

INFORMATION SOURCES USED BY TIGER NUT (*CYPERUS ESCULENTUS*) FARMERS FOR IMPROVED SUSTAINABLE AGRICULTURE DEVELOPMENT IN ADUAMOA, GHANA.

¹Grace Obeng-Koranteng; ²Raphael Kwame Kavi; ³Kwabena Asiedu Bugyei and ⁴Peter Anafo

¹Council for Scientific and Industrial Research, Institute for Scientific and Technological Information, Accra, Ghana

^{2,3}Council for Scientific and Industrial Research, Food Research Institute, Accra, Ghana

⁴University of Mines and Technology, Tarkwa, Ghana

ABSTRACT

This study assessed the sustainable agricultural information sources used by tiger nut (*Cyperus esculentus*) farmers of Aduamoa in the Kwahu East district of the Eastern Region of Ghana. Data was collected via an interview schedule from 150 farmers on the different sources of agricultural information, the utilization of agricultural information, and constraints of accessing information. The results show that, farmers mostly used radio and colleague farmers as their source of agricultural information. The tiger nut farmers have benefited from the use of information mainly on the application of fertilizer and weedicides. Poor public relations of the agricultural extension agents and language barrier were the main constraints to sustainable agricultural information access. The study recommended establishment of radio networks and information centers across the country as well as improvement of communication skills of extension agents for easy access and effective utilization of agricultural information by farmers.

Keywords: Tiger nut farmers, Tiger nut, Ghana, Information sources, Information usage

INTRODUCTION

The agricultural sector is considered as the mainstay of many economies in Africa. Over 80% of the population derives their sustainable livelihood from subsistence agriculture. The sector is viewed as the engine of development in most developing countries and, sustainable and reliable agricultural information is a major tool for the development of small-scale farmers and it contributes to the sustainable livelihood of people both in urban and rural areas (Ronald, Silavo & Abdalah, 2015). Ofuoku, Emah and Itedjere (2008) posited that sustainable agricultural information opens windows for sharing experiences, best practices, sources of financial aid and new markets. Information is an indispensable factor in the practice of farming and it is the basis of extension service delivery and if these recommendations are carried out, the economic value of tiger nut farming will be more sustainable.

In Ghana, 60% of the populations are employed by the agricultural sector, which supports about 80% of the population economically through activities such as farming, distribution of farm products, and the provision of other related services (Sam & Dzandu, 2015). The sector was for many years the largest contributor to the GDP until 2006 when the service sector overtook it. Available data from the Ghana Statistical Service (GSS) shows that, in 2006, the service sectors contribution was 48.8% whilst agriculture contributed 30.4% to the country's GDP. This trend had continued till 2010 when the sector's contribution rose to 51.4% whereas that from agriculture fell to 29.9% (GSS, 2011 as cited by Sam & Dzandu, 2015). But in spite of this trend of decline in agriculture, due to unsustainable practices, its development still holds the key to poverty alleviation and improved food security in Ghana and other developing countries.

Tiger nut (*Cyperus esculentus L.*) is a root tuber that is a member of the family *Cyperaceae*. Several names, according to Pascual, Maroto, Lopez-Galarza, Sanbautista, and Alagarda (2000) and Rubert, Sabastià, Soriano, Soler, and Mañes (2011), such as chufa, Zulu nuts and yellow nut sedge have been credited to the plant. A study conducted by Dakogre (2008) suggests that, tiger nut (*Cyperus esculentus*) farming is one of the leading enterprises in the Kwahu East District in the Eastern region of Ghana. It has gained acceptance among the farmers of almost all the towns in the district due to its short-term rate of returns in the form of cash and benefits. In Ghana, the nuts are chewed like sweets, or made into highly cherished milk like beverage referred to as "Atadwe milk".

However, in 2002, a research scientist, Patricia Sackeyfio of the Ministry of Food and Agriculture (MOFA) produced flour from tiger nut, following a six-month intensive research into the crop. Recognizing the difficulties that tiger nut farmers were encountering, she commenced a Sassakawa Global 2000 Supervised Enterprise Project with collaboration from the University of Cape Coast to conduct research into the crop, and came out with findings that could help reduce some of the problems faced by the farmers at Kwahu Aduamoa and surrounding areas in the district. She was able to use the product to process flour into composite cake, milk, custard, doughnut, biscuit, bread, bread rolls, fancy rolls, savory pie and many other derived products. Adding value to tiger nuts by finding more ways of processing it into useful products means that, more jobs are created in the

tiger nut industry, and thus, the value of tiger nuts as a crop and raw material increases. Increased economic value translates into increased sustainability of the industry and demand of information will be high.

This initiative was to aid in adding value to the crop in order to enhance its investment potential with the ultimate aim of sustainable means of alleviating poverty among the crop growers. Other products developed from the crop were edible oil, cream and soap. Also, the leaves of the plant can be processed into mat. (Ghana News Agency, 2002). The scientist further encouraged women cultivators of the crop to put the skills and knowledge acquired in the various processing procedures into practice to enable them derive maximum economic benefits from the crop. It is also believed that the crop has some medicinal values. For instance, it is alleged to have an aphrodisiac effect when chewed by men. The demand for tiger nuts for consumption is quite high on the local market, and as a result it is quite expensive. There are indications of a viable export market for the crop (Tetteh & Acheampong, 1998) which further increases economic value of tiger nuts as a sustainable economic, food and raw material source.

Agricultural information plays a critical role in sustainable agriculture enhancement which improves the livelihoods of farmers. Farrington, Christopolos, Kidd and Beckman (2002) states that, to reduce poverty and improve the livelihoods of poor farmers it is obligatory for them to be able to use information and services that are both production oriented (e.g., agricultural technologies credit and markets) and protection oriented (e.g., pension, health care and disaster preparedness). Unfortunately, lack of access to basic agricultural knowledge and information sources by rural farmers has negative results and many constraints for their farming output.

Information and knowledge are very vital to sustainable agricultural development of any community and when sources of information are not known by or accessible to the farmers, they continue to practice the traditional methods known to them and this affects their mode of practices in farming activities. For a farmer to be effective and knowledgeable, he needs reliable, quality, quantity and timely information. Information must be relevant and meaningful to farmers. In addition, packaging and delivering should be done properly to suit the preferred output of the farmers (Diekmann, Loibl & Batte, 2009). However, Ferris and Robbins (2005) asserts that, in most African countries lack of accurate and relevant agricultural information by small-scale farmers is a major factor constraining efforts to improve the sustainability and progression of the agriculture sector.

The significance of information in enhancing agricultural production cannot be over emphasized. Information is vital in increasing production and improving marketing and distribution strategies. Information is also imperative for the adoption of new technologies and consequent increases in yield and improved income. The absence of information has a lot of implications such as inefficiency and lowering of productivity. According to Mgbada (2006), access to adequate information is very essential to increase agricultural productivity.

Babu et al. (2011) as cited by Ronald, Dulle and Ngalapa (2014) reports that, a better understanding of farmers' agricultural information needs and information sources could help guide extension and other agricultural programmes to better target specific groups of farmers. Ajani (2014) also emphasizes a high demand for agricultural information among farmers, especially on new and more efficient farming practices and technologies, as well as recent information on pests, diseases, and marketing strategies. Hence, the present study was undertaken with the aim of seeking to provide some clarity concerning tiger nut farming

in Aduamoa in Kwahu East district to develop an understanding of the activity specifically with respect to information sources utilization.

STATEMENT OF THE PROBLEM

In the agricultural sector, information is one of the major resources to increase food production, thus effective information dissemination enhances agricultural development. Information is very crucial for farming, monitoring and control. This means that, the farmers need to follow procedures to ensure that the aim of farming is achieved and targets are attained. Bachhav (2012) believes that the use of information in agriculture sector is enhancing farming productivity in a number of ways. Furthermore, Masuki et al., (2010) suggested that agricultural information constitutes a key component in improving small-scale agricultural production and linking increased production to remunerative markets, thus leading to improved rural livelihoods, food security and national economic development.

Farmers need to be abreast with all the necessary information that will enhance cultivation. In other words, they should be well informed of issues and developments surrounding various crops that they cultivate before every farming season. Providing information on weather trends, best practice in farming, timely access to market information helps farmer make correct decisions about what crops to plant and where to sell their product and buy inputs. All these will contribute to higher crop yield which translate into sustainable economic development. Stienen, Bruinsma and Neuman (2007) pointed out that, agricultural information is generally spread across many different stakeholders, notably farmers, universities, research institutes, extension services, commercial enterprises, and non-governmental organizations. However, according to Burton (2002) most people in most underdeveloped communities do not know what information they lack and what information is available to help them solve their problems.

Therefore, the question then arises as to what sources of information are available to tiger nut growers to enable them produce to the maximum desired output. How many tiger nut growers know that the crop can be used to produce variety of products? Consequently, the key issue central to this study was to investigate the sources of sustainable agricultural information sources available to farmers that could be useful for the formulation of policies to strengthen and improve the efficiency of crop production towards sustainable development.

OBJECTIVES OF THE STUDY

The general objective of the study is to assess the sustainable sources of information for tiger nut growers in Ghana.

The following are the specific objectives: -

1. To ascertain the information sources of tiger nut farmers
2. To determine the level of usage of the information acquired
3. To identify the challenges faced by tiger nut farmers in accessing information.

LITERATURE REVIEW

Tiger nut (*Cyperus esculentus*) relatively lesser known and underutilized crop, many of which are potentially valuable as human and animal food, has been identified to maintain a balance between population growth and agricultural productivity particularly in the tropical and sub-tropical areas of the world (Adejuyitan, 2011). The nut is an important representative crop of the Spanish Mediterranean region, with nearly 2450 ha and an annual production of 9000 metric tons (CRDO, 2012). In Spain, the “horchata” industry is of considerable economic importance (Rubert et al, 2011). The annual value of tiger nut production is close to 3.3 million euros (CRDO 2012). In recent years, the popularity of “horchata” has been extended to other countries, such as the United Kingdom, France, Portugal, Argentina, and United States of America (Pascual et al, 2000; Rubert et al, 2011).

According to Abaejoh, Djomdi & Ndojouenkeu (2006), the plant is a tuber that grows freely and is consumed widely in Nigeria, other parts of West Africa, East Africa, parts of Europe particularly Spain as well as in the Arabian Peninsula. Furthermore, tiger nut milk has been classified as a medicinal drink due to its highly energetic and diuretic, rich in mineral, predominantly phosphorus, potassium and also vitamins C and E contents. It is known in Nigeria as “Aya” in Hausa, ”Ofio” in Yoruba and “Akiausa” in Igbo where these varieties (black, brown and yellow) are cultivated.

In Ghana, commercial cultivation of tiger nuts is found in areas such as Aduamoa and Esereso in the Kwahu areas of the Eastern Region. In the Central Region, it is cultivated at Bawjiase and surrounding villages in the Awutu Senya East District, Ampenyi and its surrounding villages in the Komenda Edina Eguafu District, Twifo Praso and surrounding villages in the Twifo Praso Lower Hemang District and New Ebu and surrounding villages in the Abura Aseibu Kwamankese District. Also, the crop is cultivated in commercial quantities in Adansi Danyameso in the Adansi South District in the Ashanti Region, Tanoso and surrounding villages in the Sunyani District of the Brong Ahafo Region and Tampiong in the Savelugu Nanton District in the Northern Region (Asante, 2015). According to an earlier study conducted by Tetteh and Ofori (1998) in Kwahu Aduamoa on the cultivation of the tubers, shows that women constituted about 70 % of the farmers whilst the men were about 30 %.

According to Oladele (2006) information provision is crucial for increasing agricultural production and improving marketing and distribution strategies. Thus, farmer’s access to information helps them to know about improved technologies and enhance the adoption of new innovations (Daberkow & McBride, 2003). Lack of information and technical knowledge is among the factors responsible for low crop yield (Abbas, Lodhi, Bashir & Mahmood, 2008). Utilization of relevant, accurate and up-to-date information in the agricultural sector would ensure increased productivity (Banmeke & Ajayi, 2008).

Access to reliable, timely and relevant information can help significantly and in many ways to reduce farmers’ risk and uncertainty, empowering them to make good decisions (Mittal & Mehar, 2013). Indeed, Ronald et al. (2015) citing Mahapatara (2012) suggest that, farmers need information to know the various techniques for improving and increasing agricultural productivity for higher sustainable development, for instance, the use of fertilizers, useful pesticides, high quality seeds, access to agricultural credit facilities, and good marketing of their agricultural produce.

Furthermore, Bala and Sharma (2005), Singh, Vijay, Kamal & Wakchaure (2011) were of the view that, to compete in the global market today, farmers should have the latest information regarding new techniques of farming, new methods of cultivation, new crops, seeds, pesticides, water management, marketing of the product, government policies regarding agriculture, export potential of their crops and information about allied activities like fish farming, apiculture, poultry and dairy, and weather information on local and regional levels.

According to Cartmell, Orr and Kelemen (2004) information messages must be disseminated to farmers in the manners and methods which are appropriate, and which best support the recipients. Okunade (2007) describes a variety of sources of information dissemination in agriculture, comprising results demonstrations, general meetings, group discussions, lectures, television, radio, cinema, leaflets, bulletins, letters, and circulars. Nazari and Hassan (2011) also suggest that, mass media offer powerful channels for communicating agricultural messages and related information which can enhance the capacity building of farmers. Broadcast media have the ability to disseminate information to large audience efficiently; and television can be a particularly most famous channel among farmers.

Existing research undertaken by Opara (2008), found out that the overall sources of agricultural information available to farmers in Imo State (Nigeria), as well as the farmers' preferred sources, specifies that 88.1% of the farmers' sources of information were through extension agents. On the other hand, Mokotjo and Kalusopa (2010), in their survey, establish that print sources are among the sources of information for farmers in Lesotho. Their study also revealed that, though most of the farmers have acquired primary education, the agricultural information delivered to them was written in local languages. In Pakistan, Farooq, Muhammad, Chaudhary and Ashraf (2007) also established that the leading agricultural information sources for farmers were print media and fellow farmers, as both were used by 100% of respondents. The electronic media (radio) also provide support for the growing involvement of farmers/producers and their organizations in the information dissemination arena. The rapid development of information technologies has profoundly changed the media landscape in African countries.

Muhammad (2005) revealed that, for dissemination of agricultural information in Ghana various methods are being employed by the extension wing of the Ministry of Food and Agriculture, involving both interpersonal and impersonal contacts. Various extension methods are useful in different situations and the selection of the most appropriate method is the key function of the extension agent (Nisha, 2006). Among various extension methods, radio is useful in creating awareness about new information resources. According to Okunade (2007), radio has its own distinctive place in information dissemination and can play a vital role in informing farmers in situations of urgency and emergency. Farmers can be informed quickly and swiftly about diseases and pest control, floods, and changing weather (Muhammad 2005). Farmers can also get appropriate advice from experts through radio to cope with emerging problems. In this way farmers can better plan their farming activities in a more systematic way.

METHODOLOGY

The Study Area

The authors carried out the study in Aduamoa in the Kwahu East district in the Eastern region of Ghana, as it is a major tiger nut production zone in Ghana. The Kwahu East District was carved out of the Kwahu South District, through the Legislative instrument (L.I) 1839 and inaugurated on 29th February 2008. The towns in Kwahu East district include Aduamoa, Nkwatia, Abetifi (capital), Pepease, Hweehwee, Kwahu-Tafo, Nkwantanana, Kotoso, and Abene Dwerebease. The district shares common boundaries with Sekyere East District to the north, Asante-Akim North Municipal and Asante Akim South District to the West, Kwahu West District to the East and Birim North, East Akim Municipal and Fantekwa District to the South.

Specifically, it lies between latitude 6° 30' N and 7° N and longitude 0° 30' W and 1° W. It covers a total land area of 1,462km². The area also lies within the Semi-deciduous forest zone with annual average rainfall between 1580mm and 1780mm. Cash and food crops such as cocoa, coffee, plantain, cassava, yam and vegetables (which include pepper and tomato) are mostly cultivated in the area (MOFA, 2014).

According to Obeng (2000), soils in the area belong to the Forest Ochrosols group. These soils are deeply weathered and their profiles show some appreciable amount of clay accumulation in the subsoil. The soils are red, brown and yellow-brown in colour and well to imperfectly drain. The topsoil is concentrated with some amount of organic matter with strongly leached lower horizons. The texture of the soils varies but the structure is moderate fine granular and friable in consistency. The soils are slightly to moderately acidic in the topsoil with pH normally between 6.5 to 5.1 in 1:1 soil: water ratio (Adjei-Gyapong & Asiamah, 2002). The soils are also less endowed in terms of nutrient level, especially nitrogen and phosphorus. They however quickly respond to soil amendments usually when allowed to fallow for some time (Adjei-Gyapong & Asiamah, 2002). Figure 1 below is a map of the study area: -

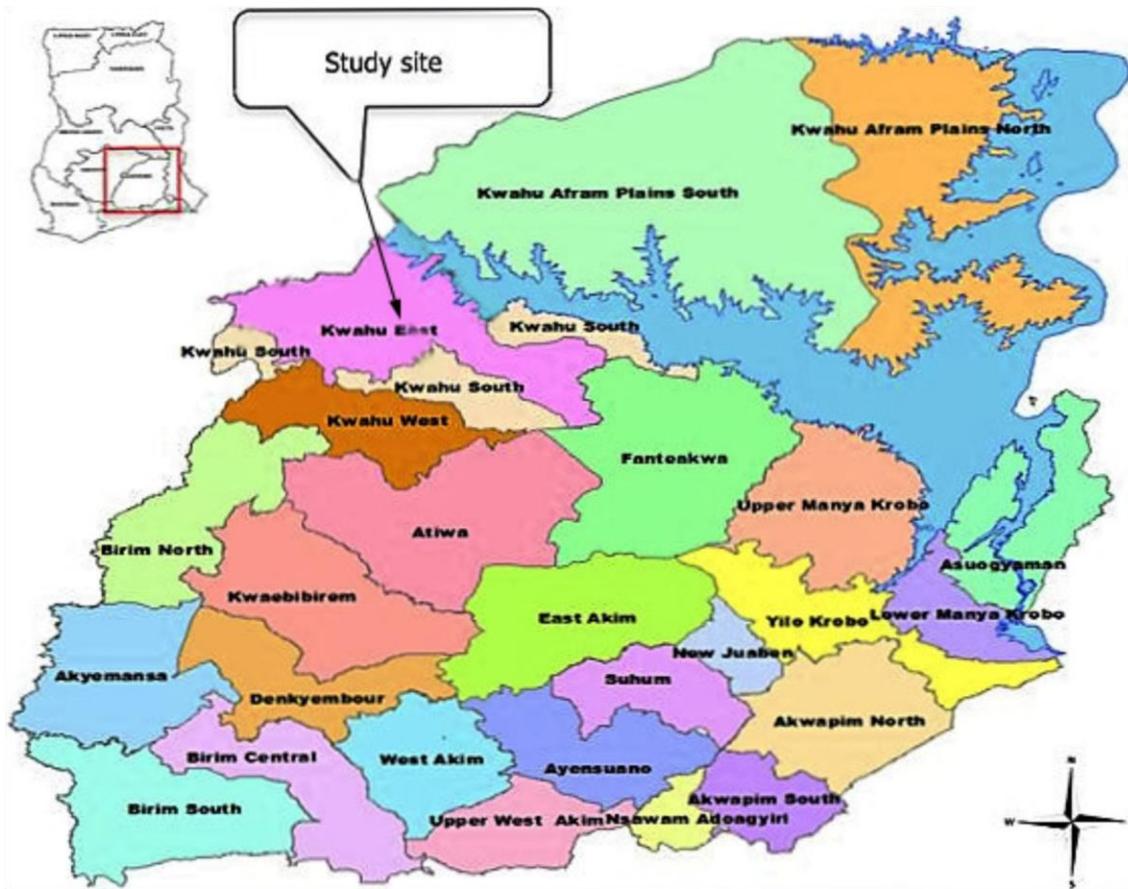


Figure 1: Map of the study area

Data Collection

Data used for this study were mainly primary and were obtained from the tiger nuts farmers using a questionnaire administered during the 2015 farming season at Aduamo area. 150 tiger nut farmers were selected and interviewed. The authors wanted to deal with the tiger nut association but unfortunately there was no such an association. Data on socio-economic characteristics, sources of information, method of information acquisition, use of information and challenges faced by tiger nut farmers in accessing information were collected and analyzed.

Data Analysis

The data collected were analyzed using IBM SPSS Statistics version 24 and Microsoft Excel 2016. Data analysis was univariate using descriptive statistics of frequencies and percentages.

RESULTS AND DISCUSSION

Demographic Information of Tiger nut Farmers

Table 1 presents the demographic information of farmers. From the table below, tiger nut cultivation is dominated by males (55.3%). However, there is quite a sizeable number of females (44.7%) who are also into tiger nut farming. An earlier study conducted by Tetteh and Ofori (1998) in Kwahu Aduamoa on the cultivation of the tubers, shows that women constituted about 70 % of the farmers whilst the men were about 30 %. The current dominance and upsurge of men in the cultivation of the crop could be attributed to the economic benefits of tiger nut farming. Hence, males now see the cultivation of crop as a profitable venture. The data also revealed that the youth (30-39 age brackets) represents more than half (59.3%) of the respondents who cultivated tiger nut. This implies that the respondents possess the strength, interest, ability, knowledge, and experience to process and possibly utilize acquired agricultural information for meaningful agricultural transformation.

Agricultural information can only be properly exploited by farmers who have certain levels of formal literacy. Farmers with basic education are more likely to adopt new technology, and become more productive. The data shows that most farmers (66.7%) have acquired basic education. The rest had no formal education (19.3%), secondary education (10.7%) and tertiary education (3.3%). Since majority of farmers have acquired some basic education this could enable them to better understand and utilize the agricultural information disseminated. Kansana, Sharma, and Sharma (1996) and Zegeye, Tadese, and Tesfaye (2001) have concluded that education positively influences the utilization of agricultural information and optimal utilization of agricultural information by the farmers may be positively impacted on their farming activities. Furthermore, majority (64.7%) were married, which confers responsibility to cater for their families and thus stimulates them to seek, acquire, and utilize sought agricultural information. Opara (2008) further notes that married farmers sought information more due to desire to produce more for family consumption and also for sale. The desire to produce more could lead to agricultural information seeking and use.

Table 1: Demographic information of tiger nut farmers

<i>Variable</i>	<i>Categories</i>	<i>Frequency</i>	<i>Percent (%)</i>
<i>Sex</i>	Female	67	44.7
	Male	83	55.3
<i>Age (Years)</i>	20-29	31	20.7
	30-39	89	59.3
	40-49	15	10
	50 and above	15	10
<i>Marital status</i>	Single	53	35.3
	Married	97	64.7
<i>Level of education</i>	No Formal Education	29	19.3
	Basic Education	100	66.7
	Secondary Education	16	10.7
	Tertiary Education	5	3.3

Sources of Agricultural Information Used

The results of sources of information on tiger nut are presented in Figure 2. The sources of agricultural information used by tiger nut farmers in the study area included radio, colleague farmers, extension agents, agro-chemical shops and television. As shown in the figure below, radio was the source tiger nut farmers used most to obtain agricultural information, identified as such by 100% of respondents in Aduamoa. The popularity of radio among the farmers is not surprising in view of the fact that many of the farmers surveyed acknowledged owning personal radio device through which agricultural information was aired to them. According to Egge, Tongdeelert, Rangsipaht, and Tudsri (2011) and Okwu, Kuku, and Aba (2007), radio as a communication medium has a number of advantages. Radio is cheap to obtain and operate, thus farmers can easily afford it. It overcomes long distance, has immediate effect, does not require literacy and is familiar in most rural households.

The effectiveness of radio in agricultural information delivery to farmers is well acknowledged in the literature. For instance, Okunade (2007) asserts that radio has its own distinctive place in information dissemination and can play a vital role in informing farmers in situations of urgency and emergency. Muhammad (2005) also comments that farmers can be informed quickly and swiftly through radio, about diseases and pest control, floods, and changing weather conditions. Radio is said to

be a more convenient medium of mass communication. This introduces some flexibility in the listening habit of farmers, who may listen while on the farm, at home or elsewhere. However, the finding of this study in respect of radio is inconsistent with the finding by Opara (2008) which shows that radio was not a major source of agricultural information to the farmers surveyed in Imo State, Nigeria.

Variations in the findings of similar researches may be explained by the fact that such studies were conducted at different times, in different places, with different people, and under different prevailing socio-economic, political and cultural settings. However, in Ghana, it is observed that, community radio using local languages has been found to be very effective but its sustainability as a source of information is in question. Government and farmer organizations should thrive to support community radio services to enable these vital sources to be continually available.

The results further show that 97.4 % of the farmers studied indicated colleague farmers as a source of their information. This result may be attributed to their easy access to co-farmers and ready availability of this information source. Fellow farmers are important sources because of interpersonal communication that is more robust with built-in feedback mechanism (Opara 2008). This result is also consistent with Asiabaka and Owens (2002), Boz (2002) and Sivayoganathan (2008 as cited by Koskei (2012) whose finding noted that farmers rank fellow farmers and friends as an important source of information. Similarly, the finding also agrees with Ajayi, Banmeke, and Solomon (2011) and Antholt (1994), who attributed the rise in farmers' preference for fellow farmers as a first-hand information source to the apparently ineffective public extension services in developing countries. Although this source is important, care must be taken in its application as current and accurate information can only be used if farmers are knowledgeable, thus regular farmer education is required for agricultural information to improve sustainable agricultural development.

Other significant sources of information to the farmers revealed in this study are extension agents (91.4%), agrochemicals shop (70.2%) and television (29.8%). It is curious that television was ranked lower than radio. This may be because the former was not widely used by the farmers because of problem of affordability and perhaps television broadcast information that is too general and lacks local farming context, thus could be irrelevant for the farmers. Television has an advantage over the radio for being audiovisual. Thus, it is a more effective means of information delivery than radio. In developing countries, extension officers play a vital role in agricultural information dissemination. Hence frequent education through workshops and seminars could sustain this information source.

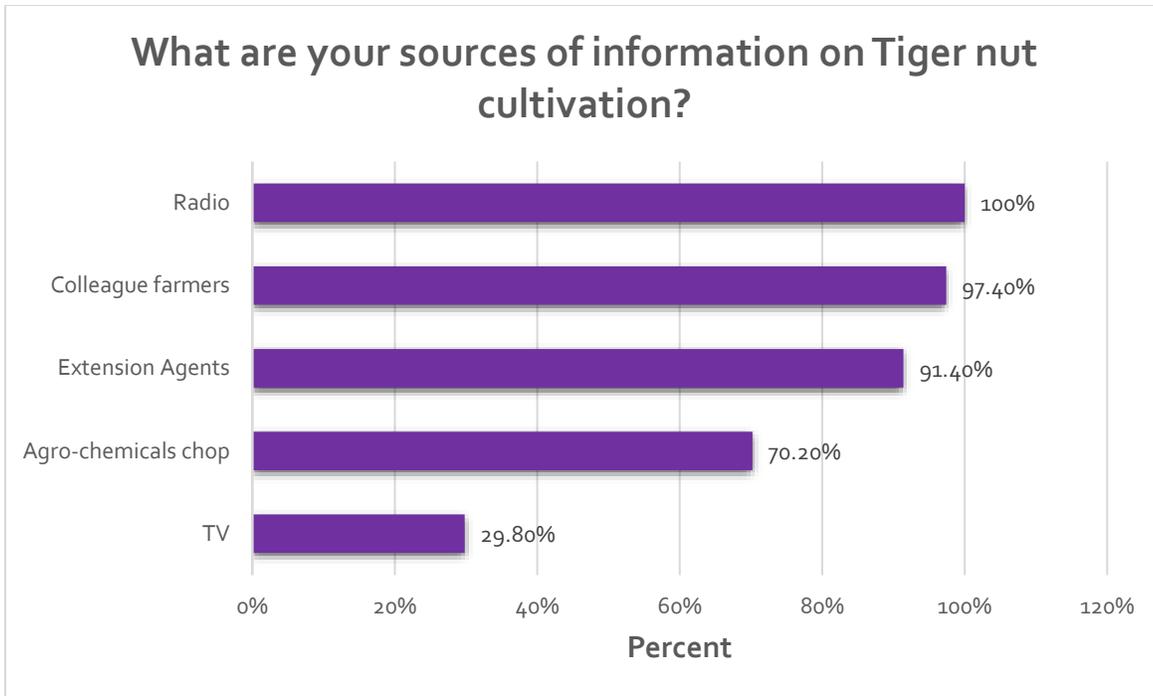


Figure 2: Sources of information on tiger nut

Usage of Tiger nut Information

To establish the purposes for which tiger nut farmers utilize available information sources in Aduamoa, multiple statements was provided to farmers to solicit responses in the usage of information on tiger nut. Figure 3 shows that 100% of tiger nut farmers have benefited from use of information in the application of fertilizer, while 96% also benefited from the use of information in weedicides application. Similarly, 90.1% of tiger nut farmers indicated that they benefited from the use of information on soil improvement practices, and 43% in the use of information in market pricing. Also, 25.8% of farmers indicated that they benefited from the use of information in pest management practices.

The outcomes of the study are in agreement with Obidike (2011) who report that farmers benefit from the use of information on new methods of crop preservation, introduction of new herbicides and pesticides for the control of farm weeds and insect pests’ methods of crop disease treatment and control, better systems of crop rotation and fertilizer application and types of soil and best soil type for planting. Also, Byamugisha, Ikoja-Odongo, Nasinyama and Lwasa (2008) outline the following as the likely benefits of using current agricultural information; improvement in farming techniques and knowledge of when to use manure or fertilizer, how to treat diseases and what crops to plant.

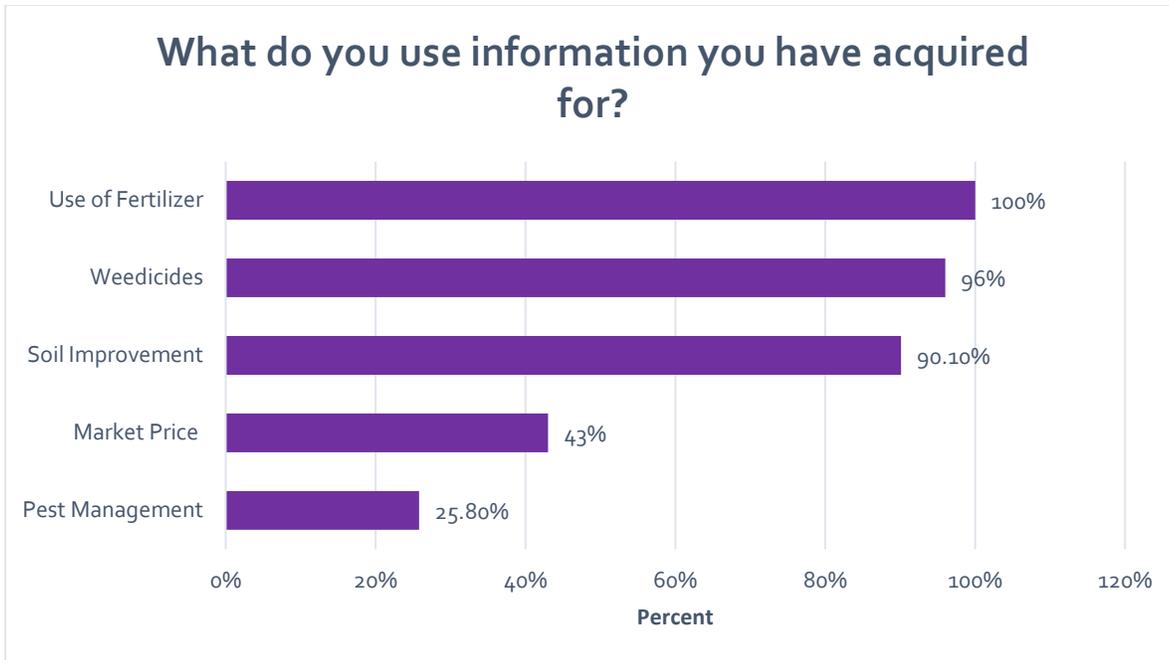


Figure 3: Usage of Tiger nut information

Challenges Faced in Accessing Agricultural Information

From this study six (6) constraints were mentioned by tiger nut growers as shown in Figure 4. These barriers serve as obstacles to their quest for information for better production of the crop. The data in figure 4 revealed that 100% of the tiger nut farmers attributed poor public relations on the part of agricultural extension agents, although they recognized these agents as a worthy source of information. Agriculture requires information and technical expertise hence the need for extension services, however due to various factors extension services are not readily available to all farmers. A consensus exists that extension services, if functioning effectively, improve agricultural productivity by providing farmers with information that helps them to optimize their use of limited resources (Muyanga & Jayne, 2006). Agricultural extension has a strong reliance to transfer agricultural knowledge (Hedjazi, Rezaee, & Zamani, 2006) generated through research with the aim of acquiring useful information and changing attitudes and practices by farmers. It is considered as a process of bringing desirable change in the behaviour of the farmers to adopt innovations relating to agriculture in such a way that they are clear and convinced of their utility (Khan, 2005).

Next, television seems to be a less popular medium of mass communication method for extension delivery, as 88.7% of the farmers reported that information is not broadcast on television in the local languages. Since most of the farmers have basic or no formal education, the use of the English language is likely to serve as a barrier to communication. It is therefore not surprising that inability to read and write was cited as a limitation by 86.1% of the farmers. Next, 76.8% indicated lack of money to purchase do it yourself manuals as a barrier, whilst 48.3% of the farmers cited lack of training programmes, workshops and seminars as a challenge and also 43% stated lack of farmers field flora, where they could gather information on new methods

of using insecticides, weedicides, pesticides and fertilizer application as a limitation to their quest for information. Figure 4 below shows the details.

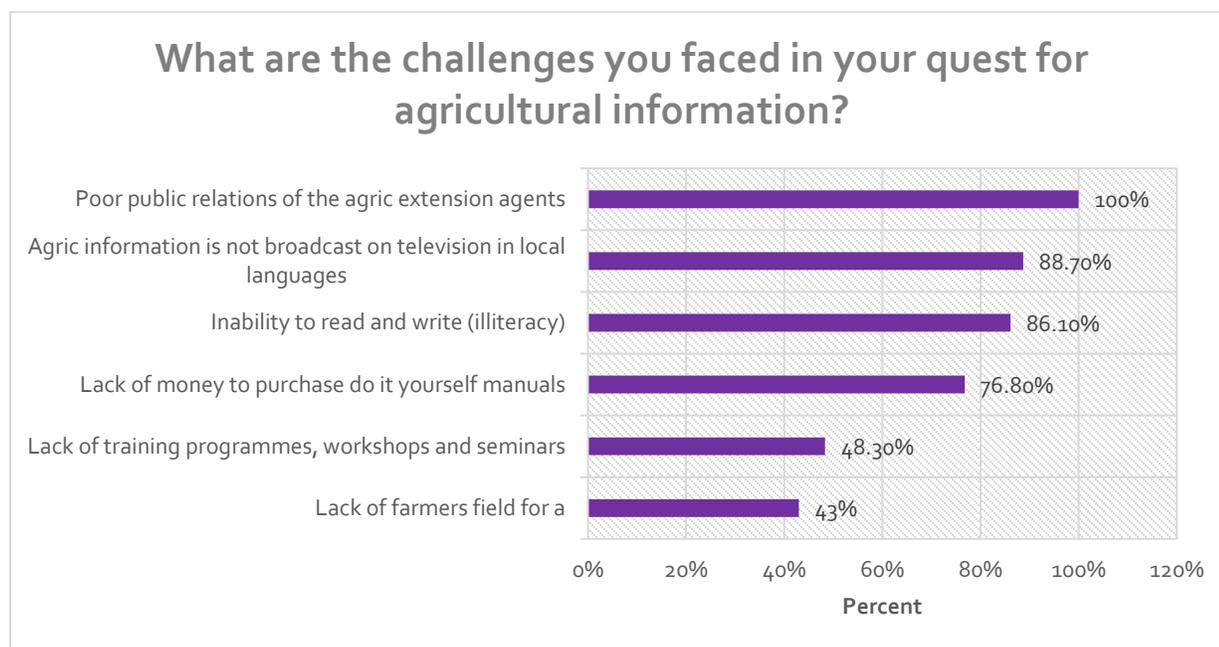


Figure 4: Challenges faced in accessing agricultural information

CONCLUSION AND RECOMMENDATIONS

The significance of sustainable agriculture practices for the farmers to a large extent depends upon the effective sources of information. The role of information in enhancing sustainable agricultural development cannot be overemphasized. Reliable and sustainable sources of Agricultural information plays a crucial role in sustainable agricultural development which has direct and indirect effects on all stakeholders in the industry including the livelihoods of the farmers. A variety of agricultural information sources were available to the farmers studied. These consisted of radio, fellow farmers, agricultural extension agents, agro-chemical shops and television programmes. The majority of the information reached the farmers through radio. The farmers mostly utilized agricultural information for the application of fertilizer and weedicides.

Based on the findings of this study, the following recommendations were made:

- Establishment of sustainable regional farm radio /community radio networks across the country. Since radio has proven to be the major source of agricultural information utilised by tiger nut farmers, it implies that tiger nut farmers listen to radio. Radio is effective particularly in making farmers aware of new technologies. It can be used by extension agents to deliver repackaged agricultural information from subject matter specialists to farmers. Therefore, it is possible to reach more farmers through this channel. More radio networks will also reduce the need for more extension

workers, and huge logistical support needed for them. The government of Ghana should also consider the need to provide radio sets at reasonable cost or even free to farmers to promote the sustainability of using radio as an agricultural information platform, given the huge benefits.

- Education and training of extension agents needs to emphasize the acquisition of persuasive communication skills to enable them function effectively as change agents. This will help improve the relations between the extension agents and farmers. Improved relations set a stage for information to be more easily and effectively exchanged between the extension agents and the farmers as well as other stakeholders of the tiger nut industry.
- Efforts must be made to ensure that radio and television broadcast sustainable agricultural information in local dialects to enable the illiterate farmers understand and apply the information. The programs should also be broadcast at favorable times to make sure the farmers are listening. The area of coverage should also be as wide as possible to reach a large number of farmers.
- For easy access and effective utilization of agricultural information in this digital age, there is the need for establishment of information centres in all rural communities in Ghana. Such information centres would be able to provide the rural farmers the desired agricultural information in a format that would be comprehensible to them, taking into cognizance the prevailing high illiteracy rate, cultural differences and limited technology (Aina, 2007).
- Farmers should be exposed to a wide variety of information sources to help them get information about improved technologies so as to enhance the adoption of new innovations. Agriculture related institutes under the Council for Scientific and Industrial Research in Ghana should organise training, technology transfer and extension programmes which are all targeted towards enhancing the adoption of sustainable modern farming techniques to improve agricultural productivity and increased production.

REFERENCES

- Abaejoh, R., Djomdi, I., & Ndojouenkeu, R. (2006). Characteristics of tiger nut (*Cyperus esculentus*) tubers and their performance in the production of a milky drink. *Journal of Food Processing and Preservation*, 30, 145-163.
- Abbas, M., Lodhi, T. E., Bashir, A., & Mahmood, M. A. (2008). Dissemination of wheat maize seed and fertilizer in North Tanzania. *Indian Journal of Agricultural Economics*, 48 (1), 1-12.
- Adjei-Gyapong, T., & Asiamah, R. D. (2002). *The interim Ghana soil classification system and its relation with the World Reference Base for Soil Resources. Quatorzième Réunion du Sous-Comité ouest et centre africain de corrélation des sols pour la mise en valeur des terres*. Rome, Italy: FAO
- Adejuyitan, J. A. (2011). Tiger nut processing: its food uses and health benefits. *American Journal of Food Technology*, 6 (3), 197-201.
- Aina, L.O. (2007). *Globalisation and Small-Scale Farming in Africa: What role for Information Centres? World libraries and information congress 73rd IFLA General Conference and Council*. Durban, South Africa.
- Ajani, E. N. (2014). Promoting the use of information and communication technologies (ICTs) for agricultural transformation in Sub-Saharan Africa: Implications for policy. *Journal of Agricultural and Food Information*, 15(1), 42–53.
- Ajayi, M. T., Banmeke, T. O. A., & Solomon, O. (2011). Information needs of oil palm farmers in Esan Central Local Government Area of Edo State, Nigeria. *Nigerian Journal of Rural Extension and Development*, 3, 45–56.

- Antholt, C. H. (1994). *Getting ready for the twenty-first century: Technical change and institutional modernization in agriculture* (World Bank Technical Paper 217). Washington, DC: The World Bank.
- Asante, F. A. (2015). *Process development and evaluation of tiger nut based chocolate products*. Unpublished PhD dissertation submitted to the Kwame University of Science and Technology, Kumasi, Ghana.
- Asiabaka, C. C., & Owens, M. (2002). *Determinants of adoptive behaviors of rural farmers in Nigeria*. Retrieved from <https://aiaee.org/attachments/article/1330/asiabaka13-20.pdf>.
- Bachhav, N. B. (2012). Information needs of the rural farmers: a study from Maharashtra, India: a survey. *Library Philosophy and Practice (e-journal)* paper 866. Retrieved from <http://digitalcommons.unl.edu/libphilprac/866>.
- Bala, B., & Sharma, S. D. (2005). Effect on income and employment of diversification and commercialization of agriculture in Kullu district of Himachal Pradesh. *Agricultural Economics Research Review*, 18, 261-269.
- Banmeke, T. O. A., & Ajayi, M. T. (2008). Farmers' perception of the agricultural information resource centre at Ago-Are, Oyo State, Nigeria. *International Journal of Agricultural Economics & Rural Development*, 1 (1), 22-29.
- Burton, S. (2002). Development at any Cost: ICTs and People's Participation in South Africa. *Communication*, 28 (2), 43-53.
- Byamugisha, H. M., Ikoja-Odongo, R., Nasinyama, G.W., & Lwasa, S. (2008). Information seeking and use among urban farmers in Kampala district, Uganda, *Agricultural information and IT: Proceedings of IAALD AFITA WCCA 2008* (pp. 571-582). Retrieved from <http://www.cabi.org/GARA/FullTextPDF/2008/20083298139.pdf>
- Cartmell, D.D., Orr, C.L., & Kelemen, D.B. (2004). Methods of information dissemination to limited-scale land owners. Retrieved from <http://agrifecdn.tamu.edu/saas/files/2011/02/infodissemination.pdf>.
- CRDO (2012). *Consejo Regulador de la Denominaci'on de Origen Chufa de Valencia*. Retrieved from <http://www.chufadevalencia.org>.
- Daberkow, S. G., & McBride, W. D. (2003). Farm and operator characteristics affecting the awareness and adoption of precision agriculture technologies in the US. *Precision Agriculture*, 4, 163-177.
- Dakogre, T. (2008). *Morphological characterization and evaluation of tiger nut in Ghana*. Unpublished Master's Thesis submitted to The Department of Crop Science, School of Agriculture, University of Cape Coast.
- Diekmann, F. C., Loibl, M.T., & Batte, M. (2009). The economics of agricultural information: factors affecting commercial farmers' information strategies in Ohio. *Review of Agricultural Economics*, 31(4), 853-872.
- Egge, M., Tongdeelert, P., Rangsihaht, S., & Tudsri, S. (2011). Preferred sources of information among sorghum farmers in Awbere District of Somali Regional State, Ethiopia. *Kasetsart Journal (Social Sciences)*, 32: 319-326.
- Farooq, S., Muhammad, S., Chaudhary, K. M., & Ashraf, I. (2007). Role of print media in the dissemination of agricultural information among farmers. *Pakistan Journal of Agricultural Science*, 44(2), 378-380.
- Farrington, J., Christopolos, I., Kidd, A. D., & Beckman, M. (2002). *Can extension contribute to rural poverty reduction? Synthesis of a six-country study*. Agricultural Research and Extension Network, paper no.123, London: ODI.

- Ferris, S. & Robbins, P. (2005). *Developing market information services in Eastern Africa: The FoodNet experience: Local, national and regional market information services*. Ibadan, Nigeria: International Institute of Tropical Agriculture (IITA), Ibadan Nigeria.
- Ghana News Agency (2002, December 4). *Flour made from tiger nut*. Retrieved from <https://www.modernghana.com/news/28683/flour-made-from-tiger-nut.html>.
- Hedjazi, Y., Rezaee, R., & Zamani, N. (2006). Factors affecting the use of ICTs by Iranian Agriculture Extension Specialists. *Journal of Extension Systems*, 22, 1-15.
- Kansana, H. S., Sharma, R. P., & Sharma, S. K. (1996). Knowledge and adoption of wheat technologies among contact and non-contact farmers. *Agricultural Science Digest*, 16, 154–156.
- Khan, S.A. (2005). *Introduction to extension education*, In R. A. Memon & E. Bashir (Eds.). *Extension Methods* (3rd Ed.). National Book Found, Islamabad, Pakistan.
- Koskei, R. C. (2012). *Access and use of information by small holder tea farmers in Bureti district, Kenya*. MSc. Thesis submitted to Egerton University, Njoro, Kenya.
- Masuki, K. F., Kamugisha, R., Mowo, J. G., Tanui, J., Tukahirwa, J., Mogoi, J. & Adera, E. O. (2010). *Role of mobile phones in improving communication and information delivery for agricultural development: lessons from South Western Uganda*. ICT and Development-Research Voices from Africa. International Federation for Information Processing (IFIP) Technical Commission 9-Relationship between Computers and Society. Workshop at Makerere University, Uganda. 22-23 March.
- Mgbada, J. U. (2006). Effectiveness of information sources on improved farming practices to women farmers in Enugu State, Nigeria. *Global Approaches to Extension Practice*, 2 (1), 67- 78.
- Ministry of Food and Agriculture (2014). *Regional agricultural profiles: Kwahu East District*. Retrieved from www.mofa.gov.gh.
- Mittal, S. & Mehar, M. (2013). *Agricultural information networks, information needs and risk management strategies: a survey of farmers in Indo-Gangetic plains of India*. Socioeconomics Working Paper 10.
- Mexico, D.F.: CIMMYT.
- Mokotjo, W. & Kalusopa, T. (2010). Evaluation of the agricultural information service (AIS) in Lesotho. *International Journal of Information Management*, 30, 350–356.
- Muhammad, S. (2005) *Agricultural Extension: Strategies and skills-* (2nd ed), Faisalabad, Pakistan: Unitech Communications.
- Muyanga, M., & Jayne, T.S. (2006). *Agricultural extension in Kenya: practice policy and lessons. practice and policy lessons*. Tegemeo Institute of Agriculture and Policy Development, Egerton University, Kenya.
- Nazari, M. R., & Hassan, M. S. B. H. (2011). The role of television in the enhancement of farmers’ agricultural knowledge. *African Journal Agricultural Research*, 6 (4), 931-936.
- Nisha, M. (2006). *Understanding Extension Education*. New Delhi, India: Kalpaz Publications.
- Obeng, H. (2000). *Soil classification in Ghana*. Centre For Policy Analysis (CEPA): Selected Economic Issues, No.3.
- Obidike NA (2011). Rural farmers’ problems accessing agricultural information: a case study of Nsukka local government area of Enugu State, Nigeria. *Library Philosophy and Practice (e-journal)*. Retrieved from <http://unllib.unl.edu/LPP/>.
- Ofuoku, A. U., Emah, G. N., & Itedjere, B. E. (2008). Information utilization among rural fish farmers in central agricultural zone of Delta State, Nigeria. *World Journal of Agricultural Sciences*, 4(5), 558-564.

- Okunade, E. O. (2007). Effectiveness of extension teaching methods in acquiring knowledge, skill and attitude by women farmers in Osun State. *Journal of Applied Science Research*, 3(4), 282–286.
- Okwu, O. J., Kuku, A. A., & Aba, J. I. (2007). An assessment of use of radio in agricultural information dissemination: A case study of radio Benue in Nigeria. *African Journal of Agricultural Research*, 2(1): 14–18.
- Oladele, O. I. (2006). Multilinguality of farm broadcast and agricultural information access in Nigeria. *Nordic Journal of African Studies*, 15 (2), 199–205.
- Opara, U. N. (2008). Agricultural information sources used by farmers in Imo State, Nigeria. *Information Development*, 24(4), 289–292.
- Pascual, B., Maroto, J. V., Lopez-Galarza, S., Sanbautista, A., & Alagarda, J. (2000). Chufa (*Cyperus esculentus* L. var. *sativus* Boeck.): an unconventional crop studies related to applications and cultivation. *Economy Botany*, 54, 439-448
- Ronald, B., Dulle, F., & Ngalapa, H. (2014). Assessment of information needs of rice farmers in Tanzania: a case study of Kilombero District, Morogoro. *Library Philosophy and Practice (e-journal)* paper 1071. Retrieved from <http://digitalcommons.unl.edu/libphilprac/1071>.
- Ronald, B., Silayo, G. F., & Abdalah, K. J. (2015). Preference sources of information used by seaweeds farmers in Unguja, Zanzibar. *International Journal of Academic Library and Information Science*, 3(4), 106-116.
- Rubert, J., Sabastià, N., Soriano, J. M., Soler, C., & Mañes J. (2011). One-year monitoring of aflatoxins and ochratoxin A in tiger-nuts and their beverages. *Food Chemistry*, 127, 822-826
- Sam, J., & Dzandu, L. (2015). The use of radio to disseminate agricultural information to farmers: The Ghana Agricultural Information Network System (GAINS) Experience. *Agricultural Information Worldwide*, 7, 17-23.
- Singh A., Sharma, R. K., Agrawal, M., & Marshall FM (2010). Risk assessment of heavy metal toxicity, through contaminated vegetables from wastewater irrigated areas in Varanasi India. *Tropical Ecology*, 512, 375–387.
- Stienen, J., Bruinsma, W., & Neuman, F. (2007). *How ICT can make a difference in agricultural livelihoods*. In: The Commonwealth Ministers Reference Book. Retrieved from <http://www.iicd.org/files/ICT%20and%20agricultural%20livelihoods.pdf>.
- Tetteh, J. P., & Acheampong, A. (1998). *Effects of organic manure on the growth and yield of tigernut (Cyperus esculentus L.)*. Proceedings of Soil Science of Society. Ghana.
- Tetteh, J. P., & Ofori, E. A. (1998). Baseline survey of tiger nuts (*Cyperus esculentus*) production in the Kwahu South District of Ghana. *Ghana Journal of Agricultural Science*, 31, 211-216.
- Zegeye, T., Tadese, B., & Tesfaye, S. (2001). *Determinants of high yielding maize technology adoption: empirical evidence from southwestern Oromia*. Research Report No. 38, Addis Ababa, Ethiopia: Ethiopian Agricultural Research Organization (EARO).

ABOUT THE AUTHORS

Grace Obeng-Koranteng is a Librarian at the Council for Scientific and Industrial Research, Institute for Scientific and Technological Information (CSIR-INSTI) Accra, Ghana.

Raphael Kwame Kavi is a Librarian at the Council for Scientific and Industrial Research, Food Research Institute, Accra, Ghana.

Kwabena Asiedu Bugyei is a Scientific Information Officer at the Council for Scientific and Industrial Research, Food Research Institute, Accra, Ghana.

Peter Anafo is an Assistant Librarian at the University of Mines and Technology (UMaT), Tarkwa, Ghana.