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EXPLORING THE EFFECTIVENESS OF AGRICULTURAL TECHNOLOGIES TRAINING AMONG SMALLHOLDER FARMERS IN SUB-SAHARAN AFRICAN COMMUNITIES

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ABSTRACT*:* *Knowledge and capacity development on improved farm technologies and techniques are essential for agricultural growth. Despite the extension effort to facilitate adoption and diffusion of innovation through farmers visit and training expected transformation in food production process is yet to be achieved hence, there is the need to evaluate the effectiveness of farmers' engagement in technologies development. This study was carried out to ascertain the effectiveness of agricultural technologies training among smallholder farmers in Sub-Saharan African communities. Multistage sampling techniques were used to select 200 smallholder farmers. The respondents consist of the lead and trainee farmers in the spread of knowledge and support the technology adoption which is the distinctive aspect of the study. Data were collected using focus group discussions, in-depth interviews and structured questionnaires. The collected data were analysed using deceptive statistics, likert type scales and spearman correlation. The results of the study revealed that agricultural technologies training were very effective among the smallholder farmers. A great proportion (70.5%) of the farmers indicated that the training was very effective. There was a rapid increase (85%) in the level of adoption of agricultural technologies after the participatory training among the respondents compared to pre-training (49.5%). The findings also revealed that 13 Good Agricultural Practices (GAPs) technologies were fully adopted by the majority of the smallholder farmers. In addition, our results also showed that there was a strong positive correlation (r = 0.001**, p<0.05) between agricultural technologies training sessions and adoption of Good Agricultural Practices (GAPs). The results reported that the use of participatory agricultural technologies training and trust in the lead farmers influenced farmers' decisions to adopt and implement the recommended good agricultural practices technologies. The study recommends a policy agenda of Government that will favor improvement of agricultural extension and training for rural development to promote agricultural productivity, improving standard of living of smallholder farmers and national food security.*

KEYWORDS: good agricultural practices, technologies, smallholders, lead farmers, adoption

INTRODUCTION

Agriculture was the most important sector of Nigeria's economy before the country attained independence in 1960, and contributed 75% of the country's earnings through export and produced more than 50% of the GDP (FMARD, 2012; Sennuga, 2019). However, the sector was neglected when the petroleum industry was rapidly expanded. Aregheore (2013) examined the relative decline in the sector which caused a high dependence on imported foodstuffs and consequently consumer preference increased for these imported food stuffs. The rate of population growth surpassed the food production in the country when growth rates in the early 1970s were 8% - 10% per year while agricultural production declined by 4% per annum (Aregheore 2013). The FAO (2012) found sharp recovery in production of major food crops from 1995 to 2004 as a result of a succession of good harvests, leading to a reduction in cereal imports, a surge in public and private investment in crop production and higher producer prices.

When outlining the increase in the contributions of the agricultural sector to GDP in Nigeria and subsequent increase in agricultural production in 1993, the World Bank (2011) emphasized the contribution of 33.5% to the GDP and in the same year, 63.7% of the population was employed in the sector. The World Bank (1993) further estimated that there was a 4.1% increase in agricultural output in the same year, which was higher than the increase of 3.5% and 3.7% in the years 1995 and 1996 respectively (World Bank, 2011; Sennuga, 2019). The agricultural production value accounted for 38.7% of the country's GDP. Despite the increase in the performance of the sector, it has fallen short of the expectation of the proposed 5.5% growth rate outlined in the National Plan of 1997 to 1999. Lack of interest in farming among the youth also caused the sector to decline significantly. The 2004 estimate shows the GDP real growth rate was then 1.7%, with agricultural production accounting for 30.8% of the country's GDP, industry accounting for 43.8% and services 25.4% (World Bank, 2011).

Farmer, Community and Industry Engagement

The importance of engaging farmers and community members in all stages of technology development and the research process cannot be underrated. In practice, the idea of engagement guides the formation of a partnership among farmers, extension workers, industry and policy makers (Sennuga, 2019). However, the successful engagement of farmers and community members at the early stage of technology and innovation development can play a significant role in providing constructive advice to farmers and promoting on-farm technologies, while at the same time providing valuable information to extension workers and other stakeholders both in research and policy-making. Thus, the proper conduct of such studies can help to establish lasting trust and partnership between all players in research processes. In farmer engagement research, the end user and researcher work closely together to ensure the relevance of the research and development. This effective engagement take place where there is two-way communication and mutual trust between the researcher and the community members, as well as where the results of the research can be shown to benefit the community. Farmer engagement research allows for the proper understanding of the cultural, social, environmental, economic, political factors and the impact of the imposition of values and beliefs of the participants (Sennuga, 2019).

In order to improve the adoption of good agricultural practices technologies among community members, it is essential to have a better understanding of farm practices that are directly under the control of farmers and the community. Hence, engaging farmers or end users in research and extension activities through participatory research and extension (PR&E) is highly encouraged. Farmer engagement should also be considered right from the outset, from concept development and planning stages, through implementation, to monitoring and evaluation of the project. However, the involvement of farmers as early as possible in decision-making has been frequently cited as important if community engagement in research processes is to lead to viable solutions (Sennuga, 2019). In spite of the poor linkages between farmers, extension services and research, successful farmer engagement can be achieved by adopting the principles of Participatory Action Research which provide a dynamic relationship between farmers and stakeholders.

Research and traditional extension services have been providing production guidelines and information to farmers on adoption of improved technology and innovations particularly on Good Agricultural Practices (GAPs) over the past three decades. These have included traditional extension approaches used at various stages of development and implementation such as in Ministry Public extension model; Training and Visit extension model; Non-Governmental Organizations extension; Farmer Field School extension model etc., all of which have the potential (to varying degrees) to adoption of technology, to increase productivity, improve natural resources and generate higher income among smallholder farmers (Ajani 2014). However, traditional extension models and public extension programs for smallholder farmers in Sub-Saharan Africa have been widely criticized by scholars as ineffective and inefficient (Anderson *et al.* 2010; Davis 2010; Aker 2011, Sennuga, 2019). Good Agricultural Practices (GAPs) technology was the focus of engagement with the smallholder farmers and extension workers in the area.

Principles of Good Agricultural Practices (GAPs) Technologies

These principles describe farming that uses available technology and optimally promotes sustainable agricultural productivity and natural resources management that contributes to: food security; access to sufficient, safe and healthy food; improved livelihoods, to achieve economic viability; agricultural and environmental sustainability; as well as social responsibility. According to FAO (2010), the key areas of concern when implementing a GAP program are:
Soil Management, Water Management, Crop and fodder production, Crop protection, Animal production, health and welfare, Harvest and on-farm processing and storage, Energy and waste management, Human welfare, health and safety.

Relevant Good Agricultural Practices (GAPs) Technologies for the Region

After a comprehensive analysis of possible GAPs technologies for the study locations based on the scientific evidence as to whether they are suitable for the region and careful consideration of farm household in making improved decision about technologies adoption. The following factors were put into consideration in selecting 16 GAPs - climatic factors, economic factors, edaphic factors, socio-economic factors and government policies. However, these 16 GAPs were carefully selected and considered relevant to the region: Improved seeds, Soil management, Spraying of herbicide, Pest use/pest control, Improved planting spacing of crops, Use of crop residue to feed livestock, Fertilizer application, Striga control, Irrigation/water management, Crop rotation, Cover crops, Improved storage, Compost and green manure, Zero tillage, Spacing, Mulching.

The effectiveness of agricultural technology adoption training programme among smallholder farmers in Sub-Saharan African Communities is yet to be established and this is why this study was conducted. Therefore, the main objective of this study is to ascertain the effectiveness of agricultural technology adoption training among smallholder farmers in Kaduna State, Nigeria. The specific objectives of this study are to:

i. examine the socio-economic characteristics of smallholder farmers;
ii. assess the effectiveness of agricultural technologies training among all participant farmers;
iii. investigate farmers perceptions regarding effectiveness of the training programme;
iv. examine the impact of GAPs technologies training and Action Plan on Adoption by farmers;
v. highlight the factors influencing adoption of GAPs technologies.

METHODOLOGY

Kaduna State of Nigeria as the study area

The study was conducted in two rural communities (Shika and Bassawa) in Giwa and Sabon-gari Local Government Areas of Kaduna State, Nigeria. Kaduna State is politically classified as belonging to the North-West zone of the six (6) Geo-political zones of Nigeria which is located in the Northern Guinea Savannah agro-ecological zone of the country and experiences a tropical continental climate with two recognizable seasonal, dry and rainy reasons. Administratively, the state is divided into twenty-three Local Government Areas. Among these are Giwa, Sabon-gari, Kaura, Kaduna North, Birni Gwari. These areas are largely dominated by Hausa and Fulani with other ethnic groups. This study area was purposively selected primarily due to active engagement of the rural dwellers in agricultural production in the district and for its proximity to Ahmadu Bello University, Zaria to facilitate access for the researcher and his assistants. The researcher collected the list of smallholder farmers in the study area from the office of Agricultural Development Programme (ADP) the government extension sector who is working in the area.

From the context of fieldwork, the two communities are similar in agro-climatic, ethnic group, religion and cultural settings. There is no climatic or agronomic difference between these communities; they are just 300 metres apart (Sennuga, 2019). However, one is an Adopted Village from the National Agricultural Extension and Research Liaison Services (NAERLS) ABU, Zaria and the other is not. The Shika community gets only public extension services with about 3000 smallholder farmers per extension agent while Bassawa community receives extension services plus the research education establishment from Adopted Village Program with estimated ratio 1:85 farm families (Sennuga, 2019). The major cash crop in the area is ginger where commercial quantities of 1,728.930 metric tons are produced annually as well as food crops including yam, maize, millet, groundnut, rice, cassava, beans, guinea corn (Sennuga, 2019).

Participants and data collection

The sample size for the study was 200 smallholder farmers. It consists of 100 farmers from each community. Village meeting were organized during the first visit to the study area. However, during the second visit (May-June 2016) to the study area, the researcher, assisted by two extension workers from academia (NAERLS) who communicate effectively in local dialect (Hausa language) and are also familiar with the targeted study area, undertook a farmer participatory training programme on 16 Good Agricultural Practices (GAPs) technologies. The farmer participatory training was strategically designed by the researcher as a farmer-centered process of purposeful and creative collaboration between the researcher and smallholder farmers. Eight extension workers also participated in the workshop/training. The main purpose of this collaboration was to develop GAPs technologies that would meet the local environmental conditions of the smallholder farmers via exchange of experiences with the farmers and to actively involve the end-user (farmers) in the development process. Rather than developing and releasing "perfected" technology packages which may eventually not meet the farming and living conditions of the farmers (a typical top-down approach). However, the workshop/training commenced in the study area on Monday, 4th May 2016. The session was designed to allow the researcher and farmers to effectively work together to develop 16 GAP technologies and an Action Plan to implement the technologies. The detailed procedure was as follows:

i. Prior to the training session farmers were asked whether they were aware of GAP technologies.
ii. Farmers were requested to list all the agronomic practices (GAPs) they were aware of.
iii. The researcher helped them to organize and capture the list on the flipchart.
iv. Following the list mentioned by the trainees, the researcher discussed extensively the merit and demerit of each technology listed by the smallholders and also showed them the pictures of the improved technologies on the slide presentation.
v. Following the discussion, the researcher pointed out major conclusions and, together with the participants, 16 Good Agricultural Practices (GAPs) technologies were defined.

The 16 GAPs technologies collectively defined with the farmers comprised of fertilizer application; water management; soil management; crop rotation; spraying of herbicide; pesticide control; mulching and so forth. A distinctive aspect of the current study was that the study utilized "lead farmers" and "trainee farmers" in the communities to spread knowledge and support the technology adoption of GAP technologies to trainee farmers. The farmers were divided into two groups. Hence, the two groups allow the study to investigate the effectiveness of the GAPs technologies training and extension services provided by the researcher.

- 50 "lead farmers" 25 from each community were randomly selected by the researcher and extension staff from NAERLS who were also recruited as a research assistance and enumerator. The "lead farmers" were carefully chosen according to the following criteria: completion of secondary education; respected farmers in the village; belonging to the active age group; ability to read and motivate others. Village chiefs were prioritised since they normally have the aforementioned abilities.

The lead farmers acted as "ambassadors" for the current study. It is particularly difficult for foreigners or outsiders to come to the villages and tell the rural people what to do without having someone there to establish trust. Therefore, the lead farmers have such trust and they were also the exemplar for other farmers in the communities in terms of technology adoption. The major role of the lead farmers among others was to advise and train other farmers (trainee farmers) in the village on GAP technologies.

- The researcher trained 50 lead farmers, 25 from each community (Bassawa and Shika).
- The lead farmers were asked to train 3 farmers each (altogether 150 trainee farmers). The process was monitored. Altogether the researchers trained 200 smallholder farmers during the phase.

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- This is called the farmer-to-farmer extension model of technology dissemination where lead farmers are trained and then pass on the technologies to the trainee farmers in the community.

Study sample and sampling technique
A combination of purposive and multi-stage random sampling was adopted to in the study to select 200 respondents, 100 from each community Bassawa and Shika. However, the methodologies employed for data collection were based on quantitative evidence around Good Agricultural Practices (GAPs) and on profiling research communities through household surveys, while the qualitative research focused on the behavior of the communities in relation to technology adoption training. In the same vein, this study seeks to have a deeper understanding, exploration and in-depth analysis of a real-life situation, which the effectiveness of agricultural technologies training programme and adoption of GAP technologies. Data were collected using focus group discussion, in-depth interview and structured questionnaire.

Data analysis
The data collected were analyzed using the Statistical Package for Social Sciences (SPSS) to produce percentages from frequency distribution, spearman correlation and ranking etc.

FINDINGS AND DISCUSSION

Socio-economic characteristics of the rural dwellers in the study area
The socio-economic characteristics of the respondents investigated in the study included: age, sex, marital status, household size, level of education, major crops cultivated, household assets and income level. The age of the farmers in the households ranged from 20 to 70 years. 59.2% of them fell within the middle age of 31-50years in both communities. This suggests that the majority of the respondents were within their economic active age and this enhances their productivity in order to be food secure (Table 1). The old age group (51-70) had the lowest impact in farm work with 24.2% contributing to active farming among the sampled population. However, it is generally assumed that younger people tended to be more productive than their older counterparts. In the same vein, the results in Table 1 below showed that all the respondents were males; this is because the cultural traditions of the study area do not allow females to be actively involved in farming activities (Sennuga, *et al*. 2020).

In term of the martial status of the respondents, overwhelming majorities (96.7%) of the respondents were married with half of these households having 10 or more members; the remainder had larger families of 21 plus members reflecting polygamy within the communities. The result is not surprising because large family sizes are the norm in the Northern Nigeria and large families provide accessible workforces. Furthermore, the cultural tradition and religion allows the men to marry at most four wives. The use of household labour for several activities was very common in the study area with activities such as ploughing, harrowing, planting, weeding, chasing away straying domestic animals, irrigation activities and harvesting. In the same vein, large household may also help to access more agricultural information.

Educationally, 44% of the respondents had acquired primary education, while 17% had secondary education. Only 7.5% of the respondents possessed higher education (Table 1). This suggests that

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the respondents in the study area obtained the basic education required for better understanding and ability to embrace new technologies especially the adoption of GAPs modern farming technology. In addition, it is generally thought that the level of education enhances the ability to comprehend and also adopt relevant agricultural information. Indeed, according to Kalungu and Filho (2016), and Sennuga (2019) highly educated farmers tend to adopt relevant agricultural technologies better than more illiterate ones. In term of household asset, 58% of the household keep poultry, a greater proportion (61.7%) keep sheep and goats. A sizeable proportion of the respondents (42%) also indicated that they rear cattle and only 6.5% specified that they keep other livestock such as camel, duck, turkey etc. The baseline livelihood survey shows that no single household keeps pigs in the study area. This was attributed to the religion (Muslims) of the respondents. It was revealed during the focus group discussion that the Muslim faithful do not rear pigs (Sennuga, *et al.* 2020).

Table 1: Demographic representation of the socio-economic Characteristics of the smallholder farmers (n= 200)

Variables	***Percentage***
Age (years)	
20-30	15.8
31-40	31.7
41-50	27.5
51-60	17.5
61-70	6.7
> 70	.8
Gender (Sex)	
Male	100
Female	0
Marital status	
Single	3.3
Married	96.7
Household size	
≤10	50.8
11-20	36.4
21-30	12.1
>31	.7
Level of education	
No education	30.8
Primary	44.3
Secondary	17.0
Tertiary	7.5
Family education	
No education	3.3
Primary	55.0
Secondary	35.8
Tertiary	2.5
No Children yet	3.3
Household Asset	
Poultry	58.0
Sheep and goats	61.7
Cattle	42.8
Other livestock	6.5
Pig	0

Effectiveness of agricultural technologies training among all participant farmers (n = 200)
As presented in Figure 1, it was revealed that the majority (70.5%) of the respondents indicated that the overall training on GAP technologies intervention programme was very effective in providing them with knowledge and skills, while 27% of the respondents stated that the training was relatively effective and a negligible proportion (2.5%) expressed that they did not find the training effective. The findings show that the overall GAP training programme was effective for a great majority (97.5%) of the respondents. The findings agree with Ajayi (2014) who stated that smallholder farmers in developing countries would adopt new innovation if adequate technical supports and resources were made available to them.

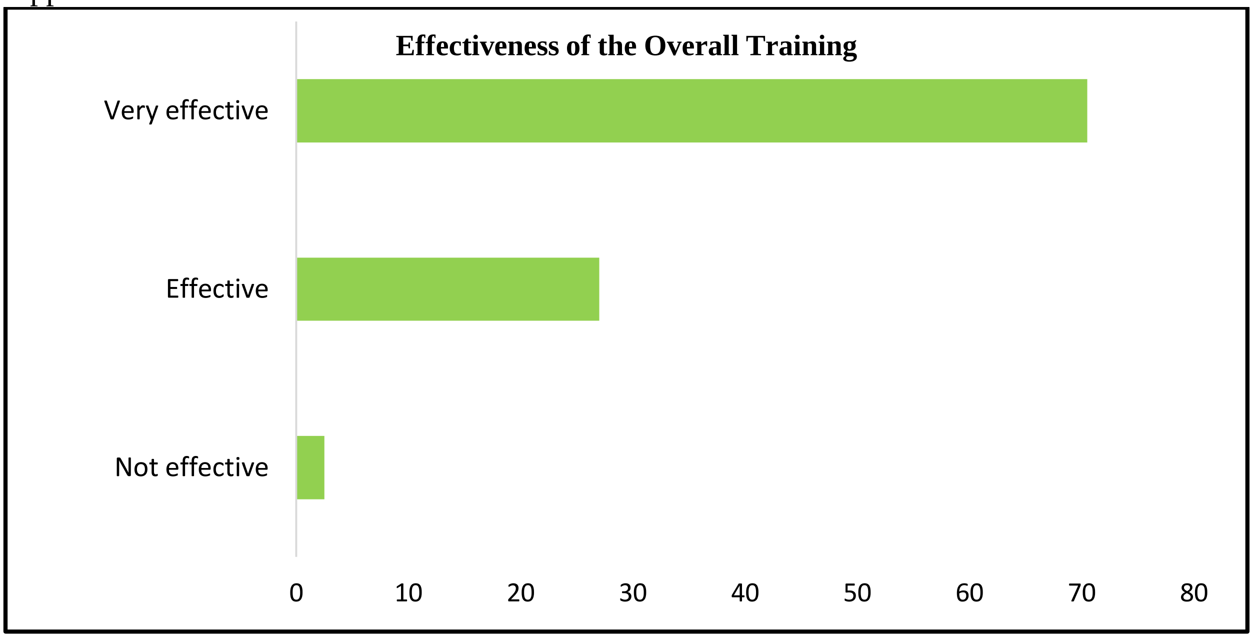

Figure 1: Effectiveness of GAPs technologies training among participant farmers (n = 200)
Source: Field Survey 2016 **Scale: 100%**

Effectiveness of the Training Programme Delivered by the Researcher among the Lead Farmers and Adoption of GAP
Lead farmers were asked to rank the effectiveness of the training provided by the researcher. The exact question was "How would you rate the effect of the GAP training sessions provided to you by the researcher?" A 3-point Likert scale was used to record these responses, (1= less effective, 2= effective and very effective =3). The study results revealed that the majority of the lead farmers 95% found training very effective. The results also revealed the existence of a significant and positive correlation between the effectiveness of the training and GAP adoption among the lead farmers (Table 2). The study results show that adoption of improved seeds (r = 0.34**), soil management (r = 0.47**) and spraying of herbicide (r = 0.45**) significantly and positively correlated (Spearman Rank) with the level of perceived effectiveness of the training (Table 6.1). Similarly, nine GAP technologies are significantly and positively correlated among the trainee farmers these included improved seeds (r = 0.59**), soil management (r = 0.33**), spraying of herbicide (r = 0.25**), fertilizer application (r = 0.55**). This implies that the GAP training had positive effect on recommended GAP adoption.

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Table 2: Spearman rank correlation of the Effectiveness of Training Programme Delivered by the Researcher among the Lead Farmers and Adoption of GAP

GAP Technologies	Lead farmers (Trainer)	P-value	Trainee farmers	P-value
Improved seeds	0.34**	.000	0.59**	.001
Soil management	0.47**	.000	0.33**	.002
Spraying of herbicide	0.45**	.000	0.25**	.000
Pesticide use/Pest control	0.36**	.001	0.49**	.001
Improved planting spacing of crops	0.63**	.002	0.62**	.002
Use of crop residue to feed livestock	0.33**	.000	0.38**	.000
Fertilizer application	0.26**	.000	0.55**	.001
Striga control	0.35**	.001	0.33**	.000
Water management/irrigation	0.85**	.002	0.25**	.000
Crop rotation	0.63**	.000	0.859 ^{NS}	0.377
Cover crops	0.75**	.001	0.077 ^{NS}	0.564
Improved storage	0.39**	.002	0.098 ^{NS}	0.732
Compost and Green Manure	0.32**	.000	0.086 ^{NS}	0.312
Zero tillage	0.098^{NS}	0.531	0.079^{NS}	0.472
Spacing	0.037^{NS}	0.426	0.098^{NS}	0.381
Mulching	0.055^{NS}	0.735	0.095^{NS}	0.426

Source*:* Survey 2016; Lead farmers n =50; Trainee farmer n=150

Trainee Farmers' Perceptions on the Effectiveness of the Training Delivered by the Lead Farmers to their Peers (N= 150)

Figure 2 reports data on the participants' perceptions of the effectiveness of the training delivered by the lead farmers to their peers (trainees farmers). As shown in figure 2, the majority of the trainee farmers surveyed (98%) indicated that the training was effective and increased their level of agricultural production especially in this recession period in Nigeria. The findings show that participants were happy with the training delivered to them by the lead farmers. This result revealed that lead farmer extension approach is an effective model because farmers trust their fellow farmers (85%) even more than extension workers in the area. This result concurs with the FAO (2013) which strongly recommends the use of the lead farmer model in passing knowledge to smallholder farmers.

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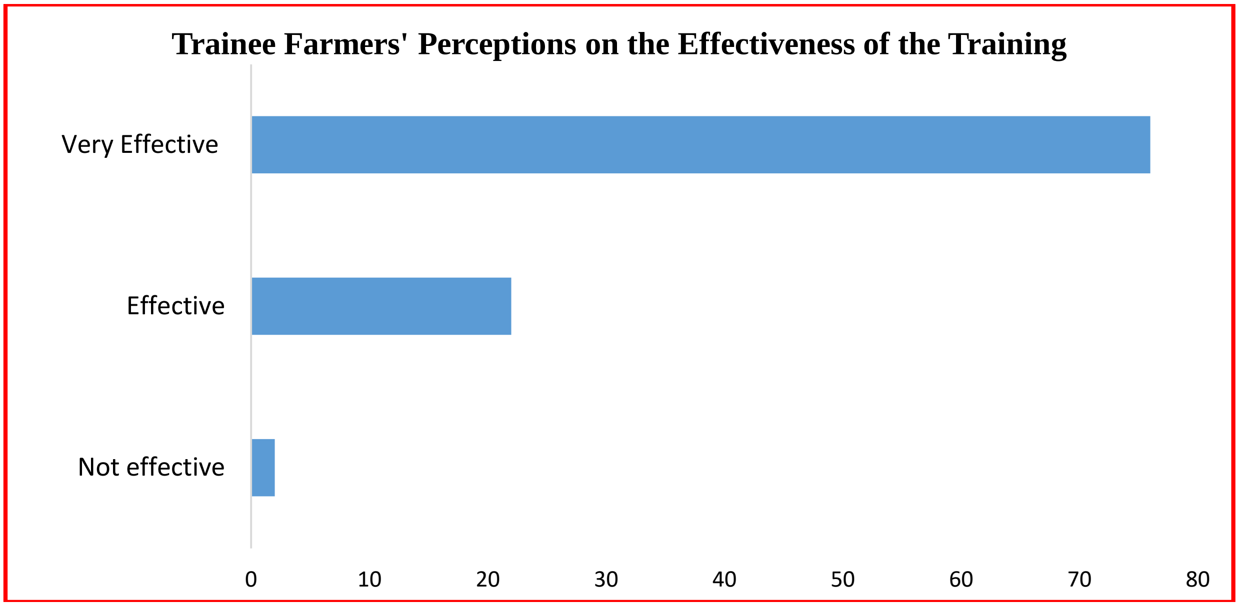

Figure 2: Trainee Farmers' Perceptions on the Effectiveness of the Training Delivered by the Lead Farmers to their Peers (N= 150) Scale: 100%
Source: Survey 2016; Trainee farmers (n=150)

Impact of GAPs technologies training and Action Plan on Adoption by farmers

Table 3, the non-parametric Spearman rank test was used to predict the impact of the GAP technologies training on the adoption of the sixteen GAPs technologies recommended to the farmers. The results indicated that the coefficient of thirteen GAPs recommended technologies were positive and statistically significant among the farmers, showing increased adoption post-training (see Table 3). What emerges from the analysis of these findings suggests that the impact of the participatory GAPs training intervention provided to the farmers has been positive and effective which resulted in technology adoption.

Table 3: Spearman rank test between GAP technologies and adoption using n=200

GAP Technologies	Adoption Level	Spearman Rank	P-value
Improved seeds	85.0	15.0	0.000**
Soil management	84.5	30.0	0.000**
Spraying of herbicide	80.0	28.0	0.001**
Pesticide use/Pest control	79.0	27.5	0.000**
Improved planting spacing of crops	74.5	40.0	0.000**
Use of crop residue to feed livestock	69.5	23.5	0.000**
Cover crops	69.5	30.0	0.000**
Striga control	68.5	25.5	0.001**
Water management/irrigation	68.0	35.0	0.000**
Crop rotation	66.5	20.5	0.002**
Fertilizer application	60.0	35.5	0.000**
Improved storage	60.0	37.5	0.057**
Compost and Green Manure	59.5	35.0	0.036**
Zero tillage	58.5	30.0	0.123NS
Spacing	58.5	27.0	0.570NS
Mulching	69.5	48.0	0.327NS

Source: Survey 2016; P < 0.05 is significant

The results presented in Table 4 shows that 13 GAPs were fully adopted and the farmers responded positively when asked whether they had benefited from the participatory GAP training sessions. The results reveal that 83% indicated that it was beneficial, while 91% reported that they acquired information, skills and knowledge and increased agricultural production and productivity (79%) as a result of taking part in the participatory GAP training (both lead farmers and trainee farmers). This shows that the agricultural technologies' training was successful and beneficial to the vast majority of the participants.

The results of the evaluation survey further found that 73% of the farmers indicated that the GAP participatory training sessions had a positive impact on their crop productivity this cropping season (Table 4). This shows that the farmers actually benefited from the GAP training sessions they attended whether delivered by the research team or by the lead farmers and the information and skills acquired enabled the majority of them to practice them.

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Table 4: Distribution of GAP Adoption and Action Plan (n = 200)

Impact of GAP Adoption and Action Plan	%
Do you think the GAP participatory training sessions was beneficial?	
Yes	83
No	17
Were you able to apply the Information gather, knowledge and skills gained from the training?	
Yes	91
No	07
I don't know	02
Do you think the GAP participatory training sessions had a positive impact in your crops productivity?	
Yes	79
No	21
Adoption of GAP among with-SMS farmers	
Fully Adopted	73
Partially Adopted	20
Not Adopted	7

Source: Survey 2016

When probed on the impact of the action plan on adoption, analysis of findings indicated that the majority of the farmers (80%) said that they were able to work much faster and easier on their farmland since they knew the next activities to perform through the action plan developed during the GAP training. This implies that the respondents were able to save more time and become more productive. At this juncture, it could be concluded that without attending these participatory GAP training sessions (both direct to the lead farmers and in-direct to trainee farmers), the smallholder farmers would not have been able to adopt the same level of recommended GAP technologies and subsequently would not have improved their crop productivity to the same extent.

Factors Influencing Adoption of GAP Technologies among Smallholder Farmers

As mentioned previously, 13 GAPs technologies were fully adopted by the majority of the smallholder farmers. Moreover, the evaluation survey conducted among the farmers requested the participants to list and ranks the perceived barriers to agricultural technologies adoption. Generally, the level of illiteracy was not the main reason preventing rural farmers from adopting GAPs technologies. Poor information and lack of capital were rated as the most significant barriers to GAP adoption (Figure 6). The factors posing the greatest barriers perhaps deserve particular attention when planning and implementing improved agricultural technologies development for the rural communities. This suggests that farmers were not able to follow the action plan, thus resulting to non-adoption of three GAP technologies.

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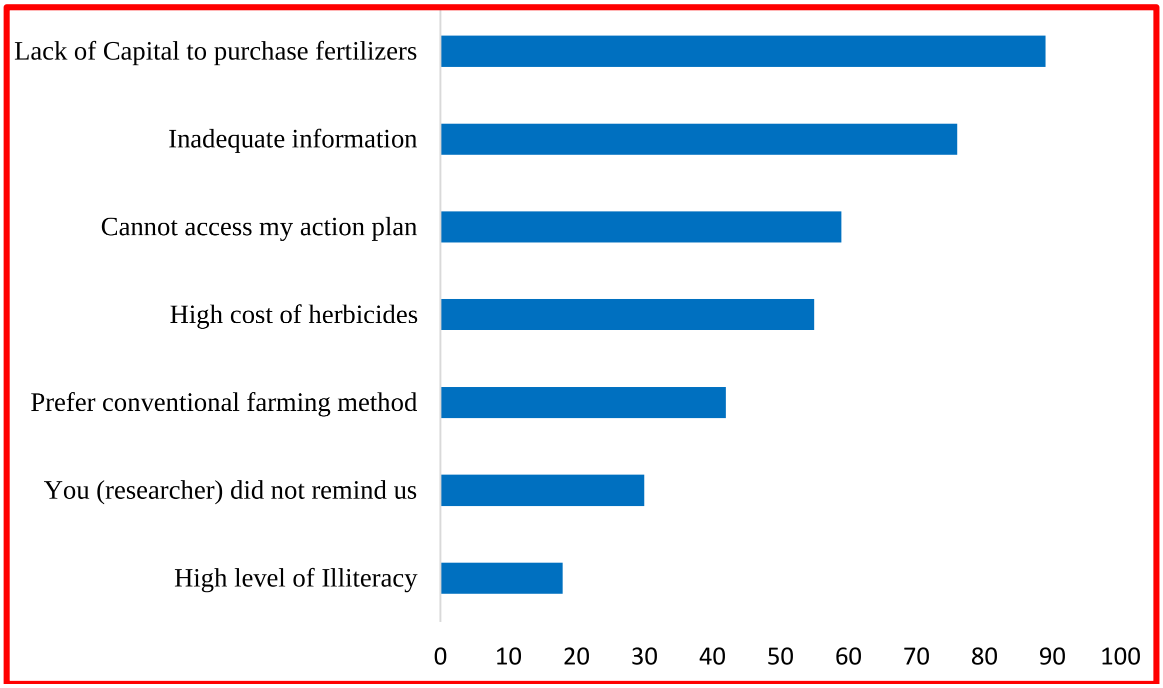

Figure 6: Factors influencing adoption of GAP technologies among smallholder farmers Source: Survey 2016; n=100%

CONCLUSION

From the study, our results revealed that agricultural technology training was very effective and the smallholder farmers. A great proportion (70.5%) of the farmers indicated that the training was very effective. There was a rapid increase (85%) in the level of adopted of agricultural technologies after the farmer participatory training among the respondents compared to pre-training (49.5%). Our results also showed that there was a strong positive correlation ($r = 0.001^{**}$, $p<0.05$) between agricultural technologies training sessions and adoption of Good Agricultural Practices (GAPs). The results reported that the use of participatory agricultural technologies training, trust in the lead farmers influenced farmers' decisions to adopt and implement the recommended good agricultural practices technologies. The use of information and participatory technologies training offered to the smallholders was largely an educational process which they converted into useable knowledge. Parsa *et al.* (2014) stated that effective training provides a person with the ability to recognize opportunities, become endowed with knowledge, self-esteem and the skills to act on them. In addition, Sennuga, *et al.* (2020) emphasized that better-trained smallholder farmers are known to make greater use of information, skills, advice and the training, and are more diligent and proactive in adjusting to agricultural changes and adopt new improved technologies.

Recommendations

The study recommends that Federal Government should set forth a new, expanded policy agenda favoring agricultural extension and training for rural development focusing on promoting agricultural productivity, improving standard of living of smallholder farmers and national food security. Furthermore, there is need for stable political environment that will generate a forward-looking policy in the agricultural sector in Nigeria. In addition, the State Ministry of Agriculture should build a platform to promote dialogue and cooperation among research institutions, agricultural extension workers and rural farmers with the aim of developing participatory extension and information services network for agricultural technology adoption, food security and income generation for the rural dwellers. Finally, agricultural extension workers should promote demand-driven participatory approach and communities' needs should be strengthened rather than top-down approach. Government should motivate agricultural extension agents to continue to impact positively on the rural farmers.

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