



MDP-IFAD RESEARCH REPORT

**APPRAISAL OF CLIMATE RESILIENT AGRICULTURAL PRACTICE ON THE
PRODUCTIVITY OF FEMALE SMALLHOLDER CEREAL FARMERS
IN EMBU COUNTY, KENYA.**

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ACRONYMS and ABBREVIATIONS

ASAL- Arid and Semi-Arid Lands

ASAP -Adaptation for Smallholder Agriculture Programme

CA - Conservation Agriculture

CRAP- Climate Resilient Agricultural Practice

EAGC- East African Grain Council

EBL -Equity Bank Limited

EGF -Equity Group Foundation

EU -European Union

FAO -Food and Agriculture Organisation

FGD- Focus Group Discussion

GOK- Government of Kenya

IFAD -International Fund for Agricultural Development

KCEP -Kenya Cereal Enhancement Programme

KCEP-CRAL -Kenya Cereal Enhancement Programme – Climate Resilient Agricultural Livelihoods Window

KII - Key Informant Interview

M&E -Monitoring and Evaluation

NRM -Natural Resource Management

PCU - Programme Coordinating Unit

SDGs -Sustainable Development Goals

SPSS - Statistical Package for Social Sciences

SSA - Sub Saharan Africa

USD -United States Dollar

WB- World Bank

EXECUTIVE SUMMARY

Climate change is a universal challenge with no limitations, which has posed a threat to the survival of the green scenery. This challenge requires a coordinated and combined effort to combat. Changes in climate which results from global warming, has affected the greens thereby tampering with the production of crops. Crop production appears to be vulnerable to climate variability, due to increase in CO₂, increase in temperature and changes in the pattern of rainfall, and most often leads to decline in crop production. Kenya, which is a country with a lot of agricultural capacities and prospects has had their agricultural productivity truncated due to these extreme climatic changes.

However, adaptation, mitigation, capacity building and availability of funds through combined efforts as been seen as ways to enhance the production of crops. Adaptation to climate variability and extreme events serves as the basis for reducing vulnerability to long-term climate change. KCEP-CRAL has contributed immensely to improved productivity of the farmers amidst the extreme climatic conditions by putting in place simple adaptation practices such as the use of drought resistant crops or thermal stress-tolerant varieties, planting of crops with accurate timing of rainfall, promoting water conservation, and management practices which includes using efficient fertilizer management, diversifying crops, and improving pest management which could help reduce climatic threats. The study was expected to: Evaluate the perception of the farmers on climate change; Assess the perceived impact of climate change on cereal production; Examines the climate resilient practices employed by female farmers in Embu County; Examine the impact of climate resilient practices on female smallholder farmers; Appraise the challenges faced by the female smallholder farmers in Embu County. The study was carried out in six wards, which includes: Mwea, Makima, Kiambeere, Mbeti South, Nthawa and Evurore. This survey utilized a number of approaches and methodology including literature review of numerous Programme documents, and other published literature sources. In addition, quantitative and qualitative research methodologies were applied including: individual household (HH) interviews; Focus Group Discussions (FGDs); Key Informant Interviews (KIIs), structured observation and informed judgment. A total of 334 farmers were interviewed, out of which 200 were beneficiaries of KCEP-CRAL and 134 non beneficiary farmers, 2 FGDs contacted and 4 KIIs.

Results indicate that adoption of climate resilient agricultural practices has led to improved productivity of the female smallholder farmers. A test of change was carried out using the Mann-Whitney U test, which reveals that a statistically significant change was observed in the income level of the female cereal farmers before and during the program ($p < 0.001$). The average annual income of farmers used to be lesser than 40,000 Kenya shilling prior KCEP-CRAL, subsequently, there has been an annual average income of 65,000 Kenya shilling, this is due to the increased transition in harvest rate from 47% to 53%.

Conclusively, through the observation from this report, cereal farmers in Embu County, have experienced significant changes that KCEP-CRAL's intervention imparts, through the climate resilient agricultural practices employed, there has been increased the quality farm activities and farm yields amidst the dilapidating weather conditions. However, it is observed that no significant measures has been structured on mitigating the effects of this extreme climatic conditions, only adaptation options are explored which has not tackled the farmers challenge totally because they still depend solely on rainfall to grow their produce. As a response to climate change, adoption of renewable energy sources, promotion of sustainable forest and land use should be considered to mitigate the effects of drought, also more practice of irrigation could reduce the effects of extreme climate variability.

Keywords: Climate change, climate variability, climate resilient agricultural practice, productivity.

CHAPTER ONE: INTRODUCTION

1.1 Background of Study

Smallholder agriculture is not just a source of food but a driver of economic development, particularly for the 75 percent of the world's poor who live in rural areas. However, agricultural production is straining natural resources, suggesting that productivity improvements are required to feed a growing population (FAO et al., 2017). Agriculture and food security are further threatened by climate change, particularly in Sub-Saharan Africa, and particularly for smallholder farmers (Morton, 2007; Schlenker and Lobell, 2010; Wheeler and von Braun, 2013). Climate change has already substantially reduced production in many parts of the world (Lobell et al., 2011). In response, governments and development agencies are encouraging the adoption of 'climate smart' agricultural technologies, including conservation agriculture, with the goal of bolstering productivity, enhancing resilience to weather shocks, and reducing negative externalities (FAO, 2013; Lipper et al., 2014).

In Kenya, the bulk of their economic growth is largely dependent on the agricultural sector, about 75% of Kenyans owe their livelihood to agriculture with cereal as their major production. The National Cereals and Produce Board of Kenya (NCPB) established in 1985 under the National Cereals and Produce Board Act (Cap 338) of the laws of Kenya is mandated by the Government to regulate and control the marketing and processing of grains in Kenya. This is done for licensing and regulating the key players in the sector, which include traders, farmers and millers among others,(Grain Production in Kenya, 2005).

Women, contribute immensely to the agricultural and rural economies in all developing countries. Women's activities typically include producing agricultural crops, taking care of animals, processing and preparing food, taking paid employment in agricultural or other rural enterprises, collecting fuel wood and water, engaging in trade and marketing, caring for family members and maintaining their homes (FAO, 2011a). In most developing countries, women's role has been relegated, due to the fact that women, in almost every nation, face more severe constraints than men in access to productive resources. Recognizing the different roles that women and men play in the agriculture sector is key to identifying the diverse challenges they face and to tailoring projects and programmes on their specific needs.

Women's empowerment would increase the productivity of these agricultural produce (cereal). Study has also shown that women's empowerment in Kenya agriculture can spur increased maize productivity among smallholder farmer households. Whereas all women's empowerment indicators (except *workload*) significantly increased productivity, the number of production decisions indicators seems to have greatest effect on productivity. The results further show that, female- and male- managed plots experienced significant improvements in productivity when the women who tended them were more empowered. These results suggest that future rural development interventions that aim to increase agricultural productivity in Kenya could achieve greater impact by integrating women's empowerment into existing and future projects, e.g., by focusing on women's access to credit, asset accumulation and community leadership. (PMC, 2018).

The development agenda for Kenya is being widely affected by climate change and its resultant impacts, which could cost the economy a significant percentage of the country's GDP.

1.1.1 Kenya Cereal Enhancement Program, Climate Resilient Agricultural Livelihood (KCEP-CRAL)

Kenya Cereal Enhancement Program, Climate Resilient Agricultural Livelihood (KCEP-CRAL) is a seven year project (2015-2022) funded by Government of Kenya (GOK), International Fund for Agricultural Development (IFAD). The goal of the project is to “*contribute to the reduction of rural poverty and food insecurity of smallholders in the ASALs by developing their economic potential while improving their natural resources management capacity and resilience to climate change in an increasingly fragile ecosystem*”. This goal is pursued via two development objectives which reflect the poverty-environment nexus namely:

- (i) To graduate smallholder farmers to commercially oriented, climate resilient agricultural practices through improvements in productivity, post-production management practices and market linkages for targeted value chains.
- (ii) To empower the target county governments and communities to sustainably and consensually manage their natural resources and build their resilience to climate change.

The objectives of KCEP-CRAL are in line with:

Kenya's Vision 2030: The Kenya's long-standing development plan which aims at creating a “*globally competitive and prosperous country with a high quality of life by 2030*” and “*providing a high quality of life to all its citizens in a clean and secure environment*”.

And is directly addressing the following SDGs:

Goal 2: End Hunger, achieve food security, improved nutrition and promote sustainable agriculture;

Goal 5: Achieve gender equality and empower all women and girls;

Goal 6: Ensure access to water and sanitation for all;

Goal 13: Take urgent action to combat climate change and its impacts;

Goal 15: sustainably manage forests, combat desertification, halt and reverse land degradation halt biodiversity loss.

Goal 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

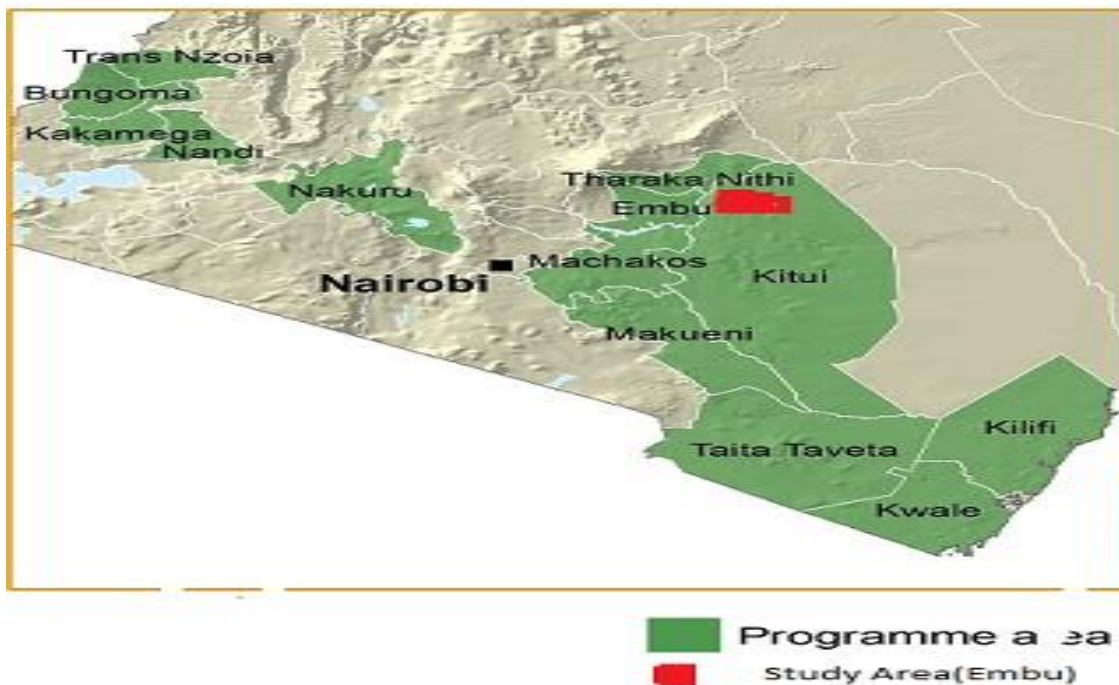


Figure 2.1: Map showing the coverage of KCEP-CRAL

Source: (IFAD, 2014)

1.2 Problem Statement

The cumulative impacts of climate change have the potential to reverse much of the progress made towards the attainment of the Sustainable Development Goals (SDGs) and Kenya's development blueprint-Vision 2030. Most of the people in Kenya are vulnerable to the impacts

of climate change because of their poverty; with about 46% of the population classified as poor. The reliance of the majority of the population on rain-fed agriculture and livestock production puts them in a vulnerable position. First because of the negative impacts that adverse weather conditions have on their production systems and also due to fluctuating market prices for their produce, both locally and internationally. Mean annual rainfall in Kenya follows a bimodal seasonal pattern with the long rains generally occurring in March to May, while the short rains occur in October to December. These seasonal patterns have become unreliable resulting in frequent crop failures. Most farmers also lack relevant weather forecast data and information that would assist them to reduce their losses and/or to diversify to more suitable crops, such as drought resistant crops during the dry periods and the slow-maturing varieties when the conditions are wetter than normal. (Samwel et. al., 2017).

1.3 Justification of the Study

Kenya Cereal Enhancement Program- Climate Resilient Agricultural Livelihood (KCEP-CRAL) is approximately four years old and has been on-going since 2016 in Kenya. Being a long-term development initiative with a plan projected to 2022, it is important to look into its impacts so far on the cereal farmers. This can be achieved by assessing the livelihoods of cereal farmers who are poor small scale farmers in Eastern Kenya. The KCEP-CRAL, implemented since 2015, progressively aims at reducing poverty by boosting farmers' yields and food security through sustainable agriculture and linking small-scale farmers to profitable agricultural markets while generating cereal credits. Therefore, this study will not only add to the existing knowledge, but also aid our knowledge on the impacts of climate resilient agricultural practices (CRAP) employed by the farmers. It will also help identify the resilience level attained through the program's output and farmers input and inform future project implementation processes. This is crucial in reconciling the divergent narratives of project implementers and the project's beneficiaries bearing in mind that KCEP-CRAL lifespan is still long with approximately three years remaining to its completion. This research study will also help widen researchers' and climate change practitioners' varied perceptions on climate resilient agricultural based initiatives in light of WB's 'climate smart' agriculture concept. (Abiola et.al., 2019)

1.4 Aim and Objectives of the Study

The aim of this study is to assess the impact of IFAD's Kenya cereal enhancement Program on female cereal farmers in Embu county. The study's specific objectives are to:

- i. Evaluate the perception of the farmers on climate change.
- ii. Assess the perceived impact of climate change on cereal production.
- iii. Examines the climate resilient practices employed by female farmers in Embu county
- iv. Examine the impact of climate resilient practices on female smallholder farmers.

1.5 Research Questions

This study is based on four research questions which are specific to cereal enhancement program on the productivity of female smallholder cereal farmers in Kenya. The questions are:

- i. What is the perception of farmers on climate change?
- ii. What is the perceived impact of climate change on cereal production?
- iii. What are the climate resilient practices employed by the farmers in Embu county?
- iv. What are the impact of climate resilient practices on female smallholder farmers?

1.6 Limitation of the study

The study was limited to only one (1) out of the thirteen (13) Counties covered by Kenya Cereal Enhancement Program-Climate Resilient Agricultural Livelihood window (KCEP-CRAL) and this was majorly due to time and some unexpected constraints. Language was also limitation as interpreters and enumerators needed to be used and this limited in-depth communication with respondents. The results in this study are only specific to the findings gotten at Embu County

CHAPTER TWO: METHODOLOGY

2.1 Study Area

Although the Kenya Cereal Enhancement Programme -Climate Resilient Agricultural Livelihoods (KCEP-CRAL) area covers thirteen Counties in three main regions namely: **Bungoma, Kakamega, Nakuru, Nandi** and **Trans Nzoia** in the western region, **Embu, Kitui, Tharaka-Nithi, Makueni** and **Machakos** in the Eastern region, **Kilifi, Kwale** and **Taita Taveta** counties in the Coastal region. However only one (1) county; **Embu** of the participating counties was selected for this research, due to insufficient time.

Embu County is located in Eastern Kenya and borders **Tharaka Nithi County** to the North, **Kitui County** to the East, **Machakos County** to the South, **Muranga County** to the South West, **Kirinyaga County** to the West, and **Meru County** to the North West.

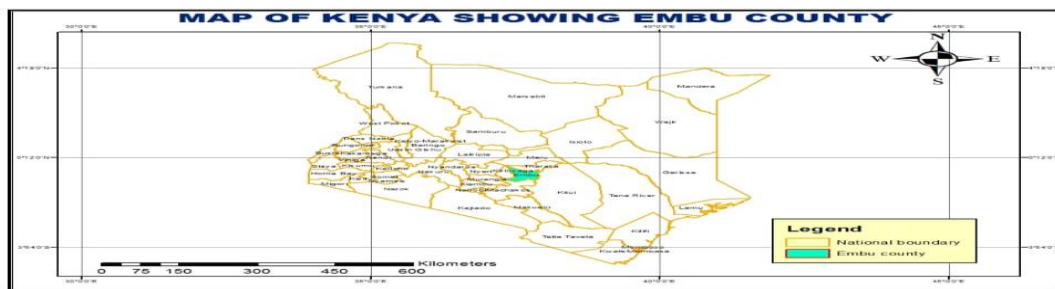


Fig 2.1: Map of Kenya showing the research location.

Embu County

The County is inhabited by the Embu, Mbeere, Kamba and Kikuyu communities and hence presents a cosmopolitan complexion. The programme is implemented in all sub-counties in Embu, which are: Mbeere-South, Mbeere North and Ruyenjes. The study covers six wards which includes Mwea, Makima, Kiambeere Kiambeere, Mbeti-south, Evurore and Nthawa.

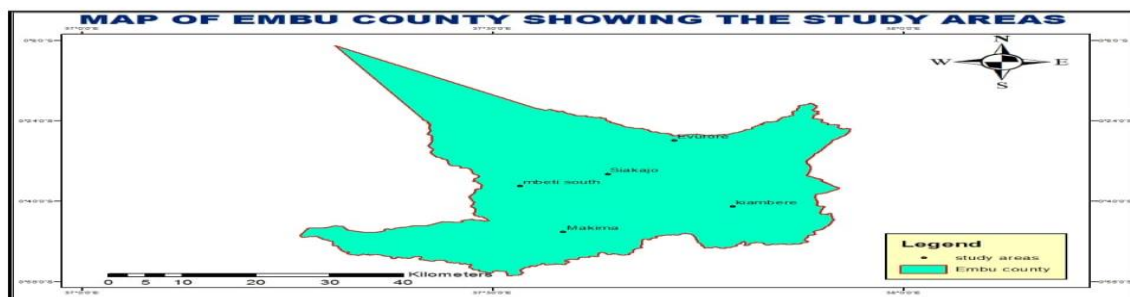


Fig 2.2: Map of Embu county showing the study areas.

2.2 Nature and Sources of Data

This study will make use of both primary and secondary data. The primary data would be gotten from the administration of questionnaires to female small holder cereal farmers. In order to achieve the objectives of this research, the survey approach applied a number of techniques including: desk review of relevant documents, Quantitative Research consisting of female smallholder cereal farmers, Qualitative Research consisting of Key Informant Interviews (KIIs), Focus Group Discussions (FGDs) with World Agricultural Officers (WAO), Agronomist , one of partners of the program(KALRO) and observation combined with use of informed judgment through field visits.

Quantitative Research: Quantitative research was used to establish metrics of the established indicators through use of a statistical sample. Individual structured questionnaires were then administered and this methodology generated numerical data, provided uniformity in data-collection.

Qualitative Research: Qualitative participatory research was used to explore and understand people's beliefs, experiences, attitudes, behavior and interactions. This method generated non-numerical data and consisted of Key Informant Interviews (KIIs), Focus Groups Discussions (FGDs) and Observation/Informed Judgment.

2.2.1 Target population

The target population was female smallholder cereal farmers, both the beneficiaries and the non beneficiaries of Kenya Cereal Enhancement Program, Climate Resilient Agricultural Livelihood(KCEP-CRAL) in the study area (Embu). Purposive sampling was used to select participants for the Focused Group Discussions (FGD) in which two groups of 12 participant in a group was formed and Key Informant Interview (KII) with 4 key informants depending on the study objectives.

2.3 Sampling Method

Purposive sampling method was used and 300 female cereal farmers within Embu County will be served the questionnaire, 200 beneficiaries of KCEP-CRAL and 100 non beneficiary farmers.

2.3.1 Determination of sample size

The target population of the project area (Embu) will be stratified among the beneficiaries and non beneficiaries of KCEP-CRAL (based on availability and extent of activities) in the area constituting the first stratum.

2.4 Data Analysis

Descriptive and inferential statistics will be utilized to analyze the data that will be gotten

from the field. With descriptive statistics, frequencies, percentages, charts and cross tabulation accurate results of the analysis will be provided. Chi-square will be used as an inferential statistic tool in analyzing the data so as to achieve the objectives of the research.

Analytical Techniques

Analysis of objectives, data collection and method of analysis.

S/N	Objectives	Data Collection	Data Required	Method of Analysis
1	To evaluate the perception of the farmers on climate change.	Questionnaire, Focus Group Discussion and Key Informant Interview.	Information on the knowledge of the farmers on climate change	Frequencies, percentages, charts and cross tabulation and inferential statistics (T-square)
2	To assess the perceived impact of climate change on cereal production.	Questionnaire, Focus Group Discussion and Key Informant Interview	Information on the impact of climate change on cereal production	Means and inferential statistics (T-square)
3	To examine the climate resilient practices employed by female farmers in Embu county	Questionnaire and Key Informant Interview	Data on the climate resilient practice employed by the farmers	Means and inferential statistics (Chi-square)
4	To examine the impact of climate resilient practices on female smallholder farmers.	Questionnaire and Key Informant Interview(KII)	Data of the improvements of the farmers since their practice of climate resilient agriculture.	Means and inferential statistics (Chi-square)

CHAPTER THREE: RESULTS AND DISCUSSIONS

3.1 SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF FARMERS

This section contains the socio-economic and demographic information of the farmers who participated in the study. Information such as age, marital status, household size, monthly income, highest education level attained, and their occupation.

The table below reveals the descriptive statistics of a few of the variables. It was obtained that 46 out of 330 farmers are young adults which is between the ages of 18 to 35, while 186 farmers constitutes the middle age between the ages of 36 to 55years and the last age group consists of the aged, from ages 55years and above. It is evident here that majority of the female farmers are middle aged, which is more than half of the total population with 56.4%. The mean age of the farmers is 49 years which is tending towards the older generation in few years to come.

This table below also illustrates the proportion of their marital status, majority of the farmers were married which accounted for 86.7% while 2.4% of the farmers are either divorced or separated, and the remaining population are single. It is eminent in this results that most farmers (186) only went through the primary school education, 64 farmers reached secondary level and 58 farmers went to either technical, vocational or tertiary education, as education is seen as a vital aspect of human capacity building, their educational level usually has an influence, a sought of positive effect on the modes of farming of the respondents. The modal value of the family size of the respondent consists of 4 to 6 persons per household in about 206 families, 54 households having about 7 occupants. 95.2% of the respondent reported farming as their main source of income, while 0.6% were civil servants and it's the least with the other 3% of the respondent being business women. The respondents earnings varied per season, in the nation where they have two farming seasons in a year. 148 respondents earn between 1,500ksh to 10,000ksh per each season which includes the March, April, May(MAM) and October, November, December(OND) seasons, and this is a more common trend to 33.6 % respondents who earn about 1000ksh and 14.7% respondents who earn above 10000ksh.

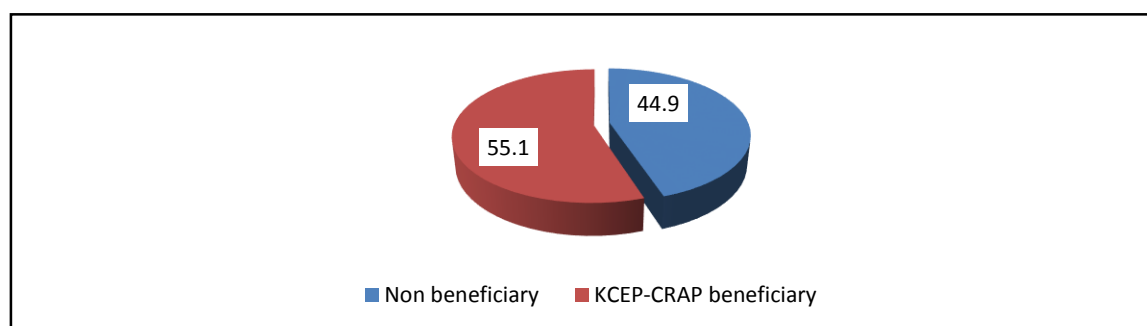
Table 1: Socio-demographics characteristics

Characteristics	Frequency	Percentage
Age group		
Young adults	46	13.9
Middle Age	186	56.4

Aged	98	29.7
Mean	49.4	
Standard deviation	12.4	
Marital status		
Single	36	10.8
Married	288	86.7
Divorced/separated	8	2.4
Level of education		
Primary education	186	60.4
Secondary education	64	20.8
Vocational/technical education	28	9.1
Tertiary education	30	9.7
Members of households		
1 – 3 persons	74	22.2
4 – 6 persons	206	61.7
>= 7 persons	54	16.2
Occupation of household head		
Farming	316	95.2
Civil servants	2	0.6
Businesswoman	10	3.0
Others	4	1.2
Income		
<= 1,000 Ksh	96	33.6
1,500 – 10,000 Ksh	148	51.7
> 10,000 Ksh	42	14.7

This chart shows the variables with which this research is conducted. There are two variables which includes the beneficiaries of KCEP-CRAL which is the main reason this research is conducted and the second group is the non-beneficiaries of KCEP-CRAL which is representing the control group for this study. Both respondents are regarded as the source of primary data. The beneficiaries of KCEP-CRAL are the larger group with 55.1% while the non- beneficiaries are 44.9%.

Figure 1: Percentage of the two groups of farmers who participated



The result below states that an enormous population of the respondent practices rainfed agriculture with 95% conversely, only 5% practices irrigation. While almost 100% of the farmers relies on rainfall as water to grow their crops, only 5% uses a controlled water to grow their crops. Both agricultural practice are good but one is more suitable while the other is more convenient. In a county like Embu where there insufficient rainfall, the farm yield would be effected. The more rainfall, the higher the farm yield, lesser rainfall will automatically lead to low yield.

Figure 2: Agricultural practices

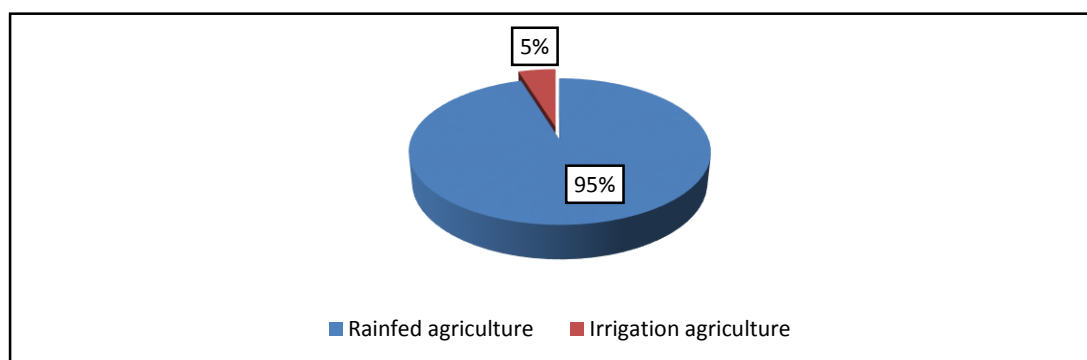


Table 2 shows the location in which the farmers sell their farm produce; the respondents revealed that they sell their farm produce at two strategic locations which is; the farm gate, market or both locations. For the non-beneficiaries, the most common point of sale is the market, where 88 non-beneficiary farmers sell. Moreover, majority (116) of the beneficiary farmers also sell their farm produce in the market. Only 2 and 10 of the non beneficiaries and beneficiaries farmer respectively sell at both market of farm gate. The remaining percentage sell their produce in the farm gate accounting for 51.2% and 48.8% of the non-beneficiaries and beneficiaries respectively.

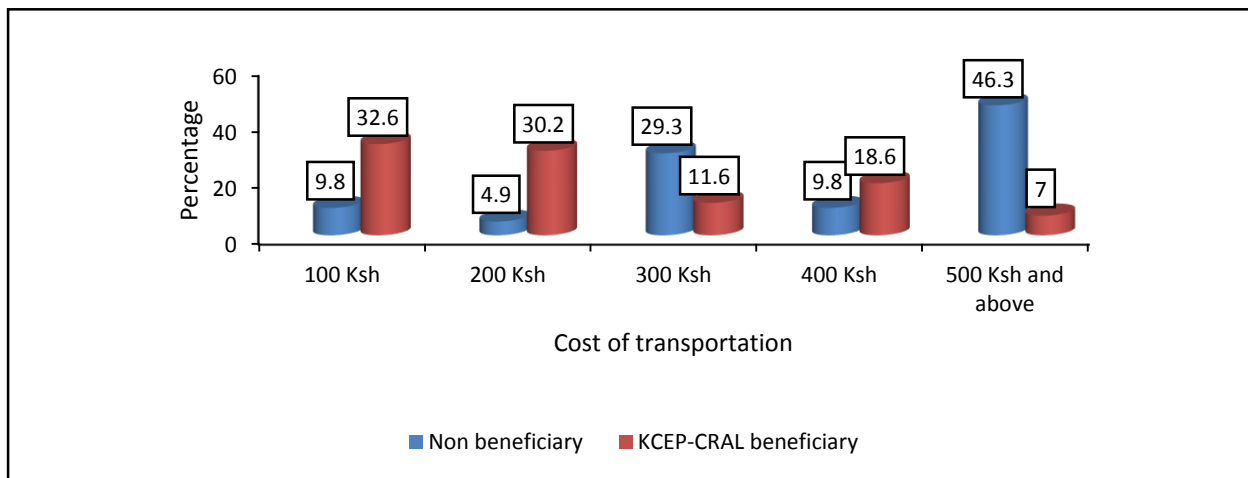
Table 2: Location of farm produce sale

Sales location	Non beneficiary	KCEP-CRAL beneficiary
Farm location	42 (51.2%)	40 (48.8%)
Market	88 (43.1%)	116 (56.9%)
Both farm location and market	2 (16.7%)	10 (83.3%)

Based on the responses from table 2, the cost of transportation to the market is assessed for farmers who sell in the market. Cost of transport to the market is varied due to their farm locations, wards, and sub-county, some farmers have their farm location close to the market while others do not. 9.8% of the non beneficiaries spends 100ksh on transportation of goods while 32.6% of the beneficiaries spends 100ksh for same. 29.3% and 11.6% of the non beneficiaries and beneficiaries transports their produce with 300ksh. 9.8% of the non beneficiaries and doubling percentage of the beneficiaries spends 400ksh on goods transport. There is a steep difference in the non-beneficiaries and beneficiaries who spends 500ksh and above in the transportation of their goods with 46.3% and 7% respectively.

In all, 4.9% of the total population of non beneficiaries has the least percentage of transporting their produce at 200ksh where as 46.3% of the non beneficiaries has the highest percentage of goods transportation with above 500ksh.

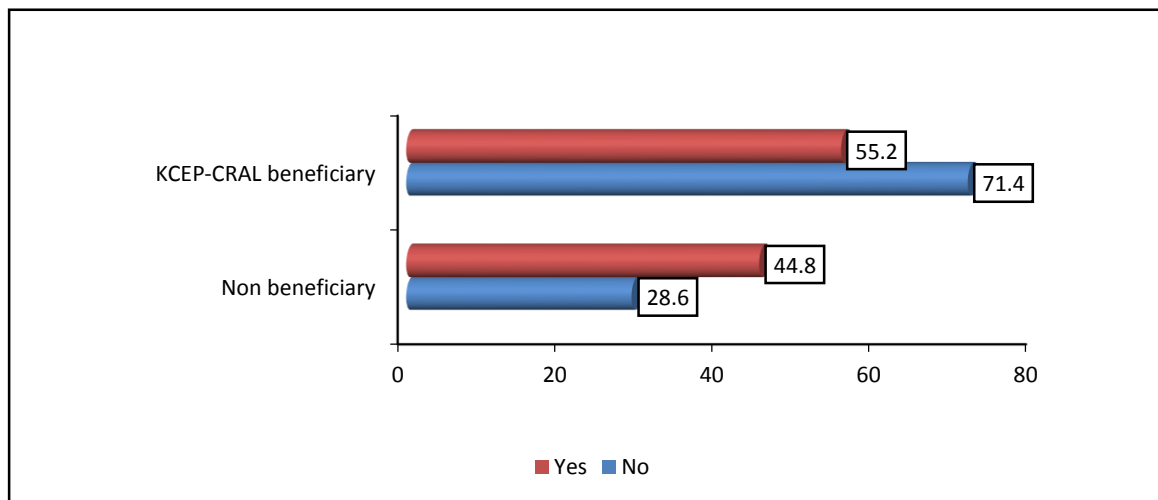
Figure 3: Cost of transportation to the market



The chart below reveals the percentage of the farmers who make use of pesticide. Farmers revealed that a crop as sorghum is usually infected by birds because of its sweet nature, so it is necessary to know if the farmers take measures to conquer infestation.

55.2% of the beneficiaries make use of pesticides before KCEP-CRAL while 71.4% of the beneficiaries and 28.6% of the non beneficiaries do not use pesticides.

Figure 4: Use of crop protection chemicals before KCEP-CRAL programme



This table depicts the frequency of pesticide usage among the non beneficiaries and the beneficiaries of KCEP-CRAL before they subscribed to the program(KCEP-CRAL). The frequency here is per season, in which there are two seasons in a year. 48 farmers out of the non beneficiaries uses crop protection chemicals, one to three times in a season while 92 of the non beneficiaries uses the pesticide 4 times or more per season. For the beneficiaries 84 farmers uses pesticide one to three times per season while 70 farmers uses pesticides more than 4 times in a season, which implies that every year farmers uses insecticide/pesticide 2 to 6 times, while others uses it about 8times in a year. This however, reveals that most of the farmers have been making use of pesticides to guard their crops from infestation. Both groups, are assumed to be non-beneficiaries of KCEP-CRAL because the beneficiaries were questioned on their activities before they joined the program

Table 3: Application of crop protection chemicals before KCEP-CRAL programme

Number of times	Non beneficiary	KCEP-CRAL beneficiary
1 – 3 times	48 (36.4%)	84 (63.6%)
>= 4 times	92 (56.8%)	70 (43.2%)

Since KCEP-CRAL's inception, the beneficiaries now make use of pesticides more. 138 beneficiaries now confirmed the use of crop protection chemicals as opposed to 10 beneficiaries who do not make use of the chemicals to prevent their crops from infestation. There is a swift increase in the number of farmers that now make use of the pesticide.

Table 4: Use of crop protection chemicals during KCEP-CRAL programme (Beneficiaries only)

Response	Frequency	Percentage
Yes	138	93.2
No	10	6.8

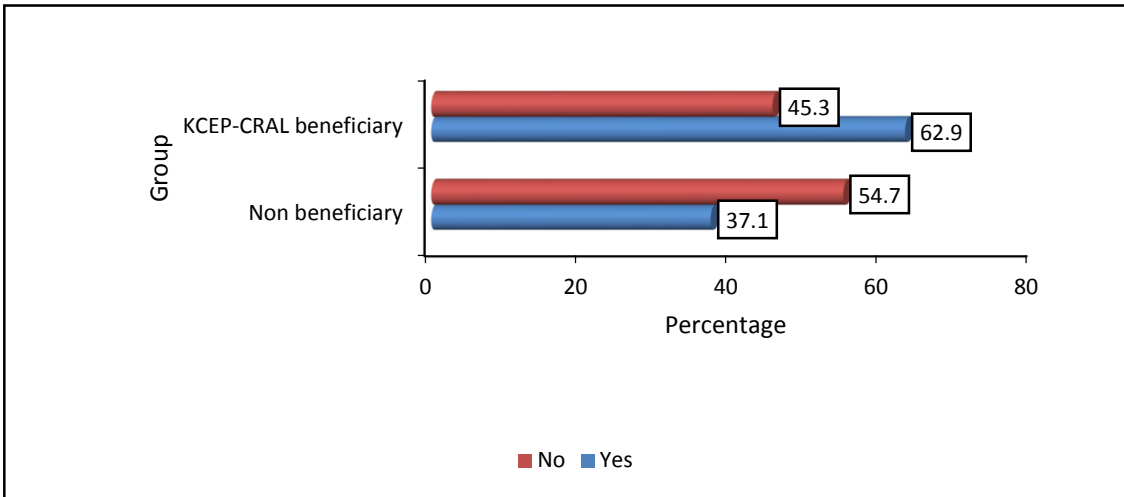
In correspondence with the response in table 4, the research seeks further knowledge on the often time crop protection chemicals is being used among on the beneficiaries KCEP-CRAL. It has been determined that 62 farmers uses pesticide one to three times in a season while 88 farmers uses pesticide 4 times and above. With this information, it is established that a larger number of farmers now uses pesticides more than they use previously.

Table 5: Frequency of crop protection chemical application since KCEP-CRAL programme (Beneficiaries only)

Response	Frequency	Percentage
1 – 3 times	62	41.3
>= 4 times	88	58.7

The research sought information on the farmers ability to access the market for the sale of their produce before being introduced to KCEP-CRAL. This is to juxtapose the farmers' improvement since the evolution of the program. 45.3% of the beneficiaries are not able to access the market while 54.7% of the non beneficiaries were also not able the penetrate the market. On the other hand, 62.9 % of the beneficiaries are able to make profitable sales while 37.1% of the non beneficiaries have access to market. All these reflects the capacities of the farmers to access market before KCEP-CRAL existed.

Figure 5: Ability to easily access market before KCEP-CRAL programme



Information on market accessibility after the program revealed that, out of the 132 respondent, 112 farmers are able to gain easy access to the market as opposed to just 20 farmers who were unable to gain easy access to the market. KCEP-CRAL has an initiative that allows the farmers sell their produce easily; after the goods are harvested, the farmers takes produce to the aggregation center where the buyers get the goods. There is also a partnership with the Kenya breweries who buys the produce at 35ksh per kilogram. Although not all farmers adhere, because they believe they could sell their produce at an higher rate, compared to the offers at the Kenya breweries or the aggregation center. However, the prices of the produces are mostly determined by the supply.

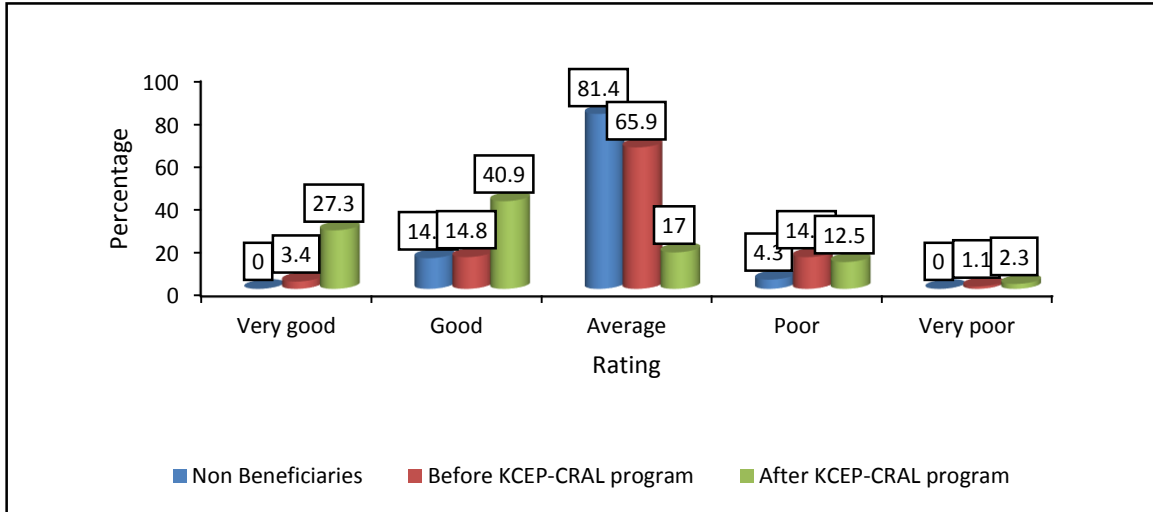
Table 6: Ability to easily access market during KCEP-CRAL programme (beneficiaries only)

Response	Frequency	Percentage
Yes	112	84.8
No	20	15.2

The chart below reveals, the crop yield of the beneficiaries; before and after the program and the non beneficiaries.. Majority of the non beneficiaries with 81.4% confirmed that they have an average crop yield, while none of them attest to a very good or very poor crop yield. Also, for the beneficiaries KCEP-CRAL, most of them also signified an average yield of crop with 65.9%. meanwhile majority of KCEP-CRAL beneficiaries revealed that they have a good crop yield, better than their yield before they subscribed to the program. Some others confirmed they have a very good crop yield. This reveals that the farmers are truly having better farm produce due to

KCEP-CRAL's intervention. Although some other beneficiaries gives a counter notion by stating poor and very poor crop yield with 12.5% and 2.3% accordingly. The farmers who experience low crop yield is due to the extreme climatic conditions in their wards, some wards are found to be more fertile than the others.

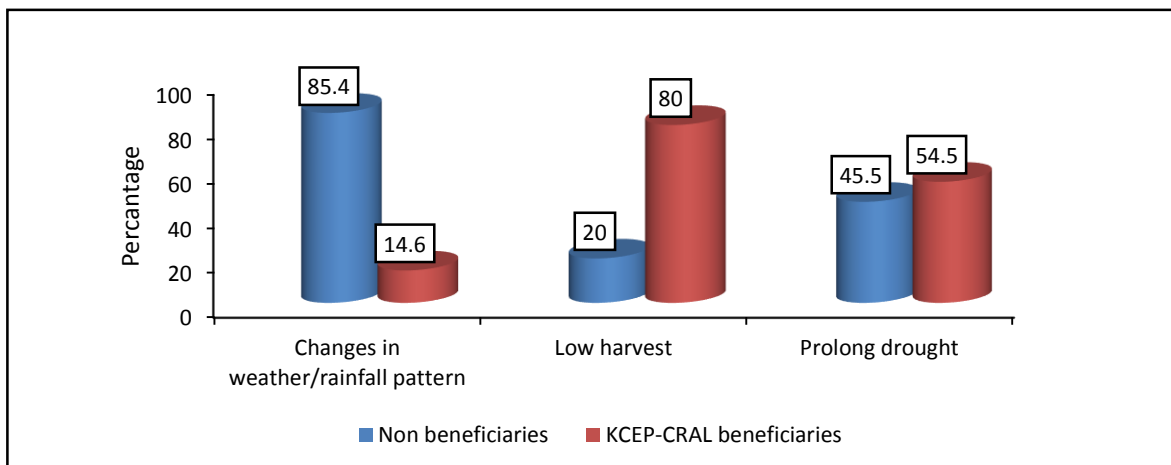
Figure 6: Farm yield rate



Due

to the climate change which is adversely affecting Kenya, there is the need to understand its dwellers perception on these changes. There are also two respondent groups, which are the beneficiaries and the non beneficiaries. 85 % of the non-beneficiaries understands climate change as changes in weather or pattern of rainfall while 14% of the beneficiaries states climate change as changes in weather and rainfall pattern. 80% of the beneficiaries however perceive climate change to be low harvest of crops and 20% of the non beneficiaries says climate change is low crop yield. 45.5% of the non beneficiaries and 54.5% of the beneficiaries refers to climate change as prolonged drought.

Figure 7: Farmers perception on climate change



According to the study, 124 non beneficiary farmers and 132 beneficiary farmers out of the 264 farmers confirmed that climate change has a negative effect on the crop production, this implies that climate change does not have any positive features on the growth of the cereals. Only 6 non beneficiary farmers and 2 beneficiary farmers says the climate change affects their cereal production positively. The majority response is understood due to little rainfall in the County.

Table 7: Impact of climate change on cereal production

Response	Frequency	Percentage
Non beneficiaries		
Negative	124	95.4
Positive	6	4.6
KCEP-CRAL beneficiaries		
Negative	132	98.5
Positive	2	1.5

Table 8 reveals the descriptive statistics of the farmers(non beneficiaries and beneficiaries) on the specific and commonly expressed view of the kind of climate change the respondents experience. 114 and 150 of the non beneficiaries and beneficiaries suggest they experience dry land or low rainfall, 50 and 74 of the non beneficiary farmers and beneficiary respectively farmers proposes hot temperature. 26 non beneficiary farmers and 10 beneficiary farmers says they experience low humidity, while 4 and 6 farmers of the non beneficiaries and beneficiaries says they experience high rainfall. The response here confirms the situation of climate in Embu county. Dry land, low rainfall, hot temperature, low temperature are all the attributes evident in a semi arid and arid land which Embu County is.

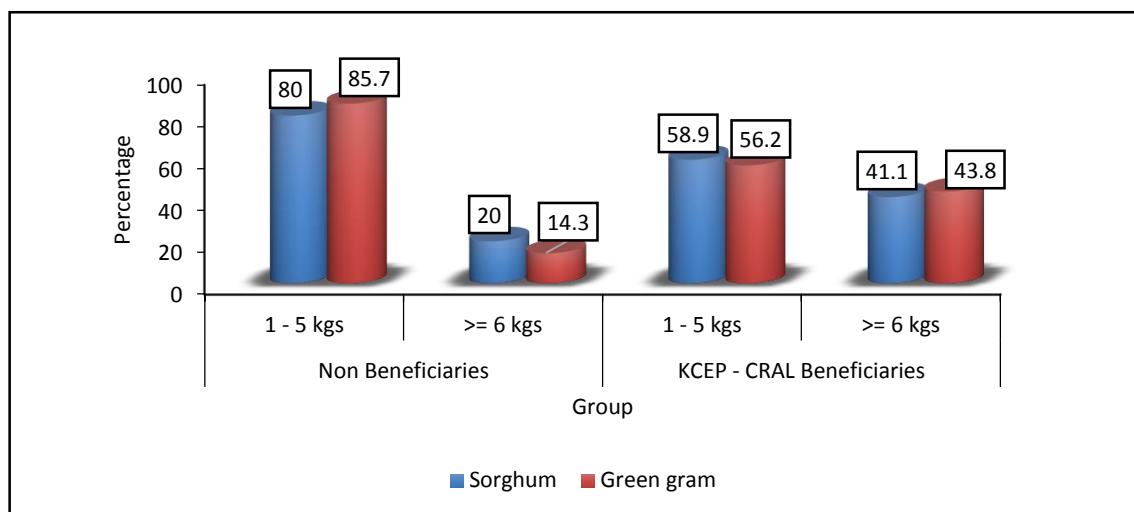
Table 8: Climatic conditions experienced

Response	Non beneficiaries	KCEP-CRAL beneficiaries
Dry land/low rainfall	114 (43.2)	150 (56.8%)
Hot temperature	50 (40.3%)	74 (59.7%)
Low temperature	26 (72.2%)	10 (27.8%)
Humidity/high rainfall	4 (40.0%)	6 (60.0%)

Figure 8 illustrates the quantity of seeds planted by the two groups of farmers interviewed. Information here only deals with the two climate resilient seeds adopted by KCEP-CRAL which is sorghum and green gram.

. 80% of the non beneficiaries plant between 1 to 5kg of sorghum, only 20% planted above 6kg of sorghum. The non beneficiaries, that cultivated between 1kg to 5kg of green gram is approximately 86% while the remaining 14% planted 6kg or more of green gram. For the beneficiaries of KCEP-CRAL approximately 60% and 56% plants between 1 to 5kg of sorghum and green gram respectively, while 41% and 44% planted 6kg and above of sorghum and green gram respectively. The chart reveals that of the most of KCEP-CRAL beneficiaries cultivated more of 6kg seeds than the non beneficiaries. KCEP-CRAL gives 4kg of green gram and 4kg of sorghum to the farmers, suitable for one acre of land, so most farmers plant within that kg, other farmers that plant more than 4kg has additional seeds from their store, so they plant excess to have an increased harvest.

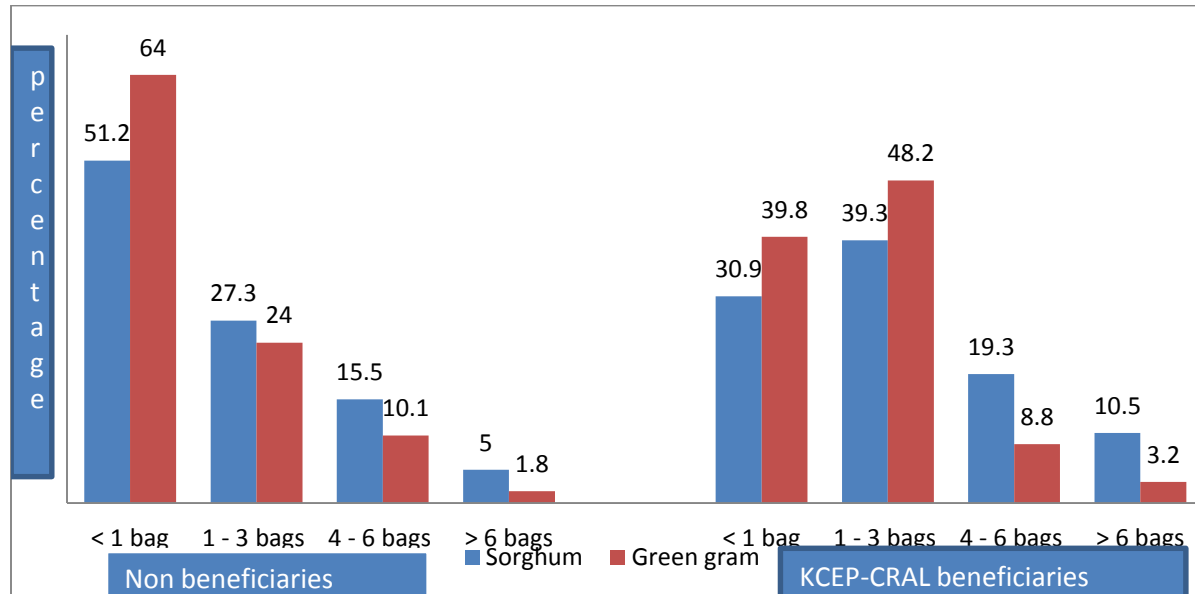
Figure 8: Amount of cereal cultivated



This chart below, explicitly measures the yields of the farmers (both the non-beneficiaries and beneficiaries) in bags, it is observed that a larger percentage of the non-beneficiaries harvest less than one bag of both sorghum and green gram, with 51.2% and 64% respectively, whereas the average yields for the beneficiaries of KCEP-CRAL is between one to three bags of sorghum and green grams with 39.3% and 48.2% respectively. This simply describes the impact of the program on the beneficiaries. However, there are more beneficiaries of KCEP-CRAL than non beneficiaries who harvest over 6bags of both sorghum and green gram per season with 5.5% and 1.4% more. It is however note worthy to state that a bag is equivalent to 90kg, which simply means some farmers have productive yields of over 630kg. It is also observed that sorghum has

higher percentage of yields from 4bags to 6bags, which simply implies that sorghum seed tends to be more productive.

Figure 9: Bags of cereal harvested



The primary aim of KCEP-CRAL is to reduce the effects of climate change by providing climate resilient practices. The table, therefore, shows the farmers adoption of the climate resilient practice. 148 out of 164 respondents reveals they adopted the climate resilient practices, while only 16 of them responded negatively to the adoption of the climate resilient practices. Since, almost 100% of the farmers adopted the practices, this shows that KCEP-CRAL has helped in reducing climate change impacts on crop production.

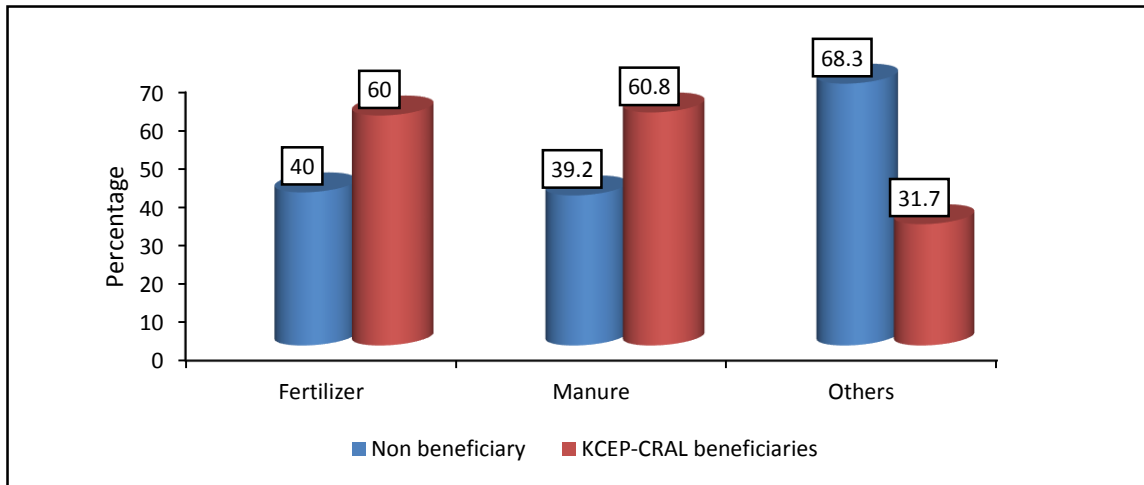
Table 9: Adopted CRAL practices (beneficiaries only)

Response	Frequency	Percentage
Yes	148	90.2
No	16	9.8

Every farmer requires a substances to enhance the growth of their crops. 60% and 40 % of the beneficiaries and non beneficiaries of KCEP-CRAL, uses fertilizers to grow their crops. 39.2% and 60.8% of the non- beneficiaries and beneficiaries respectively makes use of manure. While 68.3% of the non beneficiaries and 31.7% of the beneficiaries uses other substance. The respondents here could all be viewed has the non beneficiaries because the beneficiaries response

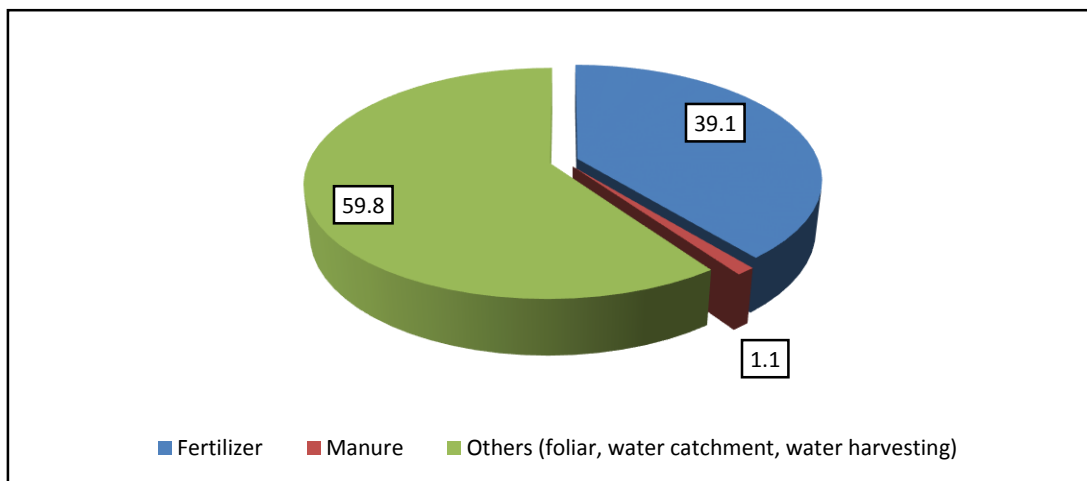
here was before they joined KCEP-CRAL. The next graph will reveal what the beneficiaries of KCEP-CRAL now use to enhance their crops since they participated in KCEP-CRAL.

Figure 10: Type of soil nutrient used before KCEP-CRAL



Information on the substance used to enhance the soil since farmers’ participation in KCEP-CRAL. Approximately 60% uses other substance such as foliar to enhance the growth of their crops while 39% uses the common fertilizer, only 1% still uses manure to improve their soil fertility. Majority of the farmers uses foliar because it was recommended and given to the farmers. Foliar has been tested has a better fertilizing substance most especially for arid and semi arid lands. However, they provide the farmers with different varieties of pesticide each season because of the resistant of the pest in the farm, research has shown that resistant insects do not die if they are used to only one chemical.

Figure 11: Type of soil nutrient use during KCEP-CRAL



This table seeks to access the impact of certain climatic conditions on the farmers farm activities. The two groups of farmers are also interviewed here. 128 non beneficiaries reveals a

positive impact of rainfall as well as 142 beneficiaries who confirm the positive effect of rainfall on the farm activities. Only 12 and 34 non beneficiaries and beneficiaries validates rainfall having a negative effect on their farm activities. while 14 and 32 non beneficiaries and beneficiaries says drought or dry season has a positive effect on their farm activities. 10 and 14 non beneficiary and beneficiary farmers respectively says climate change has a good effect on the farm. 47% and 53% of the non beneficiaries and beneficiaries accordingly suggests that climate change does not have a positive effect on the farm. others(minority) feel indifferent about the effects of climate change on the farm. most farmers confirmed rainfall having positive effect is because the farmers solely depend on rainfall for the growth of their crops. Without these rains the farmers would have no harvest. However, land preparation for planting of seeds and dry planting could only be done when there is no rainfall.

Table 10: Effects on farm activities

Response	Non beneficiaries	KCEP-CRAL beneficiaries
Rainfall		
Positively	128 (47.4%)	142 (52.6%)
Negatively	12 (26.1%)	34 (73.9%)
Dry season		
Positively	14 (30.4%)	32 (69.6%)
Negatively	126 (47.4%)	140 (52.6%)
Climate change		
Positively	10 (41.7%)	14 (58.3%)
Negatively	114 (47.5%)	126 (52.5%)
Indifferent	20 (45.5%)	24 (54.5%)

The impact of Climate Resilient Agricultural Practice(CRAP) is measured in table 11. 7.1% of the farmers reveals that CRAP has not helped to improve and increase their productivity. 13% opines that there is a slight increase in their productivity since they started climate resilient practice. Over 78% of the farmers suggests that there is an average increase in productivity with the aid of climate resilient agricultural practice(CRAP). Only two farmers confirms an huge increase in the productivity.

Table 11: The extent of CRAL’s practice on increase in productivity (beneficiaries only)

Response	Frequency	Percentage
No increase	12	7.1
Slight increase	22	13.1
Average increase	132	78.6
Huge increase	2	1.2

The study would not be complete if there isn’t gender specific information, This section seeks to know whether KCEP-CRAL has been able to remove certain societal barriers that hinder women from carrying out certain farm activities. 80.2% are of the opinion that the program has helped removed societal barriers in the county. While 19.8% believes the program has not done well in removing societal barriers that hinder women in the county. Generally, Embu county does not have restrictions or taboos placed on women farm activities. the most prominent form of barrier women face is patriarchal domination from their husbands, who refuses them land to farm.

Figure 12: Removal of societal barriers that hinder female smallholder (beneficiaries only)

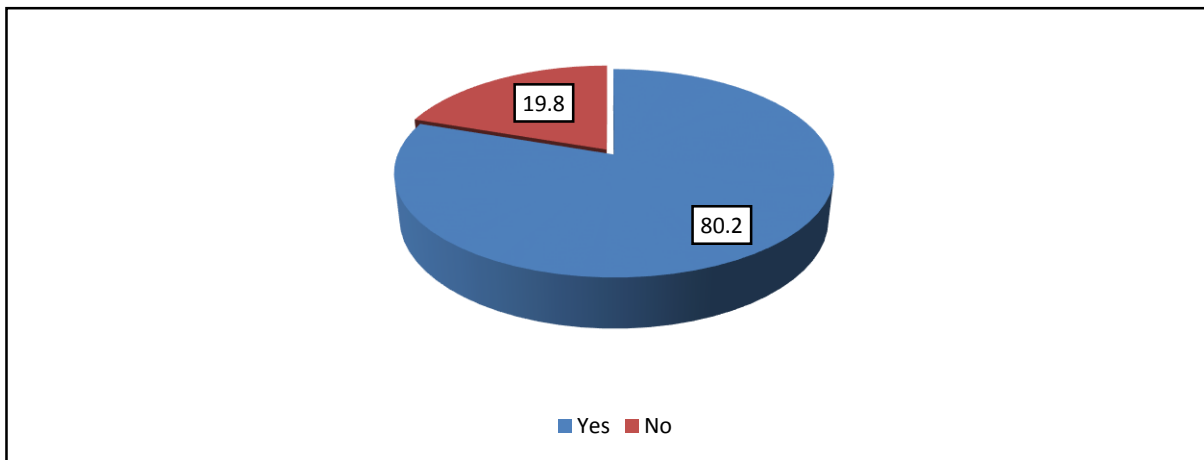


Table 12 exposes us to the challenges female farmers face in farm activities. The most common challenge is women over working, which means combining household chores with farm work and lack of decision on what to sell accounts for 14%. Other challenges includes lack of capital, pest and diseases, climate change, back pains and lack of market access.

Table 12a: Challenges faced by women (beneficiaries only)

Response	Frequency	Percent
Climate change	6	3.3
High cost of input, lack of capital	12	6.5
Inadequate income, inadequate rainfall	4	2.2
Inequality	2	1.1
Lack of capacity building, prolong drought	4	2.2
Lack of capital, high cost of inputs, No access to loaning facilities due to lack of little4 deeds	4	2.2
Lack of farm inputs, tools, money for works	6	3.3
Lack of food for our children	4	2.2
Lack of funds	6	3.3
Lack of funds for certified seeds and fertilizers	2	1.1
Lack of money for labour	8	4.3
Late farm practice, delayed farm inputs, more4 training for farmers	4	2.2
No access to both local and international market	10	5.4
No market for surplus cereals	10	5.4
None	2	1.1
Over working, no power on the sale of produce	26	14.1
Pest and diseases	20	10.9
Poor rainfall	4	2.2
Poor rainfall and lack of farm inputs due to lack2 of capital	2	1.1
Prolong drought	4	2.2
Suffering from back pain	2	1.1
Unreliable rainfall	2	1.1
We lack collective market	2	1.1
Women combine domestic work with farm work	8	4.3
No response	30	16.3

This section seeks knowledge on the importance of KCEP-CRAL to the female farmers and to evaluate their willingness to continue the program after the intervention. 146 farmers confirms that KCEP-CRAL has helped to remove gender inequality in the society, only 16 farmers says KCEP-CRAL has removed gender inequality. From the study, it is observed that most of the beneficiaries of KCEP-CRAL are women with very few men in the program, this reveals that the program gives more attention to women considering the fact that they are usually more interested in farm activities. For the second information, 98.8% of the farmers says they would continue the program after KCEP-CRAL has stopped giving inputs only 1% of the farmers disclose that they can not continue the practices except the program continues. Almost 100% of the farmers says they could sustain CRAL's practices even after the intervention has stopped while about 4 farmers says they can not sustain the program on their own. Overall, KCEP-CRAL has succeeded in imparting the farmers by building their capacities and by instilling and spurring in them the zeal to continue the practices on their own.

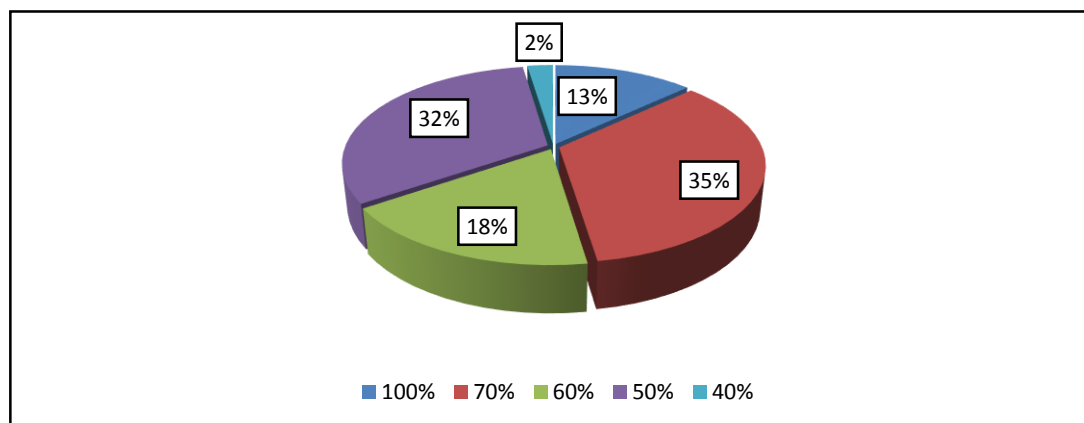
Table 13: General enquiry (beneficiaries only)

Response	Frequency	Percentage
Response to KCEP-CRAL removal of gender inequalities		
Yes	146	90.1
No	16	9.9
Farmers response to continuity of CRAL practices		
Yes	164	98.8
No	2	1.2
Farmers response to sustaining the initiative		
Yes	158	97.5
No	4	2.5

Information on the sustenance of the CRAL practices as presented in figure 14, revealed that only 2% says the continuity of the KCEP practices is 40% possible, 32% gives it a 50/50. 18% of the farmers confirms 60% possibility of the practice sustenance. 35% of farmers gave the

practice sustainability 70%. Only 13% of the farmers confirmed that they could continue the program's practice fully after the intervention has stopped with 100%. Study shows that majority of the farmers wants the continuity of KCEP-CRAL because they doubt their ability to continue those climate resilient practices. However, some other farmers could boldly continue these practices without any intervention. The sustainability of the program's practices is very important for building a sustainably climate resilient ecology.

Figure 14: Sustenance of KCEP-CRAL practices after its intervention (beneficiaries only)



The income of the farmers from cereal production, prior KCEP-CRAL and during KCEP-CRAL was analyzed to check the statistical significance. Worthy to note that, there is a significant difference in the income level of the farmers before and during the program(p-value=0.001). 24% of farmers earn about 50,000ksh to 70,000ksh prior to KCEP-CRAL, during the program, 75% now earn between 50,000ksh to 70,000ksh annually,

Table 14: Hypothesis I: There is no significant changes in the income level of female cereal smallholder farmer before and after the intervention of KCEP-CRAL

Income	Classification		χ^2	P-value
	Before KCEP-CRAL	After KCEP-CRAL		
			23.534	0.001*
0 – 49,000 Kshs	94 (46.5%)	108 (53.5%)		
50,000 – 70,000 Kshs	16 (24.2%)	50 (75.8%)		
80,000 Kshs and above	24 (80.0%)	6 (20.0%)		

* statistically significant

FIGURE 15: ADAPTED VERSION OF SHARP TOOL FRAMEWORK FOR MEASURING FARMING SYSTEMS RESILIENCE TO CLIMATE CHANGE ON LIVELIHOOD



For the purpose of this study, I would assess the resilient stage of the farmer's livelihood using the sharp tool and these are the parameters to ascertain the resilient livelihood. Resilience can be referred to as the concept and ability of farming system to cope with challenges (Folke et al., 2010; Folke 2016; Bullock et al., 2017). Based on the questionnaire administered we would stick to these six tool, starting with the Socially self organized; according to the study it was reported that a larger percentage of the beneficiaries have access to market, though the market access was so beneficial because they have better sales in the ordinary market compared to the KCEP-CRAL organized marketing which requires an opportunity for improvement on the programs part.

Optimally redundant; the farmers have a negative experience with the market accessibility, because some of the respondent confirmed that there has not being any collective marketing. Meanwhile their land management practices are in place as well as access to certified cereal.

Exposed to disturbances; the farmers however, experience a weather negatively affected by lack of rainfall, irregular rainfall patterns which is a natural phenomenon. However, the program to a large extent as been able to curb pest infestation and disease with the inputs given to the farmers, even though it is not a total reduction.

Ecologically self regulated; KCEP-CRAL has achieved an 100% improvement in this aspect because a huge number of farmers are satisfied with the fertilizers, pesticides and climate resilient practices adopted, even though irrigation is not fully included in the practice.

Appropriately connected; when it comes to seed, breed sources and market information, the farmers are well informed but access to weather forecast information is a rare thing for them, coupled with the fact that they live in an area where the weather is unpredictable.

Reflective and shared learning; based on the information received from the research, over 80% of the farmers now have access to better farm practices and improved capacity. The farmers are not only taught theoretically but practically, using a demonstration site to practices all the resilient agricultural practices and the farmers themselves choose which practice is best suited.

O' Leary, (1998), has used different terms to create three resilience model which I will adopt as stages of resilience attained. The three models are (i) the compensatory model, (ii)the challenge model and (iii)the protective factor of immunity versus vulnerability model, and they are characterized by

(i)**compensatory model stage**; adopts resilience as a feature that neutralizes exposures to risk. Risk factor and compensatory factors independently contribute to the prediction outcome, while Werner and Smith(2001) suggests four central characteristics to label resilient; an active approach towards problem solving; a tendency to perceive experiences in a positive light even when they were suffering; the ability to gain other people's positive attention and a strong reliance on faith to maintain a positive life view.

(ii)**the challenge model stage**; proposes that a risk factor provided, if not too extreme, can actually enhance a person's adaptation. This simply implies that, the experience prepares an individual for the next challenge(O'Leary,1998).

(iii)**protective factor model stage** of resilience; states that there is an interaction between protection and risk factors, which reduces the probability of a negative outcome and moderates the effect of exposure to risk.(O'Leary, 1998), which indicates that the protective factor foster positive outcomes and healthy personality distinctiveness despite unfavorable or aversive life circumstances.(Bonanno, 2004; Ungar, 2004).

To ascertain the climate resilient livelihood, I will adopt O'Leary's protective model which is characterized as an interaction between protection and risk factors, to reduces the probability of a negative outcome and moderates the effect of exposure to risk.(O'Leary, 1998.) I would conclude by saying that, the climate resilient agricultural livelihood is at the protective model stage.

CHAPTER FOUR: SUMMARY OF MAJOR FINDINGS, CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The focus of this study is to prove with empirical evidence the impact of climate resilient agricultural practice on the productivity of the female smallholder farmers in Embu County. From the result findings, it can be deduced that the intervention of KCEP-CRAL is a major breakthrough for improving the productivity of the smallholder farmers and as a substantial benefit on their livelihood status. Living standards of the beneficiaries has improved as a result of increased yield, through the access to more certified seeds, better farm practices, and becoming a rebranded person through sensitization and capacity building. The farmers confessed to the breakthrough they have experienced in practicing farming with the inputs KCEP-CRAL has given to them which is not gender biased but it's even more considerate of the female gender. Some farmers have also revealed their progression from low yield as a result of the best practices brought about by KCEP-CRAL.

KCEP-CRAL has brought about an huge level of success in the aspect of climate resilient agricultural practice, they have involved farmers and beneficiaries to a wide range of best resilient farm practices among which includes introduction and adoption of conservation agriculture – a concept for resource-saving agricultural crop production that strives to achieve profits through high sustainable production without halting the environment. This is believed to be a very helpful practice to the farmers who practices in areas with high potentials of climate variability and have cereal farming as their major source of livelihood. Access to drought resistant seeds has been one of the best benefits the farmers enjoy, because the seeds goes through a thorough scrutiny of seed selection, to affirm the seeds which are best situated for the extreme climatic conditions. Use of different pesticides has also been introduced to the farmers as an effective way of preventing loss of farm produce to pests and animals. Others include introductions dry planting, water harvesting, crop spacing, crop rotation, mulching, minimum land tillage, water conservation, tied ridges, zaipits and soil terrace.

The project in itself was faced with some short comings as attested to by the respondents. It must be noted that emphasis must be laid also on the level of worsened responses of the beneficiaries of the KCEP-CRAL, having the understanding that the purpose of every research is to improve on the existing situations and circumstances.

Operational Challenges

- ❖ It was discovered that many of the inputs that were supplied to the beneficiary most often than not arrive late, which drastically affects the farmers production, because the farmers are unable to carry out dry planting. Moreover, some days of the productive season would have passed by, reducing the number of days left for rainfall on the crops. This requires a major push in distribution to foster early dispensation of inputs and its sustainability.
- ❖ Following this, it was realized that the program only seeks to create adaptation mechanisms and not mitigation options. There is a lot of climate resilient practices put in place to help the farmers strive and bounce back amidst the climatic odds but there has been much action to prevent or reduce the severity of the climatic conditions. All the climate resilient agricultural practices employed are adaptive options which does not clearly prevents the climate variability challenge.
- ❖ The study also looked at marketing links and it was discovered that although there is a market available for the sale of produce, most of the farmers are not subscribed to it because they are bought at lower prices compared to the market prices. However, some of this farmers are not aware of this collective marketing, which reveals an element of weak market linkage especially affecting the supposed profits from cereal production.

4.2 Recommendation

Irrigation systems should be provided for the cereal farmers to capture the effectiveness of the climate resilient practices, there are good practices as confirmed by the farmers but since the weather is not favourable to the program, measures should be taken for the farmers to have access to controlled water to grow their crops without sole dependence on rainfall.

It is important that market linkage to should be strengthened so as to improve farmers income, the marketing structure among the farmers in Embu County has not been fully implemented and this has a negative effect on the profit of the cereal smallholder farmers.

Sustained early dispensation of inputs to the farmers should be considered because it is pertinent for dry planting and improved farm yields.

More of sorghum seeds should be given because they tend to have higher yields than green gram. Mitigation options should also be explored adaptive options is not enough to enhance effective production of crops and resilient livelihood.

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APPENDIX

IFAD-MDP FIELD PRACTICUM (QUESTIONNAIRE)

APPRAISAL OF CLIMATE RESILIENT AGRICULTURAL PRACTICE ON THE PRODUCTIVITY OF FEMALE SMALLHOLDER CEREAL FARMERS IN EMBU COUNTY KENYA(KCEP-CRAL)

My name is _____. We are conducting research in Kenya in collaboration with the Center for Sustainable Development, University of Ibadan in Nigeria and International Fund for Agricultural. I do not represent the government or any political party. The purpose of this research is to learn about Climate Resilient Agricultural Practices and how this practices as impacted the livelihood of cereal farmers. All information you may provide will be confidential and will be used solely for this study. Your participation is voluntary and you can choose to not participate. With your permission, I will ask you a set of questions related to this research, and this should take about 20 minutes. I will be taking some brief notes as you answer the questions.

Please tick (√) where necessary and provide suggestions where required. Thank you.

SECTION A: Socio-Economic Characteristics

- 1. Date of Interview: Name of Interviewee:
- 2. County/Location/Village:
- 3. Age of Respondent:
- 4. Sex:
- 5. Highest Educational Qualification
- 6. Marital Status
- 7. No. of people in household:
- 8. Length of Residence in Village.....
- 9. Occupation:
- 10. Income
- 11. How often? Daily Weekly Forth-nightly..... Monthly.....

SECTION B: The Agricultural Activities of Female Smallholder Cereal Farmer

12 How many years have you been farming?

1 year 2 years 3 years 4 years 5 years and above

13 As a farmer do you farm for commercial purpose or for household use

14 What kind of agriculture do you practice? Rainfed agriculture Irrigation agriculture

If irrigation, how do you irrigate your crops.....

15 Where do you sell your farm products? Farm location Market

16 If at market, how much do you pay for transportation before KCEP? 100kshs
200kshs 300kshs 400kshs 500 and above

NOW? 100kshs 200kshs 300kshs 400kshs 500 and above

17 Do you have difficulties in transporting your farm products from farm to the market
Yes no

IF yes what are the difficulties

18 Do you make use of crop protection chemicals to prevent your crops from pest before KCEP? Yes No

If yes, how many times per year?

NOW? Yes No

If yes, how many times per year?

19 Were you able to access the market easily to make sales before the Kenya cereal enhancement programme? Yes No

Now? Yes No

20 Do you plant the crops independently(without help) Yes No

If no, how?.....

21 How much is your income per annum before KCEP? 50000kshs to 70000kshs
80000 to 100000kshs 110000 to 130000kshs 140000 to 160000kshs 160000
and above others specify

NOW?How much is your income per annum now? 50000kshs to 70000kshs 80000 to
100000kshs 110000 to 130000kshs 140000 to 160000kshs 160000 and above
 others specify

SECTION C: Land Use, Access and Tenure

22 How many acres of land do you practice farming on before KCEP? One acre two acres three and above

23 NOW? One acre two acres three and above

24 How would you rate your farmland yield before KCEP-CRAL? Very good Good Average poor very poor

25 NOW? Very good Good Average poor very poor

26 Do you own the land you practice farming on? rent the land rotate the space

27 If you don't own the land how much do you pay for the land in Kshs?

28 How often do you pay for the land? Daily monthly yearly

29 Are you convenient with the land or space you occupy? Yes no

30 If no, what are the inconveniences?
.....

SECTION D: CLIMATE CHANGE AND ITS IMPACT ON CEREAL PRODUCTION

31 Have you heard about climate change? Yes No

32 What do you understand about climate change?

33 Is your climate changing? Yes No

If yes, how is it changing?

34 Is climate change having any impact on your cereal production? Yes No

If yes, what are the impacts?

35 What kind of change in climate are you experiencing?

Dry land/low rainfall hot temperature low temperature humidity/high rainfall

SECTION E: IMPACT OF CLIMATE RESILIENT PRACTICES ON CEREAL PRODUCTION

36 What type of cereals do you grow on your land before the Kenya Cereal Enhancement Programme? Green grams Sorghum Maize Millet Beans
Others specify.....

Now? Green grams Sorghum Others specify

37 How many kg of cereal/ Seed do you plant before KCEP?

Green gram 2 4 6 8 others specify

Sorghum; 2 4 6 8
others specify

NOW? Green gram; 2 4 6 8
others specify

Sorghum; 2 4 6 8
others specify

38 How many bags of cereal do you harvest before the KCEP?

Green gram; 2 4 6 8
others, specify

Sorghum; 2 4 6 8
others, specify

39 NOW?

Green gram; 2 4 6 8
others, specify

Sorghum ; 2 4 6 8
others, specify

40 As a member of KCEP, have you adopted climate resilient agricultural practice(CRAP)?
No Yes

41 If yes, which climate resilient agricultural practice have you adopted?

42 Have you been introduced to seed multiplication/bulking? Yes No

If yes, what has been the impact of seed multiplication/bulking? Better access to certified seeds More affordable certified seeds Improved income New house owned New assets owned Others (please specify)

If no, why ?

43 What do you use to enhance the growth of your crops before KCEP? fertilizers
manure others, specify

44 Now? fertilizers manure others specify.....

45 How often do you work on the farm? Daily weekly monthly others specify
.....

46 How does rain affect your farm activities? Positively negatively

47 How does dry season affect your farm activities? Positively negatively

48 How does the climate change affect the female farmer on the farmland? Positively
negatively indifferent

49 To what extent has climate resilient agricultural practice (CRAP) increased productivity
female smallholder cereal farmers access to both local and international market?

No increase

Slight increase

Average increase

Huge increase

50 Has Kenya cereal enhancement programme, climate resilient agricultural practice (KCEP-
CRAP) removed the societal barriers that hinder female smallholder farmers in Embu county?
Yes no

51 What challenges are women facing in cereal production?
.....
.....

52 Has the environment contributed to increased productivity of female smallholder cereal
farmers? Yes No

53 Has the KCEP CRAL help to remove the gender inequalities of women subordination in
the community? Yes No

54 Would you continue with the KCEP-CRAL initiative even after the intervention? Yes

No

55 Can you sustain the KCEP-CRAL programme? Yes No
If No, why?

56 Giving 100% has the maximum grade point, how would you rate the likelihood of KCEP-CRAL's initiative surviving over the years

100% 70% 60% 50% 40% 30% below 30%

FOCUS GROUP DISCUSSION GUIDE FOR KCEP-CRAL BENEFICIARIES

Address of the respondent

Phone Number of the contact

What are the achievements of KCEP-CRAL so far?

What areas have you benefited the most ?

Are there new markets created for you to sell your produce?

Is there climate change?

What kind of climate change are you experiencing?

How has climate change affected cereal production?

Are there vital areas you think KCEP-CRAL is leaving out?

What do you think they could have done better?

How can you describe your current agricultural practice compared to three years ago?

What are the effects of climate change on cereal production before the implementation of climate resilient agricultural practice (CRAP)?

What are the impacts of climate change on cereal production during the implementation of climate resilient agricultural practice (CRAP)?

Do you adopt the climate resilient agricultural practice?

Which climate resilient agricultural practice do you adopt?

How can you describe the current agricultural practice compared to three years ago?

Has the program helped in the development and productivity of your market and how?

What effect does the dry season have on the farm products?

What challenges do you face during the raining season?

What challenges do you face during the dry season ?

Is there accessibility to international markets or goods are sold only within the county?

Has KCEP-CRAL helped to reduce the societal barriers that hinder women? If not, what are the problems?

FIELD PHOTOS



Data collection from key informants



Farmers' demonstration site at Siakago, Mbeere North south. Data collection and FGD at Mbeti south.



Data Collection, questionnaire administration with the facilitator and key informant interview



Data collection and questionnaire administration.