsigbey *et al*., 2001). These diseases are endemic in all the production areas in northern Ghana. Yield losses due to these diseases are close to 100% in a wet year when farmers abandon harvesting their farms because of poor yields.

Seasons with moderate rainfall could result in yield reductions ranging 28 > 50% depending on the predominant disease(s) in that location.

Aflatoxin contamination affects groundnut trade and profitability worldwide. Groundnut rosette disease (GRD) is the most devastating disease of groundnut in sub-Saharan Africa. Using resistant sources, breeding lines with resistance to early and late leaf spots and rust and GRD and with low levels of aflatoxin contamination have been developed. Molecular markers have been identified for use in marker assisted breeding for rust and late leaf spots (CGIAR, 2012).

***Insects/Pests*:** All legumes suffer significant losses to insect pests, especially chickpea, cowpea and pigeon pea.Major insect pests on peanut include hoppers, millipedes, termites, and white grubs. Termite damage is prominent during late harvested crop.

Integrated Pest Management (IPM) systems, including host-plant resistance where available, have been the focus of research on control methods (Abate *et al*., 2012).

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