IMPACT OF SOIL AND CROP MANAGEMENT TECHNOLOGIES SCHOOLS ON MAIZE PRODUCTIVITY AMONG SMALLHOLDERS IN NORTH RIFT VALLEY, KENYA

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ABSTRACT
The Farmer Field School (FFS) approach has been tried widely and has created positive impact on crop and soil productivity in many Asian and African countries. Kenya Agricultural Research Institute (KARI) introduced FFS approach in the year 2001 as an alternative to conventional approach to promote dissemination of Soil and Crop Management Technologies. The purpose of this study was to determine the impact of Crop Management technologies (CMTs) disseminated through Farmer Field Schools (FFSs) on maize productivity among the smallholder farmers in North Rift, Kenya. Eight technologies were scaled-out using the approach and the conventional extension methods. A survey methodology with an Ex-post facto research design was used with a sampling frame consisting of 6,560 small-scale farmers. A sample of 180 FFS and 180 Non-FFS farmers was chosen for the study, using proportionate stratified random sampling. Data was collected through interview schedules administered to FFS and Non FFS farmers. Descriptive statistics was used to compute percentages, means and standard deviations. Oneway Analysis of Variance (ANOVA) was used in the study. The results of ANOVA indicated a statistically significant difference between the means of the groups (F=94.320, df =2, p=0.000). Therefore, and the null hypothesis four was rejected. It was concluded that there was a statistically significant difference in the means of the two groups. Results indicate that there was a statistically significant difference in the means of the FFS participants before and after FFS participation (p=0.000) and also between the Non FFS participants and the Participants after FFS training (p=0.000). *The main recommendation from this study was therefore, the need to scale-up and scaling out the S&CMTs using the FFS approach in counties in the North Rift region of Kenya.*

Key words: Extension Methods and Approaches, Technology Dissemination and Adoption, Farmer Field School, Farming system, Crop and Soil Management Technologies and Farm productivity.,

1.1 Introduction

The Conventional extension approaches have minimally succeeded in reaching millions of smallholders with new technologies. Farmer Field School (FFS) has gained popularity as an extension and education program worldwide. The FFS approach started in Indonesia in 1989 and has rapidly expanded to many parts of Sub-Saharan Africa, India and other countries. According Braun et al (2006), FFS approach is in place in at least 78 countries worldwide. In Kenya more than 2,000 FFSs with over 60,000 farmers had graduated (Duveskog, 2013). Many donors, governments, and Non Governmental organizations (NGOs) continue to promote FFSs in Sub-Saharan Africa and Asia today. As a result of its popularity, there was some discussion as to whether the FFS approach should be scaled up and scaled out and be incorporated into mainstream extension practices (AnandajayasekeraSm, Davis, and Workneh, 2007).

In Kenya, the Soil Management Project (SMP) phase (1) which was initiated in 1995 in four Districts of Trans Nzoia, Uasin Gishu, Keiyo and West Pokot in the North Rift of Kenya, with funding from the Rockefeller Foundation. The SMP succeeded in developing eight promising Soil and Crop Management (S&CM) technologies (Table 1 and 2).
These S&CM technologies was disseminated and largely adopted by farmers in the experimental clusters. In the year 2001, these technologies were up scaled beyond the experimental clusters to wider farming communities in within Kenya Agricultural Research Institute (KARI)-Kitale mandate region of Trans Nzoia, West Pokot, Uasin Gishu and Keiyo Districts using conventional extension, Farmer Participatory Research (FPR) and the FFS approaches. The primary focus of this study was to investigate the impact of the already disseminated S&CMTs through FFSs on the farming systems and productivity among the small scale farmers in North Rift, Kenya.

1.2 Statement of the Problem

There have been relatively few efforts worldwide to document in a systematic manner the impact of FFSs. Extension and researcher actors often find themselves with many questions unanswered about when, where, and how FFSs should be applied and create impact on Maize Productivity among Smallholders in North Rift Valley, Kenya among smallholder farmers. However, no study had been undertaken and documented on the impact of S&CMTs disseminated through the FFS approach on maize productivity among the smallholder farmers in the study locations of the North Rift, Kenya. Hence this study was undertaken.

1.4 Purpose of the Study

The purpose of the study was to determine the impact of the Soil and Crop Management technologies promoted through farmer field school approach on maize productivity among the smallholder farmers in North Rift region of Kenya. The study examined if there was any significant difference in means between the FFS participants and Non FFS related to the set objectives in order to determine the impact of the approach.

1.5 Theoretical framework:

Experiential learning theory is based upon Kolb's learning cycle (Kolb, 1984) that link theory and practice in a four-stage cycle (Figure 1):

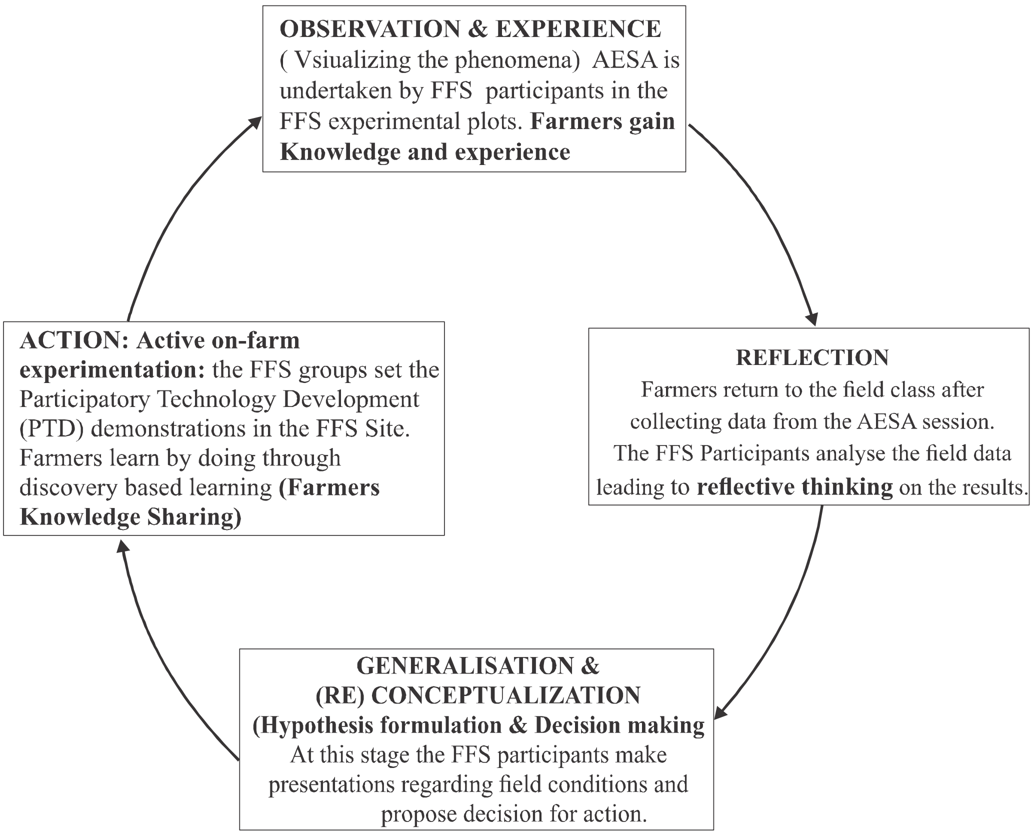

***Figure 1.* Experiential Learning Cycle Interfaced with FFS Process Adopted from Kolb's Learning Cycle (Kolb, 1984)**

All FFS learning activities apply the learning cycle. For example, in soil and crop management technologies on the use of organic and inorganic fertilizers for maize production or in the original model of the rice IPM FFS, the agro-ecosystem observation and analysis activity, begins with the observation of a maize experimental plot or in the case of a rice-field agro-ecosystem. Participants collect data in the field where they gain experience through observation of the issue or visualizing the phenomena at hand and return to the meeting place "field classroom" to analyse the data (reflection). The participants make use of their data to prepare a presentation regarding field conditions and propose decisions for actions regarding the rice field, such as whether to apply or not apply fertilizer or insecticides (generalization and conceptualization leading to a hypothesis). The decision is then implemented over the following week (experimentation) and the cycle begins again. In the FFS model, besides experience and actual observation in a formal Agro-Ecosystem Analysis (AESA), the process of reflective thinking is a crucial step in the learning process: making sense out of experiences, evaluation, and share with other learners (Bunyatta, 2006 and De Jager, 2007). This model of learning is different from the learning pursued in the conventional extension system where the individualism in the learning gives rise to the various categories of farmers according to Rogers (2003) as innovators, early adopters down the continuum to the laggards as depicted in the adoption theory.

1.6 Objectives of the study

1. To determine and compare the level of productivity on the use of correct maize varieties by

FFS Participants before and after enrolling and undergoing FFS training in the north Rift of Kenya

2. To determine and compare the level of change in Productivity of maize on the use of organic/ inorganic fertilisers between the FFS Participants before and after participating in FFS training.

3 To determine and compare the impact of Soil and Crop Management promoted through FFS approach on productivity related to level of production per unit area for maize of the FFS participants before and after participation in FFSs with those of non FFS participants in North Rift of Kenya.

2.0 Materials and Methods

2.1.1The Study Location

The study area was Yuya Location of Kaplamai Ward, Trans-Nzoia County, Matunda Ward of Kimilili Sub County-Trans-Nzoia County and Kipsangui Location of Siwa Sub County, Uasin Gishu County in the North Rift Valley, of Kenya. Table 1 and 2 shows the eight S&CM technologies that were developed by SMP of KARI. The schools were facilitated by a multidisciplinary team of researchers, extensionists and farmer innovators who had undergone season- long FFS training of trainers' course on how to open and conduct FFS in the year 2001.

2.1.2 Research Design

The study employed a survey research method with an *ex-post facto* research design. This design according to Kathuri and Pals, (1993) refers to examining the effect of "a naturalistically occurring treatment after the treatment has occurred". The study examined what had been done in the research sites as it pertains to implementation of several FFSs in the years 2001 and 2002.

2.1.3 FFS Enrollment

There were eight soil and crop management technologies validated and disseminated within the first batch of eight FFSs and later fourteen FFSs in the second batch as shown in Table 1 and 2 respectively.

Table 1: FFS Enrollment per School and technology disseminated in the 1st batch -Yuya location, Kitale-Trans Nzoia District

S&CM Technology	School Name	Members				
		M	F	Total	Before	After
1. Forage production and utilization	Khuyatana	13	18	31	30	30
2. Organic/inorganic fertilizers for maize	Bikholwa	5	16	21	18	18
3. Introduction of legumes other than beans	Bulala	18	10	28	21	21
4. Organic/organic fertilizer for vegetable	Busime	9	13	22	17	17
5. Introduction of suitable maize varieties	Twende	7	11	18	11	11
6. Quality seed production	Upendo	6	24	30	16	16
7. Low cost soil conservation methods	Mteremko	11	9	20	11	11
8. Indigenous technical knowledge for pest control	Mutua	8	14	22	16	16
Totals		77	115	192	140	140

Source: Soil Management Project Report Trans Nzoia District- 2001

Table 2: FFS enrolment per School, Graduands and technology disseminated in the 2nd batch FFS site of Matunda, Motosiet, Birbiret locations of Trans Nzoia District and Kisionet location of Uasin Gishu District, Kenya

Soil &Crop Management Technology	School name	Members			FFS graduands	
		M	F	Total	Before	After
1. Forage production and utilization	Mwangaza	13	18	31	26	26
2. Use of organic/inorganic fertilizers for maize	Mawazo	14	16	28	18	18
3. Variety selection in maize (H-614, 625,626,512 511).	U-Hututu	15	20	35	24	24
4. Organic/inorganic fertilizer for vegetable production	Weonia	19	24	43	36	36
5.Introduction of maize varieties & org/inorg for maize	Amua	18	11	29	16	16
6. Forage production, utilization, and Low cost soil conservation methods.	Motosiet-Mwangaza	8	22	40	32	32
7. Introduction of legumes other than beans	Samiko	16	14	30	26	26
8. Organic/inorganic fertilizer for vegetable production	Jiokoe	11	15	26	18	18
9. Use of organic/inorganic fertilizers for maize	U-kapsara	9	16	25	22	22
10. Use of organic/inorganic fertilizers for maize	Miti-Moja	13	17	30	21	21
11. Organic/inorganic fertilizers for maize	Matekesi	21	24	45	40	40
12. Introduction of legumes other than beans	Kamito	23	21	44	39	39
13. Forage production / utilization and organic/inorganic fertilizers for maize	Kaplelach - Koror	11	14	23	24	24
14. Use of organic/inorganic fertilizers for maize	Kamaisoi	12	15	26	19	19
Totals		220	247		361	361

Source: Soil Management Project- 2004

2.2 Sample and Sampling Procedures

2.2.1 Sampling of FFS Participants

A Proportionate stratified random sampling was used to determine the sample of FFS participants. The FFS Participants was stratified into their FFSs and simple random sampling method through the use of table of random numbers, was applied in selecting the respondents. The total of FFS Participants is 501 and was distributed into twenty two FFSs as shown in Table 3.

The sample of FFS respondents was 180 and proportion was worked out using the following formula derived from Tuchman, (1978): $\frac{Ps}{\Sigma Ns} \times n = ns$

Where: Ps = Population in the stratum

ΣNs = Total population of FFS Participants.

n= Required Sample

ns= Sample size per FFS

Example Khuyetana- is $\frac{30}{501} \times 180 = 11$ & Bikholwa FFS $\frac{18}{501} \times 180 = 7$ as shown in table 2. The same procedure of calculation was followed for other schools to arrive at the sample as indicated in Table 3.

Table 3: FFS population and sample per School

Name of FFSs	Population (FFS Graduands)		Sample	
	Before	After	Before	After
1) Khuyetana	30	30	11	11
2) Bikholwa	18	18	7	7
3) Bulala	21	21	8	8
4) Busime	17	17	6	6
5) Twende mbele	11	11	4	4
6) Upendo	16	16	5	5
7) Mteremko	11	11	4	4
8) Mutua	16	16	5	5
9) Mwangaza*	26	26	9	9
10) Mawazo	18	18	7	7
11) Umoja-Hututu	24	24	9	9
12) Weonia	36	36	13	13
13) Kwanuzu	16	16	5	5
14) Motosiet Mwangaza	32	32	12	12
15) Samiko	26	26	9	9
16) Jiokoe	18	18	7	7
17) Umoja-Kapsara	22	22	8	8
18) Miti Moja	21	21	8	8
19) Matekesi	40	40	14	14
20) Kamito	19	19	7	7
21) Kaplelach Koror	24	24	9	9
22) Kamaisoi	39	39	13	13
Total	501	501	180	180

Source: SMP, 2001

N/B- No. One to eight indicate 1st generation or batch of FFS of which **140** farmers graduated while the 2nd batch generation of FFSs Starting from Mwangaza FFS * 9 down to No 22 of which **361** farmers graduated making a total of **501** as indicated above.

2.2.2 Sampling of non-FFS participants

The total population in the research locations is 6,240 households out of which 501 were the households who participated in the FFS training (SMP, 2001). The remaining 5739 households formed the non-FFS participants. The non- participants households of 5739 were subjected to stratified simple random sampling technique. Farmers were stratified according to locations and finally villages and then simple random sampling was employed to select 180 non-FFS respondents through the use of table of random numbers. The sample size was 360 farmers This group of farmers formed the control group which was compared with FFS participants in terms of the variables designed for the study.

2.2.3 Data Collection Procedures

The study used an interview schedule and a standardized test in data collection. The interview schedules were pre-arranged through making appointments for the interviews to take place at the homes of the randomly chosen respondents.

2.2.4 Data Analysis

In analysis, both descriptive and inferential statistics was employed. The null hypotheses were tested at α 0.05 level of significance. Collected data was coded and analyzed by the Statistic Package for Social Scientists computer program. A t-test was used by the researcher to compare the sample means to determine whether there was any statistically significance difference between means scores of the two groups.

3.0 Results and Discussion

3.1.1 A comparison of level of productivity on the use of correct maize varieties by FFS Participants

The use of correct maize varieties was disseminated through FFSs in the study locations. The aim was to establish the level of change in productivity related to income before and after adopting the use of correct maize varieties through FFS. The results are presented in Table 4.

Table 4: A comparison of level of productivity on the use of correct maize varieties by FFS Participants

		Before FFS P		After FFS P	
Soil and Crop Management Technologies	**Level of change in productivity related to income**	**Frequency**	**Per cent**	**Frequency**	**Per cent**
Correct maize varieties level of change in productivity related to income	No change	34	18.9	0	0
	Very little change	50	27.8	4	2.2
	Moderate change	81	45	32	17.8
	High change	14	7.7	64	35.6
	Very high change	1	0.6	80	44.4
	Total (n)	**180**	**100.0**	**180**	**100.0**

Key: FFS P-Farmer Field School Participation.

The results in Table 4 on use of correct maize varieties by FFS Participants revealed that before the introduction of the technology 18.9 percent of the respondents had no change in their level of productivity as compared to no respondent after FFS participation in the same category. In contrast, after the farmers enrolling and participating in FFSs, the results indicate that 35.6 percent of the farmers were in the high and 44.4 percent very high levels of their farm productivity respectively. This shows a positive impact of S&CM technology in particular the use of correct maize varieties by the farmers in the study locations.

3.1.2 Productivity on the use of organic/ inorganic fertilisers for Maize by FFS Participants

The results presented in Table 5 on the use of half recommended rates of combination of organic and inorganic fertiliser on maize was disseminated through FFSs in the study locations. The aim was to assess the level of change in productivity of maize and income accruing from the maize yield per acre. It was to ultimately establish if FFS training on the use of organic and inorganic fertilisers combination at half recommended rates as a technology had led to increased productivity and hence enhanced income in maize production. The results are presented in Table 5.

Table 5: Productivity on the use of organic/ inorganic fertilisers for Maize by FFS Participants

		Before FFS P		After FFS P	
Soil and Crop Management Technologies	**Level of change in productivity related to income**	**Frequency**	**Percent**	**Frequency**	**Percent**
Maize: level of change in productivity related to income	No change	58	32.2	2	1.1
	Very little change	50	27.8	14	7.8
	Moderate change	60	33.3	36	20.0
	High Change	11	6.1	60	33.3
	Very high Change	1	0.6	68	37.8
	Total (N)	**180**	**100.0**	**180**	**100.0**

Key: FFS P-Farmer Field School Participation.

The results in Table 5 show that the use of organic/ inorganic fertilizers on maize and their impacts on level of productivity related to income. The results on use of the use of organic and inorganic fertilizers combination at half recommended rates on maize, revealed that before the introduction of the technology 32.2 percent of the respondents had no change in their level of productivity as compared to only 1.1 percent in the same category after participating in soil and crop management FFSs, In contrast, after the farmers enrolling and participating in FFSs, the results indicate that 33.3 percent of the farmers were in the high and 37.8 percent very high levels of their maize productivity respectively. This shows a positive impact of S&CM technology in particular the use of organic and inorganic fertilizers combination at half recommended rates on the maize for increased productivity.

3.2 Impact of S&CMT on productivity of Maize per unit area between FFS and non FFS participants

The impact of SCMT promoted through FFS approach on productivity of FFS participants before, after participation and non FFS participants.

This objective was designed to find out from the respondents which of the Soil and crop management technologies disseminated through Farmer Field School approach had an impact on farm productivity related to level of production per unit area for maize of the FFS participants before and after participation in FFSs and also for non FFS participants. The maize yield for every respondent was converted to income. The results are presented in Table 6.

Table 6: Production of maize (in 90kg bags) per acre of FFS and the Non FFS participants

Participation	Mean	N	Std. Error of Mean	Std. Deviation
FFS Participants before	11.7750	180	.42607	5.71636
FFS Participants after	19.8556	180	.58502	7.84887
Non FFS participants	12.0083	180	.38610	5.18013
Total	14.5463	540	.46573	6.2484

Key: one acre = 0.4 hectares and 1 bag of maize weighs 90kg.

The results in Table 6 indicate that the FFS Participants after participation had a higher mean number of bags (19.85), followed by non FFS-participants (12.00) and the lowest were the FFS participants before participation (11.77). The Non FFS and FFS participants before undergoing FFS training indicate that they were almost having the same mean number of maize bags of 12 bags per acre which is equivalent to 30 bags per hectare.

3.3 Test of significance to determine the impact of S&CMTs on productivity of Maize per unit area between FFS and non FFS participants

The hypothesis stated that: ''There is no statistically significant difference between FFS participants before and after participation in FFSs and Non-FFS farmers on their productivity in terms of the level of production per unit area for maize as a result of the impact of S&CMTs promoted through FFS approach in North Rift''. The mean production of maize per unit area of the three groups was compared using one-way analysis of variance (ANOVA). The results are presented in Table 7.

Table 7: Test of significance of Production per Acre (bags of maize) between FFS participants before and after FFS participation and the Non FFS participants

Group comparison Source of variation	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7615.723	2	3807.862	94.320	.000
Within Groups	21679.619	537	40.372		
Total	**29295.343**	**539**			

N= 540

The results of ANOVA (Table 7) show a statistically significant difference between the means of the groups (F=94.320, df =2, p=0.000). Therefore, the null hypothesis was rejected. It was therefore concluded that there was a statistically significant difference in the means of the two groups.

In many Farmer Field Schools which have been studied show that most FFS projects have shown evidence of positive impact on rural communities and sustainable agricultural development leading to improved income and livelihoods (Tripp et al., 2004., Mancini, 2006., Praneetvatakul., S.I., and Waibel, H., (2006). Van de Fliert (2002) noted that when aiming at achieving impact in farmers' fields, with impact implying both qualitative improvement of farmers' living conditions and quantitative measurements and coverage in terms of farm productivity and improved soil fertility management thus reflected in increased crop yields per unit area.

Onduru., De Jager., Hiller & Van den Bosch R (2012) in their study, which explored whether farmers participation in FFS, and exposure to good agricultural Practices led to changes in productivity of tea. They found out that by a comparison between the "before FFS" and "after FFS" participation, revealed a significant positive change in tea productivity for FFS members (mean increase of 1297 kg ha-1, $p < 0.01$; t-test) but separately also for non-FFS members (mean increase of 1121 kg ha-1, $p < 0.05$; t-test). However, the overall increase in productivity above the baseline year ("before FFS") tended to be higher for FFS (19% increase) than non-FFS members (15% increase). From their findings it showed that participation in FFS training enhanced tea productivity among the smallholders in the study location of Kericho County in Kenya.

In this study the main indicators of impact on productivity and farming system was maize yield per unit area measured in terms of hectares, level of change in productivity for kales, cabbages, local vegetables, fodder production such as Napier grass and Rhode grass.

3.3.1 Post hoc multiple comparison analysis

Subjecting the results to further post hoc multiple comparison analysis (Table 9), the results indicate that there is a statistically significant difference in the means of the FFS participants before and after FFS participation (p=0.000) and also between the Non FFS participants and the Participants after FFS training (p=0.000).

Results from the ANOVA and the post hoc multiple comparison analysis, it can be concluded with confidence that, farmers who underwent the FFS training are producing more bags of maize per unit area as compared to the same farmers before undergoing the FFS training. The non-participants and the FFS participants before FFS training are producing at the same level as shown in Table 8, hence there was no statistically significant differences in their means (p=0.935).

Table 8: Post Hoc Multiple Comparisons

		Mean Difference	Std. Error	Sig.
FFS before	FFS after	-8.08056*	.66976	.000
	Non FFS	-.23333	.66976	.935
FFS after	FFS before	8.08056*	.66976	.000
	Non FFS	7.84722*	.66976	.000
Non FFS	FFS before	.23333	.66976	.935
	FFS after	-7.84722*	.66976	.000

n=540; *. The mean difference is significant at the 0.05 level.

3.3.2 Paired sample T-test

When the data (Table 7) for participants before and after FFS training was further subjected to the paired sample t-test, the results concurred with the ANOVA results shown in Table 8 above. The results in Table 9 show that there is a statistically significant difference in the level of productivity in the means of the FFS participants before and after the FFS training (t= -16.33, df=178, p=0.000).

Table 9: Mean production of maize per acre of FFS participants before and after participation

FFS participation	Participants	Paired Differences Mean	Std. Deviation	Std. Error Mean	T	Df	Sig.
Pair 1	Bags of maize before & (90kg Bags) of maize afterFFS participation	-9.19143	7.44456	.56276	-16.333	178	.000

n=180

The results in Table 10 show that there is a statistically significant difference in the level of productivity in the means of the FFS participants before and after the FFS training (t= -16.33, df=178, p=0.000). These findings are consistent with (Davis *et al* 2010) where in their study found out that farmer field schooling had a significant impact on crop productivity in Kenya and Tanzania. They concluded that FFS participation had a significantly larger impact on crop productivity and also the value of crop productivity per acre for farmers participating in an FFS increased by about 80 percent and 23 percent in Kenya and Tanzania respectively. This demonstrates the FFSs approach effectiveness in increasing crop productivity.

4.0 Conclusions and Recommendations

4.1.1 Conclusions

Based on the finding of the study, a number of conclusions are drawn as follows:

1. The use of correct maize varieties was disseminated through FFSs in the study locations. It was found out that there was higher level of change in productivity related to income after accepting to use the correct maize varieties as a result of undergoing FFS training the farmers who never participated in FFS training. Results showed that the Non-FFS participants had no change in their level of maize productivity. Therefore, it was concluded that there was a positive impact of S&CM technology in particular the use of correct maize varieties by the farmers in the study locations.
2. The farmers who participated in the FFS training on the use of organic and inorganic fertilisers combination at half recommended rates as a technology had achieved high maize yield per acre and hence enhanced income accruing from maize production. While the same farmer before the introduction of the technology had no change in their level of productivity as compared to same farmers after participating in soil and crop management FFSs. It was ultimately established that FFS training on the use of organic and inorganic fertilisers combination at half recommended rates as a technology had led to increased productivity and hence enhanced income in maize production. Therefore, it was concluded that there was a positive impact of S&CM technology in particular the use of organic and inorganic fertilisers combination at half recommended rates on maize productivity among the FFS farmers in the study locations.
3. The mean of production of maize per unit area of the three groups was compared using one way analysis of variance (ANOVA). The findings showed a statistically significant difference between the means of the three groups of FFS participants before and after attending the FFS training sessions and the Non FFS Participants. Therefore, it was concluded that there was a statistically significant difference in the means of the three groups.
4. The ANOVA and the post hoc multiple comparison analysis findings showed that, the farmers who had undergone the FFS training produced had higher maize production per acre as compared to the non-participants and the FFS participants before FFS training. From this finding it showed clearly that when farmers are trained through FFS approach, they achieve higher maize yield per acre. It therefore, be concluded that FFS approach had a greater impact on maize productivity than the conventional extension approach. FFS is a more superior approach in enhancing the adoption and practice of soil and crop management technologies as it has been demonstrated in this study. This implies that FFS if adopted will make farmers harvest more maize thus becoming food secure and can earn extra income.

4.1.2 Recommendations

From the findings and conclusion of the study, the following key recommendations are made that have implication on the adaptability and sustainability of the FFS as an educational and a participatory extension approach.

1. Impact of FFS on productivity among small scale farmers

In the case of this study it showed a positive impact in terms of productivity. The Key recommendation is that FFS are not necessarily an alternative to existing extension approaches, but certain principles of FFS could be incorporated into existing extension approaches and methodologies, to make them more effective in reaching small scale farmers and hence creating positive impact in alleviating poverty.

2. Promotion of farmer-to-farmer extension

Farmers are best educators of other farmers, and so farmer-to-farmer extension, visits and peer training can greatly help in information exchange and dissemination. This was revealed through the impact study in the North Rift, Kenya research sites. Therefore, FFS is a good forum for farmer-to-farmer change of new ideas, innovations and information. Opening up of more farmer-led-field schools is a strong tool for dissemination/diffusion of S&CM technologies amongst the small-scale farmers. Other commodity based FFSs for example rice, maize, green grams and among other technologies together as a consortium and facilitating the process of information exchange and building FFS networks.

3.**Awareness of FFS approach to stakeholders**

A major recommendation arising from this work is that more national awareness of the FFS approach to all stakeholders in agricultural development. The key stakeholders are from the lowest cadre of both extension and research officers to the policy makers who should be sensitized on key attributes of the FFS methodology in creating impact in crop productivity as evident in the increase in maize yield.

4. It is important to continuously monitor how the FFS graduates are applying the knowledge they learn and changes taking places in their social behavior towards accepting and adopting new agricultural innovations.

The results from study showing there was a positive impact of FFS as disseminating forum is thus likely to assist in further fine-tuning the FFS approach in terms of the technologies disseminated and also in identifying key entry points for relevant development activities in an area.

5. **FFS approach should be adopted as an empowerment forum for improve productivity**.

It is prudent to note that there have been Several studies conducted globally showing positive effects of FFSs on productivity (Gockowski et al. 2006; 2004; Yamazaki and Resosudarmo 2006). In this study there was a positive impact of Soil and Crop Management Technologies promoted through Farmer Field Schools on Farm Productivity in relation to maize production among FFS participants as compared to non-participants.

Farmers are advised to adopted Soil and Crop Management Technologies since increased maize productivity hence income accruing from maize sales for the FFS Participants. The two key practices adopted by the FFS participants included the use of organic and inorganic fertilizers at half recommended rates for improved productivity and adoption of the correct maize variety which in this study played a role in booting maize productivity hence improved income among the FFS participants.

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