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Effect of mixed cropping on socio-economic welfare of farmers in Uasin Gishu County, Kenya

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Abstract
One of the biggest challenge currently facing humanity and farmers across the globe is the actual consequence of reduced agricultural diversity. This study considers the consequence of reduced agricultural diversity on global health, income and food security and thus the greatest way out of these problems is by diversifying crops and this has been considered as the best solution globally regionally and locally. The purpose of this study is to establish the effect of mixed cropping on the socioeconomic welfare of farmers in Uasin Gishu County. This study was guided by human capability approach. This study focused on 34,692 households in Ainabkoi, Uasin Gishu County. The target population consisted of small holder rural farmers in Kapsoya, Kaptagat and Ainabkoi/Olare wards. The study adopted a descriptive survey design. Sample size was determined using sample size determination formulae by Yamane (1967). 395 farmers and 10 key informants were interviewed and distributed proportionally across 3 wards in Uasin Gishu County. The data was collected using questionnaires and an interview guide. The study established a positive and significant correlation between mixed-cropping and socio-economic welfare of farmers in Uasin Gishu County. Results further indicate that a unit change in mixed-cropping leads to 44.3% change in socio-economic welfare of farmers in the study area (R^2 = 0.443).First, agricultural transformative policies should strengthen extension services with a special focus on cropping systems, viable crop enterprises, return from the different type of crops, needs and access to credit and irrigation facilities. There should be increased and guaranteed access to inputs and subsidies from the County Government of Uasin Gishu as well as other stakeholders and the priority should be given to farmers owning a small portion of land as they were more inclined to participate in crop diversification. There is a need for farmers being in the forefront to learn from their progressive farmers. There is also need to promote capacity building for certification of production systems according to internationally accredited systems that can provide possibilities for diversification within the traditional crop. Farmers need to form producer groups so that they can galvanize their resources and promote collaborations for sustainable development in the agricultural sector. The findings of the study will go a long way in ensuring that agricultural diversification is given a top priority by the stakeholders in this field in this county. The study will be beneficial to the farmers in Uasin Gishu County who consistently suffer from issues related to food security. It will aso form a basis for further research. It will further be beneficial to Counties, NGOs in food security amongst other stakeholders.

Keywords: Mixed cropping, farmers, food Security, livelihoods, socio-economic welfare, Uasin Gishu County

Introduction

Attaining global food security is still one of the major problems for the future given there has been constant growth in the number of people, change in diet as well as impacts of climate change. It has been widely noted that attention has shifted to agricultural intensification and diversification as a way of increasing food production as well as diverse varieties although food insecurity in most of the places is considerably attributed to income and distribution (Hazell & Wood, 2008) [13]. Little research has been conducted on how agricultural diversification can lead to achievement of food security, with there being enormous evidence that increase in diverse agro ecosystems are possibly to function better today and under varying environmental conditions since a wider range of functions and reactions to change will brace the system (Lin, 2011; Michler & Josephson, 2017) [6, 19].

Globally trends keep changing and new dynamics for example incorporated food chains, are changing the context of food production, distribution and consumption across the world. In as much as these changes provide diversification ideas and opportunities there are new challenges that are arising. Farmers have to discover new concepts to cope and ensure they meet the changing demands, instead of selling the traditionally produced goods (World Bank, 2002) [31]. There is a need for farmers to change farming methods in order adopt new ways which are in tandem with the ever-changing dynamic environment. Over the past thirty years studies and agricultural extension services of the irrigated system has led to increased surplus production of food that satisfies the population in the wake of increased population growth and has led to reduction in the number of people living below the poverty line (World Bank, 2018b) [33].

In sub-Saharan Africa (SSA), most people live in rural areas characterized by higher poverty rates than urban areas, and a great number of these rural households rely directly or indirectly on agriculture. Agriculture remains the mainstay of nearly all nations in sub Saharan Africa and is considered as the breadbasket of both rural and urban households hence being a major source of income earner (FAO 2016) [9]. Most

of these farming households are small and accounts for nearly 80% of all farms (World Bank 2018b) [33]. Therefore, farming is highly regarded as significant in alleviating food security and poverty. These livelihoods mainly rely on subsistence farming to provide food to the table as well as produce little which they sell for household income.

There has been solid expansion of agriculture recently in Sub-Saharan Africa and has led to major achievements in terms of nutrition and poverty. For the period between 2001 and 2014, the annually mean rise of agricultural productivity in sub Saharan Africa without addition of statistics from South Africa was close to 3.3 % thus somewhat lower the 3.7 % recorded in South Asia (Abera, 2019) [1]. Majority of Sub-Saharan African countries are currently facing triple burden of malnutrition and micronutrient deficiencies taking place at the same time with risen predominance of over-nourishment and obesity. The poverty ratio has reduced significantly from 55.6% recorded in 2002 to 41 % recorded in 2013 (Barrett *et al.* 2017) [4] as well as the rate of malnourishment reduced significantly from 28.1 percent in 2000 to 20.8 percent in 2015 (FAO 2015a) [8].

Despite these gains, malnutrition and food insecurity continues to be the leading public health challenge in most of the countries in Sub Saharan Africa. Although the number malnourished people in these countries has reduced, the total number of those facing chronic food deprivation is continually rising from 175.7 million during 1990-92 to 256 million in 2017 an astounding 23.2 percent of sub-Saharan Africa's population. Children are the most affected lot of those with undersized growing from 50.1 million in 2010 to 58.7 million in 2017 (FAO *et al.* 2018) [7].

Diversification and specialization of agricultural production according to research has been proven to bring positive impacts to a farming household's welfare (World Bank, 2013) [32]. Nevertheless, a high degree of on-farm diversification can also minimize the possibility of obtaining advantages of economies of scale or expose the household to new threats, inherent when adopting new breeds and varieties. More than 75% of Kenya's population earns its living from agriculture, which in turn relies on rainfall (UNEP & GOK 2007) [30]. Kenya's vulnerability to food insecurity is highest among pastoralists and small-scale agriculturalists most of whom are residents in Uasin Gishu County. Uasin Gishu County is the leading County in Kenya in producing maize and wheat therefore; it is referred to as the "bread basket" of the country. But over the years, the rising population growth in the county, has continually exerted pressure on natural resources especially land. Such pressure and continued subdivision of land through inheritance in turn encouraging very small piece of land whose commercial viability is low (FAO *et al.* 2018) [7].

In Kenya the most vital economic segment is agriculture which puts in 24% of GDP directly and 27% indirectly. The segment's indirect donation is chiefly attained through relations with manufacturing, supply and service linked sectors. A third of Kenya's farming products are exported, and this is 65% of the nation's entire export. The sector accounts for 18% of total formal employment, and more than 5 million smallholder farmers are engaged in various agricultural related activities. Extreme weather and climate changes influence the entire economy, which depends greatly on agricultural products like cash crops, food crops and animals (FAO, 2016) [9]. The country faces tremendous development challenges in almost all the sectors: poverty is endemic, deforestation is continuing, food insecurity is rampant, malnutrition and infant mortality rates remain high.

Extensive studies by the Kenya National Bureau of Statistics (2019), the number of households that are living below poverty level Uasin Gishu County is 41.0 percent (465,000). The main driver of poverty in the County includes limited economic diversity because most of the population depends on agriculture, over reliance of the majority of the rural population on subsistence farming, limited opportunities for employment, inadequate access to credit, disempowered groups especially women and youths with limited access to property and incomes and lack of useful skills amongst the youths to enable them take part in the labor market (FAO *et al.* 2018) [7].

Statement of the Problem

Nutrition and food security are vital government responsibilities in Kenya. The nation's tomorrow relies on strong citizens and an economy that is more flexible to the impacts of climate change, global swings in staple food prices and hazards like the fall armyworm. These risks destabilize the economy threatening Kenyans' well-being and livelihoods. Kenya undergoes a double puzzle of handling under nutrition and arranging for increasing over nutrition and increasing diabetes rates. Transformation of the farming sector will develop elasticity and improve the country's capacity to offer nutritious food for all citizens (KNBS, 2019) [15]. While there are many aspects of agriculture that affect the socio-economic welfare of people in Uasin Gishu County, the study aims at establishing effect of agricultural diversification on the socio-economic welfare of farmers in Uasin Gishu County with key focus on mixed farming.

Objectives of the Study

To assess the effect of mixed cropping on socio-economic welfare of farmers in Uasin Gishu County

Research Questions

How does mixed cropping influence socio-economic welfare of farmers in Uasin Gishu County?

Literature Review

Human Capability Approach

The main proponent of this approach is Sen (1981) [24]. The approach states that the main goal of justice and reduction of poverty levels should be to expand the freedom of the people so that they can enjoy valuable things and take part in various practices. The theory further argues that people should be able to get free access to the prerequisite resources with positive impacts to their lives and they should have the ability to make choices that favor them. Sen (1983) [23], insists that economic growth and the increment of goods and services are vital for human development. Although, like Aristotle, he restates the known argument that wealth is evidently not the good we are seeking; for it is simply useful and owing to something else (Sen, 1990) [22]. Sen notes that various people and societies generally differ in their capacity to turn income and commodities into beneficial attainments.

Sen (1985) [20] further makes these distinctions in his capability approach; Functioning is the achievement of a person, what she or he manages to do or be. It reflects a part

of the 'State of that person. A functioning hence refers to the use a person makes of the commodities at his or her disposal. Capability thus brings out a person's ability to gain a given functioning for instance avoiding hunger, rather fasting or going on hunger strike as an alternative. Capability approach also gives a central role to the ability of people to take charge and to be agents of their own lives. People need to be empowered so that they can take a lead role in defining priorities that fit their local contexts and priorities as well as select the best means to attain these. Sen (1999) [25], further established that if status quo or normal way of life has to be changed or scarified to escape poverty, then it is the people who should be involved directly and must have the opportunity to take part in deciding what should be chosen.

Through being agents' people can build up an environment in which they can be educated and speak freely (Chambers, 1994b) [5]. In regard to the above subject, agricultural diversification is key in empowering people to be ready to tackle the vagaries in the ever changing world. Food security has been a key endeavor in the global south. Over 70% of the people in the developing world have depended on the agricultural sector for the supply of food, direct and indirect employment, foreign exchange amongst other factors.

Mixed cropping on socio-economic welfare of farmers

According to Lin (2011) [6], mixed cropping is highly regarded as the best way to improve socio-economic welfare of farmers globally, regionally and locally. Mixed cropping can be conceptualized as planting different crops in the farm to increase diverse production which extensively improves the nutritional status of the household through household dietary diversity as well as satisfying the market needs. Mixed cropping can be achieved by planting both short and long-term crops (Lin, 2011) [6]. This insulates the economic capability of the household as well as food security. Secondly by cultivating drought resistant crops e.g. sorghum is a strategy that reduces crop loss in instances where there is rainfall failure.

Mixed cropping is suitable for small-scale farming where harvesting is by hand. It has been put in place to advance income and food production for small farmers and reduce the possibility of total crop breakdown even if one of the crops fail, the same field might still produce other crop successes (Government of Kenya, 2019). Mixed cropping also needs lesser nutrient inputs like fertilizers, pruning, pest control and irrigation than monoculture farming. Mixed cropping is considered as ecologically practicable, cost effectual and effective means of decreasing losses in agriculture particularly among smallholder farmers (Joshi 2005) [14]. It involves cultivation of different varieties of crops in the same or different species by intercropping or rotations. It is regarded to increase resilience of the households since it can cushion the households especially from the weather shocks (Joshi, 2005) [14].

According to Lin (2011) [6], mixed cropping provides an alternative away from the use of chemicals to uphold soil fertility, improves soil fertility, control pests, stable and consistent production, nutrition diversity, and health. Truscott *et al.* (2009) [28], regards diversification of crops as a solution to the control of parasites and enhancing soil fertility in agriculture. According to Shoffner and Tooker (2012) [26], mixed cropping is efficient since it increases natural enemies of insect pests, infringing the disease cycles, restraining weeds and volunteer crop plants thus leading to the creation of a dilution effect hence reducing resource concentration and modification of the microenvironment within the crop canopy making pest infestation difficult. Mixed cropping especially crop diversification can lead to a strong biodiversity particularly where farmers grow indigenous crop varieties (Goyal & Nash, 2017) [12].

Soil fertility enhancement can be regarded as one of the positive gains of mixed cropping and therefore basis of durable and productive farming systems (Lin, 2011) [6]. Soils which are managed well lower pest infestation incidences, enhance water use by plants and advance overall crop yields. In addition, crop diversification has a positive effect to climate change effects through the ability of local flora to hold carbon hence producing less carbon dioxide. It so implies that crop diversification contributes to food security by enhancing productivity, resilience of farming systems and livelihood outcomes (Abera, 2019) [1].

Socio-Economic Welfare of farmers

The International Labor Organization approximates that 62% of Kenya's entire employable inhabitants of 28 million earns a little return from farming, incorporating farmers and other off-farm jobs linked to farming. Farming activity is at the core of most Kenyan societies, either for tilling or pasture for more than 8 million farmers, however, as an income basis the other millions of Kenyans engaged in agriculture (Abera, 2019) [1]. However, it is significantly observed that the agricultural employment growth rate is lesser compared to other sectors, at ~2.3% for agriculture 3.8% for manufacturing and 4% for services. Besides, in farming, crops accounted for the biggest ratio of jobs, at 83%, with livestock and fisheries at 14% and less than 3% respectively (ASDS, 2019-2029) [3].

A regional scrutiny of Kenyan farmer earnings indicates that they differ by county and value chain and are impacted by aspects like agro ecology, access to markets, and accessibility to extension services, seeds and fertilizer. For instance, a maize farmer in Trans Nzoia has an earning ability of KES 10,200 per acre verses KES 2,400 per acre in Kakamega (ASDS, 2019-2029) [3]. Whereas majority of Kenyan households report a satisfactory amount of food quality, rural households and pastoralist communities are likely to have lesser nutritional variety compared to the national averages and high micronutrient shortages incorporating iron and Vitamin A (ASDS, 2019-2029) [3]. In comparison to other East Africa Community (EAC) nations, Kenya fares well in accessibility per capita, although is behind in affordability and quality nutrition. Kenyan children <5 years old get more calories on average than their EAC peers and thus lesser frequency of stunting, at 26%, a vital CAADP indicator (ASDS, 2019-2029) [3].

The rural households have been distinguished by their inability to engage in profitable ventures. They have poor nutrition, low health standards, and low productivity. Their earnings are also distinguished by seasonal variations. Households in these areas have limited access to markets and service institutions like credit institutions, extension and plant protection (Tanner, *et al.,* 2015) [27]. In Kenya 65 % of the population live in the rural areas and they rely on agriculture. However, agricultural productivity has remained low. Productivity has been poor because of erratic rainfall and other challenges the farmers face.

Nutrition and food security is a vital government responsibility. The nation's tomorrow relies on strong citizens and an economy that is more flexible to the impacts of climate, global swings in staple food prices and hazards like the fall armyworm. These risks destabilize the economy threatening Kenyans' well-being and livelihoods. Kenya undergoes a double puzzle of handling under nutrition and arranging for increasing over nutrition and increasing diabetes rates. Transformation of the farming sector will develop elasticity and improve the country's capacity to offer nutritious food for all citizens (ASDS, 2019-2029) [3].

Market access to staple foods and asset accumulation are emphasized, in improving welfare. If smallholder farmers can have better access to markets, infrastructural developments, strong farmer organizations and promotion of contract farming their welfare standards can improve. Jaleta *et al.* (2009), also introduces the value chain concept in commercialization that with increased household market participation, it directly impacts on value chain actors such as input suppliers, output traders, transporters, processors, financiers and others, these enjoy economies of scale generated from raised demand and supply; it reduces the cost per unit of operation and eventually increases their house hold incomes. It's further argued that selling agricultural produce at village level further provides employment and income (Kowagoe, 1994) [17].

Research Methodology

The study adopted a descriptive survey design. It is one of the widely used non-experimental research designs across disciplines to collect large amounts of survey data from a representative sample from the targeted population since it provides insights into the research problem by describing the variables of interest. The study focused on 34,692 (KNBS, 2019) [15] households in Ainabkoi, Uasin Gishu County. The target population consisted of small holder rural farmers in the following wards Kapsoya Kaptagat and Ainabkoi/Olare wards. The study also utilized Agricultural Extension Workers who are 10 in number (Uasin Gishu Integrated Development Plan, 2019). For this study, the sampling frame was drawn from households in 3 wards including Kapsoya Kaptagat, Ainabkoi/Olare wards in Ainabkoi sub-County who undertake different farming activities. Sample size was determined by us the sample size determination formula by Yamane (1967) [34] who suggested a simplified formula for calculation of sample size from a population. According to him, for a 95% confidence level and p = 0.5, size of the sample should be;

$$n = \frac{N}{[1+N\,(e^2)]}$$

Where, N is the population size and e is the level of precision.

Let this formula be used for our population, in which N =34,692 with a 5% level of precision.

Assuming 95% confidence level, we get the sample size as;

$$n = \frac{34,692}{1+34692(0.05^2)}$$

= 395 Households involved in different farming activities

This study used questionnaire as the instrument for data collection and an interview guide.

This study ensured the extension workers were sampled were aware of the data collection by providing prerequisite documentations and notifying them days before the activity commences.

Before actual data collection, a pilot study was done. The results of the pilot study was used to refine the measuring tools by removing redundancies and inconsistencies in the instruments after testing its validity. In this study, a pilot study was carried out in Moiben sub-county and it established that a reliability index for mixed farming was at 0.768. This was in agreement with Field (2009) [10], who established that a reliability index of 0.7 and above merited to be used in any given research. The validity of research instrument was carried out and the overall KMO value was established to be 0.647. The results above agrees with Field (2009) [10], that a validity index of the research instrument of 0.6 and above is considered reliable hence the overall index and that of each variables met the threshold.

The frequencies and percentages was used to establish the effect of agricultural diversification on socio-economic well-being of farmers in Uasin Gishu County. Data analysis was done using descriptive Statistics which include the mean, median, and mode, while variability measures include the standard deviation, variance, the minimum and maximum variables, and the kurtosis and skewness. While inferential statistics used included correlation, regression

Findings and Discussions

Introduction

These findings of the study are presented in this chapter based on the available data.as shown below.

Response rate

The study targeted a total of 395 respondents from among the households in Uasin Gishu County. Members from the households aged twenty years and above were considered for the study. A total of 309 questionnaires were returned, screened for completeness, and coded for analysis. This represented 78% response rate and was considered adequate for use in the analysis process. This is was complimented by Kothari (2019) [16], who established that a response rate for a field survey above 70% is appropriate for use in data analysis.

For this study, the 22% of the questionnaires were not returned and this was contributed by the fact that at the time of data collection there was no responsible person at the household to fill the questionnaires even after making follow ups. It was also noted that some of the questionnaires were not filled to the end hence they were discarded and not considered for the study. Others were not collected back completely because the respondents could not be traced during the time of collection. This data is presented in table 1 as shown below.

Table 1: Response Rate

Response	Distributed	Returned	Non response
Number of questionnaires	395	309	79
Percentage %	100	78	22

Furthermore, interviews were conducted in the County and all the 10 officers who were targeted were interviewed. The response rate for key informants was 100% since they were not many and data could be collected from them face to face in less than 1 hour.

Demographic Factors

The study sought to establish the response about the demographic factors of the respondents. Among the demographic factors that were analyzed include gender, age distribution, land size, farming period and kind of farming done by farmers in Uasin Gishu County. According to Adewuyi *et al.* (2020) [2], gender is a very important aspect of the household and hence it was very important for this study to understand the distribution of the gender as it has an influence on the household well-being. In regard to gender of the respondents, the study sought to establish the distribution of male and female respondents who participated in the study. Gender has an influence on agricultural diversification in any country because the male have a different perspective on the issue of food security from that of women. At the household level also there is an interplay between the flow of resources, kind of decisions that are made and the type of farming that should take place in it. The response was presented in figure 1 as shown below.

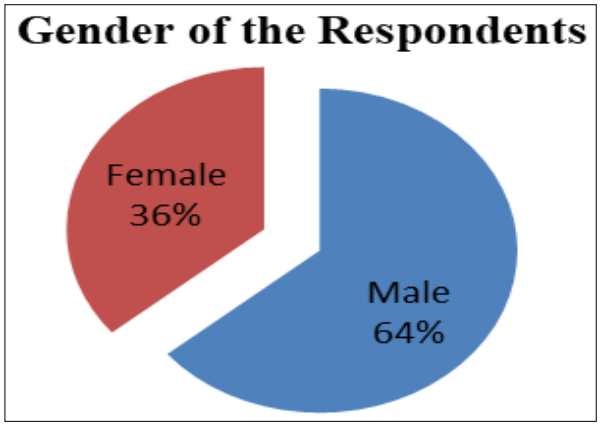

Fig 1: Gender Distribution

The results shows that there were more male respondents than female who participated in the study. From the figure above, 64% of the respondents were male while 36% were female. This results represent scenarios from male dominated communities where men are key decision makers in the family and hence they also influence flow of resources at the household level.

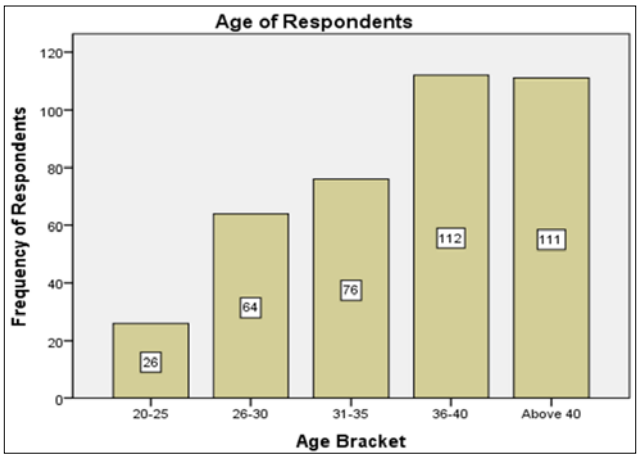

Fig 2: Age bracket of the respondents

The study sought to establish the age bracket of the respondents as it has an influence on farming activities in Uasin Gishu County. The study considered the respondents who were 20 years and above. The results show that 29% of the respondents who participated in the study were aged between 36-40 years followed by 28% who were aged above 40 years. A further 20% are aged between 31-35 years. Another 16% are aged between 26-30 years and lastly, those aged between 20-25 years was represented to be 7%. This shows that the number of people who are still productive in the agricultural sector was below 40% and hence could easily make decisions on the type of farming that was appropriate for them. The study concludes that majority of the farmers in the county are young and can easily influence the type of farming activities they feel can improve on the well-being.

The study also sought to establish the size of the land set aside for farming activities as it has a direct effect on agriculture and food security in the County. Secondly, the size of land depicts farmers' productivity levels in the study area. The results are presented in table 2 below

Table 2: Response on Land Size.

Land size	Frequency	Percent
Below 2 acres	87	28
3-5acres	74	24
5-9 acres	68	22
10 acres	56	18
Above 10 acres	25	8
Total	309	100

The results indicate that 28% of the farmers in the study area had land size below 2 acres while 24% of the farmers had a land size of 3-5acres. A further 22% of farmers had a land size 5-9 acres followed by 18 % of farmers who had 10 acres. Only 8 % the farmers had a size of land above 10 acres. This shows that most of the farmers had small pieces of land hence could not sufficiently merit for crop diversification. Furthermore, the study concludes that the small parcels of land negatively affected food production hence food insecurity in the study area.

The study further assessed the extent to which farming period had an influence on the diversification of farming activities in the study area. This was important because it informed the researcher on the extent to which farmers were familiar with the study area and could easily explain the extent of the success or failure of crop diversification in Uasin Gishu County. The results are presented in table 3 as shown below

Table 3: Period of Farming.

Farming period	Frequency	Percent
Below 2 years	43	13.9
2 years	34	11.1
5 years	105	33.9
10 years	73	23.7
Above 10 years	54	17.5
Total	309	100

The results indicate that 34% respondents who participated in the study had been into farming for 5 years. 23.7% of the respondents had practiced farming for 10 years followed by 17.5% who had practiced farming for over 10 years. A further 13.9% had practiced farming activities in the study area for 2 years and below and 11.1% had practiced farming for 2 years at the time of the study. This implies that most of

the farmers who participated in the study were aware of the agricultural activities in the study area since they had done it for more than 5 years. The study further concludes that the farmers had practiced farming for a relatively long time and therefore they understood clearly the farming dynamics in the study area and hence could make sound decisions regarding farming activities

The kind of farming was also an important aspect in understanding the effects of diversification of socio-economic welfare of farmers in Uasin-Gishu. The results were presented in figure 3.

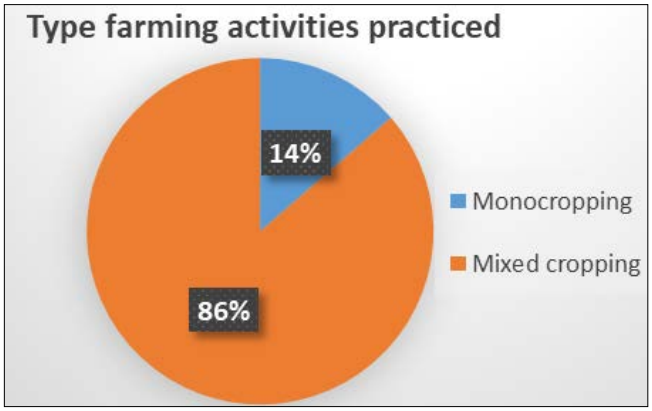

Fig 3: Type of farming activities practiced

The study showed that 86% of farmers involved in mixed farming while 14 % practiced mono cropping. This is a clear indication that farmers are aware of the benefits of mixed farming as compared to mono cropping as it improves house hold food security while mono cropping does not. According to Adewuyi *et al*. (2020) [2], with the advent of climate change, mixed farming is highly recommended in modern farming practices as it improves the socio-economic welfare of farmers globally. The study concludes that farmers in Uasin Gishu County are well versed with farming activities of all types since they fully understand their merits. The study further corroborated the findings of Lin (2011) [6], who noted that crop diversification enhances and promotes livelihoods and promotes maximization of land especially for small holder farmers.

Effects of mixed cropping on socio-economic welfare of farmers in Uasin Gishu County.

The study sought to assess the effect of mixed cropping on socio-economic welfare of farmers in Uasin Gishu County. The results were summarized using percentages, mean and standard deviation. The respondents were required to rate the statements on the five scale Likert where: 1= Strongly disagree; 2 = Disagree; 3= Not sure; 4= Agree; 5=strongly agree. Furthermore, M=Mean; SD=Standard Deviation. The results are presented in table 4 as shown below.

Table 4: Effect of mixed cropping on socio-economic welfare of farmers

Statement Items	1	2	3	4	5	M	SD
Socio economic welfare of farmers has been improved by planting drought resistant crops in Uasin Gishu County	4.1%	6.9%	9.5%	37.3%	42.2%	4.06	1.079
Farmers plant crops that take short periods of time in order to improve on their socio-economic welfare in the county	0.3%	5.9%	11.1%	27.8%	55.0%	4.31	.908
The revenue accrued from Agricultural production in Uasin Gishu county has improved farmers welfare in the county	1.8%	2.3%	13.6%	27.8%	54.5%	4.31	.918
Uasin Gishu county government has strategies in place to improve the socio economic welfare of farmers	0	7.2%	13.1%	32.9%	46.8%	4.91	.923
Farmers have improved their socio economic welfare through mixed cropping in Uasin Gishu county	0	1.0%	4.9%	30.6%	63.5%	4.57	.637
Mixed cropping has been adopted by many farmers in Uasin Gishu county	1.5%	5.9%	7.7%	24.4%	60.4%	4.36	.963

The results in table 4.4 show that 37.3% of the respondents agreed and 42.2% strongly agreed with the statement that the socio economic welfare of farmers has been improved by planting drought resistant crops in Uasin Gishu County. While 9.5 were not sure as to whether socio economic welfare of farmers has been improved by planting drought resistant crops in the study area. Also 6.9% and 4.1% disagreed and strongly disagreed as to whether socio economic welfare of farmers has been improved by planting drought resistant crops in the study area. This implies that most respondents who participated felt that planting drought resistant crops played a significant role in improving the socio-economic welfare of the farmers. The mean response of 4.06 and a standard deviation of 1.079 shows that more than half of the respondents have adopted the new technique of planting drought resistant crops.

The results also indicated that 55% of the respondents strongly agreed that most farmers planted crops that a take short period time in order to improve on their socio economic welfare in the study area. 27.8% of the respondents agreed that farmers planted crops that a take short period time in order to improve on their socio economic welfare in Uasin Gishu County. Only 0.3% strongly disagreed on the revenue accrued from agricultural production and strategies put in place by the county. This shows that most farmers in the study area are putting in the sector sufficient effort in the agricultural sector in order to their socio-economic welfare in the long run. Results further agree with the findings of Joshi (2005) [14], who noted that mixed cropping is ecologically applicable, cost effective and a means of boosting livelihoods for small holder farmers in developing countries.

According to the results above, 54.5% of the respondents indicated that revenue accrued from agricultural production in the County has improved farmers welfare in the study area while a further 27.85% of the respondents agreed with the statement. However, 2.3% and 1.8% of the respondents disagreed and strongly disagreed with the statement that that revenue accrued from agricultural production in the County has improved farmers welfare in the study area. The study concludes that most of the farmers practice mixed farming and are aware of the benefits that bare accrued from the same.

On whether Uasin Gishu county government has strategies in place to improve the socio economic welfare of farmers, 48.8% of farmers strongly agreed while 32.9 agreed. 13.1 of

the respondents were not sure as to whether Uasin Gishu county government has strategies in place to improve the socio economic welfare of farmers or not. However, 7.2 % 0f the respondents disagreed with the statement. This shows that most farmers were aware of the strategies that had been put in place by the County in order to improve their welfare. However, they could not tell how such strategies could improve their welfare and to what extent.

The results also sought to establish whether farmers have improved their socio economic welfare through mixed cropping in Uasin Gishu County. The results indicated that 63.5% of the farmers strongly agreed and 30.6% agreed with the statement above. 4.9% of the respondents were not sure as to whether farmers have improved their socio economic welfare through mixed cropping in Uasin Gishu County. Lastly, only one percent of the respondents disagreed with the statement above. The results concluded that farmers have improved their socio economic welfare through mixed cropping in Uasin Gishu County based on the response from most of the respondents. This shows that farmers who practice mixed cropping are getting the dividends of doing so since their socio-economic welfare has improved over time. The study findings are complimented with the findings of Lin (2011) [6], who noted that crop diversification enhances and promotes livelihoods and promotes maximization of land especially for small holder farmers.

The results further establishes that 60.4% of the respondents strongly agreed that many farmers have adopted mixed farming and therefore it had improved their socio-economic welfare.24.4% of farmers further agreed with the statement above. The mean response for adaptation of mixed farming by many farmers was 4.24 with a standard deviation of 1.033 further complimenting the response from respondents. The results generally show that most of the respondents were aware on the effect of mixed cropping on socio-economic welfare of farmers in Uasin Gishu County. Furthermore, farmers were aware of the benefits accrued from diversification of farming activities in the study area. This findings are further supported by the research done by Government of Kenya (2019), which established that crop diversification helps in advancing incomes and food production for small holder farmers in the Country.

Socio-economic welfare of farmers in Uasin Gishu County

The study sought to examine socio-economic welfare of farmers in Uasin Gishu County. The results were summarized using percentages, mean and standard deviation. The respondents were required to rate the statements on the five scale Likert where: 1= strongly disagree; 2 = Disagree; 3= Not sure; 4= Agree; 5=strongly agree. Furthermore, M=Mean; SD=Standard Deviation. The results are presented in table 5 as shown below`.

Table 5: Socio-economic welfare of farmers in Uasin Gishu County

Statement Items	1	2	3	4	5	M	SD
Farmers in Uasin Gishu County have their income improved due to Agricultural diversification in Uasin Gishu County	1.6%	1.6%	6.3%	27.3%	63.3%	4.49	0.813
Farmers have their employment needs met due to Agricultural Diversification in Uasin Gishu County	0.8%	3.9%	12.5%	49.2%	33.6%	4.11	0.825
Due to Agricultural diversification, food security of farmers has been improved in Uasin Gishu County	0.8%	0	10.2%	30.5%	58.6%	4.46	0.741
The socio-economic welfare of farmers have generally been improved due to diversification of the Agricultural sector in Uasin Gishu County	0.8%	0	10.2%	37.5%	51.6%	4.39	0.734
Due to improved socio-economic welfare in Uasin Gishu County, many farmers are investing in the agricultural sector	0.9%	3%	7%	25%	64.1%	4.48	0.823

On whether farmers in Uasin Gishu County have their income improved due to agricultural diversification, 63.3% of the respondents strongly agreed with the statement. A further 27.3% of the respondents agreed with the statement as well. Additionally, results revealed that 6.3% of the respondents were not sure with the above statement. Further analysis revealed that 1.6% of the responds disagreed and strongly disagreed with the above statement as well. The results further established a mean of 4.49 with a standard deviation of 0.813 indicating that indeed farmers were aware of the benefits agricultural diversification on their socio-economic welfare. The study agrees with the findings of Osman *et al* (2015), who noted that agricultural diversification should enable farmers to produce high value crops that would generate the highest returns for the improvement of their living standards.

The study sought to establish whether farmers had their employment needs met due to agricultural diversification in Uasin Gishu County. Results reveal that 49.2% of the respondents agreed with the statement while 33.6% of the respondents strongly disagreed with the statement as well. 12.5% of the respondents were not sure whether farmers had their employment needs met due to agricultural diversification in Uasin Gishu County. On the other hand, 3.9% and 0.8% of the respondents disagreed and strongly disagreed respectively that farmers had their employment needs met due to Agricultural Diversification in Uasin Gishu County. This is supported by the mean of 4.11 and a standard deviation of 0.825 implying that the agricultural sector in Uasin Gishu County employs over 70% of the residents and it is a determinant of the economy of the study area.

The study sought to establish whether it is due to agricultural diversification that food security of farmers has been improved in Uasin Gishu County. Results revealed that 58.6% and 30.5% of the respondents strongly agreed and agreed respectively that it is due to agricultural diversification that food security of farmers has been improved in Uasin Gishu County. Further analysis revealed that 10.2% of the respondents were not sure as to whether it is due to agricultural diversification that food security of farmers has been improved in Uasin Gishu County. Only 0.8% of the respondents strongly disagreed that it is due to agricultural diversification that food security of farmers has been improved in Uasin Gishu County. The study also generated a mean of 4.46 and a standard deviation of 0.741 indicating that they agreed that it is due to agricultural

diversification that food security of farmers has been improved in Uasin Gishu County.

On whether the socio-economic welfare of farmers has generally been improved due to diversification of the agricultural sector in Uasin Gishu County, results revealed that 51.6% and 37.5% of the respondents strongly agreed and agreed respectively with the statement above. Also, the study revealed that 10.2% of the respondents were not sure if the socio-economic welfare of farmers has generally been improved due to diversification of the Agricultural sector in Uasin Gishu County. 0.8% of the respondents strongly disagreed that the socio-economic welfare of farmers have generally been improved due to diversification of the agricultural sector in Uasin Gishu County. The study concludes that it is due to the diversification of the Agricultural sector in Uasin Gishu County that the welfare of farmers has improved since the results had a mean of 4.39 and a standard deviation of 0.734.The study further agrees with the findings of Zeller *et al,* (2016) [35], who established that the welfare of farmers can include combining food security, health, nutrition, education, housing, clothing, human and other civil rights amongst other perspectives.

The study also sought to examine whether it is due to improved socio-economic welfare in Uasin Gishu County that many farmers are investing in the agricultural sector. The study revealed that 64.1% and 25% strongly agreed and agree respectively with the above statement. Further analysis revealed that 7% of the respondents were not sure as to whether it is due to improved socio-economic welfare in Uasin Gishu County that many farmers are investing in the agricultural sector. Results further established that 3% of the respondents disagreed that it is due to improved socio-economic welfare in Uasin Gishu County that many farmers are investing in the agricultural sector. The study was further supported with a mean of 4.48 and a standard deviation of 0.823 revealing that it is due to improved socio-economic welfare in Uasin Gishu County that many farmers are investing in the agricultural sector

Correlation analysis

The nature of the relationship between mixed cropping and socio-economic welfare of farmers was determined by testing the correlation between the variables. According to Cohen, West and Aiken (2003), the nature of a relationship between variables under test is established using correlation analysis. This study used Pearson correlation (r) to test whether the relationship between the variables was significant or not at 95% level of confidence. The relationship between the two variables was considered to strong and significant if the r value was more than 0.6 and the p-value was < 0.05. It was considered to be moderate if the correlation (r) was between 0.5 and 0.6 and it was considered weak if the correlation (r) was < 0.5. The results are presented in the table 6 as shown below,

Table 6: Correlation analysis

Variable		Socio-economic welfare
Mixed cropping	Pearson Correlation	0.666**
	Sig. (2-tailed)	.000

In table 6, results indicated that there was high and significant correlation between mixed cropping and socio-economic welfare of farmers in the study area(r=0.666, p<0.05). This shows that mixed cropping has a high influence on the socio-economic welfare of farmers in Uasin Gishu County which is very significant.

Simple Linear Regression Analysis

Regression analysis assists in establishing the magnitude of relationship between and amongst variables. It is also used to establish whether the relationship between variables is statistical or just by chance. Moreover, regression analysis is also used to test the effectiveness of a variable in predicting the effect of the independent variable on dependent variable. The study tested regression analysis and summarized it as shown in table 7 below;

Table 7: Simple Linear Regression model summary

Independent Variables	R	R-Square	Adjusted R-Square	Standard Error	P-value
Mixed Cropping	.666[a]	.443	.442	.765	.000

Dependent Variable: Socio-economic welfare

From the study, R represents the correlation between dependent and the independent variables. The study established a positive and significant correlation between mixed-cropping and socio-economic welfare of farmers in Uasin Gishu County (R=0.666; p = 0.000). Furthermore the study used r-square to establish the magnitude of relationship between independent and dependent variables. In other words R-square was used to indicate the proportion of variance in the dependent variable that can be explained by a unit change in the independent variable. Results indicate that a unit change in mixed-cropping leads to 44.3% change in socio-economic welfare of farmers in the study area (R^2 = 0.443).

Summary, Conclusion and Recommendations

Summary of findings

The findings were summarized as follows;

Demographic Variables

The study sought to establish a number of demographic factors given that they also affect the socio-economic welfare of farmers in Uasin Gishu County. The response rate of the study was 78%. This was accepted as appropriate for further analysis of results since was tandem with Marton (2006), who noted that a response rate of above 70% is considered appropriate for a descriptive survey. Secondly, the study considered gender as a very important factor for this study. The study established that most of the respondents were male. This implies that men are the key decision makers at the household level and this had an influence on the response rate in Uasin Gishu County. Furthermore, this was a reflection of the power play at the household level in the study area.

Another factor that was considered for the study was age. Results established that most of the respondents were between 20 and 40 years. This shows that most of the respondents were still in the productive age and hence this had an influence on agricultural activities in the study area.

On whether land size had impact on the agricultural activities in the study area, the study established that most farmers had relatively large pieces of land dedicated towards agricultural activities in Uasin Gishu County. The study further noted that these agricultural activities had a direct influence on the food security and socio-economic welfare of farmers in Uasin Gishu County. The study also sought to examine the extent to which the period of farming had an influence on socio-economic welfare of farmers in the study area.

Majority of the respondents noted that they number of years of farming had an influence on the agricultural activities since this culminated into experience on farming activities in the study area. The study also sought to examine the kind of farming that farmers in the study area are involved in. Results revealed that most farmers are engaged in mixed farming as an activity since it was more convenient in the study area. The study concludes that this kind of farming is highly recommended in modern farming practices in the study area as it has a direct bearing on the socio-economic welfare of farmers not only in Uasin Gishu but also globally.

Effects of mixed cropping on socio-economic welfare of farmers in Uasin Gishu County.

The study sought to examine the extent to which mixed cropping affected the socio-economic welfare of farmers in Uasin Gishu County. The study sought to establish the extent to which respondents agreed and disagreed with various statements regarding mixed cropping in Uasin Gishu County. The results obtained established that most of the respondents noted that the socio economic welfare of farmers has been improved in the study area when farmers planted drought resistant crops in the county hence reducing crop losses as a result of drought and famine. This implies that most respondents who participated in the study were aware that planting drought resistant crops play a significant role in improving the socio-economic welfare of the farmers in the County. The results also indicated that most of the respondents were of the opinion that most farmers planted crops that a take short period time in order to improve on their socio economic welfare. This shows that most of the farmers in Uasin Gishu County are of the opinion that improving the socio economic welfare requires farmers to engage in agricultural activities that can yield results in a short period of time.

Most of the respondents were of the opinion that many farmers had adopted mixed farming and therefore it had improved their socio-economic welfare. This implies that mixed cropping/farming had significant returns to farmers than mono cropping. Most of the respondents further established that Uasin Gishu County had strategies put in place to help farmers who practice mixed cropping or farming. How these strategies influenced their socio-economic welfare in Uasin Gishu County is what they could not tell. Results further indicated that mixed cropping had been adopted by most farmers in the study area since it had better returns as compared to mono cropping

Further analysis revealed that there was a positive and significant correlation between mixed cropping and socio-economic welfare of farmers in the study area. Also, the results indicated that a unit change in mixed cropping had 44.3% change in the socio-economic welfare of farmers in Uasin Gishu County.

Conclusion

The main objective of the study was to establish the effect of mixed cropping on socio-economic welfare of the farmers in Uasin Gishu County. Based on the results obtained, the study concluded that mixed cropping has a strong and positive influence on socio-economic welfare of the farmers in the region. Also, the study concludes that most farmers take part in mixed cropping which has significantly influenced their socio-economic welfare in the study area. Based on results on regression analysis, the study concludes that the magnitude of relationship between mixed cropping and socio-economic welfare of farmers in Uasin Gishu County is very strong. The study further concludes that mixed cropping has greatly determined the socio-economic welfare of farmers in the study area.

Recommendations

The study recommends the following strategies for strengthening agricultural diversification amongst the smallholder farmers;

1. First, agricultural transformative policies should strengthen extension services with a special focus on cropping systems, viable crop enterprises, return from the different type of crops, needs and access to credit and irrigation facilities. This will aid in transfer of technology and enable the farmers to define their problems and come up with solutions on the best practical and agronomic methods on crop cultivation. Moreover, capacity building through extension services dramatically augments farmers' skills and knowledge for performing better in crop production.
2. There should be increased and guaranteed access to inputs and subsidies from the County Government of Uasin Gishu as well as other stakeholders and the priority should be given to farmers owning a small portion of land as they were more inclined to participate in crop diversification.
3. There is a need for farmers being in the forefront to learn from their progressive farmers. This can be achieved through small group formation amongst farmers region-wise to facilitate skills and experience sharing as well as providing a platform for the bargaining power of their produce.
4. There is also need to promote capacity building for certification of production systems according to internationally accredited systems that can provide possibilities for diversification within the traditional crop. With this to materialize, farmers need assistance in acquiring the technical knowledge of these systems and support in accessing related markets for their farm produce.
5. Furthermore, there is need for the public sector research systems to be promoted and funded by the County Government so as to widen their technical capabilities in new research and management areas evolving from the diversification process.
6. Lastly, farmers need to form producer groups so that they can galvanize their resources and promote collaborations for sustainable development in the agricultural sector. This will help in the formation farmer groups are sustainable and up to date with agricultural production related issues in Uasin Gishu County.

Areas for further studies

From the study and related conclusions, the researcher recommends the following areas for further studies;

1. Further studies should be done on the same variables in other counties to compare the findings. This will help in the validation or invalidation of current research results.
2. Also, research should focus on a multi stakeholder perspective that includes farmers, county extension workers, seed distributors and private agricultural extension workers, NGOs in the field of Agriculture in order to build more literature on the above subject
3. Other factors that determine socio-economic welfare of farmers in the study area other than the current variable should be studied so as to enable more research to be done and help farmers in achieving their farming objectives.

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