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Indigenous Farming Techniques Affecting House Hold Food Security in Lower Nyakach Division in Kisumu County, Kenya

Ochollah. O. Fredrick
Student, Department of Geography, Kisii University, Kenya
Dr. Dennis Mamboleo
Lecturer, Department of Geography, Kisii University, Kenya
Dr. Daniel Nyantika
Lecturer, Department of Geography, Kisii University, Kenya

Abstract:
The Global community has made a commitment through the Sustainable Development Goal (SDG) 2 to ending hunger and achieving food security and improved nutrition by 2030. However, recent evidence points to increasing hunger and food insecurity in the world. A consortium comprising the World Food Organization (FAO) estimates that the number of undernourished people has increased from 784 million in 2015 to 821 million people in 2018, with around 22.8% of the population in sub-Saharan Africa (SSA) facing chronic food deprivation. Whereas adoption of indigenous farming practices aligned to local climatic knowledge has recently been touted as a panacea to food crop production, the level of household food insecurity in some regions in Kenya keeps rising. In Lower Nyakach division of Kisumu County, Kenya, there has been a steady decline in Maize crop production over the last five year, with each household receiving approximately five bags of maize from their farms to feed an average of five persons per household each year. This questions the effectiveness of indigenous farming practices in influencing household food security in the area. The purpose of the study was to assess the influence of indigenous farming practices on household food security among households in Lower Nyakach Division of Kisumu County, Kenya. Specific objectives were to: assess the influence of indigenous pest control practices; establish the influence of indigenous ploughing methods, and to determine the influence of cultivation systemson food security among households in Lower Nyakach Division.The study was guided by the observation learning theory which depicts learning to be a function of observing, retaining and replicating behaviour executed by others. This was a descriptive research design on a target population of 3756 households. The researcher sampled 10% (250) households which was stratified based on population in each location. Questionnaire was used to collect data from household heads while interview schedule was used to collect data from agricultural officers and CBO/NGO leaders who have been assisting the farming families with inputs. Findings showed that indigenous farming techniques used by the households have determined food security to a moderate extent (M=2.9; SD=1.246) in the area. Pest control (65.6%; M=3.71), method of ploughing (48.3%; M=2.86) and adopted season of cultivation (45.6%; M=2.75) all had influence on food security. It was concluded that pest control being a major determinant of food security, the families in the study area have depended on multiple weeding using hand tools to control pests and weeds as opposed to mechanical or use of pesticides and herbicides. The study recommends that the farming families should be supported with sufficient farm implements as well as pesticides/herbicides. Further research should be done on contribution of farm implements subsidies to local farmers on household food security in rural areas

Keywords: *Indigenous farming practices, pest control, methods of ploughing, adopted seasons of cultivation, Lower Nyakach division, Food security*

1. Introduction

Indigenous knowledge including traditional farming exists in every community since it is a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about their relationships with one another and with their environment (Hart and Mouton, 2005; Chege, Semenye and Lemba, 2018).Studies (Gearheard et al, 2010; Chaudhry, Ahmed and Farooq, 2014; Kazmi, Chaudhry, Ahmed and Khan, 2014) have argued that recently, increased awareness has arisen of the failure of conventional agricultural practices to be effectively and equitably applied to the different types of zones in which agriculture is practised. This has resulted in greater attention being paid to local or indigenous knowledge. According to International Fund for Agricultural Development(IFAD,2013), indigenous knowledge is mostly used to observe, monitor and report weather-related changes: this is important to smallholder farmers. It is one of the most significant issues affecting food security of a household (Chege et al, 2018).However, paucity of literature seems to exist with regards to how specific indigenous farming practices have had influence on food security particularly among households in developing countries.

Food is recognized as a basic human right, and lack of or inadequate food consumption has serious implications for general body health and well-being, growth, development and cognitive ability among children, and labour productivity (World Food Organization [FAO], International Fund for Agricultural Development [IFAD] and the World Food Program [WFP] (FAO, IFAD & WFP, 2014). Adequate quantity and quality of food are, therefore, important for ability to grow, learn, and earn a living. This implies that food insecurity is a threat to overall human well-being, as well as efforts geared toward poverty reduction and economic growth. Researchers (Demeke et al, 2017; Murendo et al, 2018) have opined that supporting investments in diversified livelihood systems in general and in small livestock assets such as poultry in particular are viable intervention classes to improve household food security and nutrition for very poor, marginalized smallholders. It is thus critical to understand the drivers of current food insecurity and the farming practices capable of mitigating its effect particularly in the wake of changes in climatic conditions.

While food insecurity is driven by multiple factors, including climate shocks, conflict and insecurity, economic and political instability, an important though often neglected contributory factor is crop loss from pests and diseases, according to Food Security Information Network (FSIN, 2018). The Organization of European Cooperation for Development and the Food and Agricultural Organization (OECD & FAO, 2012) posit that worldwide, around one-third of attainable crop production is lost annually to pests, with a large share of the losses occurring in developing countries. For instance, it is estimated that the recent outbreak of the fall armyworm (FAW) pest in Africa has the potential to cause annual maize losses of up to 20.6 million metric tons per year in 12 SSA countries (Day et al., 2017). Similarly, Pratt, Constantine and Murphy (2017)also demonstrated that five major invasive pests are capable of causing a combined annual economic loss of US$0.9–1.1 billion to smallholder maize production in just six East African countries. The impact of FAW on maize yield in Africa has been reported as very large. Day et al. (2017) estimated the impact of FAW between 22 and 67% of yield in Ghana and Zambia, resulting in millions of US$ in losses. Similarly, Kumela et al. (2018) estimated the impact of FAW to 32% of yield in Ethiopia and 47% of yield in Kenya. These estimates, however, are based on socio-economic surveys focusing on farmers' perceptions, but not on rigorous field scouting methods such as the one proposed by McGrath et al (2018).

Indigenous knowledge including complex set of knowledge and technologies existing and developed around specific conditions of populations and communities indigenous to a particular geographic area is critical in development and adoption of successful cultivation systems for improved crop production (Gearheard et al, 2010). However, indigenous knowledge reflected in methods of ploughing or tillage for improving food security tends to have attracted limited attention. In their study which evaluated the indigenous knowledge systems in Pakistan, Chaudhry et al (2014) concluded that sustainable agricultural development requires; optimal use of local resources and the meeting of basic needs, development of related indigenous manpower and human resources. Ba, Lu, Kuo and Lai (2018) explored traditional farming and its role in sustainable development of the mountainous area based on the indigenous community of Wutai in Taiwan and showed that continuation of traditional farming practices guided by the traditional farming calendar and characterized by mixed cropping, inter cropping, and rotation, which optimized the use of limited arable lands in the area.

Similar, indigenous knowledge including types of seeds to crop in the wake of variability in climatic conditions is critical in enhancing food security (Kazmi et al, 2014). Cultivation systemsrelevant to seasonality are critical more for small holder farmers who rely on rain-fed agriculture. Chege et al (2018) assessed the effect of indigenous knowledge on food security status among smallholder farming communities in Kenya and showed a significant positive relationship between food security and practice of indigenous knowledge. Equally, Nduti (2014) assessed how the farmers use indigenous knowledge strategies in mitigation of drought in Gachoka Division in Kenya and revealed that the area is prone to drought and drought mitigating strategies are highly required. 41.7% of the respondents' plant traditional crops in their farms while 33.3% plant hybrid crops and 25% planted both hybrid and traditional crops. It is however critical to note that studies (Nduti, 2014; Chege et al, 2018) have not highlighted on how seasonal-based cultivation systems have influenced household food security among households.

In Lower Nyakach Division in Kisumu County, households rely (*Zea mays L.*) and sorghum (*Sorghum bicolorL.*) as staple foods (Kabede et al, 2018). However, there are often poor harvests every season, with an approximate two to three bags yields to feed a household of five persons annually. According to Obuoyo, Ochola and Ogindo (2016), the area has witnessed gradual food provision decline over the last three decades that has recently intensified. Records from Nyakach Sub County Agricultural Office (2017) indicate that between 2014 and 2017, Lower Nyakach Division with four administrative locations has realised a steady decline in crop production, particularly maize crop, one of the staple foods in the area. Table 1 presents the trend of maize crop production in the area.

	2014	2015	2016	2017	No of Households
Jimo East	4585	4467	4412	4362	917
Rarieda	2120	2052	1992	1968	424
Gem Nam	2155	2064	2008	1987	431
Moro	3670	3567	3501	3484	734
Total	12530	12150	11913	11801	2504

Table 1: Trends of Maize Crop Production in Lower Nyakach Division
Source: Nyakach Sub County Agricultural Office (2018)

Table 1 illustrates that between 2014 and 2017, there was a decline of 712 bags in maize production in Lower Nyakach Division. Between 2014 and 2015, the production declined by 380 bags; 220 bags between 2015 and 2016; and

112 bags between 2016 and 2017. With a population of 2504 households (Kenya Population Census Report, 2009), each household received approximately five bags of maize from their farms to feed an average of five persons per household (KPC, 2009). This is far below an average of 91 two kilogram tins per year as recommended by the World Food Organization (FAO), International Fund for Agricultural Development (IFAD) and the World Food Program (WFP) (FAO, IFAD & WFP, 2014). This study was therefore set to assess how indigenous farming practices determine household food security in Lower Nyakach Division of Nyakach Sub County, Kisumu County.

1.1. Statement of the Problem

The Global community has made a commitment through the Sustainable Development Goal (SDG) 2 to ending hunger and achieving food security and improved nutrition by 2030. However, recent evidence points to increasing hunger and food insecurity in the world. A consortium comprising the World Food Organization (FAO) estimates that the number of undernourished people has increased from 784 million in 2015 to 821 million people in 2018, with around 22.8% of the population in sub-Saharan Africa (SSA) facing chronic food deprivation. Whereas adoption of indigenous farming practices aligned to local climatic knowledge has recently been touted as a panacea to food crop production, the level of household food insecurity in some regions in Kenya keeps rising. In Lower Nyakach division of Kisumu County, Kenya, there has been a steady decline in Maize crop production over the last five year, with each household receiving approximately five bags of maize from their farms to feed an average of five persons per household each year. For instance, between 2013 and 2016, there was a decline of 712 bags in maize production to a total of 11801 bags for 2504 households. This implied that in a household of five persons, each person consumed 0.94 bags (or 37.6 two kilograms tins) of maize in 2016. This is far below an average of 91 two kilogram tins per year as recommended by WFP, FAO, IFAD & WFP (2014).This questions the effectiveness of indigenous farming practices in influencing household food security in the area.

1.2. Objective of the Study

The main objective of the paper was to explore the indigenous farming techniques affecting household food security in Lower Nyakach division of Kisumu County, Kenya. Specific objectives were to:

- Assess the extent to which indigenous pest control practices affect household food security in Lower Nyakach division of Kisumu County, Kenya
- Establish the extent to which indigenous methods of ploughing affect household food security in Lower Nyakach division of Kisumu County, Kenya
- Determine the extent to which adopted cultivation systems affect household food security in Lower Nyakach division of Kisumu County, Kenya

2. Theoretical Orientation and Related Literature

2.1. Theoretical Orientation

This study adopted observation learning theory associated with the works of Albert Bandura (Bandura, 1977). Observational learning is the process used to explain the acquisition of novel behaviors or performance of previously acquired set of behavior under novel conditions after observing the behavior of another person and the consequences that follow the behaviour (Plavnick & Hume, 2014). Described as vicarious learning, social learning or modelling, the theory explains learning that occurs as a function of observing, retaining and replicating behaviour executed by others (Bandura, 1977). The individual notices something in the environment, remembers what he noticed, produces an action that is a copy of what was noticed, and the environment delivers a consequence that changes the probability the behaviour will be emitted again (reinforcement and punishment). Common characteristics of observational learning include the observation of behavior and consequences for those behaviors, a matching or similar response performed by the observer, and the observer coming into contact with an intermittent schedule of direct consequences that are similar to observed consequences (Greer et al., 2006). Indigenous practices form part of knowledge adopted from local behaviour of the community. The choice of the theory was therefore pegged on the fact that knowledge related to pest control practices, ploughing methods and seasons of cultivations are imitated from sets of behaviour in the community.

2.2. Literature Review

Baudron et al (2019) sought to understand the factors influencing fall armyworm (FAW) damage in African smallholder maize fields and quantify its impact on yield, using two districts of Eastern Zimbabwe as cases. A total of 791 smallholder maize plots were scouted for FAW damage and the head of the corresponding farming household interviewed. Grain yield was later determined in about 20% of these fields. FAW damage was found to be significantly reduced by frequent weeding operations and by minimum- and zero-tillage. Conversely, pumpkin intercropping was found to significantly increase FAW damage. FAW damage was also found to be higher for some maize varieties, although these varieties may not be the lowest yielding. If the incidence of plants with FAW damage symptoms recorded in this research (32–48%, depending on the estimate used) is commensurate with what other studies conducted on the continent found, our best estimate of the impact of FAW damage on yield (11.57%) is much lower than what these studies reported. Although our study presents limitations, losses due to FAW damage in Africa could have been over-estimated

Murendo et al (2018) analysed the role of nutrition education, farm production diversity and commercialization on household, women and children dietary diversity in Zimbabwe. In addition, they explored separately the roles of crop and livestock diversity and individual agricultural practices on dietary diversity. Data were collected from 2,815 households randomly selected in eight districts. Findings showed that nutrition education increased household, women, and child dietary diversity by 3, 9 and 24%, respectively. Farm production diversity had a strong and positive association with household and women dietary diversity. Crop diversification led to a 4 and 5% increase in household and women dietary diversity, respectively.

Demeke et al (2017) provided new empirical evidence on the nexus between farm production diversification and household diet diversity in East Africa. Starting with a conceptual framework for the pathways from agriculture to nutrition, we use data collected from a sample of ultra-poor, labor constrained families living in five rural districts of Kenya. They found production diversification to be positively and significantly associated with household diet diversification, with poultry ownership most strongly correlated. Hart and Mouton (2005) examined the indigenous knowledge relating to the cultivation and use of traditional vegetables in a rural parish in Uganda, using a participatory research method, Rapid Rural Appraisal. The results of the study illustrate the importance of understanding indigenous knowledge for future agricultural research and extension activities.

Tambo, Uzayisenga, Mugambi and Bundi (2020) examined the food security effects of plant clinics, a novel agricultural extension model that aims to reduce crop losses due to pests through the provision of demand-driven plant health diagnostic and advisory services to smallholder farmers. The study was based on survey data from maize-growing households in Rwanda, where 66 plant clinics have been established. Using switching regression and matching techniques as well as various food security metrics, including the food insecurity experience scale, the authors found evidence that participation in plant clinics is significantly associated with a reduction in household food insecurity. For instance, among the participating households, plant clinics contribute to a decrease in the period of food shortage by one month and a reduction in the severity of food insecurity by 22 percentage points.

Kebede, Bianchia, Baudron and Tittonell (2019) carried a three year study to assess the effect of field and landscape factors on maize stemborer infestation levels and maize productivity in Ethiopia. Maize infestation levels, yield and biomass production were assessed in 33 farmer fields managed according to local practices. When considering field level factors only, plant density was positively related to stemborer infestation level. During high infestation events, length of tunnelling was positively associated with planting date and negatively with the botanical diversity of hedges. However, the proportion of maize crop in the surrounding landscape was strongly and positively associated with length of tunnelling at 100, 500, 1000 and 1500m radius, and overrode field level management factors when considered together. Maize grain yield was positively associated with plant density and soil phosphorus content, and not negatively associated with the length of tunnelling.

Kumela et al (2018) explored on farmers' knowledge, perceptions and management practices of the fall armyworm (*Spodopterafrugiperda*) in Ethiopia and Kenya. A survey of 343 smallholder maize farmers was conducted. Most farmers in Ethiopia and Kenya had knowledge about fall armyworm; they could identify it mainly during its larval stage. Furthermore, most farmers in Ethiopia (93%) and Kenya (97%) encountered damage by fall armyworm in their farms. They estimated an average of 32% crop damage in Ethiopia and 47.3% of crop damage in Kenya, with an estimated yield reduction between 0.8 to 1 tonnes/ha. Nearly half of the farmers relied on chemical insecticides to control this pest. The majority (60%) of the farmers in Kenya perceived that insecticides were not effective in controlling fall armyworm as compared to most farmers (46%) in Ethiopia who perceived that chemical spray is effective for the control of fall armyworm. In Ethiopia, 26% of the farmers combined handpicking larvae with insecticide sprays, whilst 15% of the farmers practiced only handpicking.

Chege et al (2018) assessed the effect of indigenous knowledge on food security status among smallholder farming communities through interview schedules. Non-experimental design using descriptive survey was adopted for the study. Findings showed a significant (P= .05) positive relationship between food security and practice of indigenous knowledge. Nduti (2014) assessed how the farmers use indigenous knowledge strategies in mitigation of drought in Gachoka Division. The data was collected from informants through questionnaires, group discussions and interviews with key persons being the village elders in every village. The findings of the research shows that 62.5% of the respondents reported that the frequency of drought in the area is less than year while 29.2 % reported that drought occur after every 1 to 2 years and 8.3% reported that the drought occur after every 5 years and above. This shows that the area is prone to drought and drought mitigating strategies are highly required. 41.7% of the respondents' plant traditional crops in their farms while 33.3% plant hybrid crops and 25% planted both hybrid and traditional crops.

Kirimi, Gitau and Olunga (2013) sought to identify factors that influence household food security for Kenyan rural smallholder households, and in particular, determine if household commercialization as defined by household participation in input (fertilizer and seed) and crop output markets affects food security position. Results showed that household commercialization was associated with a reduced risk of being in the chronically food poor and oscillator groups compared to the food non-poor group. Similarly, Muthee, Kilemba and Masinde (2019) analysed the role of indigenous knowledge systems in improving agricultural productivity in Kenya. While indigenous knowledge has been the basis for local-level decision-making in many rural farming communities in Kenya, the paper finds that, its application has not been wholly integrated into the farming systems not only by local farming communities but also by researchers, extension service providers, scientists, policy makers and planners striving to improve conditions in rural areas and suggests how indigenous knowledge can be applied in improving agricultural productivity among smallholder farmers in Kenya

3. Methodology and Materials

3.1. Research Design

This study was carried out through descriptive research design. Descriptive research provides measures of an event or activity that is taking place. Descriptive research designs are usually structured and specifically designed to measure the characteristics described in a research question. According to Hair, Babin, Money and Samouel (2003), the objective of descriptive design is to portray an accurate profile of persons, events or situations. This design was useful because it aided the collection of views on activities that were taking place under such situations that the farmers operated in by means of a detailed questionnaire (Creswell, 2011).

3.2. Study Area

The study area was Lower Nyakach Division of Nyakach Sub County, Kenya. It lies to the north by Nyando division in Nyando Sub County, to the South by Upper Nyakach division, to the West by West Nyakach division and Lake Victoria to the North West. The Division covers 182.6 Km^2 and has a total population of 58,789 (RoK, 2009). The area is typically dry, with single season of rainfall (March – May) and relies majorly on other farming activities such as goat keeping among others as the main type of farming. The map of the study area is presented in Figure 1

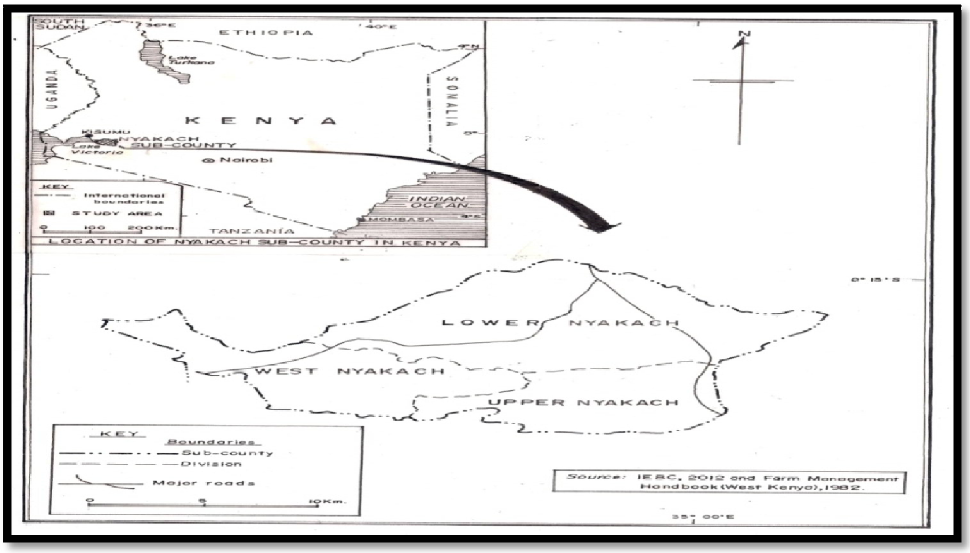

Figure 1: Map of the Study Area

3.3. Target Population and Sample Size

3.3.1. Target Population

The study targeted households from 6 sub-locations composing: Kandaria, Agoro West, Jimo East, Moro, Gem-Nam, and Rariedatotalling to 3756 in number (RoK, 2009). However, two sub locations were excluded from the main study for piloting, leaving a target of 2504 households. Additionally, the study targeted one Sub County agricultural officer, three CBO officials, and three NGO officials, resulting to 2511 as the target population.

3.3.2. Sample Size

The study used 10% of the targeted households were selected as the sample size, making up 250 households.To ensure proportional representation of each sub location according to the population of each unit, proportional stratified random sampling technique was employed, where each individual sub location served as a stratum.The distribution of sample size is shown in Table 2.

Sub Location	Target Population	Sample size	Percent
Jimo East	917	92	36.6
Rarieda	424	42	16.9
Gem Nam	431	43	17.2
Moro	734	73	29.3
TOTAL	2504	250	100

Table 2: Sample Size
Source; Kenya Population Census Report (2009)

Further, purposive sampling method was used to select one Divisional agricultural officer, three CBO officials, and three NGO officials to be used as Key Informants from whom interviews were conducted using interview schedule.

3.4. Data Collection Methods

This study basically used primary data. Primary data was obtained by the use questionnaires and interview schedules. The researcher developed a closed ended questionnaire intended to solicit responses relating to indigenous farming practices and household food security. The questionnaire developed was based on multiple-item scales and summated ratings (Likert Scale) to quantify the construct(s) of opinions of respondents regarding the study variables. Similarly, face to face interviews were conducted with the sampled officers. Respondents were allowed to explain their responses in full and the researcher had the option of probing further, just to ensure the information received was accurate and to the point.

3.5. Reliability and Validity of Instruments

3.5.1. Reliability

Split – half test method was used to measure reliability of the questionnaires. In this method, the researcher divided the scale/test in the questionnaire into two halves, so that the first half formed the first part of the entire test/scale and the second half formed the remaining part of the test/scale. Estimation of instrument reliability was based on correlating the results obtained from the pilot study involving 25 households from two locations (Kandaria: 12 households; Agoro West: 13 households) of the two parallel halves of the same test/scale (because the instrument had 8 items). The first part yielded coefficient of 0.78 while the second half yielded 0.83. This was considered sufficient and acceptable, implying that the study instruments were capable of yielding consistent responses from the sampled respondents (Nunnally, 1978).

3.5.2. Validity of Instruments

To ensure instrument validity, the data collection questionnaire was appraised by three experts in the field of Arts and Social Science. They looked at the instruments and suggested for some corrections before the actual tool was developed.

3.6. Data Analysis

Quantitative data was analyzed by the help of Statistical Packages for Social Sciences (SPSS) version 21. SPSS package was able to handle a large amount of data and given its wide spectrum in the array of statistical procedures which are purposefully designed for social sciences (Amin, 2005). Descriptive statistics such as measures of central tendency, frequency distribution, and percentages were run on all the quantitative data. Qualitative data obtained from personal interviews was analyzed through thematic analysis and organized into themes and patterns corresponding to the research questions. Six thematic analysis steps enthused by Braun and Clarke (2006) were followed. These comprised of familiarising with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the reports.

4. Findings and Discussions

The main objective of the study was to assess how indigenous farming practices determine household food security in Lower Nyakach Division. The researcher asked the sampled household heads to indicate the extent to which the presented farming practices have been affecting or determining food security among families in the area as: 1- To a very small extent; 2- To small extent; 3- Neither small nor large extent; 4- Large extent 5- Very large extent. Table 3 presents how indigenous farming practices determine household food security.

Farming Practices	**1 F(%)**	**2 F(%)**	**3 F(%)**	**4 F(%)**	**5 F(%)**	**M**
Pest Control						
Use of hand tools to remove weeds	56(22.4)	60(24)	16(6.4)	81(32.4)	37(14.8)	2.93
Use of chemical pest control	74(29.6)	71(28.4)	26(10.4)	41(16.4)	38(15.2)	2.59
Multiple weeding (more than once)	9(3.6)	37(14.8)	40(16.0)	95(38.0)	69(27.6)	3.71
Mean						3.07
Method of ploughing						
Use of hoes and jembes for ploughing/tilling of farm lands	34(13.6)	60(24.0)	26(10.4)	95(38)	35(14)	3.15
Use of machinery (like tractors) in tilling farm lands	91(36.4)	45(18.0)	48(19.2)	32(12.8)	34(13.6)	2.49
Second ploughing before planting	24(9.6)	99(39.6)	25(10)	67(26.8)	31(12.4)	2.93
Mean						2.86
Cultivation Systems						
Early planting	22(8.8)	94(37.6)	28(11.2)	63(25.2)	43(17.2)	3.04
Planting of drought resistant crops	29(8.0)	64(25.6)	35(14.0)	56(22.4)	75(30.0)	3.41
Shifting cultivation	163(65.2)	43(17.2)	4(1.6)	12(4.8)	28(11.2)	1.80
Mean						2.75
Overall Mean						**2.9**

Table 3: Indigenous Farming Techniques and Household Food Security

Table 3 illustrates that the indigenous farming techniques used by the households have determined food security to a moderate extent (M=2.9; SD=1.246) among the families in the area. Of all the pest or weed control practices adopted by the households in the study area, multiple weeding (65.6%; M=3.71) is indicated to have determined food security to a large extent among the families in the area. Similarly, use of hand tools to remove weeds (47.2%; M=2.93) is also showed to have been a determinant of food security to a moderate extent, while use of chemical pest control practices (58%; M=2.59) is shown to have determined food security among the households to a small extent. This tends to imply that the families in the study area have depended on multiple weeding using hand tools to control pests and weeds as opposed to mechanical or use of pesticides and herbicides. This finding, however, did not agree with a study by Kabede et al (2019)that found that field management in sub-Saharan Africa largely focuses on recommendations for fertilisation, trap crops, crop rotation or intercropping are the most frequently practiced farm production adaptations for enhanced crop production. Similarly, shifting cultivation practices such as crop diversity, land fallowing, and rotational cropping were the main practices adapted by villagers in a study done by Nduti (2014). The current study's finding therefore tended to suggest that based on the small sizes of land, multiple weeding for the purposes of intensifying use of the land was considered most important. The researcher was also able to present this finding in a graph (Figure 2).

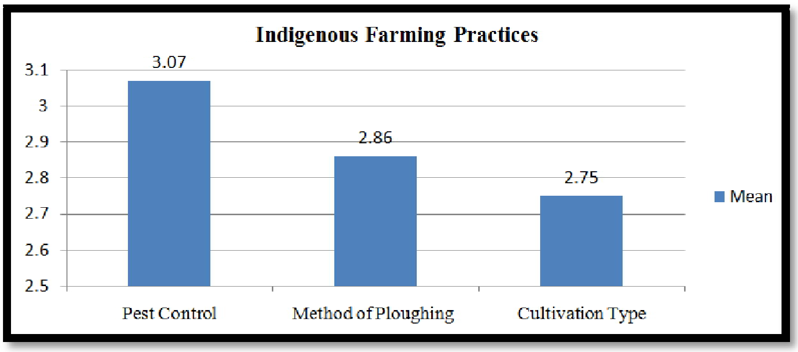

Figure 2: Indigenous Farming Practices

Table 3 also indicates that of the ploughing methods adopted in the study area, use of jembes or hand hoes (52%; M=3.15) has determined food security among households in the area to a moderate extent. On the other hand, second ploughing before planting (49.2%; M=2.93) and use of machinery like tractors to till farm land (54.4%; M=2.49) have determined household security to a small extent in the study area. This tends to imply that families in the study area rely on simple hand tools like jembes or hand hoes to cultivate their lands as opposed to use of machineries like tractors probably owing to low income facing quite a number of them. Income of the family as a determinant of household food security had been revealed in several studies (Demeke et al, 2017; Murendo et al, 2018). Such studies have indicated the fact that families with low monthly income tend to utilize simple farm inputs in their farms. This in turn deprives them of improved crop production, consequently rendering them food insecure.

Another farming practice that the researcher assessed concerns mode of cultivation. Table 4.7 indicates that, based on the respondents' views, planting of drought resistant crops (52.4%; M=3.41) has determined food security among households in the area to a large extent. However, early planting (42.4%; M=3.04) have determined food security among families in area to a moderate extent while shifting cultivation (82.4%; M=1.80) has determined food security to a small extent in the area. Based on small sizes of land possessed by the households in the area, families in the study area seem not to have the option of shifting cultivation but rely on planting drought resistant crops and sometimes early planting. Small farm size as a contributor to food insecurity had also been found by Osei et al (2013) in a study done in Ghana. Similarly, Kirimi, et al (2013) also revealed in a study done in Kenya that inability to participate in commercial farming negatively affects household food security.

Intensive cultivation of drought resistant crops was largely mentioned by key informants as an important practice that tends to boost crop production, hence ensuring some level of food security among most families, responded as:

Due to small sizes of land, families have limited options in terms of mixed farming or alternate cultivations. Families thus resort to planting draught resistant crops with a hope of achieving adequate harvest for food security (KI_4).

It is implied in the statement byKI_4 that small size of land and the need to boost crop production for food security are the dilemma that families in the study area are faced with. Thus, the common practice is planting of draught resistant crops. This however, tends to disagree with some studies like Tambo et al (2020) which established that in the face of constraints in resources, families in Rwanda resort to inorganic fertilization to boost crop harvest. It also tends to contradict a study by Chege et al (2018) which found that farmers in Kilifi South Sub County use integrated approaches like alternative and mixed farming, planting variety of seeds, and usage of composed manure to boost crop production.

5. Conclusions and Recommendations

5.1. Conclusions

The study concludes that the families in the study area have depended on multiple weeding using hand tools to control pests and weeds as opposed to mechanical or use of pesticides and herbicides. It is additionally concluded that families in the study area rely on simple hand tools like jembes or hand hoes to cultivate their lands as opposed to use of machineries like tractors.

5.2. Recommendations

The study has revealed that families in the study area have depended on multiple weeding using hand tools to control pests and weeds as opposed to mechanical or use of pesticides and herbicides. It is additionally established that families in the study area rely on simple hand tools like jembes or hand hoes to cultivate their lands as opposed to use of machineries like tractors. The study therefore recommends that the farming families should be supported or subsidised with sufficient farm implements as well as pesticides/herbicides so as to help them improve their farm produce.

6. Acknowledgement

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