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Determinants of Smallholder Farmers' Access To Agricultural Extension Channels and Their Effects on Awareness and Compliance with Good Agricultural Practices in Kenya

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Abstract

Although it is mandatory for smallholder farmers to comply with Good Agricultural Practices (GAPs) to participate in French bean farming for export, they lack uniformity in their compliance practices. Available literature doesn't show whether farmers' lack of uniformity in compliance with GAPs is affected by their social status characteristics and their choice of extension channels. A field survey was conducted among 115 French bean farmers who were sampled systematically, and the data was collected by the use of questionnaires administered through face-face interviews. The data were analyzed descriptively and by Chi-square, Pearson's correlation, and regression models to establish the association between social status characteristics of smallholder farmers versus the type and number of extension channels accessed and its association with awareness and compliance with GAPs. The study found that farmers' level of access to extension channels had a significant influence on their level of awareness of GAPs. Field extension workers were the most effective channel of extension. Moreover, gender, asset scores, farm acreage and income from the sale of French beans were among the social characteristics which had a significant influence on compliance with GAPs and farmers' level of access to extension channels. This study recommends that the dissemination of agricultural innovations to smallholder farmers should be tailored along channels of extension that are compatible with their social status.

Keywords:
Access, awareness, compliance, agriculture extension channels, good agricultural practices (GAPs)

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INTRODUCTION

Global Good Agricultural Practices (GLOBAL GAP)-also referred to as standards are a set of guidelines for food safety and quality, environmental practices, farm worker's safety, and health care practices that control fruits and vegetable producers for export into western countries (de Battisti et al. 2009; Ouma, 2010). Smallholder farmers are required to adopt these new practices including applying only the recommended amounts of pesticides and other agrochemicals and observing standard harvesting intervals after pesticide application. Besides that, all farm activities have to be recorded, hygiene and ethical practices observed and the quality of produce standardized by all (Maertens & Swinen, 2006). However, some smallholder farmers have been associated with non-compliance practices such as using pesticides that are not approved, applying excessive amounts of pesticides, grading French beans on the ground hence exposing the product to the risk of contamination, and failing to observe hygiene in the packing and holding areas (Okello, 2011; Muriithi et al., 2011). Others store pesticides in unsafe places such as in the kitchen, bedrooms and inside the farm store together with farm produce (Macharia et al., 2013). Failure by the smallholder farmers to adhere to the GLOBAL GAP standards undermines the role played by various extension agents who disseminate information on GLOBAL GAP. Moreover, literature has been silent on whether non-compliance with the standards has been due to the lack of compatibility of extension channels with farmers' social characteristics and how this affects awareness and compliance with GAPs. Rogers (2003) underscores the importance of the compatibility of innovations with the social status of adopters.

In Kenya, most smallholder farmers participate in French bean (FB) farming for the export markets through self-help groups (SHGs). SHGs have means of controlling their members' compliance practices while linking them up with extension agents (Mithöfer, 2008: de Batistis et al., 2009). According to Röling, (1988), the agricultural extension provides education, advice, training and information to farmers on techniques that are likely to improve their farm business, production, operations, farm management, environmental conservation and marketing. Extension workers advise on the appropriate use of farm inputs and strategies for controlling pests, food safety and hygiene practices (UNCTAD, 2008), and training in pest management, production of quality food and safe use of pesticides and disposal of empty pesticide containers (de Bastitis et al., 2009). Extension service providers include non-government organizations (Anderson et al., 2015) and technical agents from export companies (UNCTAD 2008; Kersting & Wollni, 2012). Some extension channels are blamed for applying similar learning methods to all calibre of farmers while ignoring the diverse social characteristics of participants (Tallontire et al., 2013). A study by Njoba (2016) found that there were gender inequalities since male farmers had more access to field extension staff than females. Other studies show that adult learning methods such as farmers' field schools are commonly used during training (Mithöfer, 2008) and that some farmers do not experience difficulties in accessing the necessary information about GLOBAL GAP standards and translating such information into specific investment needs (Maertins & Swinen, 2006; GLOBAL GAP, 2019). Additionally, some exporters who contract farmers are blamed for applying the top-down communication approaches hence hindering the farmers from giving feedback (Tallontire et al, 2013; Njoba, 2016).

Conceptual Framework

The theoretical basis for this study is the diffusion and adoption of innovations model which originated in the field of communication and was further developed by Everett

Rogers in the 1960s. The model explains diffusion as the process through which innovations (ideas or practices perceived as new) are diffused (transmitted) through certain media over some time to members of a social system. According to Rogers, farm innovations that are introduced into a community are adopted first by a few individuals who then diffuse the ideas to the rest of the members of the community. One aspect of the model avers that a farmer passes from being aware that innovation exists and how it functions followed by persuasion- that is by forming a favourable or unfavourable attitude towards the innovation by seeking more information. A farmer individually makes decisions by adopting or rejecting an innovation while those who decide to put the innovation into use later on confirm whether to continue with it or to cease if exposed to conflicting information. The second aspect focuses on the social status of the adopters. Social status refers to the rank or prestige that is attached to one's position in a society and is determined by one's social characteristics such as level of education, age, income, wealth, sources of livelihood and even contacts with change/extension agents. These characteristics also influence the time that individuals adopt an innovation (Rogers, 2003).

Rogers' views are confirmed by Issa et al. (2011) who assert that the effectiveness of extension delivery channels is affected by the level of education, income and membership in associations. Likewise, Njenga et al. (2021) established that men's higher social status based on land ownership and farm decisions affected access to information and adoption of technology, and that, some knowledge-intensive innovations require a higher level of education. Illiterate and semi-illiterate farmers experience difficulties understanding printed information and workshops facilitated by extensionists. Besides that, low income was found to impede the utilization of print-based channels of information dissemination whereas ownership of assets finances those who attend field days and enable others to buy airtime for their cellphones to obtain information. Some mass media channels such as television have also been found to be relatively expensive for poor farmers (Adolwa et al., 2012).

The group extension model has been experimented with in Kenya with a focus on a few innovations delivered via village groups headed by an elected leader and organized under schedules and field sites chosen by the village groups. Leaders from several villages form village committees which not only took the initiative of requesting for extension but also discussed alternative crop development programs. This model demonstrated that extension through groups could reach more people in a wide area and was more effective compared to extension methods that targeted progressive farmers. Training farmers through village groups had better results than the farmer training centre approach (David, 1975).

Participatory theories which articulate people-centred development' was begun by some development scholars such as Chambers Conyers and Hills, and many others after being provoked by the top-down models that assumed that external knowledge was better than indigenous/local knowledge. This top-down approach appeared to lack sensitivity to the cultural differences of the recipients of development and often led to the failure of new projects. Participatory approaches sought to counter top-down methods by advocating the participation of the majority of the population in new processes, analysis, information sharing and action among stakeholders (Dinbabo, 2003).

Regarding Farmer Field School (FFS), this extension approach disseminates and influences farmers to understand and adopt new farming technologies through groups of farmers (usually 20-35). Group members meet regularly to carry out comparative observations of new technological innovations under implementation in the crop fields during the

crop growing season. The methods emphasize discovery-based learning and hands-on experimentation. Therefore, the FFS applies participatory methods and non-formal adult learning principles which enhance the development of analytical skills of the farmers (Bunyatta et al., 2006).

Literature also stresses the importance of other extension channels for disseminating innovations. Mass media (e.g., radio, television, farm magazines) and interpersonal (face-face exchange between two or more individuals) are other communication channels that create knowledge and persuade individuals' attitudes towards the decision on whether to adopt or reject an innovation (Rogers, 2003). Communication factors such as training, information repetition, accessibility of extension agents and practical orientation also influence the adoption of innovations (Njenga et al., 2021). Farmer field days, on-farm demonstrations, and workshops are not only interactive and more accessible, most informative and reliable in disseminating information but also allow a two-way flow of information between farmers and extension agents (Adolwa et al., 2012). Therefore, this study sought to investigate the compatibility between farmers' social characteristics versus accessible extension channels, and how these affected their levels of awareness and compliance with GAPs.

Objectives and Research Questions of the Study

The main objective of the study is to examine if farmers' social characteristics affected their preference for particular extension channels and the relationship between their choice(s) of extension channels versus their levels of awareness and compliance with the GLOBAL GAPs.

The study is guided by two research questions, namely

a) What is the effect of farmers' social characteristics on their choice of agricultural extension channels?

b) What is the influence of available agricultural extension channels on farmers' level of awareness and compliance with GAPs?

The null hypotheses tested are:

Ho1: There is no significant association between farmers' social characteristics and their choice(s) of extension channels.

Ho2: There is no significant association between farmers' type of extension channels and their level of awareness of GAPs.

Ho3: There is no significant association between farmers' type of extension channels and their level of compliance with GAPs.

Ho4: There is no significant association between farmers' level of awareness and their level of compliance with GAPs.

METHODOLOGY

This study was conducted in Murang'a County in November 2019. Murang'a county is one of the major French Bean growing regions in central Kenya. and is located between latitudes 0° 34' South and 10 7' South and longitudes 36° East and 37° 27' East along the slopes of the Aberdare Mountains in the West (Murang'a County Government, 2014).

The study was purely empirical and blended with mixed research methods. The purposive sampling method was applied to select three sub-counties (Gatanga, Kandara and Maragwa) that dominate the production of French beans for export. Thereafter, a systematic sampling method was used to select the respondents. An up-to-date list of farmers was generated to enable the calculation of a representative sample size based on a target of 35 percent (163) of the 466 French bean farmers, hence K=N/n where (K=sampling interval, N= the population, and n=the sample size). Therefore, 115 French bean farmers were interviewed.

A closed and open-ended questionnaire was administered through face-face interviews to collect both qualitative and quantitative data. Secondary sources were also used to enrich survey data. To measure the two de-

pendent variables, the researchers categorized and ranked the respondents according to the number of GAPs they were aware of, their level of compliance and to determine their level of access to extension channels. These categories were subjected to Pearson's chi-square tests, correlation, and regression analysis to find their relationships with independent variables.

The independent variables that were used in this study were social status factors/characteristics (gender, age, occupation, assets, acreage under French bean and income) and extension channels. Age, assets, acreage under French bean and income. These were treated as continuous variables and measured quantitatively. Both occupation and gender were treated as categorical data. Data on the type of extension channels were collected, respondents were counted and ranked/categorized based on the number of extension channels used, and this resulted in those with low, average and high levels of extension access. Categorical data were subjected to a chi-square analysis of their relationship with other variables.

The study used the IBM Statistical Package for Social Sciences to analyze descriptive data (frequencies and percentages), correlation of variables, Chi-square test of association and linear regression. Quantitative data was analyzed to establish the relationship between farmers' social status characteristics versus access to extension channels and the association between the type/level of access to extension channels versus awareness and compliance with GAPs.

RESULTS AND DISCUSSION

Socio-economic Characteristics of French bean farmers

Sixty-eight per cent of the respondents were male and 32 percent were female. The majority (68%) of the farmers were male heads of household. Concerning age, most (51%) farmers were in the cohort of 50 years and above. Forty-four per cent of farmers had attained secondary school education, 39 percent primary and 4 percent college. Only 13 percent of the farmers had no formal education. The majority (88%) of respondents were married. There were variations in household sizes with 58 percent of respondents having between 4-6 dependents.

The majority (71%) of the farmers engaged in the commercial production of crops for the local market, (23%) in subsistence farming, 3 percent in business and another 3 percent in casual work. Income from French beans varied with 30 percent of farmers earning 41,000 Kenya shillings and above, and 18 percent 20,000-40,000 shillings. Others had an income of fewer than 20,000 shillings (41%). Only 11 percent of the farmers had no earnings. The size of land under French bean farming varied with some farmers planting 0.1-0.99 acres (29%) and the majority (71%) 1 acre and above.

The study also found that 91 percent of the respondents owned a radio, 93 percent cell phones and 84 percent livestock. More than 50 percent of the farmers had cash savings, television sets, bicycles, water pumps and wheelbarrows. The key productive assets i.e., those assets that could enhance economic activities were cell phones which could link farmers with sources of information. The study further scored the value of assets owned by respondents to determine their wealth status. As shown in Table 1, 53 percent of farmers had high, 27 percent average and 20 percent low levels of asset scores (Mwangi et al. 2022).

The Proportion of Farmers Aware of Good Agricultural Practices

Upon being asked to name 5 mandatory GAPs which they knew, respondents mentioned a total of 29 practices. Some of these were irrigation requirements for French beans (100%), the use of recommended varieties of seeds (94%) and fertilizer (96%); the importance of seeking advice from extension agents before applying agrochemicals

Table 1
Wealth Status of French Bean Farmers

Value of assets	Number of respondents	Percent
Low value (7 scores and below)	23	20
Average value (8-10 scores)	31	27
High value (11 scores and above)	61	53
Total	115	100

Table 2
Farmers' Level of Awareness of Good Agricultural Practices

Level of awareness	Number of respondents	Percent
Low (aware of 1-7 GAPs)	28	24
High (aware of 8 GAPs and above)	87	76
Total	115	100

Table 3
Respondents' Overall Level of Compliance with GLOBALGAP Standards

Level of Compliance with GLOBALGAP Standards	Number of farmers	Per cent (%)
Low (below 8 GAPs)	10	9
Average (9-11 GAPs)	47	41
High (12 GAPs and above)	58	50
Total	115	100

Table 4
Type of Agriculture Extension Channels Accessed by farmers

Extension Channels	Frequency*	Per cent (n=115)
Farm visits by field extension workers	87	76
On-farm demonstrations	72	63
Agriculture research station	20	17
Agricultural shows	33	29
Seminars and workshops	49	43
Reading farming magazines	43	37
Mass media (radio/television)	87	76

*Some farmers accessed more than one channel

(85%), the need for pest control to prevent crop damage by pests (64%), the purpose of grading harvested beans before delivery to buying centres (59%), the purpose of keeping farm records for all activities (51%), hygiene practices that should be observed when harvesting French beans (60%) and why one should wear protective gear when spraying

agrochemicals (39%). Others mentioned the pesticide spraying intervals required before harvesting (39%), the use of recommended pesticides (40%), disposal of empty pesticide containers (25%) and the need for a toilet near French bean farms (25%). Moreover, 21 percent knew the need for having designated harvesting containers while 12 percent were aware of why it was not suitable to intercropping French beans with other crops. Further, as shown in Table 2, the respondents were grouped in accordance to their level of awareness based on the number of GAPs mentioned and these were categorized and ranked into low (1-7 GAPs) and high (8 GAPs and above) levels of awareness (Mwangi et al., 2022).

The proportion of Farmers Complying with Various GLOBALGAP Standards.

An enquiry into the type of GAPs that farmers had complied with/implemented in their most recent French beans (FBs) planting season found that the farmers had adopted 19 standards. These were irrigation (100%), the use of recommended fertilizers (96%) and pesticides (96%), and land preparation before planting (95%). Ninety-four per cent planted FBs in rows and 93 percent planted only the recommended seeds. In addition, 91 percent of farmers weeded their FBs and another 59 percent graded the harvested French beans before delivering them to collection centres.

Other practices complied with entailed observing hygiene when harvesting French beans (57%), having a toilet located near French bean farms (17%) and using clean designated harvesting containers to prevent contamination of FB (15 %). Twelve per cent of the farmers reported having used protective gear when spraying agrochemicals. Ten per cent of the farmers avoided intercropping French beans with other crops. Some farmers (7%) observed the recommended harvesting interval after spraying. Other farmers complied by digging a pit for disposing of empty chemical containers (4%) and having a store for keeping agrochemicals (3%). Half (51%) of the farmers complied by keeping farm records.

Farmers were then categorized based on the number of GAP complied with. Those with 1-8 good agricultural practices were ranked as "low-level adopters", 9-11 practices- were "average-level adopters" and those with 12 standards and above- were "high-level adopters". Therefore, Table 3 indicates farmers' levels of compliance as low-level (9%), average (41%), and high-level (50%).

Types of Extension Channels Used by Farmers

The study established that respondents had access to multiple extension channels (Table 4) such as field extension agents (76%), radio and television (76%), on-farm demonstrations (63%), workshops/seminars (43%), farming magazines (37%), agricultural shows (29%) and agriculture research stations (17%). The farmers were further categorized to determine their levels of access to extension channels depending on the numbers accessed. These varied with those with the lowest sources of extension being one and the highest seven. The farmers were ranked with those having less than three extension channels being ranked under 'low level, for those accessing 3-5 extension channels average, and those with 6-7 extension channels 'high'. In terms of proportion, it emerged that 39 percent of the respondents had low, 45 percent average, and 16 percent had high access to extension channels (Table 5).

Relationship between various variables Social characteristics of farmers versus the number of extension channels.

The study stated the null hypothesis that a farmer's socio characteristics (gender, education level, occupation, value of assets, acreage under FB, and income from FB) had no relationship with their choice of agriculture ex-

Table 5
Farmers' Level of Access to Extension Channels

Level of access	Number of farmers	Percent
Low (less than 3 extension channels)	45	39
Average (3-5 extension channels)	52	45
High (6 channels and above)	18	16
Total	115	100

Table 6
*Social Characteristics of Farmers Versus Level of Extension Channels**

		Level of access to extension channels			Total
		Low	Average	High	
Gender	Male	25	37	16	78
	Female	20	15	2	37
Total		45	52	18	115
Chi-square 7.028, df=2, p<0.05					
Age	below 30 years	3	3	1	7
	30-40 years	6	6	2	14
	40-50 years	15	17	3	35
	50 years and above	21	26	12	59
Total		45	52	18	115
Chi-square 2.492, df=6, p>0.05					
Education level	No formal education	8	5	2	15
	Primary	18	23	4	45
	Secondary	17	23	11	51
	College	2	1	1	4
Total		45	52	18	115
Chi-square 5.247, df=6, p>0.05					
Occupation	Subsistence farming	15	12	6	33
	Commercial farming	30	40	12	82
Total		45	52	18	115
Chi-square 1.465, df=2, p>0.05					
Asset scores	Low (1-13scores)	31	26	5	62
	High (14 scores and above)	14	26	13	53
Total		45	52	18	115
chi-square 9.331, df=2, p=.009					
FB farm acreage	Low (0.1-0.99 acres)	20	11	2	33
	High (1 acre and above)	25	41	16	82
Total		45	52	18	115
Chi-square 9.620, df=2, p<0.01					
Income from FB in KES*	None	4	5	4	13
	Low (below 20,000)	26	18	3	47
	Average (20,000-40,000)	6	9	6	21
	High (41,000 and above)	9	20	5	34
Total		45	52	18	115
Chi-square 14.155, df=6, p<0.05					

*Kenya Shillings; *farmers had access to multiple extension channels

tension channels. The cross-tabulation of data sets in Table 6 reveals that at $p<0.05$, there was a significant relationship between the number of extension channels accessed versus:

Gender: ($\chi 2= 7.028$, df=2, $p<0.05$) where a higher proportion of male farmers also had a high level of access to agriculture extension channels compared to female counterparts. The results suggest that there were factors that put male farmers at an advantage in accessing more extension channels than women.

Value of assets: ($\chi 2 =9.331$, df=2, $p<0.05$), where a majority of farmers with low asset scores also accessed the lowest number of extension channels. Farmers with access to a high number of extension channels were associated with high asset scores, meaning that higher wealth status enhanced a farmer's access to multiple sources of extension. Therefore, the ability to diversify agriculture extension channels depended on one's wealth status.

Acreage under FB: ($\chi 2= 9.620$, df=2, $p>0.01$) had a significant association with the number of extension channels accessed. This indicates that by cultivating FB of a large acreage, farmers felt compelled to seek information from multiple extension channels to safeguard the French beans and in turn complied more with GAPs. Similar findings by Fadeyi et al. (2022) and Nyairo et al. (2021) confirm that the size of farmland is important in motivating smallholder farmers' access to innovations.

Income: ($\chi 2= 14.155$, df=6, $p<0.05$) where farmers with higher levels of income from French beans were associated with the average and higher number of extension channels. Therefore, the null hypothesis was rejected. This meant that earning higher levels of income motivated the farmers to seek multiple sources of extension to support their FB investment and comply with GAPs. In contrast, most farmers with low income from FB were associated with a small number of extension channels, perhaps due to limited resources for investment in diverse channels or being hindered by low-income earnings from FB. These findings are validated by Njenga et al (2021) who observed that low-income farmers are usually constrained in integrating new technology even when given preference by extension agents. Moreover, Issa et al., (2011) confirm that access to extension channels depends on income.

Farmers' type of extension channels versus the level of awareness of GAPs.

The study tested the hypothesis that the types of extension channels accessed had no relationship with a farmers' level of awareness (low or high) of GAPs. A cross-tabulation of the variables in Table 7 revealed that at $p<0.05$, **field extension agents** ($\chi 2 =11.650$, df=2, $p>0.01$) had a significant influence on farmers' level of awareness. Therefore, the null hypothesis was rejected. This implies that personalized interactions between field extension agents and individual farmers enhanced their level of awareness of GAPs. These findings concur with those of Njenga et al (2021) who found that accessibility of extension agents influenced farmers' access to innovations. Onemolease et al., (2007) also argued that farm visits by extension agents had a significant impact on farmers' awareness and access to farm technologies. Furthermore, Issa et al., (2011) posited that extension agents were among the most effective channels of extension.

Farmers' participation in **agriculture seminars and workshops** also had a significant relationship ($\chi 2 =8.457$, df=2, $p<0.05$) with their level of awareness of GAPs. Consequently, the null hypothesis was rejected. These results meant that farmers learnt more when they interacted with other participants while under the guidance of facilitators. Similarly, Kigatiira (2019) asserted that interpersonal communication channels (meetings, demonstrations, and field days) created an environment that enabled information exchange and feedback

Table 7
Type of Extension Channels Accessed Versus their Level of Awareness of GAPs

		Farmers' level of awareness			Total
		Low(4-11)	Average (12-13)	High(14 and above)	
Extension agent	Yes	10	27	50	87
	No	11	8	9	28
Total		21	35	59	115
Chi-square 11.650, df=2, p<0.01					
Research station	Yes	3	3	14	20
	No	18	32	45	95
Total		21	35	59	115
Chi-square 3.686, df=2, p>0.05					
Field demos	Yes	12	20	40	72
	No	9	15	19	43
Total		21	35	59	115
Chi-square 11.393, df=2, p>0.05					
Agric shows	Yes	0	12	21	33
	No	21	23	38	82
Total		21	35	59	115
Chi-square 10.358, df=2, p<0.01					
Seminar	Yes	4	13	32	49
	No	17	22	27	66
Total		21	35	59	115
Chi-square 8.457, df=2, p<0.05					
Farm Magazine	Yes	4	10	29	43
	No	17	25	30	72
Total		21	35	59	115
Chi-square 7.668, df=2, p<0.05					
Radio and TV	Yes	12	28	47	87
	No	9	7	12	28
Total		21	35	59	115
Chi-square 4.780, df=2, p>0.05					

while enhancing shared meanings between the farmers and extension providers.

Having access to farm magazines also had a significant relationship ($\chi 2$ =7.668, df=2, p<0.05) with farmers' level of awareness of GAPs, and this could be due to the capacity of farmers in understanding such magazines.

Relationship Between Farmers' Level of Access to Extension Channels Versus their Level of Awareness with GAPs

The study tested the hypothesis that there was no relationship between farmers' level of access to extension channels and their level of awareness. The chi-square test of association (Table 8) revealed that at p<0.05, there was a significant association ($\chi 2$=13.524 df=2 p<0.01) between farmers' level of access to extension channels versus their level of awareness. Therefore, the null hypothesis was rejected. These results imply that having access to diverse extension channels influenced a high proportion of farmers to gain a high level of awareness of GAPs

Relationship Between Farmers' Level of Access to Extension Channels Versus Compliance with GAPs

This study also hypothesized that there was no association between farmers' level of access to extension channels and their level of compliance with GAPs. The chi-square test of association (Table 9) shows that at p<0.05,

Table 8
Farmers' Level of Access to Extension Versus Awareness with GAPs

		Farmers' level of awareness of GAPs		Total
		Low (1-7 GAPs)	High (8 GAPs and above)	
Level of access to extension channels	Low (less than 3 channels)	19	26	45
	Average (3-5 channels)	8	44	52
	High (6 channels and above)	1	17	18
Total		28	87	115
Chi-square 13.524 df=2 p<0.01				

Table 9
Farmers' Level of Access to Extension Versus Compliance with GAPs

Level of access to extension channels	Farmers' level of compliance with GAPs			Total
	Low	Average	High	
Low (less than 3 channels)	5	16	24	45
Average (3-5 channels)	0	16	36	52
High (6 and above channels)	3	4	11	18
Total	8	36	71	115
Chi-square 8.901, df=4, p>0.05				

there was no significant relationship ($\chi 2$= 8.901, df=4, p>0.05) between the two variables. Therefore, we failed to reject the null hypothesis.

Level of Awareness versus compliance with GAPs

The study tested the null hypothesis that there was no significant association between awareness and compliance with GAPs. A cross-tabulation of the data representing the 2 variables (Table 10) shows that at p<0.05, there was a significant relationship ($\chi 2$= 35.618, df=2, p<0.01) between farmers' level of awareness and their level of compliance with GAPs. Consequently, the null hypothesis was rejected since most (94%) farmers with high levels of awareness were also linked with a high level of compliance with GAPs.

Correlation of Types of Extension Channels versus Farmers' level of Compliance

This study tested the null hypothesis that a farmer's type of agricultural extension channels (field extension agents, research stations, field demos, agricultural shows, seminars, farm magazines, and radio/TV) had no relationship with their level of awareness of GAPs.

The analysis in Table 11 indicates that farmers' level of awareness of GAPs correlated significantly with: interactions with field extension agents (r=.269, p<0.01); attending seminars/workshops (r=.304, p<0.01); reading farming magazines (r=.259, p<0.01); listening to the radio and watching television (r=.226, p<0.05) and visiting research stations (r=.213 p<0.05)

The regression model (Table 12) explains that 45.2 percent of the overall relationship between farmers' level of awareness of GAPs and extension channels (extension agent, research station, field demos, agricultural shows, seminars, farm magazines and radio/TV) was significant (R^2 =0.452, F (7, 3.925). The predictor variables of awareness of GAPs demonstrate that research stations

Table 10
Relationship between Farmers' Level of Awareness Versus Compliance with GAPs

		Farmers' Level of Compliance with GAPs			Total
		Low (1-8 GAPs)	Average (9-11 GAPs)	High (12GAPs and above)	
Level of awareness	Low (1-7 GAPs)	5	19	4	28
	High (8 and above)	3	17	67	87
Total		8	36	71	115

Chi-square 35.618, df=2, p<0.01

Table 11
Pearson's Correlation of the Number of Farmers Accessing Extension Channels Versus their Level of Awareness of GAPs

variable	aware of GAPs	extagents	research station	field demos	agric show	seminars	farm magazine	radio/TV
Aware of GAPs	1							
Ext agents	.269**	1						
Research station	.213*	0.046	1					
Field demos	0.088	0.148	0.02	1				
Agric show	.257**	0.046	0.17	.292**	1			
Seminars	.304**	.243**	.254**	.230*	.386**	1		
Farm magazine	.259**	0.02	.262**	.226*	.265**	.315**	1	
Radio/TV	.226*	0.15	0.15	0.15	0.1	.202*	.355**	1

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at **P<0.01, *P<0.05 level

Table 12
Regression Analysis of Type of Extension channels Versus Farmers' Level of Awareness of GAPs

Coefficients								
Model		Unstandardized coefficients	Std. Error	Standardized coefficients	t	P.value	Collinearity statistics	
		B		Beta			Tolerance	VIF
1	(Constant)	2.364	0.115		20.503	0.000		
	Ext agent	0.384	0.105	0.33	3.643	0.000	0.907	1.103
	Research station	0.01	0.12	0.008	0.084	0.933	0.888	1.126
	Field demos	-0.063	0.096	-0.061	-0.661	0.51	0.862	1.161
	Agric show	0.17	0.107	0.155	1.589	0.115	0.787	1.271
	Seminars	0.075	0.102	0.074	0.734	0.464	0.727	1.375
	Farm magazine	0.201	0.103	0.195	1.963	0.052	0.752	1.33
	Radio/TV	-0.055	0.109	-0.047	-0.505	0.615	0.846	1.182

(β=-0.008, p>0.05), field demos (β=-0.061, p>0.05), agricultural shows (β=-0.155, p>0.05) seminars (β=0.074, p>0.05), farm magazines (β=0.195, p>0.05) and radio/TV (β=-0.047, p>0.05) had no significant influence on farmers' level of awareness of GAPs.

Nonetheless, field extension agents (β=0.33, p<0.01) had a significant influence on farmers'' awareness of GAPs.

Correlation of Social Characteristics, Level of Extension, Awareness and Compliance with GAPs

The study tested the hypothesis that socio-characteristics (age, education, asset scores, acreage of FB, and income from FB), number/level of extension channels accessed and farmers' level of awareness influenced their compliance with GAPs. Table 13 illustrates that compliance with GAPs correlated significantly with awareness (r=0.504, p<0.01), income from French beans (r=0.526, p<0.01.) and asset scores (r=0.223, p<0.05). Farmers' level of awareness correlated significantly with the number of extension channels accessed (r=0.341, p<0.01), asset scores (r=0.290, p<0.01), acreage under French beans (r=0.202, p<0.05) and income from French beans (r=0.315, p<0.01). The analysis also indicates that access to extension channels had a positive correlation with asset scores (r=.284, p<0.01) and acreage under FB

Table 13
Multiple Correlation of Socio-status Variables, Agriculture Extension Channels, Awareness and Compliance with GAPs

	Compliance	Awareness	Extension	Age	Education	Assets	FB Acres	FB income
Compliance	1							
Awareness	0.504**	1						
Extension	0.076	0.341**	1					
Age	-0.093	-0.032	0.087	1				
Education	-0.058	0.043	0.137	-0.14	1			
Assets	0.223*	0.290**	0.284**	0.092	0.017	1		
FB Acres	0.165	0.202*	0.211*	0.1	0.008	0.350**	1	
FB income	0.526**	0.315**	0.173	-0.099	0.071	0.276**	0.243**	1

**Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at 0.05 level (2tailed)

Table 14
Regression Analysis of Predictor Variables Versus Compliance with GAPs

Coefficients								
Model		Unstandardized coefficients		Standardized coefficients	t	P.value	Collinearity statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.098	0.428		2.567	0.012		
	Awareness	0.513	0.102	0.412	5.002	0.000	0.793	1.261
	Extension	-0.122	0.073	-0.136	-1.673	0.097	0.815	1.227
	Age	-0.032	0.052	-0.047	-0.616	0.539	0.943	1.06
	Education	-0.068	0.063	-0.082	-1.088	0.279	0.949	1.053
	Assets	0.036	0.103	0.029	0.351	0.726	0.787	1.271
	FB Acres	0.003	0.078	0.003	0.043	0.966	0.837	1.194
	FB Income	0.248	0.048	0.412	5.127	0.000	0.83	1.204

Note: Dependent variable: level of Compliance with GAP, R2=.430; F (7, 11.722) =19.052; the number of observations (n)=115, p<0.001

(r=0.211, p<0.05).

The regression model (Table 14) explained that 43 percent of the overall relationship between farmers' level of compliance with GAPs, awareness of GAPs, number of extension channels accessed and social status characteristics (age, education, asset scores, acreage of FB, and income from French beans was significant (R^2 =0.430, F =7, 11.722). The predictor variables of compliance with GAPs demonstrate that the number of extension channels accessed by farmers (β=-0.136, p<0.01), age (β=-0.047, p<0.01), education (β=-0.082, p>0.05) and the size of the farm under FB (β=0.003, p>0.05), had no significant influence on farmers' level of compliance with GAPs. However, farmers' level of awareness (β=.412, p<0.01) and income from French beans (β=.412, p<0.01) had a significant influence on compliance with GAPs.

CONCLUSION

This study sought to determine whether there was compatibility between farmers' social characteristics and available extension channels, and how these affected their levels of awareness and compliance with GAPs. Regarding the first research question which enquired about the socio-status characteristics that influenced smallholder farmers' choice of agriculture extension channels, the findings showed that gender, assets, acreage under French beans and income had a significant influence on the number of extension channels that were accessed by farmers. Therefore, the study concluded that having higher high-value assets defined one's ability to raise resources for investment in GAPs for French beans for export on large acreage. In addition, high-status farmers were likely to engage in the production of French beans on large acreage which in turn enhanced the generation of higher income. The latter enabled the farmers to comply with diverse innovations and multiple sources of extension. The potential of French bean farming in generating higher incomes attracted more male than female farmers. Because of patriarchy, male farmers were also likely to be associated with a higher social status that enabled them to raise resources for investment in GAPs and access an unlimited number of extension channels. Their position enhanced their level of awareness and adoption/compliance with GAPs. Therefore, a farmer's level of income determined their level of access to extension channels, level of awareness and compliance with GAPs.

The second research question investigated the types of agricultural extension channels that influenced farmers' level of awareness and compliance with GAPs. Because farmers' level of access to extension channels had a significant influence on their level of awareness of GAPs, the study concluded that outreach by extension agents led to the provision of individualized support which was tailored to their needs and their level of understanding. This led to an increased level of awareness and adherence to GAPs.

This study recommends that dissemination of farming innovations should employ multiple sources of extension so that farmers can have diversified sources of awareness about farming innovations. Having diversified extension channels would also allow the farmers to align with the ones that are compatible with their social status.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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