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Effectiveness of Farmer Field School Training in Promoting Adoption of Best Agricultural Practices by Smallholder Coffee Farmers in Kenya

Jonathan Luusa[a*], James Obara[b], Stephen Wambugu[c]

[a]*Kenya Agricultural and Livestock Research Organization P.O. Box 57811-00200, Nairobi*

[b,c]*Department of Agricultural Education & Extension, Egerton University P.O. Box 536-20115, Egerton, Kenya*

[a]*Email: j_luusa@yahoo.com*

[b]*Email: jobara@egerton.ac.ke*

[c]*Email: stephen67@yahoo.com*

Abstract

In Kenya, there are gaps on the availability of studies of the specific extension approaches and their effectiveness on the adoption of technologies. This study sought to investigate and document the effectiveness of farmer field school training in promoting adoption of best agricultural practices (BAP) by smallholder coffee farmers in Kenya. The target population were the smallholder coffee farmers in Kenya. A descriptive survey research design was used. Data was collected using an interview schedule comprising of both closed and open ended items. The instrument was validated by experts from the Egerton University's department of Agricultural Education and Extension and the chief executive officers in the study coffee societies. The research instrument was pilot tested to determine its reliability. Using Cronbach's alpha, an index of 0.936 was obtained. Descriptive statistics as well as inferential statistics technique were used to analyze data with the help of Statistical Packages for Social Sciences (SPSS) version 22 for windows. Chi-square and correlation analysis were used to determine whether Farmer Field School training had statistically significant effect on enhancing uptake of best agricultural practices amongst smallholder coffee farmers in Kenya. To make reliable inferences from the data, all statistical tests were verified at $\alpha \leq 0.05$ level of significance.

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* Corresponding author.

The study revealed that there was a significant relationship between extent of uptake of BAP and belonging to FFS classes. This study recommends that coffee industry stakeholders should encourage smallholder farmers to belong to FFS classes in order to enhance the uptake of BAP in coffee farming in Kenya.

Keywords: Effectiveness; Farmers; Field School Training; Adoption; Best Agricultural Practices; Coffee.

1. Introduction

Agricultural extension and advisory services comprise "the entire set of organizations that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills and technologies to improve their livelihoods" [1] Extension was traditionally viewed as a means of transferring technologies developed in research stations as well as farm management practices to farmers, and used top-down institutions of delivery, as characterized, for example, by the World Bank's Training and Visit System [2]). These traditional extension methods were criticized for providing a "one size fits all" methods [3]) which failed to factor in the diverse socioeconomic and institutional environments faced by farmers, or involve farmers in the development of technology and practices appropriate to their contexts.

Extension was thus considered to have failed in achieving its main objective of farm productivity improvements and in reaching the poor, particularly in Africa [1]. Since the 1980s, the methods to reaching rural smallholder farmers has drawn increasingly on more participatory methods, which enable farmer self-learning and sharing, and also allow those facilitating farmer training, as well as agricultural researchers further upstream, to learn from the farmers [4].

Since the late 1980s, support to agriculture has shifted from top-down methods to those identifying technologies and methods of communicating technologies which are suitable to support farmers' livelihoods in a sustainable manner, including participatory methods based on the notion of creating spaces for farmer self-learning. One such method is the farmer field school (FFS), an adult education intervention with the objectives of providing skills in such areas as integrated pest management (IPM) and empowering farmers and communities. Farmer field schools have been implemented in 90 countries worldwide, reaching an estimated 10–15 million farmers. The role of agricultural extension is to help people identify and address their needs and problems [5]. There is a general consensus that extension services if successfully applied, should result in outcomes which include observable changes in attitudes and adoption of new technologies, and improved quality of life based on indicators such as health, education and housing [6].

In Kenya and other developing countries, attempts have been made to change conventional extension methods to participatory methods [7]. Conventional extension methods were perceived as top-down, inflexible and with limited farmer participation. Transfer of Technology and Training and Visit were conventional methods widely in Kenya between 1950s and 1990s [8]. They were supply driven and externally initiated without the involvement of the target farmers, hence not farmer-problem oriented [9].

Farmer Field School training has been widely used in different countries for farmer empowerment. In FFS training, farmers are no longer positioned as receivers of already developed technological packages, but as field

experts, who collaborate with the extension staff to find solutions relevant to the local realities. Farmer field school programs emphasize farmers' ownership, partnership and group collaboration. They have been used in many crops including cotton, tea, coffee, cacao, pepper, vegetables, small grains and legumes [10].

Farmer field school training were conceptualized between 1970s and 1980s and first implemented in Indonesia in 1989 to deal with the wide spread of pest out breaks in rice that threatened the security of Indonesia's basic food supplies [10]. The training was first introduced in East Africa in 1995 under the Food and Agricultural Organization (FAO) special program for food security in Western Kenya [11]. Farmer Field School training provide an environment in which farmers acquire knowledge and skills for sound management decisions, sharpen farmers' ability to make critical decisions that render their farming profitable and sustainable and empower farmers to become "experts" on their own farms [4].

Coffee Research Institute has devoted considerable effort and resources in developing several coffee technology packages. Among these is the breeding of Batian and Ruiru 11 coffee varieties, which combine characteristics of high yields, resistance to coffee berry disease and coffee leaf rust and superior coffee quality [12]. Through various research programmes, CRI has developed a package of recommendations on various coffee agronomic practices aimed at enhancing coffee productivity while keeping the cost of production low. Key among these technologies are production of certified planting materials, coffee establishment protocol, soil and moisture conservation techniques, weed management strategies, soil nutrient management techniques, canopy management practices, use of shade trees in coffee, top-working traditional varieties into disease resistant varieties (varietal conversion), pests and disease management strategies and timely picking of the red-ripe cherry for processing [12]. These recommendations collectively constitute the best agricultural practices for the smallholder coffee farmer in Kenya.

In an effort to facilitate the dissemination and utilization of these research outputs, CRI adopted and experimented with different methods of coffee extension interventions to smallholder coffee farmers in Kenya. However, the smallholder coffee sector still suffers from lack of effective and efficient support services such as extension, credit and input supply. The efforts and resources committed to technology development would be of little significance unless and otherwise they are accessed, accepted, and used by intended users. In this aspect, the communication media and public agricultural research extension and advisory services have played a large part in introducing the new technologies to farmers in Kenya [13].

The farmer field school networks in Eastern Africa support about 2000 FFSs with close to 50,000 direct beneficiaries [14]. Farmer field school training focuses on building farmers' capacity to make well-informed crop management decisions through increased knowledge and understanding of the agro- ecosystem. Farmer field school participants make regular field observations and use their findings, combined with their own knowledge and experience, to judge for themselves, what, if any, action needs to be taken [15].

The long term empowerment goals of FFS training seek to enable graduates to continue to expand their knowledge and to help others learn and to organize activities within their communities to institutionalize different practices [16]. Farmer Field School training differs from other extension methods is that, the role of

extension worker is very much that of a facilitator rather than a conventional teacher. Once the farmers know what it is they have to do, and what it is they can observe in the field, the extension worker takes a back seat role, only offering help and guidance when asked to do so [17] . The aim of FFS is to build the farmers' capacity to analyze their production systems, to identify their main constraints, and to test possible solutions, eventually identifying and adopting the practices most suitable to their farming system [4].

The uptake of new technologies is based on the theory that farmers make decisions to maximize their expected utility or benefits. Benefits may include increased profitability, health, food security, lower risk, and environmental sustainability. Farmers take up technologies when their expected utility from the new technology exceeds that of the current technology. Farmers' characteristics often considered in technology uptake models include: age, human capital (formal or informal education), and household size. Knowledge occurs when an individual is exposed to innovation's existence and gains some understanding on how it functions [18]. Field observation in coffee growing counties in Kenya indicates extension contact, field days and FFS training as the main sources of information to coffee farmers. Other sources of information to farmers such as demonstration farms, agricultural fairs, farm exchange visits, radio contact, magazines, journals, use of mobile phone and e-mail are almost non-existent [19]. Collaborative research with farmers and research driven by farmers has brought a shift from previous perceptions where farmers were seen mainly as 'adopters' or 'rejecters'' of technologies but not as providers of knowledge and improved practices [20].

Alternative participatory methods have been developed to address the weaknesses associated with the conventional extension methods. The participatory methods emerged after it was realized that most technologies developed by researchers alone were not appropriate for smallholder farmers [21].

The Farmer Field School (FFS) training has become an innovative, participatory and interactive model for farmer education in Asia, many parts of Africa, Latin America and more recently also introduced in the Middle East, North Africa and Eastern/Central Europe [22]. The method has been used with a wide range of crops and has subsequently expanded to topics such as livestock, community forestry, water conservation, soil fertility management, food security and nutrition. The aim of FFS is to build farmers' capacity to analyze their production systems, identify problems, test possible solutions and eventually adapt the practices most suitable to their farming system. The knowledge acquired during the learning process enables farmers to adapt their existing technologies to be more productive, profitable, and responsive to changing conditions, or to test and adopt new technologies [4].

In farmer field school training, farmers share their knowledge with other farmers and are trained to teach the courses by themselves in a participatory manner. The dissemination of innovations develops spontaneously when one farmer has successfully tested a new practice or technology, attracting the interest of other farmers. It creates conditions for optimal farmer learning and informed decision making abilities. Farmers consequently perceive themselves as experts in, and managers of, their own fields. Through FFS, farmers take charge of organizing experiments, leading discussions, making plans and accomplishing tasks previously considered too complex for the average farmer to apply [23].

Many studies have shown the ability among farmers to innovate and develop their own solutions to problems through FFSs, there by being part of the innovation system rather than just recipients [24].

The role of agricultural extension is vital to the diffusion of new technologies leading to increased production. Conventional and participatory learning approaches have been used for information dissemination on best agricultural practices to smallholder coffee farmers in Kenya. Information dissemination through participatory approaches such as farmer field schools has recorded encouraging results in several countries in the world [25]. Published research indicates that farmer field schools have a substantial impact in terms of increases in farm productivity, reductions in farmers' use of pesticides and improved farming knowledge [26]). However, information on the effectiveness of farmer field school training in promoting adoption of best agricultural practices in coffee farming is not readily available, forming the basis for this study, which is designed to evaluate and document the effectiveness of farmer field school training in promoting the adoption of best agricultural practices by smallholder coffee farmers in Kenya.

The purpose of the study was to determine the effectiveness of farmer field school training in enhancing uptake of best agricultural practices amongst smallholder coffee farmers in Kenya.

2. Methodology

A descriptive survey research design was used for this study. This design was appropriate to the study since the purpose was to collect information from a sample of the population of smallholder coffee farmers, in order to describe the effectiveness of farmer field school training in promoting adoption of BAP by smallholder coffee farmers in Kenya.

The study locations were Bungoma, Machakos, Meru and Muranga Counties where Coffee Research Institute initiated pilot coffee farmer field schools under the Common Fund for Commodities funded project: increasing the resilience of coffee production to leaf rust and other diseases in India and four African countries. The activity was implemented during the 2010/2011, 2011/2012 and 2012/2013 coffee years.

The target population was smallholder coffee farmers in Kenya. The active members registered with the four societies where FFS training was promoted during the 2010/2011, 2011/2012 and 2012/2013 coffee years formed the accessible population. This was 4802 farmers comprising of 2092 from Kikai, 775 farmers from Muvuti, 1094 farmers from Mukiria and 841 farmers from Kabati FCS from Bungoma, Machakos, Meru and Muranga counties respectively. Out of a total active membership of 4802, only 117 participated in FFS learning while 4685 were exposed to conventional extension approaches.

Four coffee societies were purposively selected since they implemented the farmer field school learning programme in coffee. All the 117 farmers who trained and graduated in FFS learning were used owing to their small size. Proportionate random sampling technique was applied to the societies to obtain a sample of 100 farmers who did not learn through FFS. This is in line with [27], who recommend that, for descriptive studies, a minimum of 100 subjects are required. A total sample size of 217 was thus obtained as summarized in Table 1. The sample determination formula was:

Sample size* = (Non-FFS farmers) / (Total farmers) X 100. Example for Kikai FCS has been computed:

Sample size for Kikai FCS = (2060) / (4685) X100 = 43.97, rounded off to **44*.**

Table 1: Distribution of Sample Respondents in the Study Area

FFS School (FCS)	Active Society members	FFS farmers trained and graduated	Non-FFS farmers	Sample size for Non-FFS farmers*	**Total sample size**
Kikai	2092	32	2060	44*	**76**
Muvuti	775	26	749	16	**42**
Mukiria	1094	28	1066	23	**51**
Kabati	841	31	810	17	**47**
Total	4802	117	4685	100	**217**

A self-administered structured questionnaire was used to collect data from the respondents. The items of the instrument were constructed based on the research objectives. The instrument (structured questionnaire) was chosen because of its ease in administering besides the results being readily analyzed. [28] indicate that an interview will yield a higher response rate and also give an opportunity for clarification of items after they are presented by the respondent.

To ensure the items of the structured questionnaire measured what it was intended for, the instrument was subjected to scrutiny by the four chief executive officers in the coffee societies, who assisted in reviewing the instrument to address its face and content validity.

Pre-testing of data collection instrument involved administering the questionnaire to 20 farmers who were not part of the study group. According to [29], the pilot test sample should be between 1% to 10% of the calculated sample, depending on the sample size. The calculated sample size for this study was 217; hence the pilot testing with 20 farmers falls within the acceptable range. The collected data was cleaned, coded, entered into computer and analyzed using Statistical Package for Social Sciences (SPSS) Version 22 for windows. A reliability co-efficient threshold of above 0.70 is recommended for survey research.

Data collected was organized into ordinal, nominal, interval and ratio scales. The data was cleaned, coded and entered into computer and analyzed using Statistical Package for Social Sciences (SPSS) Version 22 for windows. Descriptive statistics (mean, mode and standard deviation) were used to summarize gathered data while inferential statistics was used to test the effect of farmer field school training. The level of significance was tested at $\alpha \leq 0.05$.

3. Results and Discussions

3.1 Characteristics of the Respondents

The study gathered respondents' personal attributes which encompassed gender, marital status, age and level of education. As shown in Figure 3, the respondents consisted of 47.1% and 52.9% for male and female farmers respectively. This may imply that coffee farming related decisions such as attendance of farmer field school training in promoting adoption of best agricultural practices may not be dominated by any gender.

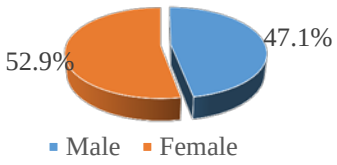

Figure 1: Gender of the Respondents

This study was represented by farmers with different age brackets. Majority of the respondents were aged 36 - 55 years comprising of 32.4%. About 29.0% of the total respondents were aged below 35 years while 24.8% were aged 56-65 years. Respondents aged 66 years and above constituted 13.8% of the sample as shown in Table 3.

Table 2: Respondents' Age Brackets

Age bracket in years	Frequency	Percent	Cumulative Percent
Below 35 years	61	29.0%	29.0%
'36 - 55 years	68	32.4%	61.4%
'56 – 65 years	52	24.8%	86.2%
'66 years and above	29	13.8%	100.0%
Total	210	100.0%	

A cumulative percentage of 61.4% of the respondents were aged less than 56 years. This implies that coffee farming in the study area is popular among the young and middle aged persons. Most of the older and aged farmers in the age brackets 56-65 and above 66 years may have stopped the growing of the crop or may have transfered the ownership to younger generation. Age have an influence on farming productivity due to the effect of technology adoption. According to [30] young and middle aged farmers are generally receptive to adoption of new technology in farming. Majority (59.0%) of the farmers were married as depicted in Figure 4. Over 19% of the respondents were windowed while 17.1% were single. At least 4.3% of the farmers did not disclose their marital status.

Most of the respondents, at 97.6% had less than tertiary level of education as shown in Figure 5.

Majority of the respondents at 33.8% had secondary level of education. This was followed by respondents with upper primary level of education as represented by 27.1% of the total responses. About 26.7% of the

respondents had no formal education while 10.0% had lower primary level of education. It was just 2.4% of the respondents who had tertiary level of education. These results imply that majority of the smallholder coffee farmers may lack adequate formal education which is necessary for better modern farming. In addition to this, the level of education of the household head can influence the kind of decision that may be made on behalf of the entire household with regard to coffee farming, attendance of trainings and adoption of new technologies. More educated farmers are likely to make better decisions, put more value on acquisition of new skills as well as quickly adopting new technologies in farming as compared to their less educated counterparts.

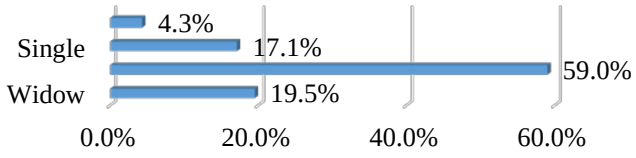

Figure 2: Marital Status of the Farmers

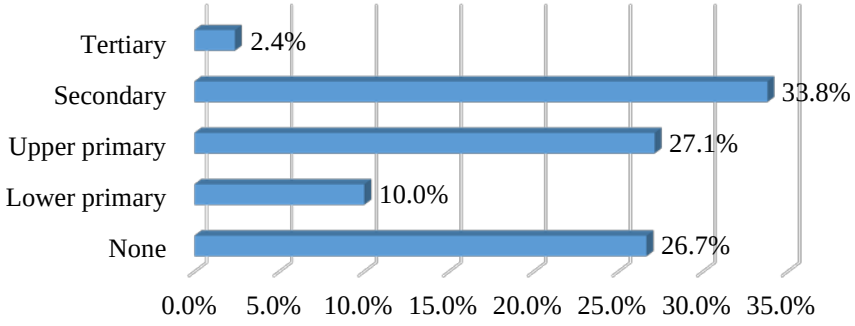

Figure 3: Respondents' Highest Level of Education

According to [31], education level of the small scale farmers influences their average coffee production per tree at 0.01 level of significance where the level of education of the small scale farmer was associated with 32.4% increase in yield per tree. Studies by [32] ascertained that the level of education of the household head affected uptake of technology, which in turn affect productivity.

3.2 Respondents' Belonging to Farmer Field School Classes

Most of the farmers in the sample were found to belong to FFS classes, 55.7%. About 44.3% of the farmers did not belong to any FFS class as shown in figure 6.

Farmers belonged to various FFS classes in order to share knowledge on coffee farming for their common good. If one is a member of an FFS class, he/she was anticipated to access training on uptake of best agricultural practices and enhance farming knowledge and hence positively influencing coffee yields.

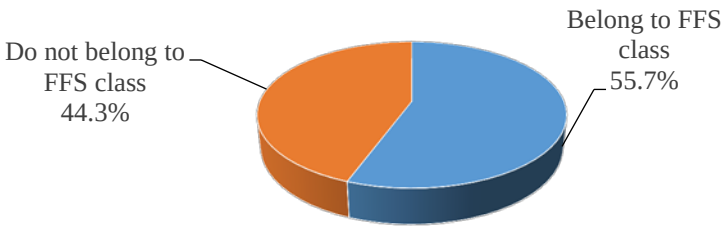

Figure 4: Farmers Belonging to FFS Classes

According to [33], FFS classes are channels through which new technologies and methods of production are transferred to farmers. They are also the main source of information for not only the best agricultural practices but also input and output markets. Membership to FFS class is key in building up necessary networks required either in production or marketing of one's farm produce. In a bid to improve his/her understanding of the production techniques, most farmers join FFS classes so that they can share knowledge and experiences involved and help solve problems facing their colleagues [23]. In addition to the educational opportunities available to farmers through FFS classes, participation within the classes leads to initiative, innovation and improvements **[34]**. Hence, coffee yield may raise leading to higher incomes, increased consumption and reduced poverty.

3.3 Respondents main occupation

The most popular occupation practiced by respondents in the study area was farming (Table 4).

Table 3: Respondent main occupation

Occupation	Frequency	Percent
Farming	166	79.0
Salaried employment	25	11.9
Non-farm businesses	14	6.7
Casual labour	3	1.4
Others	2	1.0
Total	**210**	**100.0**

Majority of the respondents had farming as their main occupation as represented by 79.0% of the total responses.

About 11.9% were in salaried employment while 6.7% operated non-farm businesses such as retail shops, posho mills, salons, welding, cyber cafes, hotels, electronic appliances, accommodation, computer training and groceries. Other types of occupations were represented by only 1.0% of the total responses.

This implies that farming is the main economic activity in Kenya.

3.4 Respondents major source of income

Since farming was the main economic activity in the study area, most of the respondents indicated that their main source of income was farming as represented by 99.0% of the total responses (Table 5).

Table 4: Major Source of Income

Source of income	Frequency	Percent
Off-farm employment	2	1.0
Farming	208	99.0
Total	**210**	**100.0**

It was just 1.0% of the respondents who indicated that their major source of income was from non-farm employment.

3.5 Effectiveness of farmer field school training in enhancing uptake of best agricultural practices amongst smallholder coffee farmers in Kenya

This study sought to determine the effectiveness of farmer field school training in enhancing uptake of best agricultural practices amongst smallholder coffee farmers in Kenya. In meeting this objective, a null hypothesis, "Ho_1: Farmer field school training has statistically no significant effect on enhancing uptake of best agricultural practices amongst smallholder coffee farmers in Kenya" was formulated and analyzed using descriptive statistics (frequencies) and inferential statistics (Chi-square).

Uptake of Best Agricultural Practices

This study sought to describe the uptake of best agricultural practices in the study area. The results are shown in table 6.

Majority of the respondents at 65.2% indicated uptake of proper field preparation and coffee establishment, with 34.8% indicating non-uptake of the practice. 56.2% of the respondents indicated uptake of weed management strategies while 43.8% indicated non uptake of the practice. As far as uptake of the application of fertilizers and organic manures for improved production and quality was concerned, majority of the respondents at 61.4% indicated to have had an uptake, with only 38.6% not embracing the practice. 58.6% of the respondents implemented proper canopy management practices to maintain the growth vigor of the coffee plant. Similarly, 58.1% of the respondents implemented the use of mulch and shade trees for soil and moisture conservation, with 41.9% indicating non uptake. 61.0% of the respondents implemented the application of Integrated Pest Management (IPM) strategies in the control of coffee insect pests were up taken by 61.0% of the

respondents, with only 39.0% not embracing the practice. Application of cultural management strategies for control of Coffee Berry Disease and Coffee Leaf Rust was represented by a remarkable uptake of 53.3% with just 46.7% of the farmers reporting non-uptake. Majority of the respondents at 54.8% indicated to have implemented top-working traditional varieties (SL) into disease resistant varieties (Ruiru 11 and Batian), with only 45.2% reporting non uptake.

Table 5: Uptake of Best Agricultural Practices

	Uptake	**Non-Uptake**	**Totals**
Practice learned from coffee FFS	**Percent**	**Percent**	**Percent**
Proper field preparation and coffee establishment	65.2	34.8	100
Application of weed management strategies	56.2	43.8	100
Application of fertilizers and organic manures for improved production and quality	61.4	38.6	100
Proper canopy management to maintain the growth vigor of the coffee plant	58.6	41.4	100
Use of certified planting materials (seedlings)	47.1	52.9	100
Use of mulch and shade trees for soil and moisture conservation among others	58.1	41.9	100
Application of Integrated Pest Management (IPM) strategies in the control of coffee insect pests	61	39	100
Application of cultural management strategies for control of Coffee Berry Disease & Coffee Leaf Rust	53.3	46.7	100
Top-working traditional varieties (SL) into disease resistant varieties (Ruiru 11 and Batian)	54.8	45.2	100
Timely and selective picking of red-ripe cherry	43.8	56.2	100

However, only 47.1% of the respondents embraced the use of certified planting materials, with 52.9% of the respondents not embracing the practice. Likewise, 43.8% of the respondents indicated uptake for timely and selective picking of red-ripe cherry, with 56.2% indicating non-uptake of the practice.

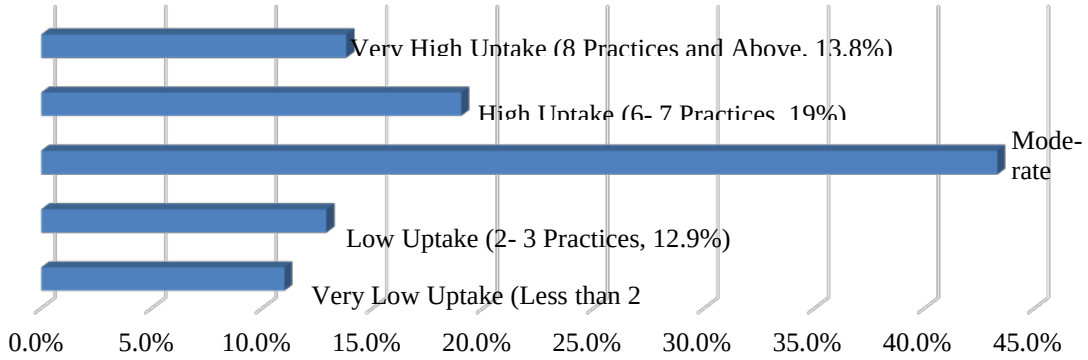

Figure 5: Coffee Farmers' Uptake of Best Agricultural Practices

NB: Minimum = 0, Maximum = 10, Mean = 6.595, Standard Deviation = 4.537

Source: Field Data (2017)

Based on the number of Best Agricultural Practices (BAP) that each respondent had adopted, this study was able to determine the farmers' extent of uptake of superior agricultural practices in Kenya. Figure 7 provides a summary of adoption of Best Agricultural Practices in Kenya.

Use of Chi-square was employed to determine whether farmer field school training had any statistically significant effect on enhancing uptake of best agricultural practices amongst smallholder coffee farmers in Kenya. The results are shown in table 7.

Table 6: Chi-square Results for the Relationship Between Belonging to FFS and Uptake of Best Agricultural Practices

	Belonging to FFS		
Extent of uptake of BAP	**Belong to FFS**	**Does not belong to FFS**	**Totals**
Very Low Uptake (≤ 2 practices)	2 (1.7%)	15 (16.1%)	17 (8.1%)
Low Uptake (2 - 3 practices)	6 (5.1%)	42 (45.2%)	48 (22.9%)
Moderate Uptake (4 - 5 practices)	36 (30.8%)	26 (28.0%)	62 (29.5%)
High Uptake (6 – 7 practices)	53 (45.3%)	9 (9.7%)	62 (29.5%)
Very High Uptake (≥8 practices)	20 (17.1%)	1 (1.1%)	21 (10.0%)
Total	**117 (100.0%)**	**93 (100.0%)**	**210 (100.0%)**

Chi-square = 85.34, df= 4, P-value < 0.001

Chi-square test was run to help determine the relationship between extent of uptake of BAP and belonging to FFS classes. A calculated chi-square value of 222.941 (significant at 5% level since p-value = 0.001 at 4 degrees of freedom) implies that there is a significant statistical relationship between these two variables.

Greater uptake of BAP is associated with belonging to FFS as opposed to non-belonging to FFS.

The results in table 7 shows that majority of the respondents who belonged to FFS had high uptake of BAP as represented by 45.3% of the total responses. About 30.8% of the respondents who belonged to FFS had moderate uptake of BAP while 17.1% had very high uptake of the BAP.

It was only 5.1% and 1.7% of the respondents who belonged to FFS who had low and very low uptake of BAP, respectively.

On the other hand, majority of the respondents who did not belong to FFS had low uptake of BAP as represented by 45.2% of the total responses.

About 28.0% of the respondents who did not belong to any FFS had moderate uptake of BAP while 16.1% had very low uptake of the BAP. It was just 9.7% and 1.1% of the respondents who did not belonged to FFS who had high and very high uptake of BAP, respectively.

The use of correlation coefficient analysis was employed in testing the null hypothesis, "Ho_1: Farmer field school training has statistically no significant effect on enhancing uptake of best agricultural practices amongst smallholder coffee farmers in Kenya".

Table 8 shows the results for the test of effect of farmer field school training on uptake of best agricultural practices in coffee farming.

Table 7: Effect of Farmer Field School Training on Uptake of Best Agricultural Practices in Coffee Farming

		Membership to FFS	Extent of uptake of BAP
Membership to FFS	Pearson Correlation	1	.397
	Sig. (2-tailed)	.	.000
	N	210	210
Extent of uptake of BAP	Pearson Correlation	.397	1
	Sig. (2-tailed)	.000	.
	N	210	210

The correlation coefficient for the effect of farmers' field school training on uptake of best agricultural practices in coffee farming was positive and significant at 5% level ($r=.397$, $p<0.05$). Based on these results, the null hypothesis was rejected, thus belonging to FFS increased the farmers' uptake of BAPs.

This study is consistent with [12] that assert that one of the effective ways of implementing various recommendations on coffee agronomic practices, aimed at enhancing coffee productivity is use of FFS. This study also agrees with [35] that observed that FFS approach represents an important tool for the empowerment of the rural poor, improving their access to information, critical analysis and decision making, optimizing productivity, improving food and nutrition security, strengthening rural institutions and having a positive impact on the sustainable management of natural resources. All these aspects are particularly relevant for vulnerable groups and may contribute to social protection in terms of community empowerment/cohesion and its own social safety nets.

This finding is in line with [36] who reported that eighty percent (80%) of what was learned on coffee management in the FFS was adopted showing farmers satisfaction with the technical options learned during the FFS sessions than their counterparts.

4. Conclusions

Majority of the respondents had implemented proper field preparation and coffee establishment, application of weed management strategies, application of fertilizers and organic manures for improved production and quality, proper canopy management practice to maintain the growth vigor of the coffee plant, use of mulch and shade trees practice for soil and moisture conservation, application of Integrated Pest Management (IPM) strategies in the control of coffee insect pests, application of cultural management strategies for control of Coffee Berry Disease and Coffee Leaf Rust and top-working traditional varieties (SL) into disease resistant varieties, Ruiru 11 and Batian. A few farmers implemented the use of certified planting materials (seedlings) and timely and selective picking of red-ripe cherry. Majority of the farmers had moderate uptake of best agricultural practices, adopting 4 – 5 practices representing 43.3% of the total responses.

The Chi- square test results for the relationship between extent of uptake of BAP and belonging to FFS classes showed that there was a significant statistical relationship between these two variables. Higher uptake of BAP is associated with belonging to FFS as opposed to non-belonging to FFS. The correlation coefficient analysis was used to test the effect of farmers' field school training on uptake of best agricultural practices in coffee farming. Based on these results, the null hypothesis was rejected, thus belonging to FFS increased the farmers' uptake of BAPs.

There was a significant relationship between extent of uptake of BAP and belonging to FFS classes. Higher uptake of BAP was associated with belonging to FFS as opposed to non-belonging to FFS. The correlation coefficient analysis confirmed that belonging to FFS increased the farmers' uptake of BAPs.

5. Recommendations

This study recommends that due to positive impact of FFS learning on the uptake of BAP in coffee farming in Kenya, the National and County governments together with other stakeholders involved in extension services delivery should encourage smallholder farmers to belong to FFS classes.

The study envisages that FFS learning has the ability to enhance uptake of BAP thereby leading to enhanced production and consequently improved economic welfare of coffee farmers.

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