EFFECT OF LAND UTILIZATION PATTERNS ON FOOD SECURITY IN NAROK EAST SUB-COUNTY, NAROK COUNTY, KENYA

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ABSTRACT
Global food security is likely to remain a disaster globally for many years if the world cannot formulate methods to control the situation. By the year 2016, an estimated 120,000 people in rural areas and 30,000 in urban centers of Narok County were food insecure. This insecurity attributed to a mismatch in food availability, access and utilization. The purpose of this study was to establish effect of land utilization patterns on food security in Narok East sub-County. The study adopted human capability approach. A descriptive research design was adopted by the study. The target population comprised of 25078 households distributed proportionally in the 4 wards. A sample of 378 household heads was determined using Krejcie and Morgan's formula of 1970. Primary data was collected using a questionnaire and an interview guide. Data analysis was done using descriptive statistics of frequencies, percentages and inferential statistics of correlation, ANOVA and regression analysis. The results were presented using frequency and percentages, tables and charts. The relationship between the variables was tested at a significant level of 5%. Results show that there is a very strong positive and significant correlation between land utilization patterns and food security ($r = .752^{**}$ and a p-value of 0.000). This implies that the relationship between the variables is very significant hence land utilization patterns have a strong influence on food security in Narok East sub-County. The study concludes that the null hypothesis that there is no relationship between land utilization patterns and food security was rejected because there is a very significant and statistical relationship between the two variables. The study will be beneficial to the farmers in the ASAL areas who have consistently experienced food security issues and also other key stakeholders in food security discourse in Kenya.

Key words: *Arid and Semi-Arid areas, Food security, Land utilization patterns, Narok East sub-County*

1.0 Introduction

Collectively, food insecurity reduces global economic efficiency by 2% –3% yearly (USD 1.4–2.1 trillion), with individual nation costs projected at 10% of GDP (Harrigan 2014). Global food security is likely to remain a problem worldwide for the next 50 years and beyond if the world cannot formulate methods to control the situation. Béné, (2020), further establishes that the number of hungry people worldwide is growing, reaching 1.1 billion in 2019.

Africa has been struggling in one form or another with food insecurity for almost half a century due to a number of factors including distribution obstacles, global climate change, lack of successful local agriculture and inability or disinterest to act by local officials (Warr, 2015). Ever since food aid to Africa began in the late 1950s, the predicament has been characterized

as a supply affair. Inadequacy of successful and widespread agriculture in SSA led to the inability of local governments to provide enough food for their populations (FAO, 2011).

Only about 2% of arable land in Kenya is equipped for irrigation. Farmers struggle to gain access to adequate seed, fertilizer and other inputs (Poulton & Kanyinga, 2014). The effects of land use processes – a source of grave, albeit familiar, concern for many people in Kenya and in East Africa generally – present formidable threats to farmers. While most Kenya households have worthy food utilization (88%), around four million individuals (12% of families) have unacceptable food utilization dynamics.

According to the global food security index of 2017, Kenya is food insecure and was ranked position 86 out of 113 countries. A snap review of Kenya's food balance sheet shows that Kenya imports most of the basic food commodities including wheat, Maize, Rice, Beans, Potatoes, sugar and Milk (M'Kaibi, *et. al,* 2017). The big four agenda on Food Security proposes that there is need for proper policy and strategic interventions with a view to mitigating the challenges the sector faces (PDU, 2018). However, one of the main challenges in the implementation of the Agenda four is inadequate budgetary allocation towards the realization of food security goal in Kenya.

According to Kivisi (2019), pre- and post-harvest crop losses, inadequate research-extension-farmer linkages to increase agricultural productivity, lack of mechanized methods of production as well as high costs and adulterated farm input like fertilizer, seeds, pesticides and vaccines are some of the main challenges the Big Four Agenda is currently facing in Kenya. To achieve food security and proper nutrition for all Kenyans, the government targets to increase production of maize from 40 million 90 kg bags annually to 67 million bags by 2022; rice from around 125,000 metric tons currently to 400,000 metric tons by 2022 and potatoes from the current 1.6 million tons to about 2.5 Metric Tons by 2022 (Gwada, Ouko, Mayaka, & Dembele, 2020).

Narok County has the proportion of households in pastoral livelihood zone with acceptable food consumption score has declined from 93 percent 2016 to 68 percent in 2018, while in the agro-pastoral livelihood zone, it has declined from 20 percent to three percent in the same duration, indicating declining household dietary diversity and food frequency. The mean coping strategy score is at 17 as of 2019 implying that households are employing severe coping strategies and engaging less in consumption-related mechanisms (Gwada, *et. al,* 2020).

According to the Kenya National Bureau of Statistics (2019), Narok County has a population of 1,153,273 with a population density of 47 persons per square kilometer. Narok County is largely divided into 4 livelihood zones namely mixed farming, agro pastoral, pastoral and formal employment. More than one third (33.8%) of the population in Narok County lives under poverty line (KNBS, 2019). The main economic activities in Narok County are tourism given the Maasai Mara game reserve, commercial farming (wheat), and livestock farming.

1.1 Statement of the Problem

Food security remains one of the main concerns for the residents of Narok East sub County, Narok County (Kileteny and Wakhungu, 2019). The transition rate of food poor households to self-reliance of food supplies has largely remained inadequate (Gwada *et. al*, 2020). According to Kenya National Bureau of Statistics (2019), an estimated 120,000 people in rural areas and 30,000 in urban centers of Narok County remain food insecure. A good percentage of this population resides in Narok East which experiences high levels of drought throughout the year.

Kileteny and Wakhungu (2019), attributes food insecurity to low allocation of funds to the agricultural sector by Narok County government which has made it difficult to carry out the extension services to enhance farmer's knowledge in improving agricultural production. According to Action aid (2017), the County loses an estimated 40% of its produce due to poor post-harvest practices. Whereas it appears that there are many factors that determine the success or failure of food security initiatives in Narok County, the thrust of this study was to establish the extent to which land utilization patterns affect Food Security in Narok East sub-county.

1.3 General Objective of the study

The general objective of the study was to assess effect of land utilization patterns on food security in Narok East Sub-County, Narok County, Kenya

1.4 Hypothesis of the Study

The study was guided by the following hypothesis;

$H0_1$: There is no relationship between land utilization patterns and food security in Narok East sub-County, Narok County,Kenya

Literature Review

2.1 Human Capability Approach

This is an economic theory pioneered by Sen (1981) and advanced by Nussbaum (2001) and mainly focuses on what people are capable of doing. According to Sen (1981), pertinence of real freedoms in assessing an individuals advantage in the community and ensuring that such freedoms can be fully disributed for the whole community to enjoy available resources and opportunities is very key under this theory. The focus of the theory is mainly on advocacy for better livelihood among people in the society (Singh, *et. al.* 2017).

The approach further affirms that for peoples' capabilities to be at the center of development, there is need for them to own both movable and immovable property like land for their own utilization. Policies should be put in place on land ownership, land tenure systems and these policies should be pro-poor to enable them flourish in all dimensions of life. Despite improving the capacity of farmers to enhance food security, there is need for entitlement to these resources because ownership of resources enhances confidence hence increased investment and productivity.

2.2 Land utilization patterns on Food Security

According to Baltisen and Betsema (2016) on "Linking Land Governance and African Food Security: Outcomes from Uganda, Ghana and Ethiopia," land governance in Uganda is characterized by the inconsistency between relatively progressive legislation and only limited implementation. Baltisen and Betsema, (2016) further assert that women's position on land and inheritance also remains weak, both legally and in practice, undermining their livelihoods and social status.

In their study on ' Influence of Livelihoods on Household Food Security in Pastoral Areas of Narok County, Kenya, ' Kileteny and Wakhungu (2019), established that livelihoods are conceptually seen as comprising different types of capital that can profit individuals and, in particular, human, social, cultural, physical and natural resources possessed by and are at the disposal of individuals. Pastoralists have developed various adaptation mechanisms within this volatile, fragile, and complex climate to maintain an ecological balance between themselves and the natural environment (Hashim, *et. al,* 2016). In this case, land use is very poor due to

inadequate government incentives, harsh climatic conditions and the very tastes and preferences of the indigenous people living in the larger Narok County. This dilemma is further compounded by the use of low yield levels to raise inputs for both food and cash crops, resulting in low crop income levels (Dietz, *et. al,* 2014. Food security in the home is based on the premise that households can meet most of their food needs through their own production and/or market purchases.

According to Omari (2016), one of the main aspects considered for the analysis in a study on "Stakeholder Issues Influencing Implementation of Food Security Projects in Msambweni District, Kenya" was the extent at which land ownership influences food security projects in Msambweni District. The results stated that land ownership was found to be a determinant of food security for households. Relatively land-rich households almost all met 80 per cent of their calorie requirements. The study further suggested that a household with a greater holding of land was found to be in a better food security position than that of land-poor households.

2.3 Indicators of Food Security

Accessibility to food is a measure of the capacity to secure privileges that are characterized as the set of assets a person needs to get access food (FAO, 2011). Food security had been majorly connected to national food production and worldwide trade until the 1970s, however, since then the idea has extended to incorporate access to food for households and individuals. According to Sanchez *et. al.* (2009), food accessibility is established by the physical amounts of food that are produced, stored, prepared, supplied and exchanged.

Food availability is a measure of the capacity to ensure privileges, which are characterized as the set of assets that a person needs obtaining access to food (FAO, 2011). Food accessibility is the net residual sum after production, the quantity of stocks and imports and the deduction of exports for every item included in the food balance sheet (World Bank, 2018).

Zuberi and Thomas (2011), further note that high food market costs are commonly an impression of deficient accessibility; persistently high expenses force needy individuals to lower consumption underneath the minimum needed for healthy and active living, and may prompt food changes and social unrest. Rising water, land and fuel shortage is likely to put greater pressure to food upheavals, even without climate change.

3. Research Methodology/Materials and Methods

The study adopted a descriptive research design. This approach guided the study to gather both quantitative and qualitative analytical data. Quantitative data was collected from farmers (household heads) while qualitative data was collected from agricultural extension workers from Narok East sub-County, Kenya. The number of Households in Narok East sub-County is 25,078 (KNBS, 2019). 5 Agricultural Extension workers were used as key informants in the study. For this study, the sample was computed using sample size formula developed by Krejcie and Morgan (1970) as shown below:

$$n = \frac{\chi^2 \times N \times P(1-P)}{\left(ME^2 \times (N-1)\right) + \left(\chi^2 \times P \times (1-P)\right)}$$

Where

n = sample size

χ^2 = chi-square for the specified confidence level at 1 degree of freedom = (3.841) from tables

N = population size

P = population proportion (0.50 in the table)

$$n = \frac{3.841 \times 25078 \times 0.5 \times 0.5}{0.05^2 \times (25078 - 1) + 3.841 \times 0.5 \times 0.5}$$

$= 24081/(63.65)$

$= 378$ Households

An ordered questionnaire was adopted for this study as the principal instrument for data collection. For the Agricultural extension workers, an interview guide was used in the study. A total of 5 copies was produced for the study. For the pilot test, 10% of sample was selected and used and hence 38 farmers and 1 ward agricultural extension worker were used to establish the validity and reliability of research instruments. The pilot study was done in Narok West sub-County, Narok County. In order to establish the overall validity of the research instrument for the study, Coefficient of Validity index was established as follows;

CVI = Level of agreement between any of the two questionnaires X 100%
Number of items in the questionnaire

= 23/31*100%
= 0.7419
= 0.74

For this study, a reliability index of 0.837 was established. Questionnaires were analyzed using descriptive statistics of frequencies, means and percentages. Descriptive statistics used the Excel software for data analysis. Analysis was done and used to check the essence of the connection between dependent and independent factors while regression and ANOVA were used to test the model's fitness to explain the connection between variables.

4 Research Findings and Discussions

4.1 Findings of the Study

The findings of the study were presented in this section after, data analysis for the purpose of tabulation and interpretation.

4.1.1 Response Rate

The study distributed a total of 378 questionnaires and only 299 were returned and used for the analysis. Table 4.1 shows the response rate.

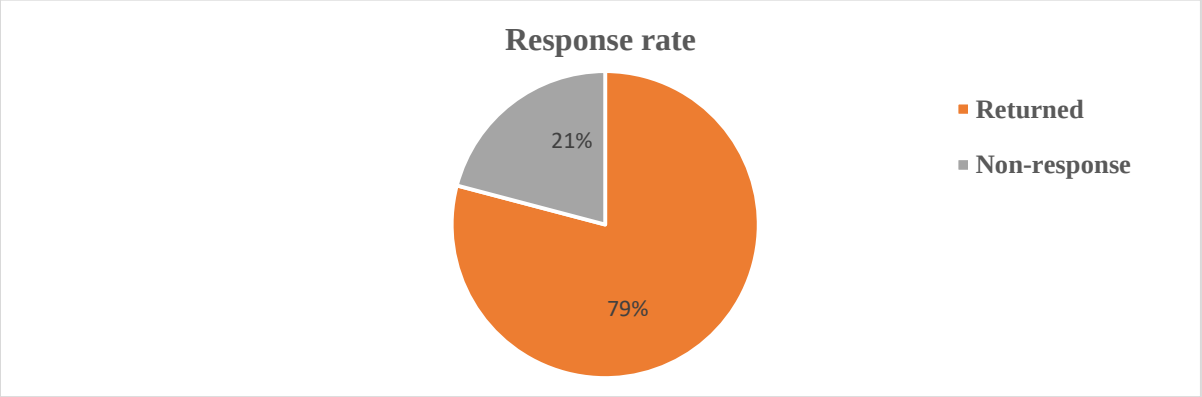

Figure 4.1: Response Rate

Figure 4.1 shows a 79% response rate, which was considered appropriate. According to Marton (2006), a response rate of above 70% is considered appropriate for a descriptive study. The interviews were conducted successfully and all the five officers who were targeted were interviewed.

4.1.2 Demographic Data

Demographic variables are important in any descriptive survey because they have an influence on the response and the overall results of the study. For this study the demographic variables

considered were; gender, education level, size of household, crops grown, land ownership titles, size of the land under crop cultivation and level of income.

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 the factors influencing food security in any country because of the differing perspectives between men and women. The response was presented in figure 4.2.

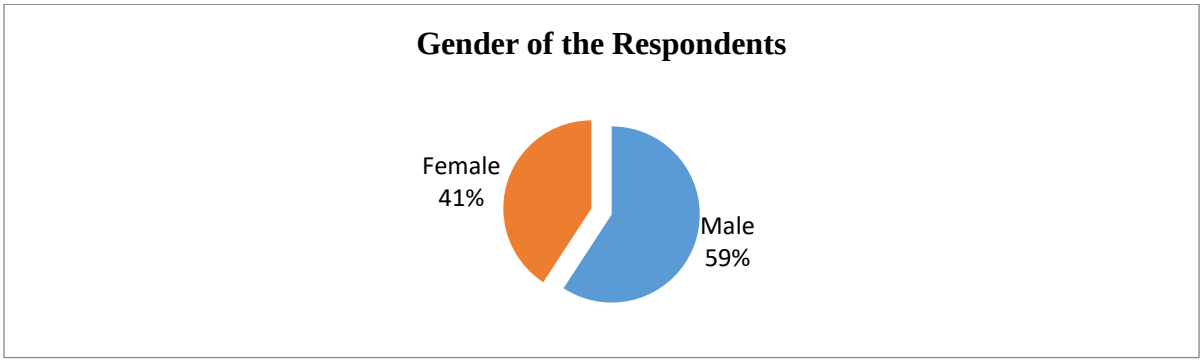

Figure 4.2: Gender of the Respondents

The results presented have indicated that 62% of the respondents were male compared to 38% female, though the margin was not very large to have influence on the overall findings of the study. This implies that most of the households that participated were headed by the male. Similar findings were noted by Alawode, Olaniran and Abegunde (2020), in their study on effect of land use and land market on food security status of farming households in South-Western Nigeria noted that majority of the farmers were male.

The study also sought to assess the response on the level of education of the respondents. The results are presented in Figure 4.3.

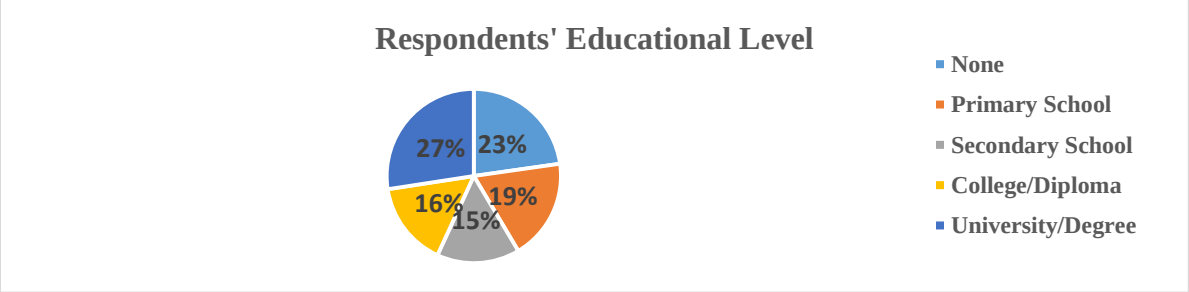

Figure 4.3: Education Level of Respondents

The results show that most of the respondents (27.8%) had attained university /degree level of education, 22.7 % had not attained any formal education, and 18.7% had only attained primary education while 15.7% and 15.4% had attained secondary school level and college / diploma respectively. Alawode, Olaniran and Abegunde (2020), noted that most of the farmers who have no good formal education can be contributing to low productivity and hence food insecurity in many developing nations.

The study also sought to find out the average house hold size among the target population. This was important for this study as it helped to assess the implication of the size of the house hold on food security in the area. The results are presented in Figure 4.4.

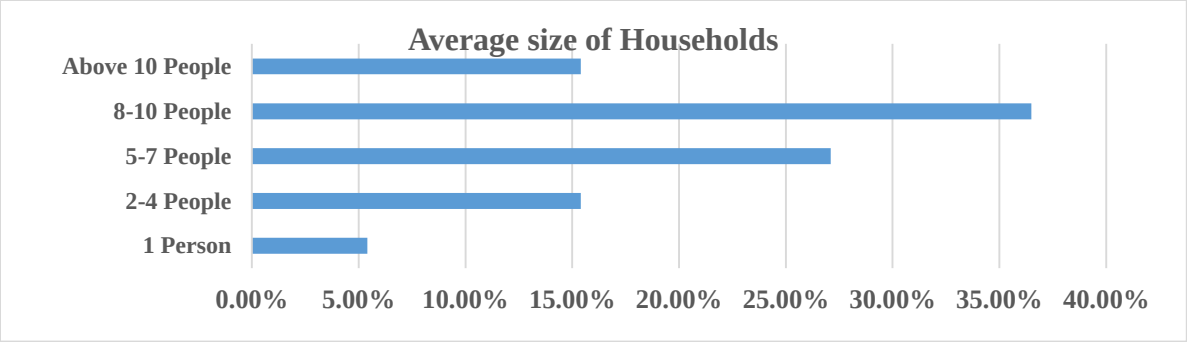

Figure 4.4: Average Size of Households

The study shows that majority of the households in the sub-County (36.5%) had an average of 8-10 persons followed by 27.1% who had an average of 5-7 persons, 15.7% had an average of above 10 persons while 15.4% had an average of 2-4 persons. This shows that most households were large and hence their demand for food was relatively higher a fact that could compromise food security in the area.

The study also sought to find out the type of crops grown in the study area. The results are presented in figure 4.5.

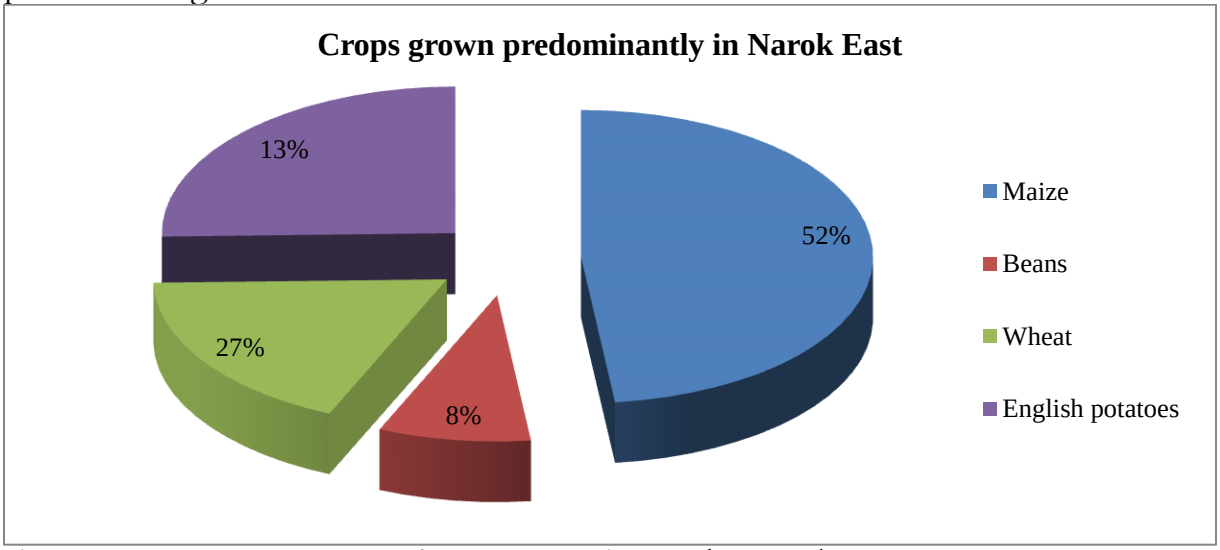

Figure 4.5: Response on types of crops grown in Narok East sub-County

The results show that most households (52 %) are involved in the growing of maize, followed by 27% who grow wheat. The study further establishes that 13% grow English potatoes and only 8 % grow beans. The results indicated that most farmers grow maize and wheat which are long duration crops and might affect the food security in the area.

In terms of the land ownership title, the study sought to find out whether the households owned the land and whether they had legal ground to the land. The results are presented in Figure 4.6.

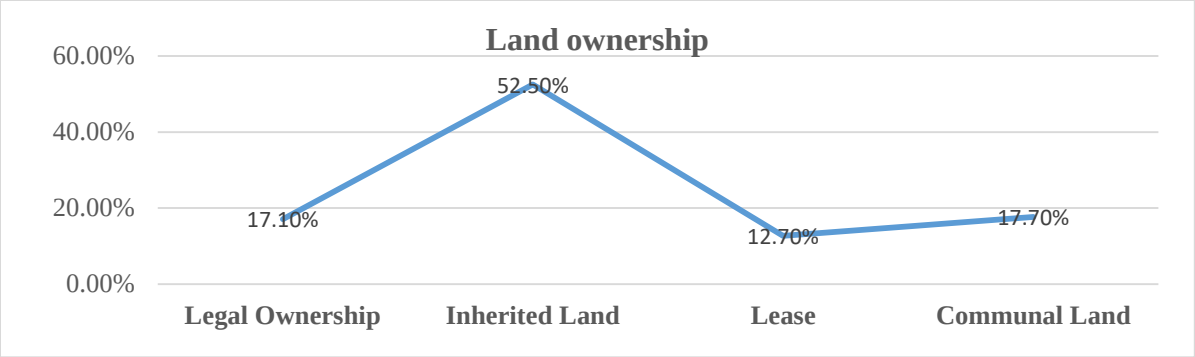

Figure 4.6: Response on Land Ownership

The results in figure 4.6 show that most (52.5%) of the respondents indicated that the land they possess was inherited, 17.7% indicated that they had communally owned land, 17.1 percent indicate that land was legally owned while only 12.7% indicated that the land was leased. Land ownership has an implication on the level of development one can be able to undertake on the land and this might have an influence on the food security in the area. This agrees with the findings of Alawode, (2013) who noted that the extent to which land ownership is acquired and acquisition has an influence on the way the land is used for agricultural production. The researcher further established that in rural areas, land can be acquired or transferred through inheritance, gift, purchase, loan, pledge and allocation by family head, local chief or any land custodian.

In regard to the size of the land under crop production the response of presented in Figure 4.7;

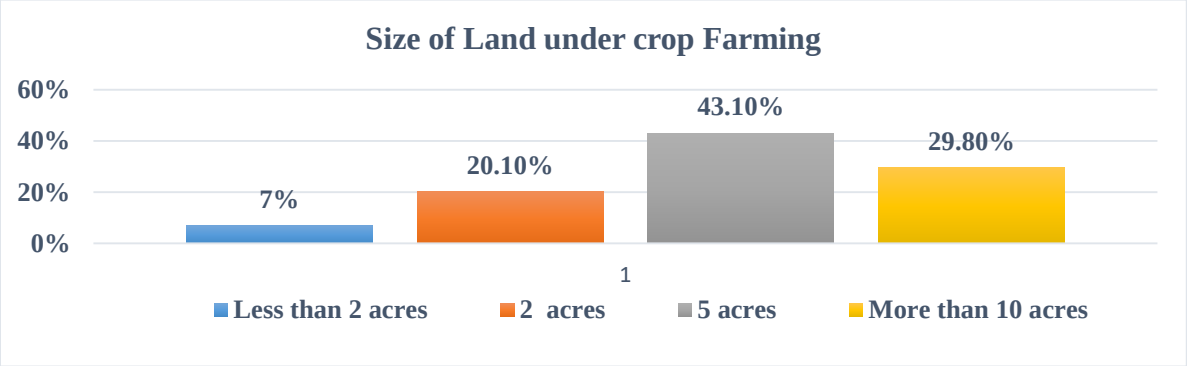

Figure 4.7: Size of Land under Crop Farming

The results show that 43.1% of the households had at least 5 acres of land under crop cultivation followed by 29.8% who had more than 10 acres, 20.1% had only 2 acres and 7.0 % had less than 2 acres under crop cultivation. This show that majority of the households had relatively large pieces of land for use in crop farming. This implies that the available land under crop farming is large enough to enhance food production. This agrees with the findings of Alawode, Olaniran and Abegunde (2020), who noted that land tenure system and the extent of competition by non-agricultural land users remain a major factor determining the extent of use of most agricultural lands in the rural areas in most African countries.

The study also sought to establish the number of years that respondents had been engaged in farming. The results are presented in figure 4.8

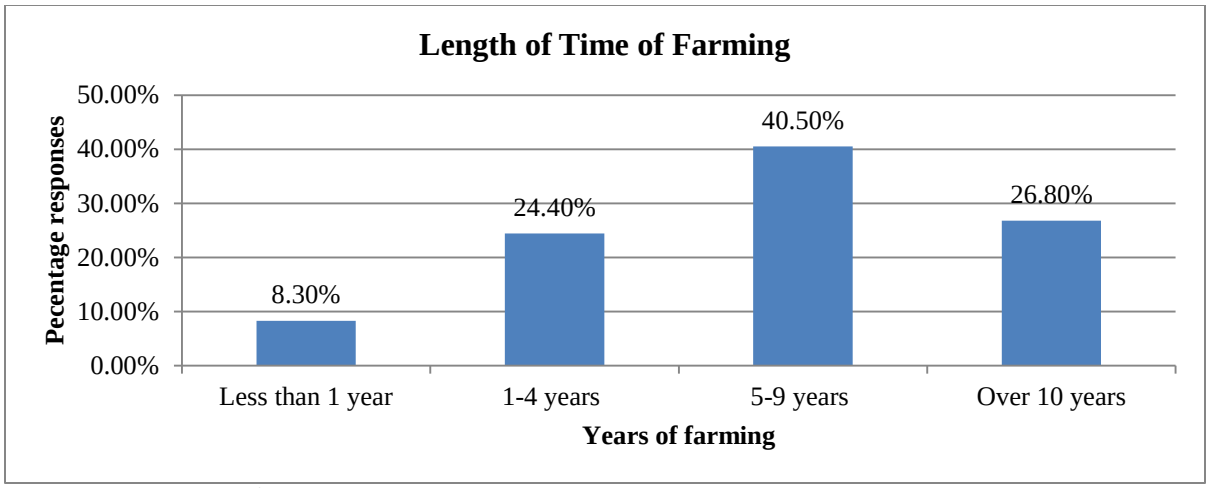

Figure 4.8: Years of Farming

The results show that majority of the respondents (40.47%) have been practising farming for between 5-9 years followed by 26.76% who have been in farming for over 10 years and 24.4% who have been in farming for between 1-4 years. The result shows that most of the respondents have been in the farming activities for more than 5 years. This implies that they have accumulated experience and understand how the farming activities influence food production and hence food security in the area.

The last demographic variable was to assess the level of income of the households. The results are presented in Figure 4.9.

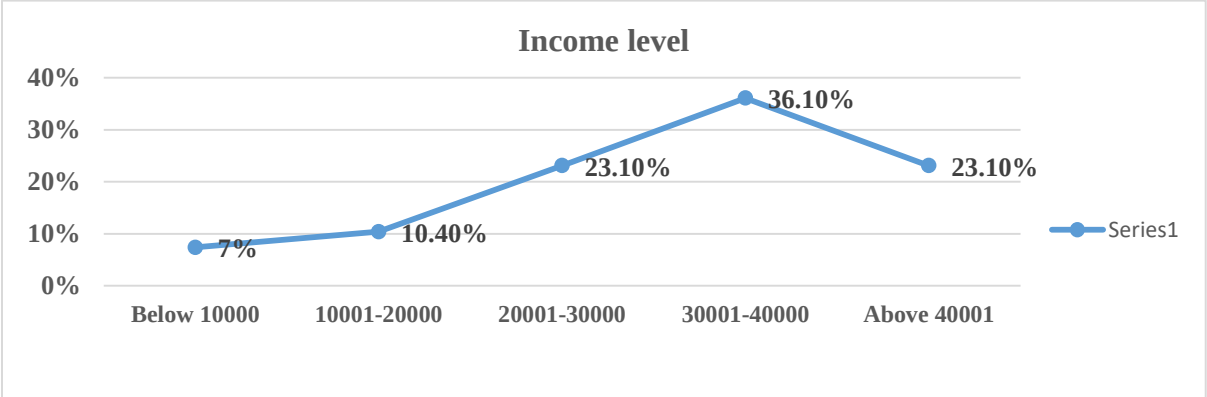

Table 4.9: Response on the Level of Income

The results show that majority of the respondents (36.1%) earned between Ksh 30,001 to 40,000, 23.1 % earned between Kshs 20,001 and 30,000 while another 23.1% earned above Kshs 40,001. Only few 10.4% and 7.4% earned between Kshs 10,001 and 20,000 and below Kshs 10,000 respectively. This implies that most households have average income that might not be enough to support their farming activities. The results agree with the findings of Chen and Ravallion (2008, who noted that over 1.4 billion people in the world live on less than US $1 a day which is the international poverty line.

4.3 Analysis for the Descriptive Statistics

This section presents the descriptive analysis of the results where the mean, percentages, standard deviation are discussed. In this section **SD** will stand for *Strongly Disagree*; **D** - *Disagree*, **NS**- *Not Sure;* **A** -*Agree*; **SA**- *Strongly Agree,* and **S.D.**- *Standard Deviation*

4.3.3 Extent to which land utilization patterns affect Food Security

The objective of the study sought to establish the extent to which Land utilization patterns determine food security Narok East Sub-County. The results of the study were analyzed descriptively using percentages, means and standard deviation in order to make deductions on how the respondents gave their response to various statement items describing the extent to which land utilization patterns determine food security in the study area. The results were presented in Table 4.1.

Table 4.1: Land utilization patterns and Food Security

Statement	SD	D	NS	A	SA	M	S. D
Food security has been determined by land utilization patterns in Narok East Sub-county	1.7%	6.0%	4.7%	19.7%	67.9%	4.46	.952
Land sub-division has determined food production in Narok East Sub-county	0	10.4%	3.0%	13.4%	73.2%	4.49	.967
The number of acreage on farming determines food security in Narok East Sub-county	0	3.7%	5.0%	21.4%	69.9%	4.58	.753
Mechanization practices have an implication on food security in Narok East Sub-county	0	34.8%	13.4%	19.1%	32.8%	3.50	1.267
Most farmers have indigenous ways of utilizing land for promoting food security in Narok East Sub-County, Narok County	1.0%	30.1%	20.4%	14.0%	31.4%	3.54	1.314
Land use is a prerequisite on food security in Narok East Sub-county	1.7%	0	4.0%	23.7%	70.6%	4.62	.721

The results show that most of the respondents (67.9%) strongly agreed, 19.7% agreed while only 1.7 % strongly disagreed while 6.0% disagreed with the statement that food security has been determined by land utilization patterns in the study area. Results further indicate that 4.7% of respondents were not sure as to whether food security has been determined by land utilization patterns in the study area. The results are further confirmed by the mean value of 4.46 and a standard deviation of .952. This implies that land use pattern in the study area is a determining factor of food security. This was confirmed by the interview results where Agricultural extension officers noted that the available land has been subdivided to smaller portions making productivity of food limited.

On whether land sub-division has determined food production in Narok East sub-County. The results indicated that 73.2% of the respondents strongly agreed with the statement, 13.4% agreed while 10.4% disagreed. A further 3% of respondents were not sure with the statement. The mean response was noted as 4.49 with a standard deviation of 0.967. This implies that and sub division has an influence on food production and hence affects food security in the area.

The study also sought to establish whether the number of acreage on farming determines food security in Narok East Sub-county. The results show that most of the respondents (69.9%) and 21.4% strongly agreed and agreed with the statement while only 5% were not sure of the statement. A further 3.7% of the respondents disagreed as to whether number of acreage on

farming determines food security in Narok East Sub-county The mean response of the study 4.58 and a standard deviation of 0.800 indicate that majority of the respondents agreed with the statement. This implies that the number of acreage under farming affects the production of food and hence is a determinant of food security in the study area.

On whether mechanization practices have an implication on food security in the study area, the results indicated that majority of the respondents (32.8%) strong agreed, 19.1% agreed while 34.8% disagreed and 13.4% were not sure with the statement. The mean response was 3.50 with a standard deviation of 1.267 indicating that most of respondents agree that mechanization practices have an implication on food security in the study area. This implies that mechanization practices have an implication on food security as they improve food production. Response from the extension officers further indicated that there is shortage of agricultural machinery which is critical in improving food productivity.

The study also established that majority respondents (31.4%) and 14.0% strongly agreed and agreed respectively that most of the farmers have indigenous ways of utilizing land for promoting food security. 30.1% of respondents disagreed with the statement while 20.4% were not sure as to whether farmers have indigenous ways of utilizing land for promoting food security. A further 1% of the respondents strongly disagreed farmers have indigenous ways of utilizing land for promoting food security. The mean response of 3.54 and standard deviation of 1.314 indicates that most of the respondents agreed with the statement. This implies that the way the farmers utilize their land especially the traditional way affects their production in the study area.

The study also sought to assess whether land use is a prerequisite on food security in Narok East Sub-county. Majority of the respondents (70.6%) strongly agreed, while 23.7% agreed .Further analysis indicated that 1.7% of the respondents strongly disagreed while 4.0% were not sure as to whether land use is a prerequisite on food security in Narok East Sub-county. The results further indicated that the response of 4.62 and standard deviation of 0.721 shows that majority of the respondents agreed with the statement. The results therefore indicate that land use is a determinant of food security in the study area.

4.3.5 Indicators of Food Security

The respondents were also required to rate the various indicators of food security which formed the dependent variable. These indicators were food availability, food utilization and food access. The results were analyzed descriptively using percentages, means and standard deviations in order to make deductions on how the respondents analyzed the various statement items describing the extent at which the study area is food secure. The results were presented in Table 4.2 as shown below.

Table 4.2: Response on the Indicators of Food Security

Statement	SD	D	NS	A	SA	M	S. D
Food availability has determined food security at household level in Narok East Sub-county	1.7%	2.3%	7.7%	14.7%	73.6%	4.56	.862
Food utilization determines food security at house hold level in Narok East Sub-county	0	12.7%	1.0%	23.1%	63.2%	4.37	1.009

Food security is determined by food access at household level in Narok East Sub-county	5.7%	4.0%	17.1%	13.4%	59.9%	4.18	1.189
Households have access to food whenever they need it in Narok East Sub-county	6.4%	12.7%	2.0%	11.0%	67.9%	4.21	1.319
Food is utilized by farmers to meet their dietary needs at household level in Narok East Sub-county	0	6.4%	7.0%	23.7%	62.9%	4.43	.877

The results shown on table 4.2 indicate that most of the respondents (73.6%) strongly agreed, 14.7% agreed while 1.7 % and 2.3% strongly disagreed and disagreed respectively that food availability determines food security at household level in Narok East Sub-county. Further analysis however revealed that 7.7% of the respondents were not sure as to whether food availability determines food security at household level in Narok East Sub-county. The mean response was 4.56 with a standard deviation of 0.862 confirmed this statement. This implies that availability of food was a determinant of food security in Narok East sub-County.

The study also sought to find out whether food utilization determines food security at house hold level in the study area. The results show that most of the respondents (63.2%) strongly agreed, 23.1% agreed while 12.7% disagreed that indeed food utilization determines food security at house hold level in the study area. However, 1% of the respondents still were not sure as to whether food utilization determines food security at house hold level in the study area or not. The mean response was 4.35 with a standard deviation of 1.009 implied that food utilization is a determinant of food security in the sub-county. This means that if the available food is well utilized at household level, then it will have an influence on food security Narok East Sub-county generally.

The results also show that most of the respondents (59.9%) strongly agreed while 13.4% agreed that Food security is determined by food access at household level in Narok East Sub-county. Only 4 % and 5.7% of the respondents disagreed and strongly disagreed with the statement food security is determined by food access at household level in Narok East Sub-county. However, 17.1 percent of the respondents were not sure as to whether food security is determined by food access at household level in Narok East Sub-county. The mean response was 4.21 with a standard deviation of 1.189 confirms that majority of the respondents agreed with the statement but still a good number of respondents still are of a different opinion. This implies that food security is determined by food access at the house hold level in the study area if all other factors are held constant.

It was also noted that majority of the respondents (67.9%) and 11 % strongly agreed and agreed with the statement that households access to food whenever they need it. Further analysis indicated that 12.7% and 6.4% of the respondents strongly disagreed and disagreed with the statement that households' access to food whenever they need it indicates food security in the area. However, 2% of the respondents are not sure whether households access to food whenever they need it. The mean of 4.43 and a standard deviation of 1.319 confirm this argument. However, the extension workers further revealed that generally majority of the households have no access to food. Further analysis from interviews reveals that most households in Narok East Sub-county are generally food insecure since access to food in the study area has been hampered by other factors like inadequate roads and the purchasing power of residents.

Furthermore, the study also sought to examine whether food is utilized by farmers to meet their dietary needs at household level in Narok East Sub-county. The findings of the study indicated that 62.9% of the respondents strongly agreed and 23.7% agreed with the statement above. Further analysis indicated that 7% of the respondents were not sure of whether food was utilized by farmers to meet their dietary needs in the study area. The study further established that 6.4 % of the respondents disagreed with the statement above. This was further supported with a mean of 4.43 and a standard deviation of 0.877 which shows that majority of the respondents agreed with the statement above

4.4 Analysis of Inferential statistics

The study sought to assess whether there was a statistically significant relationship between the variables. The analysis was done at three levels, determining the factor loading, Pearson's correlation and regression analysis.

4.4.1 Correlation Analysis for Land utilization patterns on Food Security

The study sought to establish the nature of the relationship between land utilization patterns and food security. This was tested using correlation coefficients as suggested by Cohen, West and Aiken, (2003). The relationship between the two variables was considered significant if the p value was less than 0.05. It was considered to be weak if the correlation (r) < 0.5 and it was considered to be strong if the correlation (r) was > 0.5. The results are presented in Table 4.3.

Table 4.3: Pearson Correlation analysis between land utilization patterns and food security

		Land utilization patterns	Food Security
Land utilization patterns	Pearson Correlation	1	.752**
	Sig. (2-tailed)		.000
	N	299	299

**. Correlation is significant at the 0.05 level (2-tailed).

The results further show that there is a very strong positive and significant correlation between land utilization patterns and food security ($r = .752^{**}$ and a $p = 0.000$). This implies that the relationship between the variables is very significant. This supports the work of Alawode, Olaniran and Abegunde (2020), who established that land use patterns adopted by the farmers has a significant positive effect on the food security status of the household, implying that adoption of an appropriate and use pattern enhances the food security status of farming households.

4.4.2 Test of hypothesis

The study used analysis of variance test to either accept or reject the null hypothesis. It also helps in checking whether the model fit is appropriate in making inference to the entire study population. The study established the model fitness by comparing the F- calculated and F-critical values. The results are shown in Table 4.4.

Table 4.4: ANOVA Relationship between land utilization patterns and food security

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	114.671	1	114.671	385.455	.000[b]
	Residual	88.356	297	.297		
	Total	203.027	298			

The results show that the F-statistic was very significant at 5% level of significance, implying that the model is a good predictor of the relationship between land utilization patterns and food security. The results shown in Table 4.4 shows that the F- calculated was greater than F-critical values. The F-calculated ($F_{0.05, 1, 297}$) was 385.455 which was much greater than F-Critical, ($F_{0.05, 1, 297}$) of 3.878. Since F-calculated, was greater than F-Critical, then the null hypothesis that there is no relationship between land utilization patterns and food security was rejected and the study concluded that the model is a good predictor of the relationship between land utilization patterns and food security.

Table 4.5: Model Summary

Independent variable	R	R-Square	Adjusted R Square	Std. Error of the Estimate	P-value
Land utilization patterns	.752[a]	.565	.563	.545	.000[b]

Dependent variable: Food Security

For land utilization patterns and food security, results show that the correlation is very strong, positive and significant (R = 0.752; p-value = 0.000). Further analysis was done using the R square which indicates the proportion of variance in the dependent variable that can be explained by a unit change in the independent variable. The results show that a unit change in land utilization patterns can explain 56.5% change in food security (R^2 = 0.565). This implies that land utilization patterns is a significant determinants of food security in Narok East Sub-County.

The results were further analyzed to develop the simple linear regression models for the four objectives. The results were presented in Table 4.6.

Table 4.6: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.517	.198		2.614	.009
	Land utilization patterns	.913	.047	.752	19.633	.000

From table 4.6, the data indicates that the simple linear regression can be modeled as follows for this variable; $y = 0.517 + 0.913x + 0.198$. The model is statistically significant given that the *t*- statistic (19.633) is more +2 and *p*-value <0.05.

4.8 Analysis of Variance

The ANOVA was used to check the ability of the regression model to be used to predict the relationship between the variables. Using the F-statistic and the mean square differences the results were computed and presented in Table 4.7.

Table 4.7: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	126.910	4	31.728	122.546	.000[b]
	Residual	76.117	294	.259		
	Total	203.027	298			

The results show that the F-statistic was very significant at 5% level of significance implying that the model is a good predictor of the change in the food security in the sub-County. In order to establish whether the model was fit for use in further prediction the F-statistic

computed was compared to the F-critical values. The result for F-calculated showed $F_{(0.05, 4, 294)}$ =178.701 compared to the F-Critical, $F_{(0.05, 4, 294)}$ which was 2.403. Since F calculated is greater than F-Critical at $F_{(0.05, 4, 294)}$. Therefore, the study concluded that the model is a good predictor of the relationship between the dependent and independent variables. This is further supported by the p-value of 0.000 which is very significant at 5% level of significance.

4.9 Regression Coefficients

The study further sought to determine the regressions model based on the coefficient beta values. The results were presented in Table 4.8.

Table 4.8: Regression Coefficient

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-1.000	.312		-3.204	.002
Land utilization patterns	.744	.056	.612	13.308	.000

The results show that the standardized coefficients of beta values explain the contribution of independent variables to the dependent variable. From the results shown, the study established that the contribution of land utilization patterns to food security accounts to 61.2%. The contribution is statistically significant given that the t-statistic of 13.308 is greater than + 2 and the *p*-value of < 0.05.

Summary, Conclusions and Recommendations

5.1 Summary of the Findings

5.1.1 Demographic variables

The response rate was 79% which was accepted as appropriate for further analysis of the study results. The study established that 62% of the households were headed by the males which implied that men were the main decision makers at the household unit in the study area. In regard to level of education, it was established that there was varied levels of education where some had degrees while others had the basic education. The study further assessed the size of the house hold in the study area and established that majority households (36.5%) had an average of 8-10 persons. The study further established that most households (52%) in the study area are involved in maize production. On land ownership, the study established that most respondents (52.5%) indicated that the land was mainly inherited or communally owned which might be a contributing factor to the state of food security in the study area.

It was also established that the size of land under crop cultivation was at least 5 acres in comparison to the actual size of the land. This implies that most households had committed a small proportion for food production hence contributing to the food security issues in the study area. The study further noted that most of the respondents had been in the farming practice for between 5-9 years hence it implies that they have accumulated experience and understand how the farming activities determine food production in the study area. The study also established that at least 36.1% of the respondents earned between Ksh 30,001 to 40,000, indicating an average income which was not enough to sustain increased demand for food production in Narok East.

5.1.2 Extent to which Land utilization patterns Determine Food Security

The objective study sought to establish the extent to which Land utilization patterns determine food security Narok East sub-County. The study established that most respondents agreed that food security is determined by land utilization patterns in the study area. This implies that the

various activities dedicated towards utilizing the available land may be directed towards food production or otherwise. This was also informed by the response from the Agricultural extension officers who noted that land utilization patterns affected the food production in the study area since it cannot be controlled by the County. Farmers are the key stakeholders who determine how they want to utilize their land.

The study also established that land sub-division affected food production in Narok East sub-County. Land sub-division affected the number of acres under production which in turn affected the amount of food produced and hence food insecurity. The results also showed that mechanization practices have an implication on food security as they improve food production. However, most respondents indicated that the necessary machinery were very limited in the study area and this affected their ability to enhance production. Response from the extension officers further indicated that there is shortage of agricultural machinery which is critical in improving food productivity. Inadequacy in the machinery has adversely affected land preparation, planting and harvesting hence compromising food production as farmers end up preparing land and planting when the planting season is long overdue.

Further analysis established that land use is a prerequisite on food security in Narok East sub-County. Based on the inferential analysis, the study established that there was a very strong positive and significant correlation between land utilization patterns and food security in the Narok East sub- County. The null hypothesis that there is no relationship between land use and food security was rejected because the ANOVA model indicated a very significant and statistical relationship between the variables.

5.2 Conclusions

The main objective of this study was to analyze influence of factors that determine household food security in Narok East sub-County. The findings of the study revealed that most of the households in Narok East sub-County were food insecure. Furthermore, the study concluded that there was a strong relationship between land utilization patterns and food security in the study area. In general, as food insecurity still remains prevalent among farming households in the study area. Further analysis revealed households with higher acreage of land under farming were able to achieve comparable levels of food security as compared to those who did farming on a small parcel of land. Also, adoption of appropriate land use techniques also impacted positively on the food security of the households that took place in farming activities in the study area.

5.3 Recommendations

The study further provided key recommendations as follows;
First, Narok County Government should establish alliances/collaboration with all sectors in the agricultural sector in order to develop programs for improving food security and income generation among the households in order to boost the income of farmers at the micro level.

Secondly, the study recommends that the County government should build a platform to promote dialogue and cooperation among relevant institutions and establish programs in all sectors with the aim of developing an extension and information services network for households in Narok County.

The County Government should discourage land sub-division in order to free more land for food production and hence food security in the study area. Policies on land use should be formulated in order to discourage farmers from utilizing land for aspects that is not food production.

The County Government should formulate a reasonable crop production system is necessary to improve land use efficiency. Therefore, there is need to improve the agricultural sector by using suitable crop strains, developing technology and implementing a reasonable strategy.
Additionally, Research and development needs to be promoted and supported by Narok County government so as to ensure continued research and dissemination of research findings to the household level so as to benefit farmers at the micro level.

5.4 Areas for further study

The current study proposes the following areas for further studies;
Further studies on land utilization patterns needs to be conducted in other ASAL counties to compare the findings. This will enable the current study to be inferred to the larger research universe since this will further establish the gaps that are inherent in the current study and universalize the findings
There is also need for further studies that will focus a multi stakeholder approach including the farmers, seed distributors/companies, private agricultural extension workers, NGOs in the field of Agriculture and the National Government in order to build more literature on food security in Narok County specifically and in the Country generally.
There is need of assessing other factors that determine food security in the study in Narok East sub-County other than the aforementioned as it will enable more research to be done and help farmers in achieving their farming objectives.

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