

Original Research Article

Innovative Agricultural Technology Dissemination: Finding a New Use for Motor Tricycles

ABSTRACT

Aims: Even though the screening of videos to create awareness about agricultural technologies may not be a novelty, it appears the adaptation of a motor tricycle for that purpose is an innovation. The study therefore sought to identify the awareness creation technique that is most preferred by farmers in the Northern Region of Ghana, estimate the per unit cost of creating awareness through various techniques as well as determine the socio economic factors that are likely to influence farmers' decision to patronize ISFM video shows as an awareness creation technique.

Study design: Primary data collected through farmer interviews, formed the basis for analysis in this study. Qualitative and quantitative data generated from the questionnaire administration included types and quality of awareness creation techniques utilized by farmers, farmers socioeconomic characteristics among others.

Place and Duration of Study: The study was conducted in eight districts of the Northern Region of Ghana in September 2013. Based on culture, the eight districts fall naturally into two ethnic groups, which are the Dagombas and Gonjas. The study was therefore stratified into two zones (Dagbon and Gonja Land).

Methodology: Through a multi stage sampling technique, a total of 322 farmer observations were subjected to descriptive analysis, Friedman test and logit modeling in order to generate results for discussion.

Results: Analysis of the Friedman test indicates that on-farm demonstration (1.49) was unanimously ranked by the sample to be their most preferred method of receiving agricultural information. On-stage drama (3.00) and radio (3.00) were ranked as the least preferred methods of receiving information on ISFM technologies in 'Dagbon' and 'Gonja' Land respectively. Video show (2.88) was ranked by the respondents as their third most preferred method of receiving information on ISFM technologies. The use of video and on-farm demonstration was respectively found to be the least and most expensive ways of disseminating ISFM technologies to farmers. Whereas it cost about 1 Ghana cedi (GH¢1.09) to screen an ISFM video to a farmer, it costs about thirty times (GH¢31.10) more to expose a farmer to ISFM by establishing and managing an on-farm demonstration. Results of the logit model indicates that being male (0.09), belonging to a relatively large household (0.02), not having access to extension (0.20) or being relatively young (0.01) are the factors that are likely to positively influence farmers decision to patronize ISFM video shows.

Conclusion: The study therefore recommends that agricultural technology interventions should employ either on-farm demonstrations or video shows when constrained to adopt only a single awareness creation technique. Projects that are cash constrained should opt for video shows by specifically relying on motor tricycle video vans in order to reduce cost. For maximum impact, female farmers, members of relatively small households and elderly farmers should be targeted. Future studies should focus on the effectiveness of different awareness creation techniques and their interactive effects.

Keywords: Ghana, Motor tricycles, Technology dissemination, Video show

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15 1. INTRODUCTION

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17 Awareness is a necessary condition to adoption (1; 2; 3; 4; 5). Creating awareness bridges
18 the gap between technology development and uptake. Without dissemination, technologies
19 generated would remain on the shelf of research institutes with little or no impact. According
20 to (6) and (7), a major constraint limiting technology adoption is ignorance of the existence of
21 such technologies. In Ghana, and specifically the Northern Region, interpersonal, group and
22 mass communication methods are being used for propagating new or existing technologies
23 among farmers. There are however, some strengths and drawbacks associated with each
24 awareness creation technique.

25 Farm visits and distribution of print materials are examples of interpersonal awareness
26 creation techniques. Intensive interactions that enhance understanding and allows for rapid
27 feedback are some advantages of one-on-one interactions. This method is, however,
28 expensive in terms of time (only a few individual farmers can be reached within a period),
29 capital and other resources. On-farm demonstrations and farmer learning centres are some
30 of the means through which extension workers reach out to farmer based organizations,
31 nucleus or out grower farmers as well as apex farmer organizations. Group extension
32 techniques make room for many more farmers to be reached with a higher multiplier effect
33 as compared to interpersonal techniques. However, difficulty in organizing farmers into well-
34 functioning groups is a drawback to this approach. Mass extension techniques such as the
35 use of radio, television, video shows and on-stage drama ensure that large numbers of
36 farmers are reached. In the opinion of (8), mass methods are usually not very effective in
37 disseminating complex technologies.

38 Even though several governmental and non-governmental organizations have been using a
39 combination of awareness creation techniques to reach out to farmers in Ghana, the level of
40 awareness and adoption of many improved technologies is still estimated to be low (9; 5).
41 Arguably, the present dissemination techniques may not have had a phenomenal influence
42 on enhancing the level of awareness of farmers in the Northern Region of Ghana.

43 According to (10) Northern Region has perhaps the highest concentration of development
44 projects in the country. Agricultural Value Chain Mentorship Project (AVCMP) is one of the
45 developmental projects being implemented (2011-2014) in the region. The Danish
46 International Development Agency (DANIDA) through the Alliance for a Green Revolution in
47 Africa (AGRA) funds the project. The Savanna Agricultural Research Institute of the Council
48 for Scientific and Industrial Research (CSIR-SARI), International Fertilizer Development
49 Centre (IFDC), and the Ghana Agricultural Associations Business Information Centre
50 (GAABIC) are grantees implementing the AVCMP. The project seeks to, among other things,
51 increase awareness and use of Integrated Soil Fertility Management (ISFM) technologies
52 among smallholder farmers. In order to create awareness on ISFM technologies, the project
53 is relying on a combination of awareness creation techniques such as establishments of on-
54 farm demonstrations, radio broadcasts, video shows and on-stage drama.

55 Motorcycles and bicycles are popular means of transport in northern Ghana (11, 12). They
56 often come in handy in terms of carting goods on a small scale. It appears motorcycles are
57 mostly owned by men and the well-endowed whiles bicycles are mostly owned by women
58 and the less endowed. Goods on a large scale are usually transported by donkey carts,
59 tractors and trucks depending on ability to pay and road conditions. In recent times, motor
60 tricycles (commonly referred to as motor king in Northern Region) are becoming an
61 important means of transport (12). Motor tricycles are three wheeled, uncovered (open air)

62 motorcycles with a trailer (cart). Even though motor tricycles are licensed to cart goods, they
63 are increasingly being used for commercial human transport (Appendix 1).

64 In 2012, CSIR-SARI in partnership with Countrywise Communication Ghana under the
65 auspices of the AVCMP muted the idea of screening ISFM videos to farmers in project
66 communities without electricity using motor tricycles. A motor tricycle was purchased and
67 modified to contain a Liquid-Crystal Display (LCD) projector, screen, a laptop computer and
68 power generator (Appendix 2). In 2013, a total of 20,306 farmers (8,618 females) in sixty
69 communities in ten districts in the Northern Region of Ghana viewed the ISFM videos in their
70 own dialects through the use of the motor tricycle video van (Appendix 3).

71 The authors are not aware of any study to date on the adaptation of a motor tricycle to serve
72 the purpose of screening ISFM technologies to farming communities. This study therefore
73 seeks to identify the awareness creation technique that is most preferred by farmers in the
74 Northern Region of Ghana, estimate the per unit cost of creating awareness through various
75 techniques as well as determine the socio economic factors that are likely to influence
76 farmers' decision to patronize ISFM video shows as an awareness creation technique. The
77 findings of this study have implications for agricultural policy and project implementation in
78 terms of making a choice on the awareness creation technique to adopt for agricultural
79 technology dissemination. This study will therefore make empirical contributions to the
80 agricultural technology dissemination literature.

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83 **2. METHODOLOGY**

84 **2.1 Study Area**

85 The study was conducted in the Northern Region of Ghana. The region is the largest
86 (29.5%) in the country covering a total area of about 70,384 square kilometres (13). It is
87 bordered to the east and west by the republic of Togo and Côte d'Ivoire respectively. Upper
88 East and West Regions border it to the north with Brong-Ahafo and Volta Regions bordering
89 it to the south. Politically, the region has 26 administrative districts with Tamale being the
90 regional capital (13). AVCMP is being implemented in all the districts except West Gonja,
91 North Gonja, Bole, Sawla-Tuna-Kalba and Zabzugu-Tatale. The land is mostly low lying and
92 drained by the White and Black Volta together with its tributaries. The climate of the region is
93 relatively dry with two main seasons. The rainy season usually commences in May and ends
94 in October. Mean annual rainfall ranges between 750 and 1050 millimetres (13). The region
95 falls within the guinea savannah vegetation zone. According to (13), majority (74%) of the
96 people in the region are engaged in agriculture cultivating crops such as maize, rice,
97 soybean, yam, millet, cowpea, groundnut among others. Guinea fowls, goats, sheep and
98 cattle are some of the livestock being kept.

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100 **2.2 Data and Data Sources**

101 Primary data collected through farmer interviews formed the basis for analysis in this study.
102 Qualitative and quantitative data generated from the questionnaire administration included
103 types and quality of awareness creation techniques utilized by farmers, farmers
104 socioeconomic characteristics among others. Different sampling techniques were employed
105 at different levels of data generation. Northern Region was purposively sampled because it
106 is the intervention region of the AVCMP.

107 Eight districts were purposively sampled for this study. Based on culture, the eight districts
108 fall naturally into two ethnic groups, which are the Dagombas and Gonjas. The study
109 therefore stratifies the study area in two zones (Dagbon and Gonja Land). Through simple
110 random sampling technique, two and three districts were randomly sampled from the Gonja

111 and Dagbon zones, respectively. Twenty and twelve communities exposed to all the
112 awareness creation techniques were randomly sampled in the Dagbon and Gonja zones
113 respectively.

114 The project in creating ISFM awareness at the community does not limit any of the
115 interventions to only beneficiary farmers or farmer groups. On-farm demonstrations, radio,
116 on-stage drama and video shows are therefore opened to all farmers at the community level.
117 Indeed, the communities are informed before the commencement of any awareness creation
118 effort. A list of farmers were generated at the community level and on the average, ten
119 farmers from each sampled community were selected through simple random sampling
120 technique. The number of farmers interviewed in the Dagbon zone and Gonja zone is 190
121 and 132 farmers respectively. A total of 322 farmers were enumerated for the study.

122 Also, a staff of CSIR-SARI involved in the AVCMP was interviewed in order to gain an
123 insight into the various awareness creation techniques employed, their cost and number of
124 farmers reached.

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126 **2.3 Method of Analysis**

127 **2.3.1 Descriptive Analysis**

128 Narratives of the different awareness creation techniques including per unit cost analysis as
129 well as a description of the explanatory variables included in the logit models were obtained
130 using descriptive statistics. The categorical and continuous explanatory variables in the
131 model were further subjected to the Binomial Test and Independent Sample T-Test
132 respectively, in order to determine statistical differences between farmers who patronized
133 the ISFM video shows against those who did not.

134 **2.3.2 Ranking of Awareness Creation Techniques**

135 Following from (14), farmers ranking of their most preferred methods of receiving ISFM
136 information were subjected to the Friedman test which evaluates the hypothesis that;

137 H_0 : There is no difference in farmers ranking of awareness creation techniques

138 H_1 : There are differences in farmers ranking of awareness creation techniques

139 The difference in ranks is computed using equation 1.

$$140 \quad M = \frac{12}{nk(k+1)} \sum R_j^2 - 3n(k+1) \quad (1)$$

141 Where k = number of awareness creation techniques

142 n = number of farmers

143 R_j = sum of the ranks for the j^{th} awareness creation technique

144 A decision was reached by comparing the computed statistic, M , with a critical value
145 obtained from the chi-squared (χ^2) distribution table with $k-1$ degrees of freedom.
146 Analysis of the rankings was done for both the combined dataset and the zonally
147 disaggregated data.

148 **2.3.3 Factors that Influence Farmers' Decision to Patronize ISFM Video Shows**

149 In modeling the socio economic factors that are likely to influence farmers' decision to
150 patronize ISFM video shows, the study relied on the logit model since a farmer faces a
151 binary choice, to either patronize the ISFM video show or otherwise. Following from (15), the
152 probability of a farmer patronizing the ISFM video show can be expressed mathematically
153 as;

$$154 \quad Y_i^* = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_i X_i + U_i \quad (2)$$

155 Where Y_i^* is a latent variable depicting the decision by the i^{th} farmer to patronize the ISFM
156 video show. U_i is a random error term with a normal distribution. The coefficients β_0 and
157 β_i are a vector of parameter estimates. The study however considers the marginal
158 estimates of the model for discussion. Its ability to provide the magnitude of change is an
159 advantage that the marginal effect has over coefficient estimate.

160 If a farmer patronizes the video show, then $P_i = 1$ and this transforms equation (2) into
161 $Y_i^* = \ln\left(\frac{1}{0}\right)$. Alternatively, if a farmer does not patronizes the video show, then $P_i = 0$ and
162 this transforms equation (2) into $Y_i^* = \ln\left(\frac{0}{1}\right)$. The model was estimated through the
163 maximum likelihood method while enabling the robust standard error command.

164 Empirically, the logit model is stated as follows;

$$165 \quad Y = \beta_0 + \beta_1 \text{Age} + \beta_2 \text{Sex} + \beta_3 \text{HHSIZE} + \beta_4 \text{Educ} + \beta_5 \text{Area} + \beta_6 \text{FBO} + \beta_7 \text{Ext} \quad (3)$$

166 A description of the explanatory variables are presented in appendix 6.

169 **3. RESULTS AND DISCUSSION**

170 **3.1 Examination of Different Awareness Creation Techniques**

171 **3.1.1 On-Farm Demonstration**

172 Majority of the farmers interviewed received information on ISFM technologies through on-
173 farm demonstrations. About 59% and 78% of farmers in 'Dagbon' and 'Gonja Land'
174 respectively, reported participating in an on-farm demonstration. Establishment of on-farm
175 demonstrations by the AVCMP (improved rice management, improved soybean
176 management, importance of certified seed, effect of fertilizer and inoculant under different
177 management, ISFM for upland rice, effect of urea super granule on productivity and nitrogen
178 use efficiency of rice, and ISFM for maize) and other development projects could account for
179 the popularity of on-farm demonstrations in the study area. CSIR-SARI' efforts in
180 strengthening its out-station in East Gonja coupled with AVCMP's successful establishment
181 of a farmer learning centre, could help explain the high utilization of on-farm demonstrations
182 by farmers in the zone. The decision on the type of demonstration to host is jointly
183 determined by the host farmer based organization (FBO) extension service and research (or
184 a project). The demonstrations were implemented by farmers with technical and logistical
185 backstopping from research and extension. On-farm demonstrations are practical (hands-

on), participatory (interactive) in nature and can be utilized by other farmers in a 5 kilometre radius. Its main drawbacks are that it is seasonal, not easy (in terms of resources) to replicate in every community and only a few technologies can be demonstrated at a time.

3.1.2 Radio

Radio may be referred to as the internet of Africa (16). It provides a platform for sending and receiving information. AVCMP has an alliance with 4 FM broadcasting radio stations (Radio Savannah at Tamale, Radio Kitawoln at Saboba, Bishara FM at Tamale and Simli Radio at Dalun). These stations have been partnered to broadcast at least one hour agricultural program a week. All programs are aired between 6:30 and 9:00 pm. There are however several other radio stations in Northern Region that air agricultural programs either in collaboration with a project or as part of their social responsibilities. The AVCMP does not only support its partner stations with resource personnel (from research or extension) but also organizes periodic field visits for the stations to gather feedback from their listeners. About a quarter (26%) of farmers in the 'Gonja' zone listen to agricultural programs on radio and about 82% of the respondents in the 'Dagbon' zone tuned in to agricultural programs on radio. The high quality of radio signal coupled with the predominant use of Dagbanli (the local dialect in the 'Dagbon' zone) for agricultural programs could be the factors accounting for the popularity of radio within the 'Dagbon' zone. An advantage of radio is its ability to create awareness on different themes in different languages within a relatively short period of time. It is perhaps the quickest way of creating awareness. Limitations of radio include its reliance on technology by both the station and its listenership; farmers have to rely on their imaginative powers since it is only audio and farmers have to be attentive since items and concepts may not be repeated.

3.1.3 On-Stage Drama

Dissemination of agricultural technologies through on-stage drama does not seem to be very popular in the study area. Recording on-stage drama and playing it on radio appears however to have been used in the past to disseminate agricultural information. The AVCMP reported supporting the staging of many more dramas in the 'Dagbon' zone as compared to the 'Gonja' zone; hence it is not surprising that many more farmers in the 'Dagbon' zone (13%) reported witnessing an on-stage drama relative to the 'Gonja' zone (5%). Stage drama is capable of drawing large crowd since it is performed free of charge. It is also able to connect with farmers in their local dialects. The demerits of on-stage drama include logistical challenges in moving a crew from one point to another as well as the challenge of dramatizing technical concepts. In addition, it is often a challenge controlling the audience.

3.1.4 Video

Even though the screening of videos to create awareness about agricultural technologies may not be a novelty, it appears that the adaptation of a motor tricycle for that purpose is an innovation. About 21% and 28% of farmers in the 'Gonja' and 'Dagbon' zones respectively, reported receiving agricultural information through video shows. Video shows make learning fun; it is audio-visual and the videos can be paused or replayed at the behest of the farmers. The use of motor tricycles makes it possible for the ISFM videos to be screened in difficult terrains where electricity is lacking and the road network is poor. Farmers do not pay before viewing the ISFM videos. According to (17) one advantage of video show is its ability to overcome distortions associated with information ownership since community members are all able to receive the same information at the same time. Involvement of the agricultural extension service in screening of the videos appears to be minimal. According to (18), even though the use of videos does not require face-to-face presentation by skilled trainers, it has the power of generating discussion (peer learning) among farmers after the show. The interactions could continue into several months in Ghana as a result of the country's stronger social capital (19).

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3.2 Farmers Ranking of Different Awareness Creation Techniques

Application of the Friedman test to the dataset (combined or disaggregated into zones) indicates that there are differences in farmers' ranking of the four awareness creation techniques (Table 1). The chi square values were found to be significant for data at each level of analysis. On-farm demonstration was unanimously ranked by the respondents as their most preferred method of receiving agricultural information. In addition to obtaining practical knowledge on ISFM technologies, farmers who host on-farm demonstrations receive input support as well as retain the harvest from the demonstration plots. Farmers may therefore prefer on-farm demonstrations because they get to hear, feel and taste the effects of technologies being demonstrated. On-stage drama and radio were ranked as the least preferred methods of receiving information on ISFM technologies in 'Dagbon' and 'Gonja' Land respectively. This confirms the findings of (20) who reported that radio and public meetings were ranked as the least preferred means of receiving agricultural technologies by smallholder farmers in western Kenya.

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Signals of most radio stations (located in Tamale) were reported to be either weak or absent in some parts of 'Gonja Land'. The low ranking of radio could also be due to the fact that it is not visual. Some farmers in 'Gonja Land' also complained that the time allocated for agricultural programs (usually 1 hour) was inadequate thereby limiting interactions during phone-in segments.

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Most farmers in 'Dagbon' were of the opinion that the entertainment value of on-stage dramas tend to outweigh their ISFM dissemination value. It appears that ISFM concepts are difficult to dramatize orally without using a lot of graphics. Another drawback of on-stage drama is its tendency to attract untargeted individual such as children, traders among others. These individuals do not only crowd out the target farmers but also make so much noise that the cast may not be heard. Also, on-stage dramas tend to provide little opportunity for farmers to seek clarifications on unclear concepts and terms.

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Video shows seem to be a source of entertainment and knowledge hence farmers are able to relax and learn in the evening after a hard days' work. The respondents ranked video show as their third most preferred method of receiving information on ISFM technologies. According to (17), any farmer can practically attend a video show unlike on-farm demonstrations for example, where selection to participate may be biased. Farmers in Pakistan ranked radio higher than video, in terms of their present and future preferred means of receiving agricultural information (21).

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Table 1: Farmers Ranking of Different Awareness Creation Techniques

Awareness Creation Technique	Mean Rank		
	Dagbon	Gonja Land	Overall
Demonstration	1.47	1.52	1.49
Radio	2.64	3.00	2.79
On-stage drama	3.00	2.54	2.81
Video	2.88	2.95	2.91

Test statistics			
N	190	132	322
Chi-Square	168.983	118.966	271.207
df	3	3	3
Asymp. Sig	0.000	0.000	0.000

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275 3.3 Cost Analyses of the Different ISFM Creation Techniques

276 Analysis of the four awareness creation methods in terms of cost of generation, number of
 277 beneficiaries reached and per unit cost is presented in Table 2. In the observation of (8),
 278 cost-effective awareness creation techniques are necessary to ensure widespread adoption
 279 of agricultural technologies. The establishment and maintenance of an on-farm
 280 demonstration was found to be the most expensive medium for creating awareness on
 281 ISFM. The cost of inputs and services, supervision and field days for 100 on-farm
 282 demonstrations was found to be GH¢125,000.00. The host FBO provides land and labour
 283 contributions for the on-farm demonstrations. The expenditure lines for radio broadcast
 284 include quarterly allowances (airtime was free due to a memorandum of understanding),
 285 review meetings as well as material support. The cost for 150 radio broadcasts was found to
 286 be GH¢26,000.00. A total amount of GH¢22,050.00 was spent to produce, film and screen
 287 ISFM videos in farming communities. The video crew were often hosted (for a night) after a
 288 show at the community. The cost of producing and performing on-stage drama (given as a
 289 contract to a drama troupe) in eight strategic locations was found to be GH¢14,880.00.

290 Available data suggests that the largest numbers of farmers were reached through video
 291 screening. A total of 20,306 farmers patronized the ISFM video shows. It appears video
 292 show, as an awareness creation technique is capable of drawing a crowd to itself. In central
 293 Benin, (22) and (17) reported that video shows were able to reach three times more the
 294 number of women processors reached through conventional training workshops. Even
 295 though radio is expected to reach a large number of farmers, it was estimated that only
 296 20,000 farmers were effectively reached through radio broadcasts in 2013. A total of 4,019
 297 farmers (mostly belonging to farmer based organisations) participated in a field day or
 298 hosted an on-farm demonstration. A total of 2467 farmers also witnessed a drama staged to
 299 illustrate ISFM technologies. The dramas were planned to coincide with routine market days
 300 in order to attract large number of people.

301 The use of video and on-farm demonstration was found to be the least and most expensive
 302 way of disseminating ISFM technologies to farmers. Whereas it cost about 1 Ghana cedi to
 303 screen an ISFM video to a farmer, it costs about thirty times more to expose a farmer to
 304 ISFM by establishing and managing an on-farm demonstration. According to (23),
 305 demonstration is the most cost-effective extension dissemination method relative to farm
 306 visit, group meeting, field day, workshop, seminar and tour.

307 The findings of this study is consistent with (19) who noted that videos are a low cost
 308 interactive training methods well suited for disseminating technical information to farmers
 309 with low levels of literacy. It has also been reported by (8) that the per unit cost of employing
 310 electronic media as a dissemination strategy is lower than the use of field days and farmer
 311 field schools.

312 **Table 2: Per Unit Cost Analysis of Different Awareness Creation Techniques for 2013**

Awareness Program	Total Cost (GH¢*)	No. of Beneficiaries	Per Unit Cost
		(GH¢)	
Video show using motor tricycle	22050.00	20306	1.09
Radio programs	26000.00	20000 ^a	1.30
On-stage drama	14880.00	2467	6.03
On-farm demonstrations	125000.00	4019	31.10

313 ^aThe data is a conservative estimate, actual figure is not available

314 *1US\$ = 2.1GH¢

316 3.4 Socioeconomic Characteristics of Respondents

317 Demographic statistics of the farmers sampled are presented in Table 3. Categorical and
318 continuous variables are discussed in terms of percentages and averages respectively.

319 The proportion of males (72.8%) who patronized ISFM video shows was significantly higher
320 than the proportion of males (64.3%) who did not patronize the show. It appears males have
321 more freedom to roam at night relative to females. The video show aside promoting the
322 ISFM technology is also a source of entertainment especially for men. The show also
323 creates the opportunity for male farmers to meet and interact. Female farmers may not
324 necessary need that opportunity since it is not uncommon for them to meet and interact
325 while performing chores such as fetching firewood, water and gathering of wild fruits such
326 as *Butyrospermum parkii* and *Parkia biglobosa*.

327 The level of education was generally found to be low across the sample. Farmers who have
328 had some formal education (17.4%) but did not patronize the ISFM videos were significantly
329 higher than their colleagues (12.3%) who patronized the shows. An estimate by (13) shows
330 that about 16% of the people in Northern Region can read and write in English. The videos
331 were recorded in the local dialect hence formal education did not appear to be a relevant
332 factor. On the reverse side, educated farmers may already be exposed to videos and
333 projectors and may therefore not be too eager to see the ISFM videos. Also, educated
334 farmers may be able to read and understand ISFM concepts from print material, understand
335 radio programs aired in the English among others.

336 About 59% (63%) of farmers who patronized (did not patronize) the ISFM video show
337 belonged to a farmer based organisation (FBO). FBOs are usually the point of contact for the
338 video showing team in a community. In addition, FBOs are mostly the host for ISFM
339 demonstrations and target for participatory learning and action research on ISFM. Thus in
340 terms of membership, there is no significant difference between farmers who viewed the
341 ISFM videos and their colleagues who did not.

342 Farmers who had access to research or extension and patronized (46.9%) the ISFM video
343 shows were not significantly different from their colleagues who did not (77.6%) view the
344 ISFM video. The idea of showcasing ISFM through video is being promoted by research
345 whereas extension is actively propagating ISFM through other avenues such as on-farm
346 demonstrations.

The mean age of farmers who patronized the ISFM video show is about 37 years, which is significantly lower than their colleagues who did not patronize (about 39 years) the show. Higher levels of technology appear to be more appealing to younger people as compared to the elderly. Responsibilities also tend to increase with age. These factors may have an effect on the decision to patronize the ISFM video shows.

On the average, the household size of farmers who viewed the ISFM video (about 15) are significantly larger than the household size of those who did not watch (about 10) the video show. According to (13), households in the Northern Region are generally larger than the national average and this may be due to polygamy, high fertility and commonness of the extended family system. Farmers from larger households may be more willing to seek out new technologies due to the number of people that may have to be fed. Members of a large household may have different preference for receiving agricultural information including the use of video show.

On the average, the farmers sampled cultivate less than 3 hectares of land. They seem to be homogenous in nature producing mostly on subsistence basis. This result is in conformity with (24) who reported that about 90% of farmers in Ghana are smallholders.

Table 3: Descriptive Statistics of Respondents

Variable	Patronized Video Shows	Did not Patronize Video Shows
	Percent	
Male	72.8***	64.3***
Received formal education	12.3***	17.4***
Member of FBO	59.3	63.1
Have working relationship with research or extension	46.9	77.6
	Mean	
Age	36.7*	39.3*
Household size	14.6***	10.3***
Area under cultivation	2.6	2.3

* and *** denotes $P < 0.1$ and $P < 0.01$ respectively

3.5 Factors that Influence Farmer's Decision to Patronize ISFM Video Show

In modeling the factors that are likely to influence farmer's decision to patronize ISFM video show as an awareness creation technique, the application of the logit model to the dataset is justified considering the level of statistical significance of the log pseudo likelihood as presented in Table 4. The parameter estimates of the model are presented in appendix 7. Age, sex, household size and having a working relationship with research or extension are

371 the factors estimated to have an influence on farmers' decision to patronize ISFM video
372 shows.

373 The likelihood of patronizing an ISFM video show decreases marginally as a farmer ages.
374 The video shows are screened in the evenings when it is dark. It appears that young farmers
375 are generally more adventurous as compared to the elderly hence younger farmers may be
376 more willing to participate in an evening activity and may not even bother travelling to a
377 neighbouring community to watch an ISFM video show. Also, youthful farmers tend to be
378 more innovative and technologically inclined; they may therefore be more enthused about
379 watching an ISFM video show as compared to elderly farmers who may prefer to stick to
380 their radios and other traditional means of receiving extension information. The video shows
381 also provide an avenue for interactions and bonding before and perhaps more importantly
382 after the screening of the ISFM videos. Younger farmers are therefore more likely to take
383 advantage of the opportunity to socialize relative to elderly farmers who may prefer to stay at
384 home and take care of their spouses and children. It is not uncommon for some young
385 farmers to pay and view screened football matches as a source of entertainment. Such
386 farmers are therefore more likely to patronize ISFM videos that can provide them with
387 knowledge in addition to entertainment at no cost. Further, the ISFM video shows are
388 screened by young people hence the tendency to attract younger farmers may be higher. In
389 central Benin, age was not found to be a significant determinant of women's decision to
390 patronize video shows (17). However, (4) reported a significant inverse relationship between
391 age and level of awareness of improved pigeon pea in Kenya.

392 The probability of farmers attending an ISFM video show increases by about 9% if they are
393 males. In terms of inheritance and socio-cultural practices, the people of Northern Region
394 are patrilineal hence men tend to play leading roles and are usually given preference in
395 many circumstances. If for any reason both sexes cannot leave the house in the evening,
396 then females are more likely to remain at home. Opinion leaders or executives of farmer
397 based organisations who are often contacted to prepare the grounds for the video shows are
398 usually men. Males are therefore more likely to receive first-hand information about the
399 screening of an ISFM video in a community. On the average, males tend to have the means
400 of transport and are often more daring as compared to females. A male farmer may
401 therefore be in a position to patronize an ISFM video show in a nearby community. The
402 finding of this study contradicts (4) who observed that females in Kenya are more likely to be
403 exposed to improved pigeon peas.

404 There is an increased tendency for farmers to patronize ISFM video shows as their
405 household size increases by one. It appears that the level of social networking increases as
406 household size increases hence the larger the household, the higher the possibility of a
407 member being informed or knowing somebody in a different community that is hosting an
408 ISFM video show. A large household is more likely to have members with diverse interest
409 hence the likelihood of a member being interested in an ISFM video show may increase with
410 an increase in household size. In addition, a farmer who belongs to a large household may
411 get company before, during and after the video show. This could serve as an added impetus
412 to attend the ISFM video show unlike a farmer who may have to attend the show alone.
413 Further, farmers who have large household sizes are usually wealthy and influential people
414 and may therefore be consulted or even nominated by opinion leaders to host the ISFM
415 video show. A study by (17) did not find any significant relationship between number of
416 dependents in a household and women's decision to patronize video shows in central Benin.
417 According to (4) household size did not significantly influence farmer's awareness of
418 improved pigeon peas.

The chances of a farmer patronizing an ISFM video show decreases by about 20 percent if the farmer has a working relationship with either research or extension service. Farmers who have access to agricultural extension may already be exposed if not already adopted ISFM technologies and may not therefore have any incentive to receive ISFM information again. Farmers who have had access to ISFM technologies through practical trainings and on-farm demonstrations may not be motivated to watch ISFM videos again. The finding of this study is not consistent with (4) who reported a significant and positive relationship between access to extension service and level of exposure to improved pigeon peas.

Table 4: Marginal Effects of the Logit Model

Variable	Marginal Effect	Standard Error	P > Z
Age	-0.0055**	0.0023	0.017
Sex	0.0896*	0.0518	0.084
Household size	0.0155***	0.0033	0.000
Received formal education	-0.0491	0.0611	0.421
Area under cultivation	0.0029	0.0116	0.797
Member of FBO	0.0092	0.0446	0.836
Have working relationship with research or extension	-0.2034***	0.0395	0.000
Number of observations		322	
Wald chi ² (8)		37.48	
Prob > chi ²		0.000	
Pseudo R ²		0.1551	
Log pseudo likelihood		-153.44221	

*, ** and *** denotes P < 0.1, 0.05 and 0.01 respectively

4. CONCLUSION

Despite access to production technologies as a critical step in the adoption process, the role of awareness cannot be underestimated.. Farmers are more likely to adopt production technologies they are aware of relative to those who are not exposed to such technologies. Awareness can be created using interpersonal, group and mass communication methods with each method having some advantages and disadvantages. Video shows can be classified as a mass communication method. Creatively, CSIR-SARI in partnership with Countrywise Communication Ghana under the auspices of the AVCMP, purchased a motor tricycle and modified it in such a way that it is able to house and screen ISFM video shows to remote and rural communities without electricity. In 2013 for instance, a total of 20,306 farmers (8,618 females) in sixty communities in ten districts in the Northern Region of Ghana

442 were exposed to ISFM videos in their own dialects through the use of the motor tricycle
443 video van.

444 On-farm demonstration was unanimously ranked by the respondents as their most preferred
445 method of receiving agricultural information. On-stage drama and radio were ranked as the
446 least preferred methods of receiving information on ISFM technologies in 'Dagbon' and
447 'Gonja' Land respectively. Video show was ranked as the third most preferred method of
448 receiving information on ISFM technologies. The use of video and on-farm demonstration
449 was found to be the least and most expensive way of disseminating ISFM technologies to
450 farmers. Whereas it cost about 1 Ghana cedi to screen an ISFM video to a farmer, it costs
451 about thirty times more to expose a farmer to ISFM by establishing and managing an on-
452 farm demonstration. Being male, belonging to a relatively large household, not having
453 access to extension or being relatively young are the factors that are likely to influence
454 (positively) farmers decision to patronize ISFM video shows.

455 The study recommends that agricultural technology interventions should either employ on-
456 farm demonstrations or video shows when constrained to adopt only a single awareness
457 creation technique. Projects that are cash constrained should opt for video shows by
458 specifically relying on motor tricycle video vans in order to reduce cost. For maximum
459 impact, female farmers, members of relatively small households and elderly farmers should
460 be targeted. Future studies should focus on the effectiveness of different awareness creation
461 techniques including their interactive effects.

462

463 **COMPETING INTERESTS**

464

465 The authors do not have any competing interest.

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586 **ABBREVIATIONS**

587 AVCMP Agricultural Value Chain Mentorship Project

588 AGRA Alliance for a Green Revolution in Africa

589 CSIR Council for Scientific and Industrial Research

590 DANIDA Danish International Development Agency

591 FBO Farmer Based Organisation

592 FM Frequency Modulation

593 GAABIC Ghana Agricultural Associations Business Information Centre

594 ISFM Integrated Soil Fertility Management

595 IFDC International Fertilizer Development Centre

596 LCD Liquid-Crystal Display
597 SARI Savanna Agricultural Research Institute
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599 **APPENDIX**



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601 **Appendix 1: A Motor Tricycle being used for Human Transport**
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604 **Appendix 2: A Motor Tricycle modified for ISFM Video Show**

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613 **Appendix 3: ISFM Video Screening in a Community**

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615 **Appendix 6: Description of the Explanatory Variables used in the Logit Model**

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Variable	Description	Unit of Measurement
Age	Age of farmer	Years
Sex	Sex of farmer	Dummy: 1 = Male, 0 = Otherwise
HHSIZE	Household size	Number
Educ	Received formal education	Dummy: 1 = Yes, 0 = Otherwise
Area	Area under cultivation	Hectares
FBO	Member of FBO	Dummy: 1 = Yes, 0 = Otherwise
Ext	Have working relationship with research or extension	Dummy: 1 = Yes, 0 = Otherwise

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Appendix 7: Parameter Estimates of the Logit Model

Variable	Coefficient	Robust Standard Error	P > Z
Age	-0.0354**	0.0152	0.020
Sex	0.5803*	0.3389	0.087
Household size	0.1002***	0.0244	0.000
Received formal education	-0.3183	0.3934	0.418
Area under cultivation	0.0193	0.0749	0.797
Member of FBO	0.0597	0.2887	0.836
Have working relationship with research or extension	-1.3179***	0.2969	0.000
Constant	-0.5738	0.6909	0.406
Number of observations		322	
Wald chi ² (8)		37.48	
Prob > chi ²		0.000	

Pseudo R ²	0.1551
Log pseudo likelihood	-153.44221

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*, ** and *** denotes P < 0.1, 0.05and 0.01 respectively