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An Investigation of Food Crop Farming Skills and Knowledge Held by Smallholder Crop Farmers for Sustainable Farming in Teso South Sub-County, Busia County, Kenya

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Abstract—This research study investigated the food crop farming skills and knowledge held by smallholder crop farmers in Teso South Sub-County to promote sustainable farming practices. The study objectives were; to investigate the food crop farming skills and knowledge held by smallholder farmers for sustainable farming in Teso South Sub- County, Busia County – Kenya, to examine the relationship between gender and skills of smallholders' food crop farmers in Teso South Sub- County, Busia County – Kenya and to determine association between previous trainings and food crop knowledge and skills held by the smallholder crop farmers in Teso South Sub- County, Busia County – Kenya. Data was collected using a structured questionnaire. The study revealed that smallholders' farmers had received trainings that lasted between one hour and three days, some of which had been taken 10 years ago. A Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between gender and previous training status of the smallholders' farmers, $\chi 2$ (4, n = 124) = 4.37, p = .359, phi = .18. Also, a Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between food crop farming skill and knowledge held by smallholders' farmers and previous training status of the smallholders' farmers, $\chi 2$ (4, n = 124) = 2.03, p = .731, phi = .12. The study recommended that gender should never be used to design training programmes since the proficiency levels of skill and knowledge of both male and female farmers are relatively the same.

***Index Terms*—Food crop farming, Gender, Skills and Knowledge, Smallholders farmers, Sustainable farming.**

1. Introduction

A. Background of the Study

By the year 2050, the world population is projected to be 9 billion people, 2.2 billion residing in Africa, who will inevitably increase demand for food. Sub-Saharan Africa's (SSA) population is growing at 2.8% a year, double the rate of South Asia, four times the rate of East Asia and the Pacific, and about 50% higher than the Middle East and North America region (Mabiso & Benfica, 2019). The net effect will be a food gap if agricultural productivity does not march population increase.

Since the beginning of 1960, there has been a remarkable growth in food production, aggregating 145% worldwide and 140% for Africa (FAO, 2005). However, in recent times, SSA agricultural production has remained lower than the rest of the world, an overall trend of decline attributed in part to its people, climate, soil quality, slavery and diseases (Vibeke B., Henning B., & Andre F. V. R., 2020; Jayne, T. S., & Sanchez, P. A., 2021).

In contrast to other developing regions food security has been a perennial problem, with 30% of SSA's population being food insecure (Pfister, S., Bayer, P., Koehler, A., & Hellweg, S., 2011). For agriculture to contribute to food security especially in the rural areas, sustainable food production practices must be employed, accelerated and secured to bridge the food gap (Staatz, John M.; Dembele, Niama Nango, 2008). Research studies have shown that if progress on crop yield does not occur in SSA, more land will be encroached for farming at the expense of other natural habitat. It is estimated that crop land could triple by 2050 leading approximate loss of 10% to 20% habitat, frustrating global environmental improvement tragets (Williams, D. R., Clark, M., Buchanan, G. M., Ficetola, G. F., Rondinini, C., & Tilman, D., 2021). Hence, the importance of improving yield per acre.

Sustainable agriculture, though desired in Kenya, is hampered by the fact that most rural farmers decide individually on the practices they undertake on their farms (Gebska M., Grontkowska A., Swiderek W. and Golebiewska B., 2020). There is need that farmers in the rural areas are engaged collaboratively in employing sustainable principles to achieve extensive desirable impact on agriculture. World Bank estimates in 2021 indicated that approximately 72% of the population in Kenya live in rural areas, where farm sizes have been shrinking with increase in population. Soil fertility, on the other hand, is declining and extreme weather conditions (droughts and floods) are becoming common. This signals the

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need to approach food production through farming differently.

In Kenya, sustainable rural agriculture faces a serious threat from rural exodus of youthful potential farmers to urban areas in search of income, contributing to a strain on farm food production and food security efforts. Also, farmers seem to deviate from priority food crops assigning part of their farm to cash crops (cotton, tobacco and palm oil), experience recurrent delays in farm input supply or total failure to access inputs, and weather variability extremes, has weakened smallholders' farmers' food security efforts and further constrained sustainable food production (Frankema, E., Williamson, G., & Woltjer, P., 2018). Additionally, food crop farming knowledge and skills held by smallholder farmers may need upgrading and, in some instances, shared to establish a lasting solution to food insecurity, as a range of sustainable farm food production exist (Mohammad A.H. and Hasan S.S., 2018). Possession of right farm food production knowledge and skills has the potential to unlock opportunities to enhance quality of farm produce and amount per hectare.

According to the World Food Programme (WFP) – Kenya Comprehensive Food Security and Vulnerability Survey (CFSVA) report, apart from Turkana County which has the highest levels of food insecurity in Kenya, "The next most food insecure counties (by FCS indicator) are Samburu, Tana River, Baringo, West Pokot, Busia and Siaya, (WFP, 2016, p. 4). The report further observes that, food shortages in "… rural households were more likely … than urban (36% vs 23%). Lack of food was most extreme in Turkana (86%) followed by Busia, Homa Bay, Baringo, Siaya and Wajir where more than 60 percent experienced shortages," (p. 6). This study focuses on Busia County, in particular Teso-South Constituency, which is predominantly rural and where most families depend mainly on subsistence farming and seasonal employment that pay rather too low for adequate sustainability of daily family provisions.

B. Statement of the Problem

Despite presence of countries development models, food security has and will remain a key determining factor in economic progression and societal advancement worldwide. However, the knowledge, skills and attitude held by smallholders' farmers in particular, will dictate the pace and level of agricultural development, since they contribute 70% of marketed farm crop produce. Therefore, understanding agricultural skills and knowledge they hold would be a step in the right direction to address the growing problem of food and nutrition insecurity as well as public health concern in Kenya. The big questions are what skills and knowledge do smallholders farmers possess? Have they acquired any training in food crop farming? And If they have, when was the training done? Therefore, there is a pressing need to probe the food crop farming skills and knowledge held by smallholder crop farmers in Teso South Sub-County. By identifying gaps in farmers' skill and knowledge, and understanding the factors influencing their adoption of sustainable farming practices, this research aims to inform the development of targeted interventions, extension services, and capacity-building initiatives to support smallholder farmers in transitioning towards more sustainable and resilient farming systems. Addressing these challenges is essential for promoting food security, poverty reduction, and sustainable development in the region.

C. Research Objectives

1) To investigate the food crop farming skills and knowledge held by smallholder farmers for sustainable farming in Teso South Sub- County, Busia County – Kenya
2) To examine the relationship between gender and skills of smallholders' food crop farmers in Teso South Sub- County, Busia County – Kenya
3) To determine association between previous trainings and food crop knowledge and skills held by the smallholder crop farmers in Teso South Sub- County, Busia County – Kenya

D. Research Questions

1) What food crop farming skill and knowledge is held by smallholder farmers for sustainable farming in Teso South Sub- County, Busia County – Kenya?
2) What is the relationship between gender and skills of smallholders' food crop farmers?
3) Is there a relationship between previous trainings and food crop knowledge held by the smallholder crop farmers in Teso South Sub- County, Busia County – Kenya?

E. Justification of the Study

Busia County generally and by extension, Teso South Sub County, has high fertility rate above the average of the country at 6%, which means high likelihood of farms shrinking further by subdivision through inheritance, from the current already uneconomical average 1.7 acres per household. The farm land soil fertility is declining rapidly and extreme climate events, especially droughts, are becoming more frequent. This will aggravate food security situation in the Sub County. In addition, it has been established that Covid-19 pandemic has escalated the decrease in conventional employment opportunities and compelled youthful job seekers to rely on available farms for their livelihoods. Already Busia County is experiencing employment challenges (unemployment rate at 66.7%) and registers high poverty levels. As observed, "Cultural, social, governance and political factors play a key role in food production, processing, distribution, storage and consumption," (Ministry of Agriculture, Livestock and Fisheries, 2017, p. 12). Consequently, this project research study outcome will contribute potentially to facilitation of addressing the need for increase in food crop farm output by suggesting and recommending ways to bridge farmers' knowledge and skills gaps. Furthermore, establishment of farmers' crop cultivation knowledge gaps will not only make farmers aware of what they need to be more effective, but also remarkably increase their potential to take the next necessary steps to build food crop cultivation capacity and positively impact their farm yields.

2. Materials and Methods

Study area is Teso South Sub-County, which covers 236.8 Km 2 in surface area with an estimated population of 168, 116 (KNBS 2019). The Sub County has six Wards: Ang'orom, Chakoi South, Chakoi South, Amukura East, Amukura Central and Amukura West. Teso South Sub-County has its main town located at Amagoro which lies at Latitude 0° 37′ 40.335′ N and Longitude 34° 19′ 57.2736 E at 1200 and 1500 m above sea level. The economy of Busia County depends on Agriculture with both crop and animal husbandry.

A survey research design was adopted for the study and a structured questionnaire with both closed and open-ended question was used to collect data from 124 smallholders' food crop farmers who were selected proportionately from the wards in Teso South Sub-County. The instrument was piloted in Bungoma County and was found to be reliable. The research respondents remained anonymous and their consent was first sought before being allowed to participate in the study. The Data was analysed using descriptive statistics and inferential analysis.

3. Results and Discussion

Data was collected from 124 smallholders' farmers from Teso South Sub County, Kenya. Teso South is characterized by a predominantly rural agrarian economy, with agriculture being the primary livelihood for a significant portion of the population. Demographic data was collected among other data that addressed the study objectives.

A. Demographics Descriptive

The collected demographic data captured respondents age, marital status, gender and academic levels. Table 1 shows the demographic data.

Table 1
Demographic descriptive

Demographics	Number	Percentage
Age	124	100
18 - 25 years	4	3%
26 – 30 years	7	6%
31 – 35 years	14	11%
36 – 40 years	15	12%
41 – 45 years	19	15%
46 – 50 years	22	18%
51 – 55 years	20	16%
56 – 60 years	12	10%
61 years and above	11	9%
Gender	**124**	**100**
Male	63	51%
Female	61	49%
Marital Status	**124**	**100**
Married	100	81%
Single	10	8%
Separated	1	1%
Widow/er	10	8%
Divorced	3	2%
Education Level	**124**	**100**
No Formal Education	9	7%
Primary	61	49%
Secondary	38	31%
Tertiary	12	10%
University Degree	4	3%

Source: Research Data (2021)

Age distribution of respondents showed that the age brackets of 45 – 50 years comprised the larger percentage of farmers with 18%, while age bracket 18-25 year registered the smallest percentage of 3%. The small percentage may be because most of respondents in this category could be still schooling at college or university level. There was relatively a balance on the gender that participated in the study with 51% of the respondents being male and 49% female. 81% of the respondents were married, 8% single, 1% separated, 8% window/er and 2% divorced. 7% of the respondents did not have formal education, 49% had up to primary school education, 31% had secondary school education and 3% had university degrees.

B. Previous Food Crop Farming Training Undergone

The study explored a range of things involving smallholder farmers' previous trainings, duration, the year of training, trainer, training effectiveness and farmers level of satisfaction. Table 2 shows the findings.

Table 2 revealed that smallholder farmers have undertaken training in a range of food crop training areas like crop spacing, planting, fertilizer use, crop management, and weeding. The training duration range from 2 hours to 1 day. This may be because the farmers need more time on their own farms. Also, most of the trainings had been done quite some time back - more than 10 years ago.

One Acre Fund did conduct most of the trainings with KESCAP, FOE and agricultural officers doing the rest. The farmers indicated that some trainings were effective while other not effective. The level of satisfaction ranges from highly satisfied to unsatisfied.

The duration of training seems too short especially those that took 1 hour to 3 hours to impart unique farming skills and knowledge in the farmers. The importance of re-trainings may help concretize some of the food crop farming concepts that had initially been exposed to the smallholders' farmers. Smallholders' farmers seem to not be satisfied with training on fertilizer use and crop spacing implying inadequate skills and knowledge in these areas. This could affect farm output and therefore prudent that more training on these areas is done.

C. Usage of Farm Land Under Crop

The study investigated if smallholders' farmers' usage of crop land. This included land left fallow. Table 3 shows the findings,

The study investigated if the smallholders' farmers left their land fallow sometimes. The results show that 37% agreed that they left their land fallow sometimes, while 63% said 'No'. This implies that most smallholders' farmers have their farms covered by crops all the time. Farmers who left their lands fallow said it was to make their land regain fertility, it was a new farming method, due to lack of funds to cultivate, to control pests, to graze their animals, because of rotational farming, long droughts (harsh climate), and farmer was unwell (hospitalized for three months). Those who did not leave their land fallow was because their farm lands were small, they must continue feeding their families, and don't have alternative piece of land.

Table 2
Previous trainings undertaken

No.	Area of training undergone	Duration of the training	Year	Institution which Imparted the training	Effectiveness of the training in Enhancing your competencies	Level of satisfaction*
1	Food security	3 days	2020	KESCAP	Very effective	A
2	Cassava planting	1 day	2014	FOE	Effective	B
3	Fertilizer use	2 hours	2021	One Acre Fund	Not Effective	C
4	Top Dressing	3 hours	2017	One Acre Fund	Effective	B
5	Crop management	1 day	2011	Agricultural officer	Fair/ Average	B
6	Weeding	1 day	2014	Agricultural officer	effective	A
7	Crop spacing	6 hours	2002	One Acre Fund	Not Effective	C
8	Crop farming	1 day	2015	One Acre Fund	Effective	B

* 'A' Highly satisfactory 'B'-Satisfactory 'C'-Unsatisfactory

Table 3
Usage of farm land under crop

Statements	Yes		No	
	Frequency	Percentage	Frequency	Percentage
Land left fallow	46	37	78	63
Practicing rotational farming	91	73	33	27
Selling of food crop	81	65	43	35
Seek food crop extension services	37	30	87	70
Selling food crop while on the farm	54	44	70	56
Harvesting of rain water for irrigation	6	5	118	95
Growing of cash crop	56	45	68	55
Rely on the farm for household income	88	71	36	29

Table 4
Farmers skills and knowledge

	N	Mean	Std. Deviation	Proficiency Level
Farm planning	124	3.7016	1.44256	Good
Land preparation	124	3.9274	1.33236	Good
Planting	124	3.8871	1.39808	Good
Crop Management skills	124	3.4758	1.47865	Good
Harvesting	124	3.6532	1.40293	Good
Post harvesting	124	3.4516	1.50530	Good
Resource mobilization	124	3.3226	1.52778	Moderate
Disease control and eradication	124	3.3226	1.67015	Moderate
Farm resource allocation	124	3.4839	1.48425	Good
Farm data gathering & analysis	124	3.0484	1.62728	Moderate
Standards enforcement skills	124	3.2823	1.65062	Moderate
Networking & collaboration skills	124	3.1290	1.65263	Moderate
Soft skills – negotiation, interpersonal, leadership	124	3.2661	1.62355	Moderate
Decision making	124	3.3306	1.60650	Moderate

The smallholders' farmers were asked if they practice rotational farming. 73% agreed, while 27% said 'No'. This suggests that a few farmers don't practice rotational farming. This could be because of the small holdings or instead of rotational farming they actually leave their farms fallow.

The study inquired if smallholders' farmers' sell their food crops. The findings show that 65% agreed the do sell, while 35% indicated they do not sell. This implies that most smallholders' farmers sell part of their food crops. The food crops sold include millet, maize, sorghum, cassava, sweet potatoes, arrow roots, bananas, soya beans, groundnuts and vegetable (kales, cowpeas and tomatoes)

The study explored if smallholders' farmers seek food crop extension services. The findings show that 30% seek food crop extension services and 70% do not seek extension services. It suggests that smallholders' farmers raise food crop on their own without seeking any advice from food crop extension agents. Those who reached for food crop services from extension agents received services on; pest control/ use of pesticides, planting of specific crops (groundnuts, cassava, beans, and maize), seed selection, soil testing, fertilizer application/ use, disease management, and Knowledge on variety of crops.

The study sought to find out if smallholders' farmers sold their food crops while still on the farm. The findings show that 44% do sell, while 56% do not sell food crops while on the farm. This suggests that most of the food grown by smallholders' farmers is sold off on the farm. This could have implications on food security. The crops sold include green maize, potatoes, cassava, bananas, ground nuts, and vegetables.

The study investigated whether the smallholders' farmers harvested rain water for irrigation purpose. Only 6% of the smallholders' farmers harvest rain water and 94% do not. This implies that farmers rely on rain fed farming.

The study probed if smallholders' farmers planted cash crops. The findings revealed that 45% of them planted cash crops while 55% do not. This implies a few farmers plant cash crops. The cash crops they plant include; cotton, sugar cane, watermelon, tobacco, peeper and eggplant.

Smallholders farmers were asked if they relied on the farm for household income. 71% agreed while 29% said they did not. Those who did not rely on the firm for household income indicated different sources including; salary/ employment, small business (catering, fish mongers, and 'Jua kali') and wages from casual labour.

Table 5
Cross tabulation of total skill and knowledge by different gender

			Total Skill & Knowledge					Total
			Low proficiency	Fair proficiency	Moderate proficiency	Good proficiency	High proficiency	
Gender	Male	Count	4	8	13	18	20	63
		% within Gender	6.3%	12.7%	20.6%	28.6%	31.7%	100.0%
		% within Total Skill & Knowledge	40.0%	34.8%	50.0%	58.1%	58.8%	50.8%
		% of Total	3.2%	6.5%	10.5%	14.5%	16.1%	50.8%
	Female	Count	6	15	13	13	14	61
		% within Gender	9.8%	24.6%	21.3%	21.3%	23.0%	100.0%
		% within Total Skill & Knowledge	60.0%	65.2%	50.0%	41.9%	41.2%	49.2%
		% of Total	4.8%	12.1%	10.5%	10.5%	11.3%	49.2%
Total		Count	10	23	26	31	34	124
		% within Gender	8.1%	18.5%	21.0%	25.0%	27.4%	100.0%
		% within Total Skill & Knowledge	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	8.1%	18.5%	21.0%	25.0%	27.4%	100.0%

D. Answers to Research Questions

1) Research Q1

What food crop farming skills and knowledge is held by smallholder farmers for sustainable farming in Teso South Sub-County, Busia County – Kenya?

E. Smallholders Farmers Skills

The study examined the skills held by smallholders' farmers. They were asked to indicate their skills and knowledge in the context of food crop farming on a scale of 1-5 (1- low proficiency, 5 - high proficiency). Table 4 shows the descriptive, indicating the means and standard deviations.

Table 4 shows the means and standard deviations of the food crop farming skills and knowledge of smallholder farmers in Teso South Sub County. In all the skill categories interrogated no smallholders' farmer had high level of proficiency. Good level of proficiency was recorded in farm planning (mean =3.70, SD =1.44), land preparation (mean = 3.93, SD =1.33), planting (mean = 3.89, SD =1.40), crop management skills (mean = 3.48, SD = 1.48), harvesting (mean = 3.65, SD = 1.40), post harvesting (mean = 3.45, SD = 1.50) and farm resource allocation (mean = 3.48, SD = 1.48). moderate level of proficiency was recorded in resource mobilization (mean = 3.32, SD = 1.53), disease control and eradication (mean = 3.32, SD = 1.67), farm data gathering and analysis (mean = 3.05, SD = 1.63), standards enforcement skills (mean = 3.28, SD = 1.65), networking and collaboration skills (mean = 3.13, SD = 1.65) soft skill (mean = 3.27, SD = 1.62) and decision making (mean = 3.33, SD = 1.61). the results indicate that the smallholders' farmers' skills were not advancing though they had undergone training. It is therefore that subsequent trainings should strive to move skills registered moderate level of proficiency to higher levels. This will likely impact positively productivity of food crops.

F. Chi-Square Test

1) Research Q 2

What is the relationship between gender and Skills of smallholders' food crop farmers?

The study investigated relationship between gender and skills of smallholders' food crop farmers. A Chi-square test for independence was conducted. A cross tabulation of gender and smallholders' farmers' skills and knowledge was conducted. Table 5 shows the findings.

Table 5 show that 6.3% of male farmers had low proficiency skills and knowledge in food crop farming, 12.7% had fair proficiency, 20.6% had moderate proficiency, 28.6% had good proficiency, while 31.7% had high proficiency level. For the female farmers 9.8% had low proficiency skill and knowledge in food crop farming, 24.6% had fair proficiency, 21.3% had moderate proficiency, 21.3% had good proficiency and 23.0% had high proficiency. This implies that more male farmers (31.7%) had high proficiency level while most (24.6%) of the female farmers had fair proficiency. A total of 27.4% of smallholders' farmers had high proficiency level of skills and knowledge. Chi-Square test results are shown on table 6.

Table 6
Chi-Square test of skills and knowledge held by different gender

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.365[a]	4	.359
Likelihood Ratio	4.409	4	.353
Linear-by-Linear Association	3.559	1	.059
N of Valid Cases	124		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 4.92.

The results in table 6 show that the assumptions of Chi-Square Test were not violated as all expected cell sizes are greater than 5 (greater than 26.61 - shown in the footnote). Table 7 shows the symmetric measures.

Table 7
Symmetric measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.188	.359
	Cramer's V	.188	.359
N of Valid Cases		124	

A Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between gender and previous training status of the smallholders' farmers, $\chi 2$ (4, n = 124) = 4.37, p = .359, phi = .18. The p value of .359 is greater than alpha value of .05. This means that the proportion of male farmers' proficiency level of skills and knowledge held

Table 8
Cross tabulation between whether farmers were trained before and skills & knowledge

			Total Skill & Knowledge					Total
			Low proficiency	Fair proficiency	Moderate proficiency	Good proficiency	High proficiency	
Trained Before	Yes	Count	5	14	17	16	17	69
		% within Trained Before	7.2%	20.3%	24.6%	23.2%	24.6%	100.0%
		% within Total Skill & Knowledge	50.0%	60.9%	65.4%	51.6%	50.0%	55.6%
		% of Total	4.0%	11.3%	13.7%	12.9%	13.7%	55.6%
	No	Count	5	9	9	15	17	55
		% within Trained Before	9.1%	16.4%	16.4%	27.3%	30.9%	100.0%
		% within Total Skill & Knowledge	50.0%	39.1%	34.6%	48.4%	50.0%	44.4%
		% of Total	4.0%	7.3%	7.3%	12.1%	13.7%	44.4%
Total		Count	10	23	26	31	34	124
		% within Trained Before	8.1%	18.5%	21.0%	25.0%	27.4%	100.0%
		% within Total Skill & Knowledge	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	8.1%	18.5%	21.0%	25.0%	27.4%	100.0%

Table 9
Chi-Square test of skills and knowledge held by farmer who had previously been trained

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.026[a]	4	.731
Likelihood Ratio	2.046	4	.727
Linear-by-Linear Association	.523	1	.470
N of Valid Cases	124		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 4.44.

on food crop farming is not significantly different from the proportion of female farmers. Therefore, there appears to be no association between farmers' level of proficiency in skills and knowledge held on food crop farming and gender.

2) Research Q3

Is there a relationship between previous trainings and food crop skills farming and knowledge held by the smallholder crop farmers in Teso South Sub- County, Busia County – Kenya?

The study investigated relationship between farmers previous training and food crop farming skills and knowledge held by smallholders' food crop farmers. A Chi-square test for independence was conducted. A cross tabulation of gender and smallholders' farmers' skills and knowledge was conducted. Table 8 shows the findings.

Table 8 show that 55,6% of farmers had been trained before while 44.4% had received no training. Among the farmers who had been trained before 7.2% had low proficiency in farming skills and knowledge, 20.3% fair proficiency, 24.6% moderate proficiency, 22.3% good proficiency and 24.6 high proficiency. The famers who had not received training before 9.1% indicated that the had low proficiency, 16.4 fair proficiency, 16.4% moderate proficiency, 27.3% good proficiency and 30.9% high proficiency. This shows that famers who had not received training before believed they had high proficiency in food farming skills and knowledge. Also, a smaller percentage of those who were trained before had low proficiency in food farming skills and knowledge. Chi-Square test results are shown on table 9.

The results in table 9 show the Chi-Square Test for independence results. Table 10 shows the symmetric measures.

A Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between food crop farming skill and knowledge held by smallholders' farmers and previous training status of the smallholders' farmers, $\chi 2$ (4, n = 124) = 2.03, p = .731, phi = .12. The p value of .731 is greater than alpha value of .05. This means that the proportion of previously trained farmers' proficiency level of skills and knowledge held on food crop farming is not significantly different from the proportion of farmers not trained before. Therefore, there appears to be no association between farmers' level of proficiency in skills and knowledge held on food crop farming and farmers previous training.

Table 10
Symmetric measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.128	.731
	Cramer's V	.128	.731
N of Valid Cases		124	

4. Discussions

In this study 51% of the respondents were male, while 49% were female. The farmers indicated that the trainings they had received lasted between one hour and three days and much of it was done by One Acre Fund. Also, some trainings had been done over 10 years ago, possibility of the skills and knowledge being outdated. The level of satisfaction varied with some farmers being dissatisfied while others satisfied with the training. The study results revealed that most smallholders' food crop farmers had their farms under crop throughout the year since most of the farms were small and farmers depend on them for their home food production. Those who left their land fallow intended to allow their farms regain fertility, it was a new farming method, due to lack of funds to cultivate, to control pests, to graze their animals, because of rotational farming, long droughts (harsh climate), and farmer was unwell (hospitalized for three months).

Most of the smallholders' food crop farmers (73%) practice rotational farming. A few farmers (27%) never practice

rotational farming probably due to the small farm sizes they possess. Also, 65% of the farmers sell their food crops. The food crops sold include millet, maize, sorghum, cassava, sweet potatoes, arrow roots, bananas, soya beans, groundnuts and vegetable (kales, cowpeas and tomatoes). A small percentage (30%) of smallholders' farmers seek food crop extension services. It suggests that smallholders' farmers raise food crop using their own skills and knowledge without seeking any advice from food crop extension agents. Those who reached for food crop services from extension agents received services on; pest control/ use of pesticides, planting of specific crops (groundnuts, cassava, beans, and maize), seed selection, soil testing, fertilizer application/ use, disease management, and Knowledge on variety of crops.

The study revealed that 44% of the smallholders' farmers do sell their food crops while still on the farm. The percentage of the food crops sold on the farm may impact food security for the farmers if alternative sources of food are not available. The crops sold on the farm include green maize, potatoes, cassava, bananas, ground nuts, and vegetables. Also, it was also noted that only 6% of the smallholders' farmers harvest rain water, implying that the farmers rely on rain fed farming. The study revealed that 45% of the smallholders' farmers planted cash crops. This implies a few farmers plant cash crops. The cash crops they plant include; cotton, sugar cane, watermelon, tobacco, peeper and eggplant. Also, 71% of the farmers relied on the farm for household income. Those who did not rely on the firm for household income indicated different sources including; salary/ employment, small business (catering, fish mongers, and Jua kali) and wages from casual labour.

The smallholders' farmers' skills and knowledge were probed. In all the skill categories interrogated no smallholders' farmer had high level of proficiency. Good level of proficiency was recorded in farm planning (mean =3.70, SD =1.44), land preparation (mean = 3.93, SD =1.33), planting (mean = 3.89, SD =1.40), crop management skills (mean = 3.48, SD = 1.48), harvesting (mean = 3.65, SD = 1.40), post harvesting (mean = 3.45, SD = 1.50) and farm resource allocation (mean = 3.48, SD = 1.48). moderate level of proficiency was recorded in resource mobilization (mean = 3.32, SD = 1.53), disease control and eradication (mean = 3.32, SD = 1.67), farm data gathering and analysis (mean = 3.05, SD = 1.63), standards enforcement skills (mean = 3.28, SD = 1.65), networking and collaboration skills (mean = 3.13, SD = 1.65) soft skill (mean = 3.27, SD = 1.62) and decision making (mean = 3.33, SD = 1.61). the results indicate that the smallholders' farmers' skills were not advancing though they had undergone training. It is therefore that subsequent trainings should strive to move skills and knowledge that registered moderate level of proficiency to higher levels. This will likely impact positively productivity of food crops.

A Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between gender and previous training status of the smallholders' farmers, $\chi 2$ (4, n = 124) = 4.37, p = .359, phi = .18. The p value of .359 is greater than alpha value of .05. This means that the proportion of male farmers' proficiency level of skills and knowledge held on food crop farming is not significantly different from the proportion of female farmers. Therefore, there appears to be no association between farmers' level of proficiency in skills and knowledge held on food crop farming and gender. Also, a Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between food crop farming skill and knowledge held by smallholders' farmers and previous training status of the smallholders' farmers, $\chi 2$ (4, n = 124) = 2.03, p = .731, phi = .12. The p value of .731 is greater than alpha value of .05. This means that the proportion of previously trained farmers' proficiency level of skills and knowledge held on food crop farming is not significantly different from the proportion of farmers not trained before. Therefore, there appears to be no association between farmers' level of proficiency in skills and knowledge held on food crop farming and farmers previous training.

5. Conclusion

The study respondents comprised 51% male and 49% female. the study revealed that smallholders' farmers had received trainings that lasted between one hour and three days, much of it was done by One Acre Fund. Some farmers indicated that they were satisfied with the training they had received previously, while others were dissatisfied. Some trainings had been taken over 10 years ago. Therefore, the skills and knowledge they possess may be outdated. The findings revealed that most smallholders' food crop farmers had their farms under crop throughout the year. This was because most of the farms were small and farmers had to continuously plant food crops for survival. Some left their land fallow to allow their farms regain fertility, it was a new farming method, due to lack of funds to cultivate, to control pests, to graze their animals, because of rotational farming, long droughts (harsh climate), and farmer was unwell (hospitalized for three months). Most of the smallholders' food crop farmers practice rotational farming. A small percentage of smallholders' farmers seek food crop extension services. This may present opportunities to update their skill and knowledge. Those who reached for food crop services from extension agents received services on; pest control/ use of pesticides, planting of specific crops (groundnuts, cassava, beans, and maize), seed selection, soil testing, fertilizer application/ use, disease management, and Knowledge on variety of crops.

In all the skill categories interrogated no smallholders' farmer had high level of proficiency. Good level of proficiency was recorded in farm planning, land preparation, planting, crop management skills, harvesting, post harvesting and farm resource allocation. moderate level of proficiency was recorded in resource mobilization, disease control and eradication, farm data gathering and analysis, standards enforcement skills, networking and collaboration skills, soft skill and decision making. The results indicate that the smallholders' farmers' skills were not advancing though they had undergone training. It is therefore that subsequent trainings should strive to move skills and knowledge that registered moderate level of proficiency to higher levels. This will likely impact positively productivity of food crops.

A Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between gender and previous training status of the smallholders' farmers, $\chi 2$ (4, n = 124) = 4.37, p = .359, phi = .18, implying that the proportion of male farmers' proficiency level of skills and knowledge held on food crop farming is not significantly different from the proportion of female farmers. Therefore, there appears to be no association between farmers' level of proficiency in skills and knowledge held on food crop farming and gender. Also, a Chi-square test for independence (with Yates Continuity Correction) indicated no significant association between food crop farming skill and knowledge held by smallholders farmers and previous training status of the smallholders farmers, $\chi 2$ (4, n = 124) = 2.03, p = .731, phi = .12, indicating that the proportion of previously trained farmers proficiency level of skills and knowledge held on food crop farming is not significantly different from the proportion of farmers not trained before. Therefore, there appears to be no association between farmers' level of proficiency in skills and knowledge held on food crop farming and farmers previous training.

6. Recommendation

Smallholders farmers need to be trained to acquire skills and knowledge in contemporary food crop farming. The study revealed some had received training as far as 10 years ago, some have never been trained and rely on their own skills and knowledge for food crop farming.

Frequent training is recommended to improve proficiency levels in some skills and knowledge held. Moderate level of proficiency was recorded in resource mobilization, disease control and eradication, farm data gathering and analysis, standards enforcement skills, networking and collaboration skills, soft skill and decision making.

Gender should never be used to design training programmes since the proficiency levels of skill and knowledge of both male and female farmers are relatively the same. There was no association between farmers' level of proficiency in skills and knowledge held on food crop farming and gender.

The training of food crop farmers should begin from the basics. This is because there appears to be no association between farmers' level of proficiency in skills and knowledge held on food crop farming and farmers previous training.

References

[1] Alliance for a Green Revolution in Africa (AGRA) (2014), Africa Agriculture Status Report 2014: Climate Change and Smallholder Agriculture in Sub Saharan Africa,

[2] Bryan, E., Ringler, C., Okoba, B., Koo, J. Herrero, M. & Silvestri, S. (2011). *Agricultural management for climate change adaptation, greenhouse gas mitigation, and agricultural productivity: Insights from Kenya.*

[3] FAO. FAOSTAT database. In FAO 2005Rome, Italy: FAO; 2005.

[4] Frankema, E., Williamson, G., & Woltjer, P. (2018). An economic rationale for the African scramble: The commercial transition and the commodity price boom of 1835-1885. *Journal of Economic History*, 78(1), 231–267.

[5] Gebska M., Grontkowska A., Swiderek W. and Golebiewska B. (2020). Farmer Awareness and Implementation of Sustainable Agriculture Practices in Different Types of Farms in Poland.

[6] Global Information and Early Warning System on Food and Agriculture (GIEWS) (2016), "Delayed onset of seasonal rains in parts of Southern Africa raises serious concern for crop and livestock production in 2016", GIEWS Special Alert No. 336, Food and Agriculture Organization of the United Nations (FAO), Rome.

[7] Jayne, T. S., Chamberlin, J., Traub, L., Sitko, N., Muyanga, M., Yeboah, F. K., Anseeuwe, W., Chapoto, A., Wineman, A., Nkonde, C. & Kachule, R. (2016). Africa's changing farm size distribution patterns: The rise of medium-scale farms. *Agricultural Economics, 47*, 197-214.

[8] Jayne, T. S., & Sanchez, P. A. (2021). Agricultural productivity must improve in sub-Saharan Africa. *Science*, 372(6546), 1045-1047.

[9] Man N, Saleh J, Hassan S, Zidane F, Nawi N, Umar S (2016). Training Needs of Agricultural Extension Agents Using Borich Needs Assessment Model. Asian Journal of Agricultural Extension, Economics and Sociology 13(1):1-19.

[10] Mabiso, A., & Benfica, R. (2019). The narrative on rural youth and economic opportunities in Africa: facts, myths and gaps. Papers of the 2019 Rural Development Report, IFAD Research Series 61.

[11] Masters, W. A., Djurfeldt, A. A., De Haan, C., Hazell, P., Jayne, T., Jirström, M. & Reardon, T. (2013). Urbanization and farm size in Asia and Africa: Implications for food security and agricultural research. Global Food Security, 8.

[12] MoALF. (2016) Climate Risk Profile for Busia. Kenya County Climate Risk Profile Series. The Kenya Ministry of Agriculture, Livestock and Fisheries (MoALF), Nairobi, Kenya.

[13] Mohammad, A.H. and Hasan, S.S. (2018). Potentiality of underutilized vegetables for contribution to Sustainable Development Goals (SDGs) in Bangladesh. Asian Journal of Agricultural Extension, Economics & Sociology.2018; 26(2): 1-9

[14] Moore, H. L. (2018). Prosperity in crisis and the longue durée in Africa. The Journal of Peasant Studies.

[15] Nasike C. (2020). Cutting the Hand that Feeds: The Plight of Smallholder Farmers in Kenya. Greenpeace Press Release 3rd August,2020. Retrieved from: https://www.greenpeace.org/africa/en/press/11773/cutting-the-hand-that-feeds-the-plight-of-smallholder-farmers-in-kenya/

[16] Oberc, B.P. & Arroyo Schnell, A. (2020). Approaches to sustainable agriculture. Exploring the pathways towards the future of farming. Brussels, Belgium: IUCN EURO.

[17] Okeowo T. A. (2015). Analysis of Competency and Training Needs Among Agricultural Extension Personnel in Lagos State. International Journal of Forestry and Horticulture (IJFH) Volume 1, Issue 2, July - September 2015, pp. 14-21.

[18] Pfister, S., Bayer, P., Koehler, A., & Hellweg, S. (2011). Projected water consumption in future global agriculture: Scenarios and related impacts. *Science of the Total Environment*, 409(20), 4206–4216.

[19] Shiva V. (2016), Who Really Feeds the World?: The Failures of Agribusiness and the Promise of Agroecology. Paperback June,2016

[20] Staatz, John M.; Dembele, Niama Nango. (2008). Agriculture for Development in Sub-Saharan Africa. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/9043 License: CC BY 3.0 IGO."

[21] The Economist (2020) Africa's population will double by 2050 https://www.economist.com/special-report/2020/03/26/africas-population-will-double-by-2050

[22] Vibeke Bjornlund, Henning Bjornlund & Andre F. Van Rooyen (2020) Why agricultural production in sub-Saharan Africa remains low compared to the rest of the world – A historical perspective, International Journal of Water Resources Development, 36: sup1, S20-S53.

[23] Williams, D. R., Clark, M., Buchanan, G. M., Ficetola, G. F., Rondinini, C., & Tilman, D. (2021). Proactive conservation to prevent habitat losses to agricultural expansion. Nature Sustainability, 4(4), 314-322.

[24] World Bank Data (2021) Food Imports (% of Merchandise Imports) – Kenya. Retrieved from: https://data.worldbank.org/indicator/TM.VAL.FOOD.ZS.UN?locations=KE&_ga=2.84467545.1719925134.1662287618-1417500504.1662287617

[25] World Bank & CIAT (2015). Climate-smart agriculture in Kenya. CSA Country Profile. Washington D.C.: The World Bank Group. Retrieved from: https://cgspace.cgiar.org/handle/10568/69545

[26] Word Food Program WFP (2016) Comprehensive Food Security and Vulnerability Survey: Summary report Kenya 2016.