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Agricultural knowledge and information flows within smallholder farming households in Ghana:

Intra-household Study

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Cover photo: Soybean grain. Photo credit: Lydia Wairegi, CABI

Abstract

Legume technologies are widely promoted among smallholder farmers in sub-Saharan Africa, providing opportunities for sustainable agricultural intensification (SAI), and contributing to the nutritional and economic benefits of households growing them. However, legume cultivation is relatively small in most farming systems and on the decline, attributed to low adoption of improved technologies occasioned primarily by the lack of access to actionable information. This study aimed to assess farmers' access to agricultural knowledge and information flows within households in Ghana, in order to guide message design and selection of appropriate information dissemination pathways to reach women, men and youth with legume technologies. An intra-household survey method was used and 300 households and 868 respondents were surveyed. Results show that farmers had access to various information sources, though they mainly relied on neighbours and relatives (52%) and their own experience (49%). Information shared through these sources was mainly on timing of field operations, and good agricultural practices, which may reflect farmers' inherent knowledge and adjustment over time to respond to changing environmental conditions. However, for relatively new practices such as use of *Rhizobium* inoculants and Purdue Improved Crop Storage (PICS) bags, farmers relied on external sources such as extension officers, radio and demonstration plots. Men and young people exhibited more diverse information sources compared with women and elderly people. Some information sources were the prerogative of men, such as radio and demonstration plots, while women mainly relied on their own experience and family/community members. Results have the following implications: (i) there is still a margin for improving learning of more recently introduced practices, thus it is important to link promotion with targeted information sources; (ii) targeting women and elderly people with channels that are farm-based such as extension visits and on-farm demonstrations may enhance their access to information; (iii) there is a need to focus on the complementary role of legumes in the production of key staples in the region, such as cassava, in efforts to promote SAI; and (iv) given the observed dynamics of intra-household information sharing, targeting information to various gender and age categories provides an opportunity to ensure information can effectively reach different household members.

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Acronyms and Abbreviations

ASHC	Africa Soil Health Consortium
ATT	Agriculture Technology Transfer
CABI	CAB International
Demos	Demonstration plots
Ext.	Extension
FFF	Farmer field forum
FFS	Farmer field school
GALA	Gender and the Legume Alliance
HH	Household
ISFM	Integrated soil fertility management
MFA	Ministry of Food and Agriculture
NGO	Non-governmental organization
ODK	Open Data Kit
PICS	Purdue Improved Crop Storage
SAI	Sustainable agricultural intensification
SAIRLA	Sustainable Agricultural Intensification Research and Learning in Africa
SIL	Soybean Innovation Lab
SMS	short message service (i.e. text messages)
SSTP	Scaling Seeds and Technologies Partnership
TLU	Tropical livestock unit
YARO	Youth Advocacy on Rights and Opportunities

Introduction

Background to the study

In most African countries, small-scale farmers constitute the major part of the food supply base, and improvements in productivity will need to come from them. As land is often a limiting factor for farmers, innovations that ensure sustainable agricultural intensification (SAI) in the form of inputs, and integrated soil fertility management (ISFM) have the potential to significantly improve yields and improve rural livelihoods (Dethier and Effenberger 2012). SAI practices influence levels of food production and, more broadly, the state of the global environment (Jules et al. 2011). Legume crops play a key role in ISFM, a central practice in SAI (Vanlauwe et al. 2015) through fixation of atmospheric nitrogen (N2), enhanced fertilizer uptake, supply of organic resources, and suppression of weeds, among other benefits (Vanlauwe et al. 2019, Sanginga et al. 2003). Besides, legume crops provide immediate benefits as nutritious food and for sale, particularly for medium and high resource-endowed farmers (Giller et al. 2013, Franke, van den Brand, and Giller 2014). In addition, crop residues can be used as high quality livestock feed (Maingi et al. 2001).

In Ghana legumes (cowpea, groundnut and soybean) are important as both food staples and commercial crops, with legume value chains therefore impacting significantly on food security and household income (Rusike et al. 2013). Soybean, in particular, has become one of the most important commodities, and its production has been promoted by the Ministry of Food and Agriculture (MFA) to increase cash income and improve the nutritional status of rural households. However, as yet there has been little increase in soybean cultivation. Its production has also been erratic, attributed to various factors but mainly the lack of improved production technologies and poorly organized processing and marketing channels, affecting the expected incomes from its production (Bekele et al. 2015, Mbanya 2011). Smallholder farmers use basic technologies without mechanization, and most use recycled seed and apply insufficient fertilizers and agrochemicals. In addition, there is a lack of effective government extension services (World Bank 2010). Where extension workers exist, they are inadequate in providing knowledge on production technologies especially to women farmers (Rusike et al. 2013). Moreover, getting research information into a format that is of practical use to smallholder farmers also remains problematic (Sones et al. 2015), not only in Ghana but Africa in general.

In order to enhance the efficiency of legume value chains and encourage their integration into farming systems, it is important to understand: (i) current farmer knowledge and practices in legume production; (ii) information flows through the legume value chain; and (iii) how information flow could be changed to facilitate (a) input supply from private-sector parties, (b) farmers in adopting productivity-enhancing practices, and (c) farmer access to output markets. It is also important to understand which communication channels are more suited for different gender groups.

The Gender and the Legume Alliance: Integrating multi-media communication approaches and input brokerage (GALA) project, sought to address the current opportunities for improving access to and capacity to use information and knowledge by smallholder farmers to achieve sustainable intensification in legume production in Ghana.

This study aimed to assess farmers' access to knowledge and advice on legume technologies, and information flows within smallholder farming households in Northern Ghana. The following research questions were assessed:

1. What are the most common sources of agricultural knowledge for smallholder farmers and how do they vary by gender and age category?
2. Which information sources are more suited for different gender groups and age categories?
3. How do information sources available to households facilitate farmers' awareness and uptake of legume practices?
4. What is the extent of information flow within households vis à vis gender and legume practices?

The information provided a baseline for the GALA project, and also enabled selection of appropriate information dissemination pathways suitable for men, women and youth for scaling up legume technologies. Findings are also important for public, private and non-governmental organization (NGO) sectors, providing the opportunity for increased engagement with evidence on which communication channels work, and what support is required to strengthen legume value chains in Ghana. This will enable smallholder farmers, particularly women and youth, to profit from legume technologies that allow intensification without further land degradation.

Methods

Study design

An intra-household survey approach was used for the study. Intra-household analysis aims to understand household dynamics in receipt, sharing and application of information from various sources. The primary respondent in the survey was the household head or the spouse, as these were considered to be the key decision makers for the household. The survey also allowed to interview up to three additional members of the household (only those over 18 years old). Care was taken to ensure representation of different age categories and gender within the household where possible. It was anticipated that different household members interact with different information sources, but intra-household information sharing is possible. In this case, household members could still be reached with information even if they were not directly targeted by a specific information source. Besides, decision making at household level and power relations may affect access to and utilization of information, necessitating a clear understanding of intra-household dynamics vis à vis information access and sharing.

Study area and sampling procedure

The study was undertaken in the Northern Region of Ghana covering five districts. Districts were selected based on areas where soybean growing is common. While this study aimed to understand information access and flow, it also served as a baseline for the soybean campaign. As such, selected districts and communities were those that had been targeted by the GALA soybean campaign. The selection also took into consideration areas where parallel or complementary initiatives were taking place. Some of the initiatives included: (i) Scaling Seeds and Technologies Partnership (SSTP); (ii) Agriculture Technology Transfer (ATT); (iii) AgDevCo Ghana Limited; (iv) Youth Advocacy on Rights and Opportunities (YARO); and (v) Soybean Innovation Lab (SIL). At least 300 households (868 respondents) were interviewed in the five districts (Table 1). The targeted crop was soybean.

Table 1. Sample districts, sampled households (HH) and respondent category

District	No. of HHs	Respondent category by age and gender					
		Total	Female	Male	18–35 years	36–60 years	Over 60 years
Central Gonja	59	163	64	99	92	56	15
East Gonja	61	170	78	92	90	69	11
Yendi	59	187	86	101	105	69	13
Savelugu	61	199	80	119	118	60	21
Guashiegu	60	149	15	134	73	63	13
Overall sample	300	868	323	545	478	317	73

Data collection and analysis

Data was collected in May 2017. Data collection was through face-to-face interviews with all data collected on tablets. The tablets were pre-loaded with the survey questionnaire designed with Open Data Kit (ODK) application. The data entry application had in-built range and consistency checks to ensure good quality data. The field coordinator ran checks on data while still in the field and provided feedback on data collection to a CABI-based scientist who remotely conducted quality checks on the data.

Training of enumerators for the intra-household survey was carried out by a team from CABI in April 2017. First, enumerators were trained on aspects of data collection and data entry using tablets and mobile applications. Secondly, field testing of the questionnaire gave enumerators a practical feel of mobile data collection and familiarized them with the tool. Consent was sought from each household head or primary respondent before the interviews were conducted.

The survey collected information on: (i) household demographics; (ii) social and economic characteristics; (iii) crop production; (iv) sources of agricultural information and preference for various sources; (v) information sharing within the household and community; and (vi) awareness of legume technologies.

Data was downloaded from ODK aggregate as comma-separated values (csv) files. Exploratory data analysis was undertaken in both Microsoft Excel and STATA statistical package. Descriptive analysis was mainly used in this study to provide general understanding of the study results in terms of the source of the agricultural information and how it was shared within a household, and how information received and shared translates into awareness and adoption of soybean technologies. The units of analysis were household and household members.

Results

Descriptive statistics

The survey reached 300 households, and 868 respondents. Women respondents were 37% of the total respondents. Young people (18–35 years old) were 55% of the respondents, while those over 60 years of age were just 8% of total respondents (see Table 1). Average household size was fourteen, ranging between one and 48 members (Table 2). Farming households owned relatively large pieces of land on which they farmed. Average land ownership was 35 acres, while average farmed land was 24 acres. This implies that farming households utilized up to 70% of the total owned land for crop farming. The rest could be fallow or grazing land, considering that the households also exhibited relatively high numbers of tropical livestock units (TLUs), averaging 5 TLUs across the study districts. However, it was also very common for farming households to utilize community land and/or land that belonged to traditional chiefs in the various locations. In this case, actual ownership of land referred to here may not necessarily represent legal ownership but rather what households have access to for farming activities. At least 92% of the interviewed households relied more than 60% on crop production for household income. Farmers grew mainly annual crops dominated by maize, yam, rice and legumes (groundnut and soybean). Household labour, however, was minimal (an average of four people working full time on the farm) compared with the large household sizes and farmed land. This typically shows a labour deficit for the farming households.

Table 2 Farm household characteristics across sample districts†

District	HH size	Household labour*	Farmed land (acres)	Owned land (acres)	TLUs	Cropping (% HH)‡
Central Gonja	14 (10)	3.6 (1.6)	18 (19)	28 (35)	8.1 (12.3)	93
East Gonja	12 (8)	3.6 (1.7)	22 (20)	40 (45)	3.2 (5.9)	95
Guashiegu	13 (9)	4.6 (3.4)	33 (36)	39 (39)	6.4 (15.4)	93
Savelugu	13 (7)	5.1 (3.1)	34 (33)	43 (39)	2.5 (4.4)	97
Yendi	16 (8)	2.7 (2.0)	14 (11)	24 (19)	5.4 (9.5)	83
Overall sample	14 (8)	3.9 (2.6)	24 (27)	35 (37)	5.1 (10.4)	92

†Values shown are averages (figures in parentheses are standard deviations).

*Number of household (HH) members (over 18 years old) working full time on the farm.

‡Proportion of households who indicated that crop farming contributes more than 60% of their household incomes.

TLUs, tropical livestock units (where cattle = 0.7, sheep = 0.1, goats = 0.1, pigs = 0.2, chicken = 0.01) (Bongers et al. 2015).

Sources of agricultural information

Major sources of agricultural information

Overall, the majority of respondents (52%) obtained agricultural information from neighbours and friends, or relied on their own experience (49%) (data not shown). Other mentioned common source of agricultural information were; radio, another household member, extension officers, agro-dealers and demonstration or field days. Figure 1 shows access to the various information sources by gender. There were significant differences ($P < 0.01$) between men's and women's access to and use of information from own experience, radio, extension officers, agro-dealers and demonstration plots. Men were more likely than women to use own experience, radio, extension officers and demonstration plots. On the other hand, women were more likely to seek information from agro-dealers compared to men. Across age category, there were significant difference in farmers' access to information from another household member ($p<0.01$) and agro-dealers ($p<0.05$).

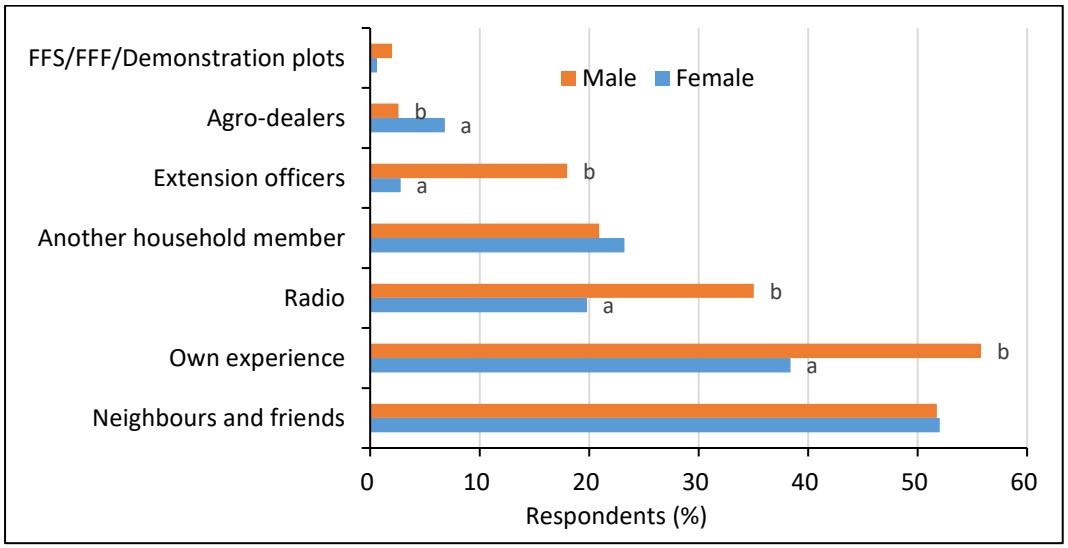

Figure 1: Farmer sources of agricultural information, by gender. For each individual information source, bars with a different letter are significantly different. FFF, farmer field forum; FFS, farmer field school.

We also assessed diversity of information sources across age category and gender (Table 3). More than 50% of respondents relied on only one source of information. A very small proportion (7%) had four sources of information. Test of significance shows significant differences ($P < 0.01$) between men's and women's access to various information sources. Men had significantly more sources of information compared with women (Pearson $\chi^2 = 69.6437$; $P = 0.000$). There was also a noted significant difference in diversity of information sources across age category, with younger people more likely to have more sources compared with older people.

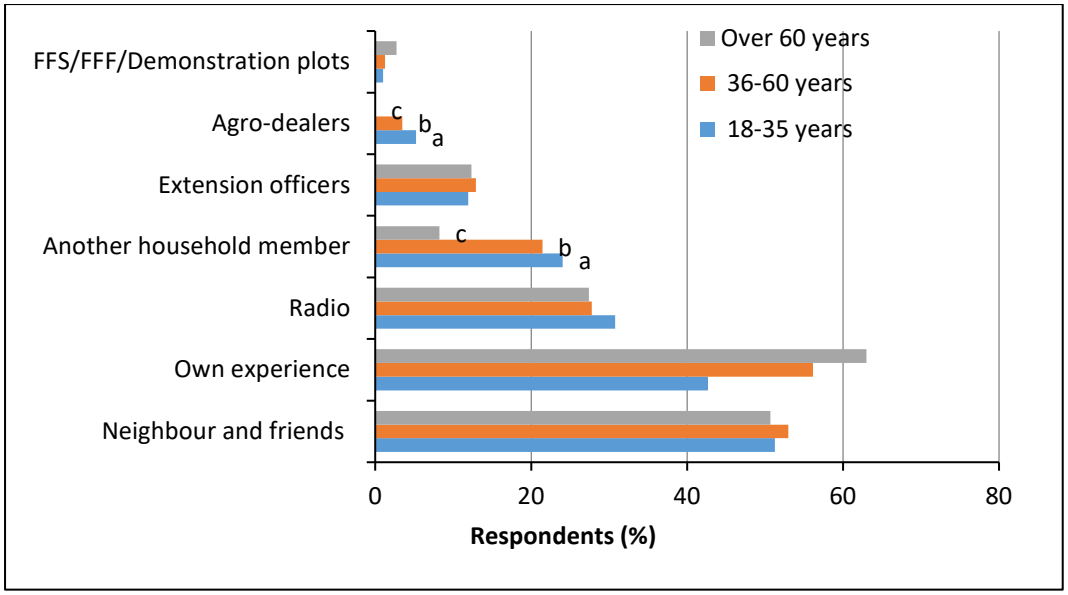

Figure 2. Farmer sources of agricultural information, by age category. For each individual information source, bars with a different letter are significantly different.

Table 3. Intensity of information sources by gender

Respondent category	Information sources available for households – frequency (%)				Pearson χ^2	P-value
	One source	Two sources	Three sources	Four sources		
Gender						
Men	43	34	14	9	69.644	0.000
Women	72	18	5	5		
Age category						
18–35 years	57	26	9	8	15.260	0.123
36–60 years	49	31	14	6		
Over 60 years	51	35	10	4		
Overall sample	54	28	11	7		

Agricultural information sources by crop

Farmers obtained agricultural information mainly on maize, soybeans, other cereals (rice, sorghum) and oil crops (Figure 3). Male farmers were more likely to receive information on maize, soybean, other cereals and other roots/tubers, compared with women. On the other hand, women farmers were more likely to receive information on sesame and other oil crops and vegetables compared with men. Information on common beans and other legumes was minimal across all respondents.

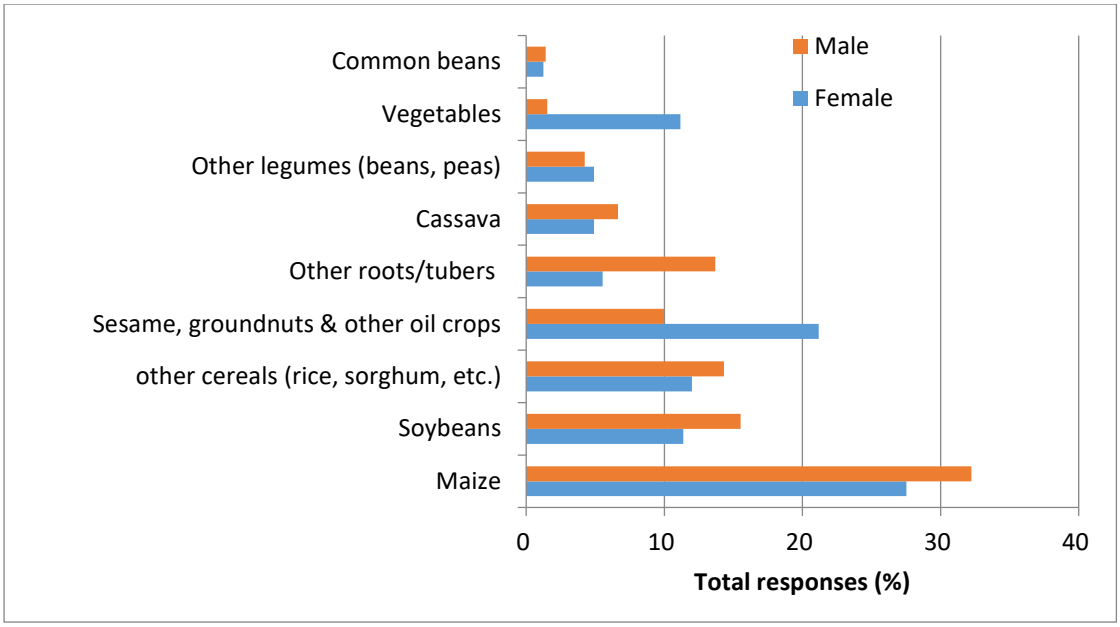

Figure 3. Most common crops targeted by different information sources.

Cross tabulation of information source by crop category shows that while farmers obtained information from various sources, most of them tended to concentrate on the maize crop in comparison to other crops (Table 4). Other cereals (e.g. rice and sorghum) also benefited from varied information sources. Information on soybean was mainly from extension officers, radio and own experience. Given that these information sources were more significantly accessed by men compared with women, this could explain why more men than women received information on soybean, despite a popular perception that soybean is a woman's crop. On the other hand, information on traditional food crops such as cassava, common bean and other legumes was minimal, dominated by own experience.

Ranking information sources

Respondents accessing agricultural information from various sources were asked to rank them according to perceived importance or usefulness, on a scale of 1 to 7, where 7 was most important and 1 least important. Importance was subjective based on whether farmers perceive information received to be useful, relevant and actionable.

Both men and women ranked neighbours and friends, and their own experience as their most important sources of information with a median score of 6 (out of 7 points) (Figure 4). In addition, men ranked other household members, extension officers and demonstration plots as equally important information sources. Extension officer, radio and demonstration plots, though not very popular information sources for women, were ranked the most important to them with a median score of 7.

Across age categories, older farmers (over 60 years old) considered their own experience and radio as the most important sources of information (Figure 5). Radio was also considered important for the other age categories (under 60 years old), over and above neighbours, other household members, own experience and extension officers. Young people and elderly people ranked other household members as an important source of information for them.

Table 4. Most common farmer information sources and crops they focus on (% of responses).

Crop category	Neighbour/friends	Own experience	Radio	Other HH member	Extension officer	Demos/FFS	Agro-dealers
Cassava	0	5	4	9	7	6	1
Common beans	0	0	0	1	1	3	1
Maize	29	33	43	31	33	29	31
Other cereals	17	12	14	13	18	14	15
Other legumes	0	5	0	3	3	5	1
Other roots/tubers	5	14	4	12	6	13	15
Sesame, oil crops	14	7	18	12	8	12	25
Soybeans	14	18	19	13	23	14	10
Vegetables	21	6	0	6	1	4	1

Demos, demonstration plots; Ext., extension; FFS, farmer field school; HH, household.

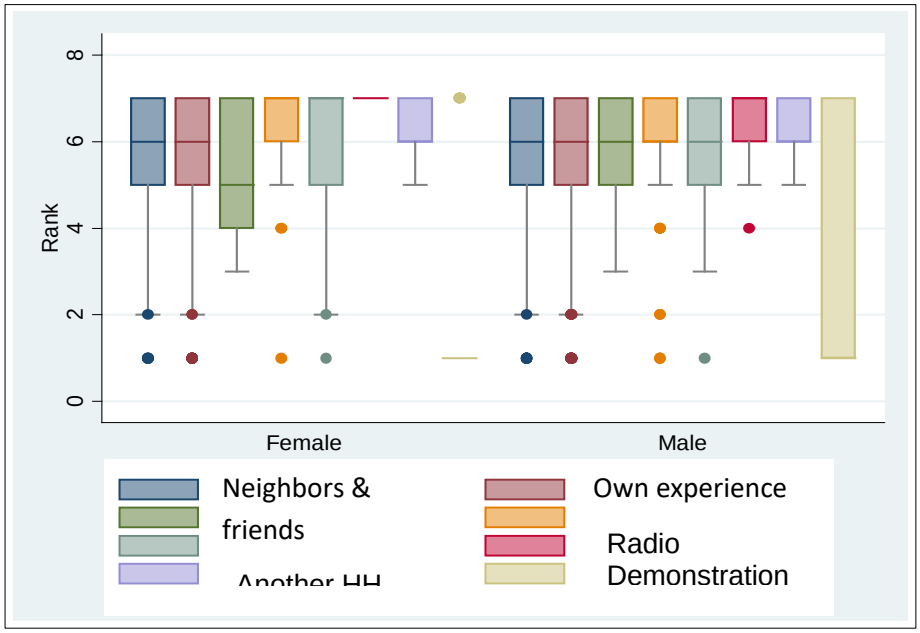

Figure 4. Ranking importance of information sources by gender using a scale of 1–7, where 7 was most important and 1 least important. Boxes indicate the lower quartile (bottom horizontal line), median (central horizontal line) and upper quartile (top horizontal line) and variability between the upper and lower quartiles (whiskers).

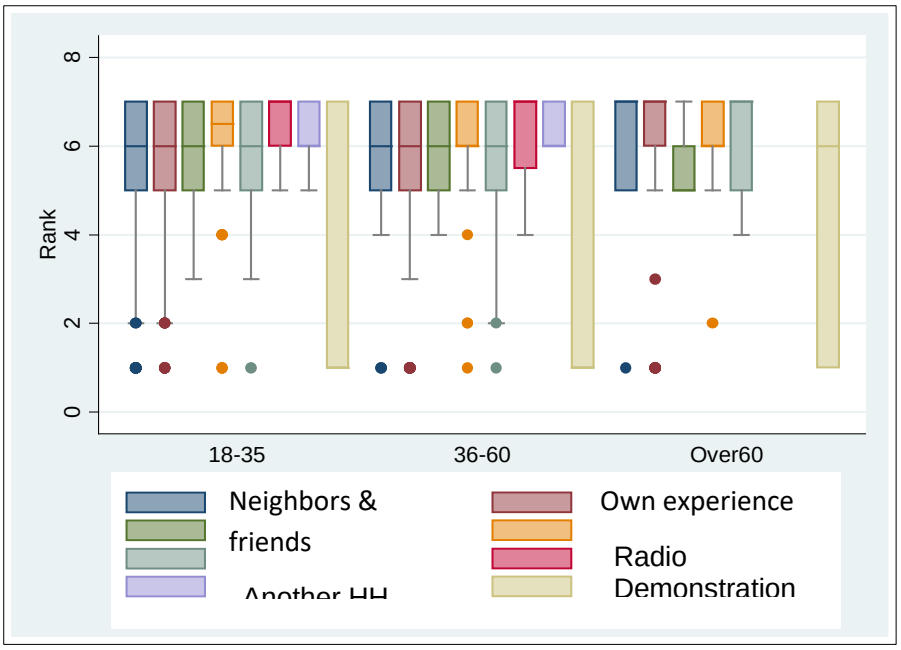

Figure 5. Ranking importance of information sources by age category using a scale of 1–7, where 7 was most important and 1 least important. Boxes indicate the lower quartile (bottom horizontal line), median (central horizontal line) and upper quartile (top horizontal line) and variability between the upper and lower quartiles (whiskers).

The result implies that some of the less accessible/popular information channels were considered to be important information sources to those that accessed them e.g. extension officers, agro-dealers and demonstration plots. These approaches offer face-to-face interactions and knowledge exchange for farmers, a plausible reason for the high ranking by respondents.

Awareness of agricultural practices

Respondents who indicated that they received agricultural advice were asked what technologies and practices they had learned, irrespective of the channel accessed. The survey focused on legume practices, in the context of SAI: timing of field operations, fertilization, chemical application, input quality, water management, crop varieties, pest management, storage and markets. Respondents mainly obtained information regarding timing of field operations – timely planting (82% of respondents receiving information from any source) and early land preparation (75%) (Table 5). A small proportion of respondents mentioned practices such as type of seed or varieties to use, *Rhizobium* inoculants, soil testing before fertilizer application, irrigation/water harvesting, and seed treatment. The trend of mentioned practices was the same across gender and age category, implying that farmers received similar information.

Table 5. Information received by farmers on various farming practices (% of respondents)†

Practice	Overall sample	Female	Male	18–35 years	36–60 years	Over 60 years
Timely planting	82	77	85	79	86	83
Earlier land preparation	75	76	74	72	78	79
Crop rotation	38	25	44	36	41	43
Chemical weeding	30	20	35	28	34	31
Chemical fertilizer/blends	23	13	26	18	27	31
Markets	18	20	17	19	16	17
Cultural pest control practices	15	17	14	13	16	17
Type of seed, varieties to use	17	11	19	15	19	22
Rhizobium inoculant	5	0	7	5	5	4
Manure use	3	3	3	1	5	4
Purdue Improved Crop Storage (PICS) bags	2	0	3	2	3	2
Soil testing before fertilizer application	1	1	1	1	1	2
Irrigation or water harvesting	1	1	1	0	1	4
Seed treatment	1	0	1	1	0	1

†percentage was computed based on those who received information from any source

Looking at type of information by source, it was observed that the most common information provided similar information (Table 6). It also appears that most of what respondents knew from their own experience was what most sources provided information on. It is difficult to say which information source would contribute more to create awareness about a specific type of technology or practice, as similar information was received irrespective of source. What may be different could be the quality of learning and subsequently the application of the information based on the source of that information; however, this was not recorded in this study.

Extension officers and demonstrations played a role in introducing farmers to technologies such as the use of *Rhizobium* inoculants and Purdue Improved Crop Storage (PICS) bags, though these were only mentioned by a small proportion of farmers. These are new technologies which farmers may not know about, as such their introduction warrants interactions with experts through extension and observations at farm level.

Table 6. Agricultural practices learned through various information sources (% of respondents)

Agricultural practice	Own experience	Neighbours and friends	Radio	Ext. officer	Other HH member	Agro-dealers	Demos/ FFS
Timely planting	85	80	87	85	82	47	79
Earlier land preparation	79	84	70	68	55	47	57
Crop rotation	45	46	23	43	27	17	14
Chemical weeding	37	30	29	44	25	3	21
Chemical fertilizer/blends	20	24	24	36	18	17	29
Markets	14	24	22	15	8	6	29
Cultural pest control practices	24	17	9	12	4	0	0
Type of seed, varieties to use	12	25	21	24	7	0	0
Rhizobium inoculants	4	3	5	21	1	0	29
Manure use	3	3	1	3	0	0	14
PICS storage bags	2	2	1	11	1	0	14
Soil testing before fertilizer	1	0	2	2	1	0	0
Irrigation or water harvesting	1	0	0	1	1	0	7
Seed treatment with pesticides	0	0	0	2	1	0	0

Demos, demonstration plots; Ext., extension; FFS, farmer field school; HH, household; PICS, Purdue Improved Crop Storage.

Information sharing within the household

Respondents were asked if they shared any of the agricultural information they received with others, and if so with whom. At least 63% of the respondents indicated that they shared information with others (Table 7). Comparatively more men than women shared agricultural information with others, and older people were more likely to share information than younger people. This may possibly be the reason why these categories of farmers – male farmers and older farmers – relied more on their own experience and information sharing across their networks in the community.

When asked with whom information was shared, the majority (75%) mentioned 'other household members' followed by 'neighbours' (30%) (Table 8). This cut across age and gender categories, as mostly information was shared within the household. On average, recipients of agricultural information engaged about four other members within their households or community. Older

household members and men engaged with more members than either women or younger people in the household.

Table 7. Sharing of agricultural information (% of respondents).

Respondent category	Frequency	%
Overall sample	551	63
Age category		
18–35 years	270	56
36–60 years	221	70
Over 60 years	60	82
Gender		
Male	395	72
Female	156	48

Table 8. Information sharing within the household (HH) and farmer networks.

Respondent category	With whom did you share information on agriculture? (%)				Average no. of people reached
	Other HH members	Relatives far away	Neighbours	Group members	
Overall sample	75	3	30	10	3.7
Age category					
18–35 years	68	3	29	14	3.5
36–60 years	81	4	30	6	3.4
Over 60 years	85	2	32	7	5.2
Gender					
Male	74	3	35	10	3.9
Female	76	3	18	10	3.2

While other household members (i.e. women and youth) were not considered important sources of information, the obvious information sharing at household level makes them an important target for receiving information about new innovations at household level. Men and older family members have a higher likelihood of sharing information at household level which could be attributed to their ability to access external sources of information gained on behalf of the household. In addition, their

position in the household as decision makers puts them in a vantage point to share information regarding farming activities.

In terms of crops, most respondents shared information on maize, other cereals and oil crops (sesame, groundnuts, etc.) (Table 9). Information sharing on these crops cut across gender and age category as well, though women and older people were more likely to share information on maize compared with men and younger people. These crops also represent mainly the crops for which farmers received information about. They are key staple and cash crops for farmers and as such, there is obvious interest to share information about them.

In terms of agricultural practices shared, crop rotation, chemical weeding, early land preparation and timely planting were the most commonly mentioned by both men and women (Table 10). A similar result was found with data disaggregated by age category. This might be explained with the fact that these practices are among the most commonly established and known by farmers. Between 10% and 15% of farmers shared information on *Rhizobium* inoculants and seed treatment, despite the indicated low levels of awareness of these technologies. This might indicate curiosity and a potential interest from farmers towards relatively new technologies.

Table 9. Crops for which information is shared with other household members (% of responders sharing information).

Respondent category	Soybean	Maize	Other cereals	Cassava	Other roots/ tubers	Other legumes	Vege-tables	Oil crops
Overall sample	25	60	30	15	23	8	10	30
Age category								
18–35 years	21	49	26	14	16	7	10	29
36–60 years	29	68	34	16	27	7	10	31
Over 60 years	33	80	35	17	37	15	13	28
Gender								
Male	19	51	31	15	11	6	22	35
Female	28	64	30	15	28	9	6	28

Table 10. Agricultural practices for which information is shared with other household members (% of those sharing information).

Agricultural practice	Overall sample	Female	Male	18–35 years	36–60 years	Over 60 years
Crop rotation	46	53	43	44	48	47
Chemical weeding	45	57	40	46	46	38
Early land preparation	28	11	35	14	39	55
Timely planting	27	8	34	13	37	53
Rhizobium inoculants	15	21	12	16	15	8
Manure use	10	19	6	11	8	7
Seed treatment	10	23	5	14	7	5
Chemical fertilizer use, blends	13	7	15	11	16	10
Cultural pest control practices	7	4	9	4	10	10
Markets	6	1	8	4	9	8
Type of seed, varieties to use	11	2	16	9	13	17
PICS bags for storage	2	3	2	3	2	2
Soil testing	1	1	1	1	2	0
Irrigation and water harvesting	0	1	0	0	1	0

Insights from the study

This study assessed farmers' access to information on agriculture and utilization of sustainable agricultural intensification practices, as well as understanding information flows within smallholder farming households. Study results highlight the following insights:

- Farmers have varied sources of information on agriculture, with more reliance on local/community-based information sources such as neighbours, fellow farmers or other household members. Men and young people exhibited more diverse information sources compared with women and elderly people. Some information sources were the prerogative of men, such as radio and demonstration plots, while women mainly relied on their own experience and family/community members. Demonstrations usually target men, while the radio is often under the control of men. Elderly people seemed to prefer sources of information based on personal interactions. A large proportion of farmers tended to rely on their own experience or personal interactions with others (e.g. neighbours/family) as a source of agricultural information, mostly for traditional farming practices such as timing of field operations and good agricultural practices. These practices, despite being the most shared even from external sources, may reflect farmers' inherent knowledge and adjustment over time to respond to changing environmental conditions. This is in comparison to relatively new practices such as the use of *Rhizobium* inoculants and PICS bags that farmers indicated they had learned about mainly from external sources such as extension services, radio and demonstrations. There

is still a margin for improving learning of more recently introduced practices, thus it is important to link promotion with targeted information sources.

- Information dissemination was generally prioritized for certain crops, in particular maize, soybean, other cereals and oil crops. This may reflect the importance attributed to these crops either by farmers, extension workers/promoters or markets. It may also be indicative of the novelty of the innovations being promoted across the various crops in response to current production challenges. Maize is a global staple that has received great attention in the recent past, so it is not surprising that there is a lot of information being disseminated on maize in the region as well. However, the lack or limited focus on key staples in the region highlights a gap that needs to be filled by current or future efforts in promoting SAI. For example, common bean and cassava are considered key staple foods in Ghana, but there seems to be no current effort to promote innovations in these crops.
- Many farmers (63%) shared information with others, reaching on average four other people. Primarily, information sharing was at household level, then with neighbours. Comparatively more men than women shared agricultural information with others, while older people were more likely to share information than younger people. For men, this could be attributed to their ability to access external sources of information gained on behalf of the household, while for older people it could be as a result of the experience they have and their position as opinion leaders.
- A few respondents were familiar with the use of new soybean technologies, such as *Rhizobium* inoculants (3%), soil testing before fertilizer application, (4%) and PICS bags (4%).

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