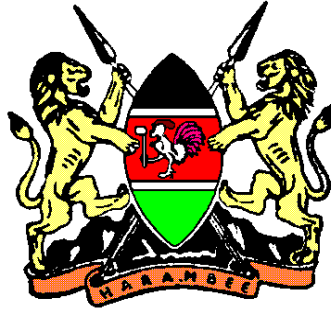


REPUBLIC OF KENYA



THE NATIONAL TREASURY AND PLANNING

STATE DEPARTMENT FOR PLANNING

DRAFT

**Can Green Grams Enhance Food and Nutrition Security in Kenya? Evidence
from top eight Green Grams Producing Counties in Kenya**

FEBRUARY 2020

KENYA 
VISION 2030
Towards A Globally Competitive and Prosperous Nation

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ABBREVIATIONS AND ACRONYMS

| | |
|-------|--|
| AFC | Agricultural Finance Corporation |
| ASALs | Arid and Semi-Arid Lands |
| AU | African Union |
| CBOs | Community Based Organizations |
| CEC | County Executive Committee |
| CGA | Cereal Growers' Association |
| EAGC | East African Grain Council |
| FAO | Food and Agriculture Organization |
| FBO | Faith Based Organization |
| FGD | Focus Group Discussions |
| ICT | Information and Communication Technology |
| INGO | International Non-Governmental Organization |
| ITC | International Trade Center |
| KALRO | Kenya Agriculture and Livestock Research Organization |
| KCEP | Kenya Cereals Enhancement Programme |
| KIHBS | Kenya Integrated Household Budget Survey |
| KII | Key Informant Interview |
| KNBS | Kenya National Bureau of Statistics |
| NCPB | National Cereals and Produce Board |
| NGOs | Non-Governmental Organizations |
| SACCO | Savings and Credit Cooperatives |
| SDA | State Department for Agriculture |
| SDGs | Sustainable Development Goals |
| SNV | Stichting Nederlandse Vrijwilligers (Netherlands Development Organization) |

| | |
|------|--|
| SSA | Sub Saharan Africa |
| UHC | Universal Health Coverage |
| USDA | United States Department for Agriculture |
| UTC | Urban Thrift and Credit |

FOREWORD

In Kenya, agriculture remains the backbone of the economy. In 2018, the sector contributed 34 percent to GDP, 12.2 percent of the formal sector employment, 65 percent of total exports and over 60 percent of informal employment in rural areas. The Agricultural Sector plays a central role in food and nutritional security, which is one of the components of the ‘Big Four’ Agenda of the Kenya Government and Sustainable Development Goal No. 2 (SDG 2) on ending hunger, achieving food security and improved nutrition. The sector also provides synergy to the other components of the Big Four Agenda including manufacturing as it provides 75 percent of industrial raw materials¹, thus supporting employment and income generation. Article 43(1) (c) of the Constitution of Kenya also provides that "*every person has the right to be free from hunger and to have adequate food of acceptable quality.*" The agriculture sector plays an anchor role in this Constitutional obligation.

The Third Medium Term Plan (2018-2022) whose theme is *Transforming Lives: Advancing socio-economic development through the “Big Four”* has clearly prioritized food and nutrition security as a crucial component in both economic and social development. Key among these is the agenda of transforming the agricultural sector through improved productivity and agro-processing, which are expected to contribute to food and nutrition security. Some of the key policy issues are to ensure that the country grows sufficient quantities of staple foods that include maize, rice, potatoes and beans. Despite Kenya being an agricultural country, official statistics indicate that national consumption outstrips the total production of staple foods.

The perennial shortage of foodstuffs compels importation of essential foodstuffs which in 2018 included 47.7 million bags of maize, 28,000 MT of beans, 2,100 MT of wheat and 750 MT of rice. Unfavorable climate, poor farming methods, inadequate marketing systems and traditional dietary practices and increasing population have all conspired to aggravate the situation.

Kenya vast Arid and Semi-Arid Lands (ASALs) is not suitable for maize, beans, wheat, rice and potato farming. With short maturity period and capacity to stand or resist such weather, green

¹ Third Medium Term Plan

grams provide a useful advantage. Besides, it is relatively highly nutritious. In realization of this untapped potential, several ASAL counties such as Meru, Kitui, Kirinyaga, Makueni and Machakos have recently fast-tracked widespread farming of green grams as a cash crop and are mainly grown by small-scale farmers under rain fed conditions and with minimal inputs.

It is in this backdrop that the State Department for Planning embarked on a survey of the production process, marketing and contribution of green grams and to look into the issues that surround the entire green grams value chain. This report examined the trends of production, consumption and area under green grams production over time. This was in a bid to obtain insights on the potential of the crop and make proposals to optimize support of food and nutrition security.

This report serves as a vital reference for key stakeholders, including public policy practitioners, development partners, civil society, academia, private sector and other decision makers on the issue of green grams value chain.

Saitoti Tomore, CBS
Principal Secretary
State Department for Planning

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Lastly I would like to appreciate all the staff of the State Department for Planning whom I may not be able to mention by name but contributed immensely in the preparation of this report. Thank you very much. May the Almighty God bless you all.

Mrs. Katherine Muoki

Director of Economic Planning

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EXECUTIVE SUMMARY

Kenya Vision 2030 identifies agriculture as one of the key sectors under economic pillar that is expected to drive the economy to the projected 10 percent economic growth annually. It has also been identified as one of the sectors that will drive the “Big Four” agenda aimed at achieving 100 percent food and nutrition security by 2022.

In Kenya, pulses are the second most important staple food commodity after cereals. They are an essential source of livelihood for millions of Kenyans and can play a part in mitigating malnutrition among Kenyans. Pulses are rich in proteins, energy, starch, and essential minerals and compounds, which are essential for healthy life. Some of the most important pulses in Kenya include the common dry beans, green grams and pigeon peas.

Arid and Semi-Arid lands (ASALs) constitute approximately 89 percent of Kenya’s land mass where green grams can do well compared to other traditional crops such as maize and beans. Several counties such as Meru, Kitui, Kirinyaga, Embu, Makueni and Machakos have recently fast-tracked widespread farming of green grams as a cash crop. For instance, the Meru County Government has a campaign dubbed “*Ndengu Pesa*” while in Kitui County it is called “*Ndengu Revolution*”. While Kenya has recently popularized the production of green grams (ITC, 2016), the exports of pulses are still depressed and this is despite the huge market prospects in the world and evidence indicating that Kenya has a great potential to grow green grams in large quantities for exports purposes.

The foregoing motivated the State Department for Planning to carry out a comprehensive desk review of data and literature from Kenya National Bureau of Statistics, East African Grain Council, Ministry of Defense and State Department for Correctional Services on the potential of green grams in supporting the “Big Four” Agenda. The analysis which was done in 2018/19 revealed significant gaps which necessitated the research team to conduct a survey in eight top green gram producing counties which included Taita Taveta, Makueni, Machakos, Kitui, Meru, Tharaka Nithi, Embu and Kirinyaga. The research team used the following approaches to collect information and finalize the research report: An interview with the Chief Officers in charge of Agriculture and

Cooperative Development in the counties; Focused Group Discussions with the farmers; and administered questionnaires to green gram growing farmers.

The key findings of the research indicate that farmers rely on rain-fed agriculture which is erratic and unreliable thus adversely affecting green gram production and yield. There is a big challenge of extension officers to adequately serve the green gram farmers in the counties visited. This makes follow up of farmers difficult and thus leads to low impact of the knowledge and hence low production. The farmers use poor farming practices such as ox ploughing due to the high cost of acquiring farming equipment and machinery from the county government and private providers. Also pest invasion affects the production and productivity of green grams in most of the counties visited. We also found that there are post-harvest losses due to poor storage facilities among the farmers. The cost of farm inputs is also very high, impacting negatively on the farmers. Further, farmers also face constraints in accessing the market due to poor conditions of roads which leads to exploitation by middle men.

Based on the findings the study prescribed the following recommendations:-

- i. County Governments should provide subsidized farm machinery and equipment (ploughs, harvesters, threshers, etc.) to maximize yields and bring down the cost of production.
- ii. The Government should consider increasing the amount of certified seeds per farmer and subsidizing the cost of other farm inputs such as fertilizer and agro-chemicals. This would lower the cost of production and thus enable the farmers produce more.
- iii. The National and County Governments should provide a crop insurance scheme to cushion farmers against losses attributable to weather variability and pests.
- iv. The County Governments should support the development of post-harvest management systems, technology and aggregation infrastructure.
- v. The National Government should develop and implement a green gram trading and blending policy for Kenya that would ensure that buying and selling is done through a legal entity e.g. cooperatives; creating clear market linkages, including export markets; considering and purchasing green grams as part of strategic food reserves; considering green grams as part of food supplies for public institutions such as disciplined forces and educational institutions.

- vi. The County government should support farmers with the requisite financial, knowledge and skills in production of green grams by strengthening extension services. Counties should also promote sustainable agricultural practices.
- vii. Farmers should form groups and cooperatives that will help in marketing their farm produce. There is also need to promote contract farming to enhance marketing of green grams and protect farmers against exploitation by the middlemen.
- viii. The farmers groups should undertake initiatives that will ensure value addition to their produce as well as branding. Counties should support and promote the development of cottage industries for value addition.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Food security means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life. Food insecurity is a major global concern because one billion people are suffering from starvation and malnutrition. In Sub-Saharan Africa, the number of people suffering from hunger is estimated at 239 million, and this figure could increase in the near future (FAO 2018).

For almost half a century, Sub-Saharan Africa (SSA) has been struggling, in one form or another, with food insecurity. The unfortunate situation has been caused by a number of factors including distribution obstacles, global climate change, inadequate markets and inability or disinterest to act by local officials.

Taking cognizance of the above, goal two of the Sustainable Development Goals (SDGs) seeks sustainable solutions to end hunger in all its forms by 2030 and to achieve food security. The aim is to ensure that everyone everywhere has enough good-quality food to lead a healthy life. Achieving this Goal will require better access to food and the widespread promotion of sustainable agriculture.

African Union's Agenda 2063 envisages a continent without any form of food or nutrition insecurity and hunger. Towards this end, measures will be adopted that lead to food sovereignty by supporting capacity to produce safe, nutritious and culturally acceptable foods, promoting research in local seeds systems and farming methods, protection of indigenous seeds and knowledge technologies, establishment of local seed banks and ensuring access to natural resources by farmers, fishers and pastoralists.

At the regional level, the East African Community agenda 2050 also seeks to promote improved agricultural interventions with emphasis on greater diversification towards domestic-oriented production and value addition. In Kenya, The Constitution of Kenya, Article 43 (1c) recognizes that every Kenyan has the right to be free from hunger and to have adequate food of acceptable

quality. To actualize these Constitutional rights, the Kenya Vision 2030 through its Medium-Term Plans is clearly formulated to drive Kenya's socio-economic transformation for higher outcomes. For instance, the third Medium Term Plan (2018-2022) integrated the "Big Four" Agenda which seeks to improve Kenyans' livelihoods and wellbeing by going back to the basics and is a critical component in the country's ability to generate wealth for sustainable development. The "Big Four" initiatives are: Enhancing Manufacturing; Ensuring Food and Nutrition Security; Universal Health Coverage and Affordable Housing.

To achieve food and nutrition security, the priority actions include assessing the status of research in agriculture and its contribution to improving production in the sector and economy in general. Further, to improve on food and nutrition security, efforts will focus on promoting indigenous food consumption and diversifying the staple foodstuffs; enhancing reduction of food wastage and food loss; strengthening the supply chains and linkages to value addition; improving on food information market systems; and increasing investment especially in agricultural inputs infrastructure.

In Kenya, pulses are the second most important staple food commodity after cereals. Pulses are an essential source of livelihood for millions of Kenyans and can play an important role in mitigating malnutrition challenges among Kenyans. Some of the most important pulses in Kenya include the common dry beans, green grams and pigeon peas. In addition, Pulses are rich in proteins, energy, starch, and essential minerals and compounds, which are essential for healthy life.

In 2018, the agricultural sector recorded a growth of 6.6 percent from 1.8 percent in 2018. This was attributed to favorable weather conditions during the period. The sector accounts for the highest contribution to GDP at 34.2 percent in 2018 followed by Transport and Storage Sector at 8.0 percent and Manufacturing Sector at 7.5 percent during the period (Economic Survey, 2019). As is common with most developing countries, agriculture is largely a subsistence activity in Kenya. For instance, 98 percent of farmers are small scale and account for 70 percent of production while 2 percent are large scale and account for 30 percent of production. Farm yields are grossly constrained by reliance on rain fed agriculture, poor seeds and poor crop husbandry.

Arid and Semi-Arid Lands (ASALs) constitute approximately 89 percent of Kenya's land mass where green grams can do well compared to other traditional crops such as maize and beans.

Several counties such as Meru, Kitui, Kirinyaga, Embu, Makueni and Machakos have recently fast-tracked widespread farming of green grams as a cash crop. For instance, the Meru County Government has a campaign dubbed “*Ndengu Pesa*” while in Kitui County it is called “*Ndengu Revolution*”. While Kenya has recently popularized the production of green grams (ITC, 2016), the exports of pulses are still depressed despite the huge market prospects in the world. This is despite evidence indicating that Kenya has a great potential to grow green grams in large quantities for exports purposes. This report demonstrates that a properly structured and innovative green grams value chain can support the food and nutrition security as well as supply of industrial raw materials and growth of incomes to support other components of the “Big Four” Agenda. The resulting higher farmer incomes would, for instance, enable them to subscribe to Universal Health Coverage (UHC) programme, acquire affordable housing and create employment for the populace.

1.2 Problem Statement

Kenya is still classified as a food deficit country despite the agriculture sector being the major driver of the economy. Official statistics indicate that food production has been declining due to dependence on rain-fed agriculture, low adoption of technology including biotechnology, frequent attacks by pests and crop diseases, climate change, degradation of agricultural land, encroachment of urbanization into arable land and rural-urban migration. Further, post-harvest losses due to poor storage, poor road network and infestation by pests and rodents exacerbate the problem.

Since Kenya is endowed with vast land classified as ASALs, in an effort to address the issue of food security, several counties such as Meru, Kitui, Kirinyaga, Makueni and Machakos with sections classified as ASALs have recently fast-tracked and promoted widespread farming of green grams as a cash crop that is mainly grown by small-scale farmers under rain fed conditions and with minimal inputs. The successes that have been recorded in green grams production in these counties shows that this is one of the crops that is climate smart and can be produced in bulk at minimal cost.

However, some counties such as Kitui and Tharaka Nithi have experienced a glut due to lack of clear marketing strategies. Other challenges facing green gram production include; low technology adoption, poor storage, inadequate policy framework and limited value addition opportunities that contributes to low prices resulting to exploitation of the farmers by the middlemen. If these challenges are left unaddressed, the farmers are likely to be discouraged and turn away from

farming green grams. Similarly, despite the high nutritional benefits of green grams, the consumption of domestic produce is yet to be well embraced locally.

It is therefore important to explore opportunities for promotion of green gram production in the country focusing on the counties that have higher potential to produce the crop. This and consumption is also important for providing lessons that can be cascaded to other agricultural produce in other parts of the country.

1.3 Objectives of the study

The main objective of this study is to analyze green grams potential in supporting the ‘Big Four’ initiatives with specific emphasis on food and nutrition security.

Specifically, the study seeks to:

- i. Examine the trends of production and consumption of green grams in Kenya;
- ii. Evaluate the nutritional content of green grams compared to beans;
- iii. Investigate the value chain of green grams;
- iv. Provide policy recommendations based on the findings on production, consumption, and marketing of green grams in Kenya.

1.4 Significance of the study

The study plays a critical role in providing policy makers with appropriate policy recommendations at National and County level towards harnessing the potential of green grams farming in achieving food and nutrition security in Kenya. Specifically, the study is significant in identifying areas of interventions towards increasing green gram production, green gram value addition and identifying potential market linkages. The results of the study are also important for benefit transfer purposes.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Introduction

The methodology adopted in this study was participatory and involved a mixture of qualitative and quantitative data analysis. Available secondary data (e.g. Economic Surveys, KIHBS 2015-16), were obtained from KNBS). Primary data was collected from the sampled counties, targeting key stakeholders in the Agricultural Sector who are involved in green grams production in the top eight green grams producing counties. This was done through interviews, questionnaires and focused group discussions. The study focused on Taita Taveta, Makueni, Machakos, Kitui, Tharaka Nithi, Kirinyaga, Embu and Meru Counties.

2.2 Sampling design

Key informant interviews were based purely on purposive sampling while the focus group discussions were designed based on cluster sampling to ensure inclusivity in geographical coverage for each of the eight counties. The target population for the study included green grams farmers in all the eight counties.

The sampling of the eight counties was determined purposively in consultation with the key stakeholders in the sector after review of various government publications on green grams production and data based on the target areas. The study then adopted purposive sampling design to identify and mobilize the study respondents to be interviewed in all the selected counties. To ensure representation of the respondents, the key informants in the counties ensured that participants were drawn from sub-county farmer groups, cooperatives and CBOs that are involved in green grams production in the county. At the household or individual level, the study adopted a purposive multistage sampling technique in identifying respondents for the individual interviews. First, the study identified the farmer groups in each of the wards through the key informant in the county. The second stage involved identification of a representative in each farmer group. This ensured that at least every ward or sub county had a representation.

2.3 Data Collection Tools and Instruments

Data collection tools were developed for the study that captured data for all the study questions at the individual interview level, Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs). Qualitative data collection tools for FGDs and KIIs guides were developed in consultation with various stakeholders in the sector to collect information that would not be collected by the individual survey questionnaire. The study employed a range of methodologies to collect both qualitative and quantitative data to address the study objectives. The methods employed are as elaborated in the next section.

2.3.1 Desk Review

This entailed a review of the various documents/ publications from the State Department for Crop Development, internet sources, reports on cereals production, various economic surveys, agricultural census reports and journal articles among others. All documents and data/ records reviewed have been appropriately referenced in the study report. The study also made use of relevant government publication from the County offices dealing with crop production and National Government offices at the County level to gather data on green grams production in the counties.

2.3.2 Key Informant Interviews

Information were solicited from key informants from the County Government offices mainly the Directors of Agriculture in the County, as well as county officials who could have more information on green grams production in the county. In certain counties, the research team visited farmers in the fields to observe the green grams in the farms, storage, and aggregation centers. The research team also visited the market centers to assess the pricing of the green grams in an effort to ascertain the findings from the KIIs, FGDs and individual survey questionnaires

2.3.3 Questionnaires

To collect quantitative data, questionnaires were also administered to the farmers and farmer groups representatives. Farmers who had challenges in filling out the forms were assisted by the planning secretariat and the county officials e.g. extension officers.

2.3.4 Focus Group Discussions

Information was also collected focused group discussions. On average, the number of participants was between 8 and 16 individuals. The FGDs took into consideration representation from the youths, elderly, women and persons with disability.

2.4 Data Analysis and Reporting

Data analysis and reporting involved a 3-tier process involving data entry, cleaning, actual analysis and report writing. Qualitative data accruing from this research was transcribed in Word then analysed through triangulation and content analysis. Where applicable, verbatim quotations were extracted to justify and augment key findings. Data presentation was arranged thematically in a manner that responds to all the research questions and research objectives. The results were presented in tables, pie charts and graphs. Cross-tabulation was used to enrich the analysis.

CHAPTER THREE

3.0 FINDINGS FROM DESK REVIEWS

3.1 Green grams production and consumption in Kenya

Green grams locally known as *Ndengu* are widely grown in Kenya. The varieties alternate between local and improved varieties. The two major varieties are KS20 (*Uncle*) which matures in 80-90 days and N26 (Nylon) which matures in 60-65 days². The potential for production of green grams in Kenya is high and thus farmer organizations for production and aggregation are important to maintain volumes of good quality grain.

Green grams have a determinate growth habit, flowers in 40-50 days and have potential yields ranging from 300-1500kg/hectare (520-600kg/acre). Development Partners and the National Government through the Kenya Agricultural and Livestock Research Organization have included this crop in their seed distribution program and promoted it not only as a food crop but also a cash crop³. Some local leaders among them the Governors of Kitui, Makueni, Tharaka Nithi and Meru Counties embraced this development and announced the '*Ndengu* Revolution' in their counties.

According to KIHBS 2015-16, production of green grams has been fluctuating over the years. Table 1 provides trends of green grams production and consumption in Kenya between 2014 and 2017. During this period, Kenya recorded an average production of 1,245,823 bags of 90 Kg of green grams with 2014 recording the highest production of 1,345,294 bags of 90 Kg and 2015 recording the lowest production of 1,165,211 bags of 90Kg.

During the same period, consumption of green grams has been increasing steadily recording a high of 7,327,777 bags of 90 Kg in 2017 from 6,354,444 bags of 90 kg in 2014 with an average consumption of 6,741,861 bags of 90 Kg. The levels of consumption exceeded production of green grams over the study period. On average the country recorded a deficit of 5,496,038 bags of 90 Kg.

² Information from field reports/farmers

³ Information from County Directors of Agriculture

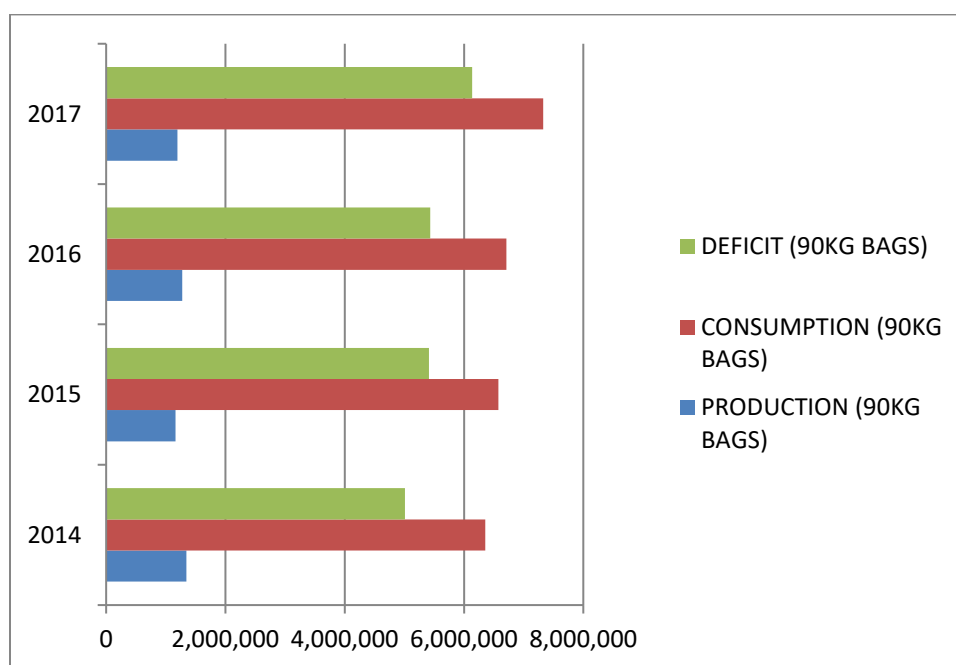
Table 1: Green grams production and consumption in Kenya 2014 - 2017

| YEAR | 2014 | 2015 | 2016 | 2017 |
|-------------------------|-----------|-----------|-----------|-----------|
| AREA (HA) | 251,516 | 198,239 | 194,625 | 302,292 |
| PRODUCTION (90KG BAGS) | 1,345,294 | 1,165,211 | 1,277,677 | 1,195,110 |
| CONSUMPTION (90KG BAGS) | 6,354,444 | 6,576,111 | 6,709,111 | 7,327,777 |
| DEFICIT (90KG BAGS) | 5,009,150 | 5,410,900 | 5,431,434 | 6,134,668 |

Source: KIHBS 2015-16

A graphical presentation of the trends in green grams production and consumption in Kenya between 2014 and 2017 is shown in Figure 1. Production-consumption deficit has been growing, suggesting opportunities for enhancing domestic production to substitute imports.

Figure 1: Green grams production and consumption in Kenya 2014-2017



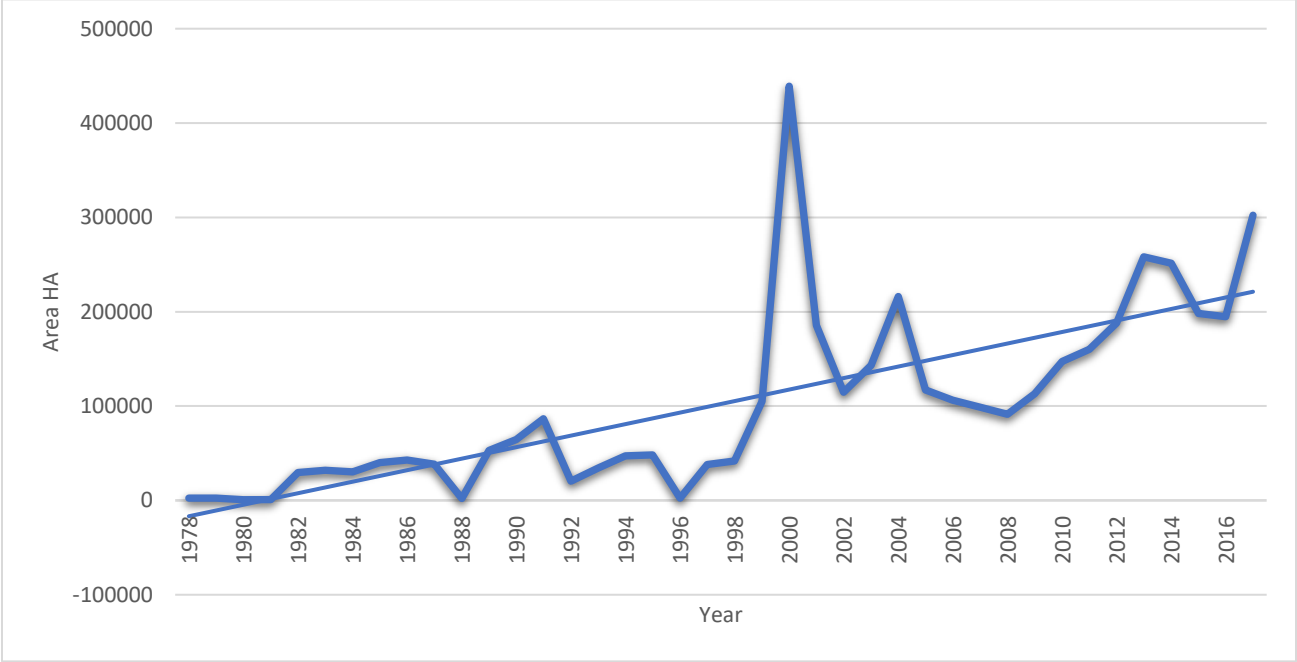
Source: KIHBS 2015-16

3.2 Area under Green Gram production in Kenya

The area under production of green grams has been rising steadily from 1978 to 2017. According to the Economic Survey (various years), the production per hectare of green grams has been increasing steadily over time (see Figure 2). There was a sharp increase in the size of land under green grams in the year 2000 to 439,073 hectares. This was attributable to massive campaigns in

the counties for the farmers to plant green grams and a promise of ready market in China and India. This was referred to Ndengu revolution in Kutui and Makueni Counties. In the 2017, the size of the land under green grams had risen to 302,292 hactares.

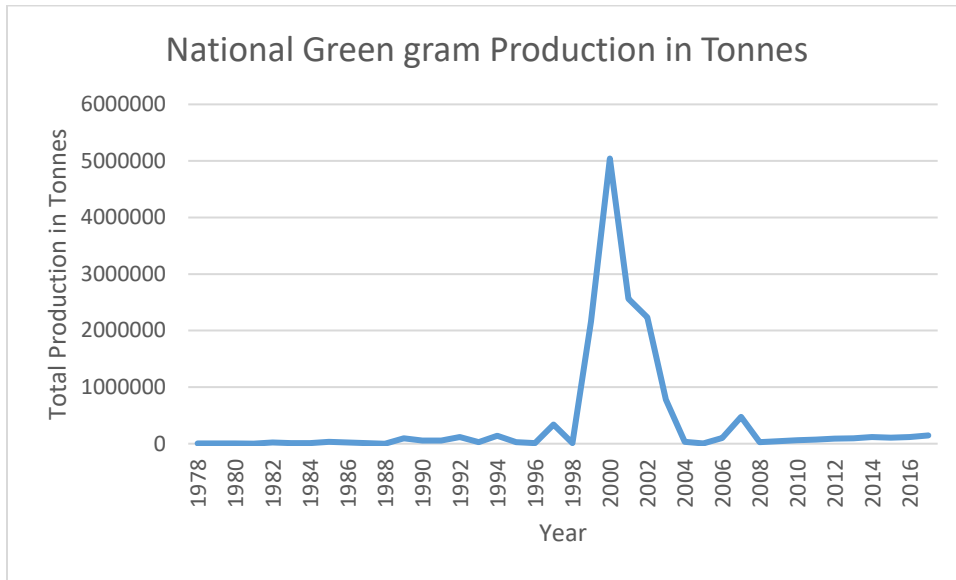
Figure 2: Trends in National Green grams Production Area in Hectares



Source: Economic Survey (various years)

The production of green grams in tones show a mirror image of total area in HA as shown in Figure 3. For instance, the production of green grams increased from 2,698 tons in 1978 to 20,405 tons in 1982 and then to 340,009 tons in 1997. In 2017 the production was 148,885 tonnes. Figure 2 shows an analysis of areas under green gram production for the period 1978 to 2017.

Figure 3: Production of green grams in tonnes



3.3 Major Green grams producing Counties in 2017

According to Economic Survey (2017), Makueni County has the largest area under green gram production totaling to 80,340 Ha. This is followed by Kitui and Machakos Counties which recorded 78,316 and 21,269 Ha respectively. Bugoma and Bomet Counties had the lowest area under green grams, with Bugoma recording 233 ha, while Bomet had none.

In terms of tonnage production, Makueni had the highest tonnage of 54,910 tons followed by Kitui and Machakos Counties which recorded 53,870 and 13,163 tons of Green grams respectively. Bugoma County had the least production of green grams with an average production of 166 tones.

Different Counties recorded different levels of productivity per Ha in tonnage. Makueni had the highest yield of green grams, with an average yield of 1.4 Tons/HA. Busia, Meru and Tharaka Nithi Counties recorded an average yield of 1.2 Tons/HA Tana River county produce the lowest yield per Ha at 0.5. Although Machakos County production is high, the average yield per Ha is low at 0.6 tonnes. Table 2 shows an analysis of major Green gram producing counties in Kenya by total hectares under green grams, total production in tonnes, and average yield in tonnes per hectare.

Table 2: Major Green grams producing counties in 2017

| County | Total Area Ha | Total Production Tons | Average Yield Tons/Ha |
|-----------------|--------------------------|----------------------------------|----------------------------------|
| Makueni | 80,340 | 54,910 | 1.4 |
| Kitui | 78,316 | 53,870 | 0.7 |
| Machakos | 21,260 | 13,163 | 0.6 |
| Tharaka Nithi | 15,297 | 6,855 | 1.2 |
| Embu | 6,045 | 4,891 | 0.8 |
| Kwale | 4,074 | 3,617 | 0.9 |
| Meru | 3,939 | 2,966 | 1.2 |
| Kisumu | 3,980 | 2,740 | 0.7 |
| Kilifi | 3,774 | 2,519 | 0.7 |
| Lamu | 2,642 | 2,332 | 0.9 |
| Taita Taveta | 1,712 | 1,217 | 0.7 |
| Migori | 1,483 | 1,094 | 1.0 |
| Busia | 586 | 728 | 1.2 |
| Baringo | 789 | 659 | 0.8 |
| Tana River | 892 | 453 | 0.5 |
| Elgeyo Marakwet | 569 | 385 | 0.7 |
| Kirinyaga | 423 | 328 | 0.8 |
| Homabay | 510 | 316 | 0.6 |
| Bungoma | 233 | 166 | 0.7 |
| Bomet | 0 | 0 | - |
| Total | 152,802 | 107,559 | 0.7 |

Source: SDA 2017

3.4 Green gram consumption by Counties

Green gram are of economic importance to the country since it has the potential to boost the living standards of people in arid and semi-arid areas (ASALs) of Kenya through improved nutrition and enhanced household incomes. Although local consumption demand outstrips production, unstructured markets and distribution are such that consumers buy the commodity at exorbitant prices though farmers sell at very low prices. Table 3 shows pulse consumption in kilogram per county in Kenya as per KIHBS, 2015/16.

Table 3: Consumption of pulses (Kg) in Kenyan Counties in 2015/16

| County | Beans | Green Grams | Dolichos | Other Grams | Peas |
|---------------|--------------|--------------------|-----------------|--------------------|-------------|
| Mombasa | 13,804,125 | 3,307,214 | 36,907 | 17,638 | 1,075,221 |
| Kwale | 9,107,814 | 2,335,753 | 14,047 | - | 77,374 |
| Kilifi | 16,262,754 | 1,365,059 | 83,961 | - | 862,933 |
| Tana River | 4,354,659 | 988,927 | 23,528 | 192,852 | 134,716 |
| Lamu | 2,009,441 | 572,391 | 153,266 | - | 140,298 |
| Taita Taveta | 4,850,810 | 1,287,644 | 106,347 | 11,960 | 211,061 |
| Garissa | 3,929,158 | 100,007 | 4,822 | - | 76,983 |
| Wajir | 6,012,023 | - | - | - | - |
| Mandera | 7,123,791 | 3,373 | - | - | - |
| Marsabit | 6,940,005 | 86,932 | - | - | 8,876 |
| Isiolo | 2,194,861 | 115,241 | 21,473 | - | 232,376 |
| Meru | 44,085,788 | 5,413,620 | 2,872,444 | 123,288 | 5,151,651 |
| Tharaka Nithi | 11,680,969 | 3,834,053 | 186,978 | - | 2,859,314 |
| Embu | 13,083,734 | 2,832,082 | 257,854 | 11,751 | 1,263,993 |
| Kitui | 18,982,383 | 4,127,897 | 2,092,828 | 32,886 | 6,022,803 |
| Machakos | 23,215,338 | 2,323,263 | 317,910 | - | 8,329,211 |
| Makueni | 22,518,122 | 2,111,224 | 38,738 | - | 5,342,956 |
| Nyandarua | 13,311,677 | 1,292,907 | 583,318 | 184,905 | 4,586,104 |
| Nyeri | 15,095,524 | 2,685,108 | 878,919 | 8,522 | 851,096 |
| Kirinyaga | 10,689,962 | 1,607,736 | 237,629 | 2,013 | 704,566 |
| Muranga | 22,214,188 | 1,523,347 | 1,217,204 | 22,362 | 1,016,166 |

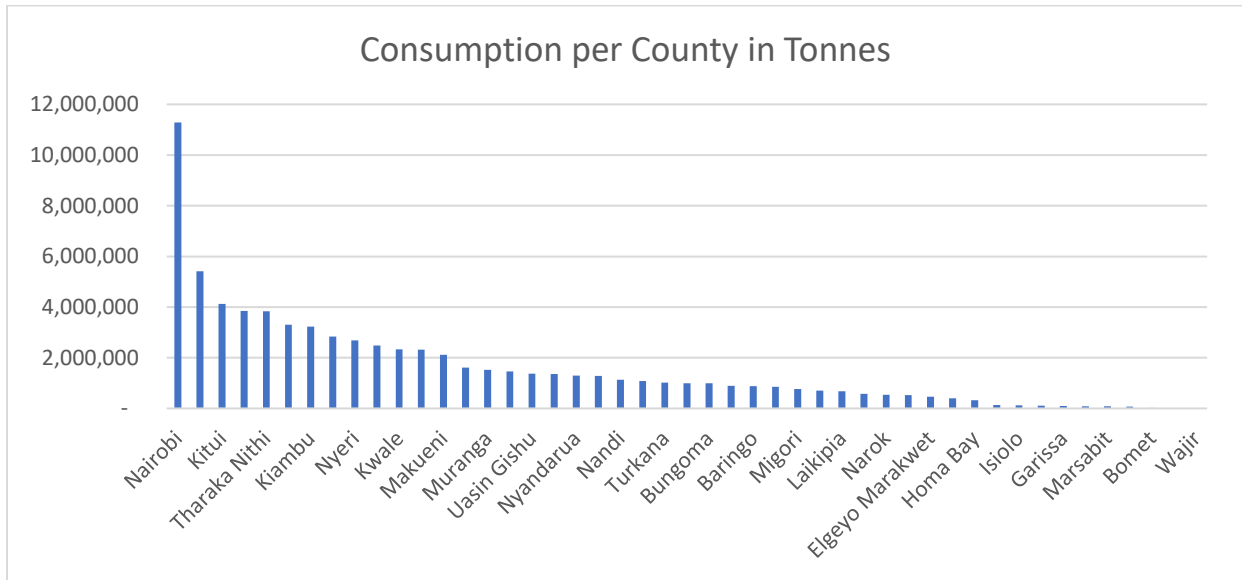
| County | Beans | Green Grams | Dolichos | Other Grams | Peas |
|-----------------|--------------|--------------------|-----------------|--------------------|-------------|
| Kiambu | 20,487,619 | 3,229,692 | 1,791,926 | 109,145 | 1,583,962 |
| Turkana | 16,455,977 | 1,016,893 | 10,698 | 799,376 | 2,091,583 |
| West Pokot | 7,495,278 | 75,027 | - | - | 8,842 |
| Samburu | 3,929,277 | 111,232 | 50,204 | - | 200,198 |
| Trans Nzoia | 18,656,307 | 894,968 | 74,556 | - | 881,755 |
| Uasin Gishu | 14,629,907 | 1,370,045 | 26,173 | - | 240,686 |
| Elgeyo Marakwet | 10,289,890 | 459,023 | - | 13,713 | 71,062 |
| Nandi | 12,866,522 | 1,135,076 | 2,354 | - | 63,210 |
| Baringo | 14,468,847 | 875,594 | 66,706 | 9,762 | 1,077,731 |
| Laikipia | 9,229,674 | 672,054 | 278,401 | - | 363,009 |
| Nakuru | 27,748,795 | 3,847,012 | 897,986 | 4,985 | 4,278,614 |
| Narok | 15,018,878 | 541,749 | 154,148 | - | 2,403,858 |
| Kajiado | 10,109,105 | 1,076,278 | 638,064 | 11,085 | 1,469,875 |
| Kericho | 15,967,071 | 404,676 | 53,320 | 7,733 | 433,612 |
| Bomet | 14,055,008 | 19,612 | - | 51,957 | 213,607 |
| Kakamega | 19,443,464 | 1,463,955 | - | 217,358 | 11,734 |
| Vihiga | 4,696,966 | 696,798 | - | - | 75,469 |
| Bungoma | 18,712,663 | 987,200 | 16,317 | 42,482 | 18,738 |
| Busia | 7,898,651 | 132,823 | - | - | 66,933 |
| Siaya | 13,444,391 | 850,910 | - | 10,115 | 62,155 |
| Kisumu | 11,503,819 | 2,482,537 | 24,259 | - | 8,369 |
| Homa Bay | 14,018,118 | 317,722 | - | - | - |

| County | Beans | Green Grams | Dolichos | Other Grams | Peas |
|---------------|--------------------|--------------------|-------------------|--------------------|-------------------|
| Migori | 11,600,291 | 764,304 | 4,899 | - | 3,542 |
| Kisii | 12,218,276 | 525,642 | - | - | 139,129 |
| Nyamira | 7,179,442 | 87,058 | - | - | 33,034 |
| Nairobi | 23,541,219 | 11,285,821 | 2,328,851 | 428,292 | 5,749,103 |
| TOTAL | 627,132,581 | 73,237,479 | 15,547,035 | 2,314,180 | 60,497,508 |

Source: KIHBS 2015/16

The table shows that Nairobi County recorded the highest consumption compared to other counties in 2015/16. Consumption level for Nairobi stood 11,285,821 kg of green grams. This was followed by Meru County which consumed 5,413,620.3 Kgs and Kitui with a consumption of 4,127,897.2 kg of green grams. Mandera, Bomet, and West Pokot recorded the lowest consumption at 3,372.7 Kgs, 19,612.29 Kgs and 75,026.59 Kgs of green grams respectively. Figure 4 shows graphically green grams consumption by county.

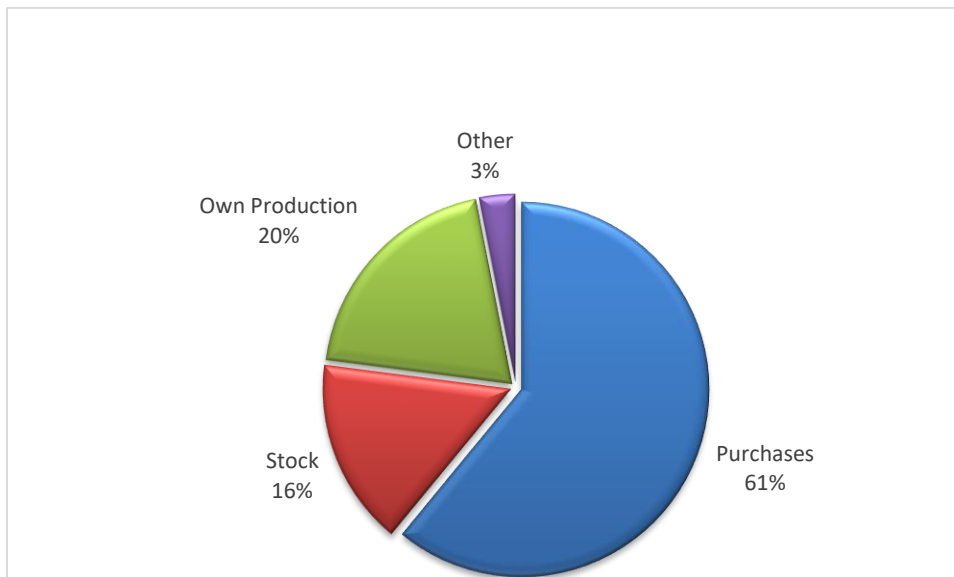
Figure 4: Green Grams Consumption by County



Source: KIHBS, 2015/16

Similarly, as shown in Table 3, the National Consumption of green grams in 2015/16 was 73,237,479 Kg. It was noted that out of this, 61 percent was from purchases, 20 percent from the own production, 16 percent from stock and 3 percent from other sources (see Figure 5).

Figure 5: Green Grams National Consumption (Kg) in 2015/16



Source: KIHBS, 2015/16

3.5 Health benefits of green grams

To attain food and nutrition security in Kenya, harnessing pulses is important. Pulses play an important role in the farming systems. They have proved to be ideal crops for achieving improvements in nutrition and health conditions, reducing poverty through higher food security and enhancing ecosystem resilience. Establishment of pulse crops increases pest/disease resistance, drought tolerance, nitrogen fixation and improving soil health. Pulses mature fast and can be grown in many parts of the country. Green grams like most of the other pulses are not only low in calories and fat, but also a good source of protein, fibre and minerals.

3.5.1 Protein Content and Price of Beans and Green grams

A survey done by KNBS in 2018 showed that, green grams have a higher protein content of 24 grams per 100 grams more than beans at 21 grams per 100 grams. This implies that green grams are essential in addressing the issue of food security and nutrition. The price of a kilo of beans and green grams has been increasing over the years (2010 - 2018). It is also to be noted that the price of a kilo of green grams was higher than that of a kilo of beans during this period. To the consumer, the cost per one gram of protein from green grams was higher than that of beans during the period. This analysis means that green grams are too expensive as a source of protein. Table 4 shows the analysis of protein content and price of beans and green grams.

Table 4: Protein content and price of Beans and Green grams

| S/No. | Item | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------|------------------------------------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | Proteins in 100 grams | | | | | | | | | |
| | Beans | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 | 21 |
| | Green grams | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| 2 | Proteins in 1Kg | | | | | | | | | |
| | Beans | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 | 210 |
| | Green grams | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| 3 | Price (Ksh per Kg) | | | | | | | | | |
| | Beans | 21.1 | 39.5 | 41.7 | 36.9 | 76.6 | 78.4 | 76.9 | 92.3 | 87.2 |
| | Green grams | 99.5 | 120.6 | 108.7 | 103.0 | 115.8 | 132.3 | 132.6 | 131.7 | 121.1 |
| 4 | Price per 1 gram of protein | | | | | | | | | |
| | Beans | 0.1 | 0.2 | 0.2 | 0.2 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| | Green grams | 0.4 | 0.5 | 0.5 | 0.4 | 0.5 | 0.6 | 0.6 | 0.5 | 0.5 |

Source: *Economic Survey (2018)*

3.6 Green grams Nutrients Contents

Green grams like most of the other pulses are a good source of protein, vitamins, minerals and fibres. Table 5 summarizes the nutritional and health benefits of Green grams.

Table 5: Nutrient Database for green grams

| Nutrients | Per 100 grams |
|-----------------------|---------------|
| Dietary fiber | 16.3 g |
| Protein | 23.86 g |
| Thiamine (B1) | 0.621 mg |
| Riboflavin (B2) | 0.233 mg |
| Niacin (B3) | 2.251 mg |
| Pantothenic acid (B5) | 1.91 mg |
| Vitamin (B6) | 0.382 mg |
| Folate (B9) | 625 µg |
| Calcium | 132 mg |
| Iron | 6.74 mg |
| Magnesium | 189 mg |
| Manganese | 1.035 mg |
| Phosphorus | 367 mg |
| Potassium | 1246 mg |
| Zinc | 2.68 mg |

Source: *USDA National Nutrient Database for Standard Reference*

3.6.1 Importance of green grams consumption

(i) Good source of healthy affordable protein

Green grams can be a good alternative source of protein for those who cannot afford meat protein or vegetarians. One hundred grams of green grams provide 7.6g of protein, a moderate amount that can help one meet the recommended daily intake (0.8g per kilogram of body weight).

(ii) Good for weight management

Green grams are low in calories and fat providing just 105kcal and 0.38g respectively per 100g of cooked (boiled) mature green grams. This is due to their complex carbs and fibre which also makes them slow to digest. As a result, they release energy much slowly increasing the feeling of fullness. For this reason, they are ideal for weight management. They are also a good source of lean protein which does not contain fat.

(iii) Good source of dietary fibre

Green grams provide moderate amounts of dietary fibre (7.6g/100g) which is key for a healthy digestive system as it increases the stool volume and transit time. The fibre also binds toxins and cholesterol by aiding their removal from the body and thereby lowering blood cholesterol which reduces the risk of cardiovascular diseases.

(iv) Rich source of folate

Green grams are rich in folate providing about 40percent (159 mg/100g) of the recommended daily intake. Folate is a very important nutrient especially during pregnancy. It helps prevent cases of neural tube defects (e.g. spinal bifida) and also ensures optimal development of tissues and cells. This is the main reason why expectant mothers are supplemented with folate during pregnancy as they have to cater for the increased need of folate. Green grams can therefore be good additions to the diets of pregnant and lactating women to help them get adequate folate.

(v) Good source of iron

Green grams like most pulses are good sources of iron, an essential mineral which aids the body to transport oxygen, boost energy production and metabolism. Iron is also important to prevent iron deficiency anemia, which is the most common nutrient deficiency worldwide. To increase availability of this iron for absorption, people are advised to eat iron rich foods, not just green grams, along with foods rich in Vitamin C which can be found in most fruits (citrus) and greens.

(vi) Good source of other minerals

Green grams are not only good sources of iron but other essential minerals including magnesium, calcium, zinc, manganese, potassium and phosphorus. Eating them can therefore enable people to get their daily dose of these minerals which are vital for the normal functioning of the body.

3.7 The value chain of green grams in Kenya

Most players in the green grams value chain operate at functional lines such as inputs, production, packaging and marketing as well as the provision of services such as information, credit and extension. As a result, their efforts remain in a niche area and are too confined to have an appreciable sector-wide impact. It's instructive that realizing the growth potential of green grams to scale will require concerted actions throughout the value chain, based on evidence-based frameworks and strengthened collaborations between all the players involved. Moreover, the potential for growth in farm-level income and productivity in Kenya will be closely tied to growth in productivity and distinct value addition at the various stages in the value chain. The various stages in the value chain are briefly explained in (i) to (v) below.

- (i) **Farm to local market:** Green grams mature within 60 to 70 days. Its harvested using labor-intensive processes and the farmers sell it to brokers who in turn sell it to the local markets.
- (ii) **Local market to wholesaler or miller:** The wholesalers buy the grain from the local markets in bulk and thereafter sell it to retailers.
- (iii) **Imports to wholesaler:** The wholesalers may also purchase imported grain in order to meet consumer demand. Importation of green grams is necessary where there is a production deficit of the grain, and there is need to satisfy consumer demand.
- (iv) **Wholesale market miller to retailer:** The wholesalers sell the grains to various retailers.
- (v) **Retailer to consumer:** Retailers sell the grains to end-users or the consumers. The consumers eat the green grams and get its benefits of protein and essential minerals which promote good health.

The process described above is illustrated in figure 6 below.

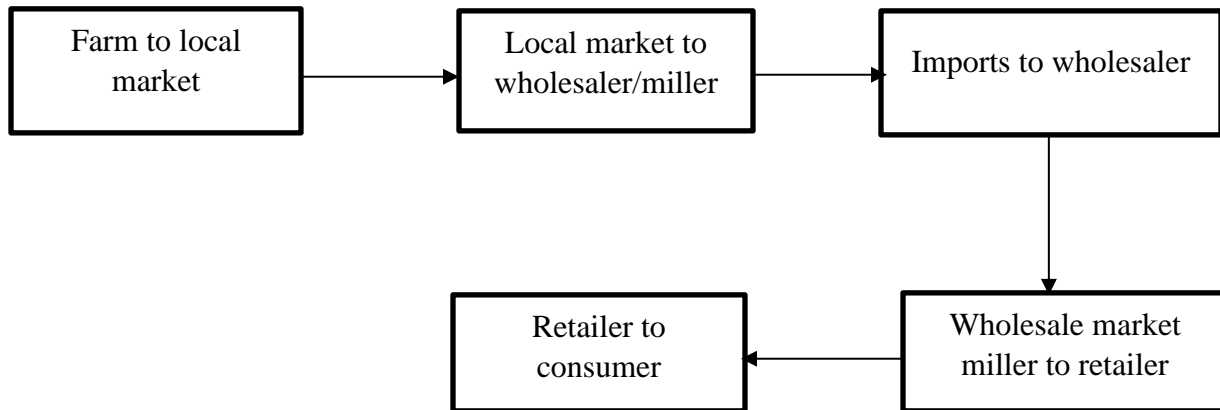


Figure 6: The Value Chain of Green grams (*Ndengu*) in Kenya

3.8 Uses of green grams

Across the country, green grams are commonly used as an accompaniment for Chapati, Rice and Ugali and preparation of snacks such as Samosa.

It is also important to note that green grams can be used for other food supplies. In this regard, green grams demonstrate cost effectiveness in providing a solution to the issue of food and nutrition security. The other potential uses of green grams for other food supplies include:-

3.8.1 School feeding program

The National Government commits to strengthening the National School Meals and Nutrition Programme with the aim of ensuring that all children in pre-primary and primary schools receive at least one nutritious meal per school day. Biscuits made from green grams could be included in the school feeding programme.

3.8.2 Supplement to beans in prison and public hospitals

Green grams can be used as a supplement to beans in prisons and hospitals. The move will be strategic by the Government to improve prisoners' and patients' welfare and thereby creating a ready market for green grams. Green grams have high nutritional value like iron which is an essential mineral for healthy life.

3.8.3 Include green grams in the menu for uniformed officers

Green grams are nutritious and can be used for uniformed officers menu as it would improve their health and create ready market for green grams.

3.8.4 Use of green grams in animal feed manufacture

Green grams may be used to manufacture animal feed as this will establish more uses of green grams to enhance consumption.

3.8.5 Used in place of imported soybeans and cotton seed cake as source of protein

Green grams are a good source of protein, low calorie food that is rich in vitamins and minerals. Therefore, it can be used in place of imported soybeans and cotton seeds. Further to the above, other innovate ways of increasing the value addition of green grams will be identified so that farmers can fetch good prices thereby increasing their incomes and at the same time sustain the demand for the crop.

CHAPTER FOUR

4.0 DISCUSSION OF FIELD STUDY FINDINGS

4.1 Land/farm characteristics

Production of green grams was found to be on an increasing trend in all the sampled counties. This can be attributed to the abundance of land and adaptation of the crop to low rainfall levels and the recognition by the County Governments of its potential and campaigns carried out dubbed the ‘*Ndengu Revolution*’.

4.2 Average land that farmers use for growing green grams

The average acreage under green grams cultivation is 2-3 acres of land per household. Green grams are grown twice a year that is during the long rains (March to June) and the short rains (October to December) except for Taita Taveta County where they are grown mainly during the short rains season only. The average yield of green grams per acre ranges from 5-7 bags with mono-cropping and 2-4 bags per acre with intercropping. The variations in yield can also be attributed to seed quality, adequate rainfall, availability of extension services and level of mechanization at farm level.

4.3 Average yield (90 kg bags) of green grams per acre

In all the counties visited, green grams are mainly grown for commercial purposes. Very little is retained for household consumption and planting for the next season. The large scale green grams farmers tend to do mono-cropping while most small scale farmers do inter-cropping of the green grams with other crops like maize, sorghum and beans. In Kirinyaga County, all the farmers reported that they do inter-cropping of green grams with maize. The average yield of green grams per acre ranges from 5-7 bags with mono-cropping and 2-4 bags per acre with intercropping.

4.4 Farming systems used

Use of hired labour is more common compared to household labour in all the counties except for Machakos County where both are commonly used. Household labour is mainly used by small scale farmers. Mechanization is low as most farmers use oxen ploughing which is cheaper than tractors, locally available and can be given on credit. Most Counties reported to have very few tractors that are owned by the County Governments and thus the queue is normally long. Others reported that the tractors come from other Counties and the charges are high. In addition, the topography of the land in Tharaka Nithi County is not friendly for use of

tractors while in Embu County, the farmers have been trained on Conservation Agriculture which discourages a lot of tilling.

The farmers mainly rely on rain for green grams farming with exception of Makueni which practices some irrigation farming along the rivers. In Meru County, the farmers indicated that green grams do not do well under irrigation while in Embu County, irrigation can do better. However, water for irrigation is not available.

4.5 Estimated percentages of farmers who grow green grams

Majority of the farmers (more than 70 percent) in Kitui, Meru, Tharaka-Nithi and Taita Taveta Counties grow green grams. In Embu, Kirinyaga and Machakos Counties, green grams are grown in two sub counties, one sub-county and three sub counties respectively. These sub counties are the semiarid areas of the counties and moreover even within these sub counties not all farmers grow green grams. Kirinyaga reported to have the least percentage at 6 percent of the farmers growing green grams. This can be attributed to farmers opting to grow other crops such as bananas, maize, watermelon, miraa among others that fetch better prices in the market.

4.6 Support services and access to farm-level inputs

Information was sought from farmers on the type of support offered by various actors, including the National Governments and County Government and Development Partners in relation to green gram production, such as access to subsidized input supplies, training and extension services and provision of market linkages. They have also supported value addition, access to credit, infrastructure development by provision of rural access roads and provision of other subsidized farming inputs e.g. subsidized tractors. Storage facilities and access to ICT enabled services for accessing information were rated low in all the eight counties.

The players in the support of green grams farming include the County Government, the National Government, KALRO, World Bank, SNV, FAO, CGA, Action Aid KCEP, EAGC and Caritas. However, the services and support offered by these players vary between the Counties and depends on their presence in the County. For instance, Caritas and World Bank promote conservation agriculture in Meru County, EAGC assists in the formation of cluster CBOs and formation of marketing and aggregation Centre's in Embu County while Action Aid and SNV links farmers to the market and provides storage bags.

4.6.1 Access to Seeds and other Inputs

The source of green grams seeds in all the eight counties is Kenya Agricultural and Livestock Research Organization (KALRO). Farmers access these seeds from the distribution by the County Government as well as privately from Agro-dealers. Some counties such as Makueni receive seed distribution from NGOs and other partners. Farmers mostly recycle the previous season's harvest as seeds, this affects the green gram yield per acre. One of the challenges identified in almost all the counties is the mushrooming of various seed distributors who have been supplying sub-standard seeds thereby affecting farmer's yields. This is an indication of the presence of unregulated market (due to lack of legislations, and where they exist, failure to enforce them) for green gram seeds.

There are two varieties of green grams noted across all the sampled counties; the KS20 and the N26. The KS20 was noted to have advantage over the N26 because it is shinny and cooks very first. Locals prefer it. The N26 on the other hand is preferred for the export market. The price for the KS20 certified seed is also higher than that of N26. The price of 2kg bag of KS20 across the county ranges from Kshs 500 to Kshs 600 while that of N26 ranges from Kshs 480 to Kshs 550 for a 2kg bag indicating that on average the certified seed for the green gram on average costs Kshs 250.

Apart from distribution of certified seeds by the county government that was reported by all the eight counties, some counties reported receiving other services such as access to subsidized tractor for ploughing (Makueni, Machakos and Kitui), support to credit access (Makueni and Embu), and market linkage and formation of aggregation centres (Makueni, Machakos, Kitui, and Embu).

4.6.2 Access and use of Fertilizer in Green Gram Farming

The usage of fertilizer in the sampled counties was found to be very low with some counties reporting not using fertilizer at all. In some counties, the farmers use animal manure as an alternative. The major reasons in some counties such as Taita Taveta, Makueni, Kitui, and Tharaka Nithi on the non-usage of fertilizer is myths about use of fertilizer. The "myths" cited include, "the fertilizer will burn the crops, it will harden the soil or it will dry up crops prematurely".

Other reasons for not using fertilizer included difficulties in access of fertilizer (Meru), and crops doing well without fertilizer (Kirinyaga). The other major issue however related to the access which include low quality fertilizer available in the market. Fertilizer application can

however have adverse effects when applied inappropriately e.g. If applied when the rain is about to end, indicating that the timing of fertilizer application is critical.

The cost of a 50kg bag of fertilizer varied from county to county with Machakos accessing the bag at the highest average price of Kshs 3,500 and Taita Taveta accessing at the lowest price of Kshs 2,500.

4.6.3 Access to Credit to Support Green Gram Farming

Access to credit for the farmers was cited as the major impediment for the farmers to expand their green gram farming across the visited counties. The financing for green gram farming is mainly out of personal savings and retained earnings. There are very few banks and SACCOs willing to advance credit to farmers for green gram farming and where they are available, the terms of payment are not favorable to farmers and especially if there is failure in rain.

A few counties however, have formed "Chamas" where farmers can access credit. In Makueni for example, Chama's/table banking such as Tetheka fund supported by AFC and UTC Cooperative society is used by farmers to access finance. In Meru they have Chama's such as Ilamu and Digi-farm supported by Safaricom (K) Ltd that finances inputs and it is done after three months, which is the maturity time for green grams farming.

The greatest challenge in accessing credit that cut across all the eight counties is the failure to repay the loan when the crop fails due to rain failure given that farmers do not have alternative means of income to repay the loan. Where source of credit is available, the short grace period given acts as a barrier to accessing credit. A longer grace period i.e. three months would be appropriate because the period is enough for the green grams to have matured.

4.6.4 Training and Extension Services

Other services provided to farmers include training on various farm management practices (pest and disease control, post-harvest management, use of weather information, conservation agriculture, water conservation, weed management, fertilizer use and storage), and extension services such as linking farmers to the market, helping farmers access credits and other inputs such as fertilizer and pesticides, mobilizing farmers to form groups, establishment of aggregation Centre's and promotion of use of and adoption of technology. Agriculture being a devolved function, it was found that the county governments offered extension services and training to green gram farmers. Counties were also complemented by the non-state actors such as INGO, NGOs, CBOs, FBOs, Farm Africa among others. The Agriculture Sector in the provision of trainings to farmers.

4.6.5 Pests and Disease Control

Pests and diseases cause great losses to farmers harvesting green grams. In green gram farming, it is no different and all counties sampled reported to have experienced attack of green grams by various pests and diseases. The most common pests across the counties include Aphids, Weevils, white flies and stock borers/caterpillars. On the other hand, the most common disease that affects green grams include leaf spot and bacteria rots. The pests and disease affect green grams at various stages. However, most pests and disease attack the crops from germination to the maturity (Aphids). There are those pests that attack at the level of bearing pods, harvest or/and storage level.

In the management of pests and disease, gaps exist in terms of knowledge for use of pesticides. Some farmers do not want to use pesticides because they believe that it destroys soil fertility. There are also issues of substandard pesticides in the market that are not effective in eliminating pests or diseases.

4.6.6 Post-Harvest Losses and Management

In all the surveyed counties, farmers indicated that they experience post-harvest losses, with some counties reporting up to 30 percent post-harvest losses (Makueni). The main cause of post-harvest losses is spoilage, due to poor and prolonged storage, spillage during transportation, breakages during threshing, destruction by rodents (such as rats) and attack by weevils.

To deal with post-harvest losses, use of hermetic bags for storage will reduce spoilage and allow farmers to store their produce for longer periods which will also help them fetch good prices. The cost for hermetic bags however is very high, beyond the reach of the farmers, with the cost being Kshs 250 per bag. To deal with breakages, farmers also use threshing machines that are made locally. The other challenge is that most farmers do not have stores for their green grams and they use their houses for storage which may not be conducive for green gram storage.

4.7 Market Level/Consumption Level

4.7.1 Market for Green grams

In all the counties sampled, 71 percent of respondents reported to sell their produce through middlemen. However, in Makueni County the processing plant in Makindu currently serves as the main selling point for farmers as well as local supermarkets through contract farming (see Table 6).

Table 6: Channel of selling produce

| | Makueni | Kitui | Machakos | Taita Taveta | Meru | Tharaka Nithi | Embu | Kirinyaga |
|-------------------|---------|---------|----------|--------------|---------|---------------|---------|-----------|
| | Percent | percent | percent | percent | percent | percent | percent | percent |
| Middlemen/Brokers | 33.3 | 81.8 | 80 | 80 | 55.6 | 70.6 | 80 | 62.5 |
| NCPB | | | | 6.7 | | | 20 | |
| Wholesalers | 66.7 | | 20 | | 11.1 | 17.6 | | |
| Retail | 33.3 | 18.2 | 33.3 | 46.7 | 22.2 | 11.8 | 20 | 37.5 |
| Consumers | 16.7 | 18.2 | 33.3 | 53.3 | 33.3 | 5.9 | 30 | 25 |

On the other hand, about 90 percent of the respondents indicated they sell green gram produce at the local market. Only 4.4 percent of the respondents reported to export part of their green gram produce as shown in Table 7.

Table 7: Market and Channel for Green Grams

| | | |
|---------|-------------------|----------------|
| | | percent |
| Markets | Sub-county | 6.6 |
| | County | 5.5 |
| | National | 2.2 |
| | Export markets | 4.4 |
| | Local market | 90.1 |
| | | percent |
| Channel | Middlemen/Brokers | 71.4 |
| | NCPB | 3.3 |
| | Wholesalers | 12.1 |
| | Retail | 27.5 |
| | Consumers | 27.5 |

4.7.2 Source of information for farmers

Farmers in Makueni County reported that the main source of market information include; Market bulletin relayed through extension officers, market surveys by the County Government, training of farmers on gross margins and contract clauses particularly for those farmers who engage in contract farming, the contract specifies details such as prices. However in other Counties, the prevailing market prices and negotiation with middlemen act as source of information for farmers.

4.7.3 Market Price of Green Grams

Prices are normally negotiated at the farm level but when farmers take their produce to the market, they sell at the prevailing market prices. Selling price per kilogram of the produce depends on seasons, during harvesting; prices are low while off season, the prices are high. From Table 8, average selling price of green gram immediately after harvest varies from one county to another. However, the overall selling price at harvest is Kshs. 61 per Kg while the 90Kg bag sells at Kshs. 5,500 on average. It was noted that the unit selling price immediately after harvest was high in Kirinyaga and Embu counties. This is as a result of high costs of labour in the two counties.

Table 8: Green Gram Gate Price at Harvest Time

| County | Average Selling Price (Per Kg) | Average Selling Price (Per 90Kg Bag) |
|---------------|--------------------------------|--------------------------------------|
| Makueni | 67.50 | 6508.33 |
| Kitui | 60.00 | 5400.00 |
| Machakos | 52.86 | 4757.14 |
| Taita Taveta | 51.33 | 4606.67 |
| Meru | 57.78 | 5450.00 |
| Tharaka Nithi | 62.12 | 5528.82 |
| Embu | 71.87 | 5931.25 |
| Kirinyaga | 85.00 | 7025.00 |
| Average | 61.43 | 5464.25 |
| Highest | 85.00 | 7025.00 |
| Lowest | 51.33 | 4606.67 |
| Range | 33.67 | 2418.33 |

Farmers reported that, at harvest time when prices are low, prices do not cover their production cost, however, during off season when prices are high, they are able to cover their production cost.

4.7.4 Access to Farm Inputs and Market Information

Access to certified seeds, was reported to be good at 68.2 percent while purchase price of certified seeds was moderately accessible at 47.7 percent see Table 9.

Table 9: Access to Farm Inputs

| | | N | percent |
|-----------------------------------|-----------------------|----------|----------------|
| Availability of certified seeds | Highly accessible | 11 | 12.5 |
| | Moderately accessible | 60 | 68.2 |
| | Not accessible | 17 | 19.3 |
| | Total | 88 | 100.0 |
| Purchase price of certified seeds | Highly accessible | 18 | 20.9 |
| | Moderately accessible | 41 | 47.7 |
| | Not accessible | 27 | 31.4 |
| | Total | 86 | 100.0 |

Certified seeds were reported to be moderately accessible with Kitui County reporting the highest percent at 91 while Meru County reported the lowest at 56 percent as shown in Table 10.

Table 10: Availability of certified seeds

| | | Makueni | Kitui | Machakos | Taita Taveta | Meru | Tharaka Nithi | Embu | Kirinyaga |
|-----------------------------------|-----------------------|----------------|----------------|-----------------|---------------------|----------------|----------------------|----------------|------------------|
| | | percent | percent | percent | percent | percent | percent | percent | percent |
| Availability of certified seeds | Highly accessible | | | 33.3 | 14.3 | 33.3 | 6.7 | | |
| | Moderately accessible | 83.3 | 90.9 | 60 | 78.6 | 55.6 | 73.3 | 70 | 25 |
| | Not accessible | 16.7 | 9.1 | 6.7 | 7.1 | 11.1 | 20 | 30 | 75 |
| Purchase price of certified seeds | Highly accessible | 16.7 | 27.3 | 35.7 | 28.6 | 33.3 | 7.1 | | 12.5 |
| | Moderately accessible | 83.3 | 54.5 | 57.1 | 21.4 | 66.7 | 64.3 | 40 | |
| | Not accessible | | 18.2 | 7.1 | 50 | | 28.6 | 60 | 87.5 |

4.7.5 Household Consumption

Farmers reported that the quantity of green grams retained at household for domestic consumption is small translating to low consumption of green grams. This is due to availability of alternatives such as beans and low awareness on the nutritional value of green grams. On average, farmers from Embu, Kirinyaga and Tharaka Nithi reported 20 percent retention of their produce at household level, while Machakos and Taita Taveta Counties reported 2 percent and 5 percent respectively.

4.7.6 Value addition

All the Counties except Tharaka Nithi and Makueni Counties reported that there is no value addition to Green grams before selling to the market. In Tharaka Nithi farmers do sorting and packaging while in Makueni County, Cottage Industries in Kibwezi do sorting, packaging and to some extent conversion of Green grams to powder form. There are more opportunities for value addition in the county such as: Plans to have large plants; good working relationships with the National Government, Policy commitments - Recognizing Green grams as a pillar for food security in the Big Four Agenda and investing in storage facilities.

Generally, about 68 percent of the respondents in the visited Counties indicated they lack access to value addition/processing of the green gram produce (see Table 11).

Table 11: Value addition

| | | | |
|---------------------------|-----------------------|----|-------|
| Value addition/processing | Highly accessible | 4 | 4.8 |
| | Moderately accessible | 23 | 27.7 |
| | Not accessible | 56 | 67.5 |
| | Total | 83 | 100.0 |

However, the study also revealed that the level of value addition by various counties was quite low as shown in Table 12. With major constraints to value addition being lack of equipment and machinery and that farmers felt that value addition is an expensive venture.

Table 12: Level of Value addition by various Counties

| | Makueni | Kitui | Machakos | Taita Taveta | Meru | Tharaka Nithi | Embu | Kirinyaga |
|---------------------------|-----------------------|---------|----------|--------------|---------|---------------|---------|-----------|
| | percent | percent | percent | percent | percent | percent | percent | percent |
| Value addition/processing | Highly accessible | | 9.1 | 7.1 | 7.7 | | | 14.3 |
| | Moderately accessible | 16.7 | 45.5 | 35.7 | 30.8 | 35.7 | 10 | 28.6 |
| | Not accessible | 83.3 | 45.5 | 57.1 | 61.5 | 100 | 64.3 | 90 |

4.7.7 Marketing of Green grams (Cooperatives)

Farmers reported that farmer cooperatives exist in some counties like Kitui and Makueni but they are not active while others do not have them (see Table 13). Most of the produce is taken

to aggregation centers. However, farmers complained that there is a lot of produce in this aggregation centers waiting to be sold.

Table 13: Membership of Green Gram Cooperative Societies

| | | | Makueni | Kitui | Machakos | Taita Taveta | Meru | Tharaka Nithi | Embu | Kirinyaga |
|--|-----|---------|---------|-------|----------|-----------------|------|------------------|------|-----------|
| Is your household a member of any marketing or cooperative society that support production or selling of <i>Ndengu</i> ? | Yes | percent | 100.0 | 36.4 | 20.0 | | 22.2 | 28.6 | 30.0 | 12.5 |
| | No | percent | | 63.6 | 80.0 | 100.0 | 77.8 | 71.4 | 70.0 | 87.5 |

Among the respondents that reported to be members of green gram cooperative societies, 71.4 percent and 47.6 percent noted that they receive marketing and access to farm input support as shown in Table 14. Further, farmers noted that, to be successful, a cooperative requires about 5,000 members which is at times difficult to get and they also lack information on their formation.

Table 14: Support from Cooperative Societies

| Type of Support Service | percent |
|-------------------------|---------|
| Access to farm inputs | 47.6 |
| Marketing | 71.4 |
| Training | 38.1 |
| Storage of produce | 4.8 |
| Other | 23.8 |

The main reasons for non-membership in green gram cooperative societies were cited to be non-existence and lack of awareness of the green grams cooperatives in the localities (see Table 15).

Table 15: Reasons for Non-Membership of Green Gram Cooperative Societies

| Reasons for non-membership in coops | percent |
|---|---------|
| No cooperative group exists in the locality | 68.0 |
| Membership/subscription fee is high | 6.0 |
| Not interested | 8.0 |
| Not aware of any cooperative group that supports <i>Ndengu</i> production/selling | 26.0 |
| Other | 4.0 |

4.7.8 Use of ICT for farming and marketing

Use of ICT among the surveyed counties was found to be very key in providing the farmers and traders with information related to market and weather conditions, and access to farm inputs both material and financial.

In some counties, County Governments have partnered with some data providers (Makueni County and Safaricom) to facilitate digital access to information by farmers. Makueni County Government has provided a platform for connecting traders and farmers. East African Grain Council's G-Soko connects store farms to traders. The traders can access information such as number of bags of grains in a particular store. In Meru County a digital platform, referred to as Digi-Farm, has been established by Safaricom to provide financial support and marketing information to small holder farmers. This platform offers farmers with subsidized farm inputs and gives loans at 10percent interest repayable within three months. This was considered to be affordable by majority of farmers interviewed in Meru County. However, use of ICT in promoting farming among farmers in the counties has not been without challenges. Low network coverage in rural areas, and low literacy levels has limited full adoption of ICT in farming.

4.8 Challenges faced in farming of green grams

i. Poor market prices

Most of the surveyed Counties indicated price fluctuations as a key challenge towards production of green grams. During bumper harvest, most farmers sell their produce to middle men who dictate the prices. In this survey, middlemen/brokers was cited by 71.4percent of the respondents as the channel through which they sell their green gram produced. The other moderately utilized channels are retailers and consumers. Direct exports by farmers was found to be negligible. The average selling price of green gram immediately after harvest was Kshs. 61 per Kg while the 90Kg bag was said to be sold at Kshs. 5,500 on average. It was noted that

the unit selling price immediately after harvest was only high in Kirinyaga and Embu Counties. This is as a result of high costs of labour in the two counties.

High accumulation of Green grams at aggregation centers forces farmers to sell their produce to middlemen so as to cater for their immediate needs. Also due to fear of post-harvest losses farmers prefer selling the produce at any given price.

ii. **Erratic rainfall**

Erratic rains have been mentioned to affect the production of Green grams in most of the counties surveyed. Heavy downpour of rainfall was cited to destroy the crops which results to low volumes of the crop output.

iii. **High cost of production**

Use of hired labour increases the cost of production. The labour costs increase during harvesting and threshing periods. Harvesting and threshing costs account for about 30percent of total cost of Green grams production. Other inputs such as pesticides and fertilizers were also mentioned to increase the cost of production. The high cost of certified seeds has led to farmers using non-certified seed thus low yields.

The cost of leasing and transportation of the produce to aggregation centers also add to the cost production. High cost of certified seeds was also cited to affect the production cost. In connection to this, some farmers tend to recycle the seeds thus leading to low yields.

iv. **Constraints in market access**

Poor road network constraint farmers from accessing the market for Green grams. The poor condition of roads increases the cost of production due to high transportation costs and time taken to deliver the produce. Penetration of cheaper similar products from neighboring countries limit markets for the local farmers.

v. **Pests and weeds**

Pests invasions affect the production and productivity of green grams in most of the counties surveyed. Weeds such as *magugu* found in Machakos are hard to control and lowers crop yield. The emergence of resistant diseases and pests has led to big losses by farmers.

vi. **Financial constraints**

Farmers who do not have other sources of income are forced to seek financial assistance from credit facilities. However, lack of collateral limits farmers from accessing the credit facilities. In addition, the one-month grace period offered by most of the financial institutions is unfavorable to some farmers. The survey established that only 16.1percent of the surveyed

respondents indicated to have made an application for loan to a financial institution for green gram farming or marketing.

vii. **Inadequate knowledge and skills among the farmers**

There is challenge of enough of extension officers to adequately serve the green grams farmers. According to the guidelines and standards for agricultural extension and advisory services 2017, the minimum technical staff to farmer ratio is 1:700. For example in Tharaka Nithi County which is expansive in terms of land size has got 22000 green gram farmers and is served by nine extension officers. This makes follow up of farmers difficult and thus leads to low impact of the training and hence low production. In addition, limited knowledge on use of pesticides has made it difficult for farmers to control pests effectively. Most of the farmers do not know the pesticides to use and thus use trial and error method.

viii. **Poor farming practices**

Limited supplies and high cost of acquiring farming equipment and machineries from the county governments and private providers has led to farmers using traditional methods of farming.

ix. **Poor governance.**

Governance challenges impede operations of cooperatives.

x. **Poor storage facilities**

Poor storage facilities especially at aggregation centers have led to big losses of farm produce.

xi. **Influx of substandard farm inputs**

Penetration of substandard pesticides in the market has made it difficult to effectively control pests. In addition, limited access to certified seeds has led to green grams farmers using mixed seeds which have led to lesser yields.

xii. **Environmental degradation**

Activities that degrade environmental status were cited in the survey. Poor farming practices among some farmers were said affects soil fertility hence low crop yield. Activities such as sand harvesting and tree cutting accelerate soil erosion and lowers land productivity thus lowering the production of the produce. Some weather conditions such as Frost/dew along Masinga dam was said to affect green grams farming.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The Agricultural Sector plays a central role in food and nutrition security, which is one of the components of the 'Big Four' Agenda and SDG 2 on ending hunger, achieving food security and improved nutrition. Green grams have been shown to have high nutritional content compared to other pulses and can help in enhancing food and nutritional security. The study on green grams farming in eight of the highest producing counties of the crop in Kenya (Makueni, Machakos, Kitui, Taita Taveta, Tharaka Nithi, Meru, Embu and Kirinyaga Counties) confirmed the potential green grams farming has as a cash crop and the prominence it has gained in the recent past as evidenced from initiatives to promote its production in some ASAL counties through a campaign dubbed the '*Ndengu Revolution*'.

Prior to the recent promotion, green grams have largely been considered for subsistence production in Kenya. The potential of green grams is yet to be fully tapped due to constraints along the value chain, including the glut experienced in 2018 owing to inadequate storage facilities, high cost of production, limited knowledge and skills among farmers, lack of market information, constraints in market access, weak cooperative societies and poor prices. Consequently, middlemen have benefitted at the expense of the farmers. These dynamics, if not addressed, can disincentivise the farmers and erode the progress achieved.

Considering the various constraints and opportunities underscored in the preceding sections of the report, the following interventions are recommended: Enhanced Access to affordable and quality farm inputs including certified seeds, fertilizer and pesticides; Research and innovation to develop drought, pest and disease resistant varieties of the crop; Strengthening training and extension services to address capacity gaps among farmers on the entire green grams value chain; Need to develop and implement marketing strategies such as contract farming to cushion farmers against exploitation by middlemen; Improved access to information through the use of ICT based market platforms, Improvement of the forecast information systems to provide farmers with reliable, accurate and timely weather information; Consider including green grams as part of Strategic Food Reserve (SFR) to address storage and price gaps; Value addition strategies; Access to credit; Crop insurance, money back guarantee and Strengthening the regulatory and institutional frameworks. Preparation of a policy paper would be a viable

option to consolidate the proposed interventions and strategies for green grams farming in Kenya.

5.2 Recommendations

i. Mechanization of green gram farming

County Governments should provide subsidized farm machinery and equipment (ploughs, harvesters, threshers, etc.) to maximize yields and bring down the cost of production.

ii. Provision of farm inputs

The Government should consider increasing the amount of certified seeds per farmer and subsidizing the cost of other farm inputs such as fertilizer and agro-chemicals. This would lower the cost of production and thus enable the farmers produce more.

iii. Crop insurance

The National and County Governments should provide crop insurance scheme to cushion farmers against losses attributable to weather variability and pests.

iv. Development of rural access roads

County Governments should maintain and improve access roads and other infrastructure for ease of access to market and reduction of transport costs.

v. Post-harvest management

The County Governments should support the development of post-harvest management systems, technology and aggregation infrastructure.

vi. Development of a policy framework

The National Government should develop and implement a green gram trading and blending policy for Kenya that would ensure that buying and selling is done through a legal entity e.g. cooperatives; creating a clear market linkages, including exports markets; considering and purchasing Green grams as part of strategic food reserves; consider green grams as part of food supplies for public institutions such as disciplined forces and educational institutions,

vii. Regulation and standards

The National and County Governments should ensure standard and quality inputs for green grams production in the market, enforce compliance on regulations for selling of inputs such pesticides and fertilizer so as to cushion farmers from substandard and uncertified products.

viii. **Research and development**

The National and County governments should support the development of drought, pest and disease resistant high yielding varieties of green grams through the relevant research institutions.

ix. **Financial and technical support**

The County government should support farmers with the requisite financial, knowledge and skills in production of green grams by strengthening extension services. Counties should also promote sustainable agricultural practices.

x. **Marketing strategies**

Farmers should form groups and cooperatives that will help in marketing their farm produce. The farmer groups and cooperatives should work to build aggregation centers where their green grams can collectively be marketed as well as source for farm inputs at negotiated rate. Further, the National and County Governments should come up with marketing strategies such as; promote buy Kenya green grams campaign among the Kenya communities and public institutions to promote consumption and demand for green grams as well as increase the proportion of green grams in the strategic food reserve. There is also need to promote contract farming to enhance marketing of green grams and protect farmers against exploitation by the middlemen.

xi. **Value addition**

The farmers groups should undertake initiatives that will ensure value addition to their produce as well as branding. Counties should support and promote the development of cottage industries for value addition. The extension officers should train farmers in value addition techniques.

xii. **Promoting use of ICT**

Promote and create awareness on ICT based market and farming information systems to provide farmers with reliable and up to date market information, weather and best farming practices.

xiii. **Benchmarking programmes**

Counties to support farmers' exchange programmes and visits to expose them to new ideas and best practices on green grams production.

i. **Partnership and collaborations**

County governments should support farmers to form partnerships and collaborations with service providers and marketers such as the Eastern Africa Grain Council, NCPB, Media, private sector, NGOs and CBOs among others on production, value addition and marketing of green grams.

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ANNEXES

Annex 1: Questionnaire

REPUBLIC OF KENYA



THE NATIONAL TREASURY AND PLANNING

STATE DEPARTMENT FOR PLANNING

**FARMER QUESTIONNAIRE FOR FIELD VISITS TO GREEN GRAM (*NDENGU*)
GROWING COUNTIES FOR THE SUPPORT OF THE BIG FOUR AGENDA**

**NOTE: THE INTERVIEWER MAY ASSIST THE RESPONDENT IN CASE OF
LANGUAGE BARRIER**

MARCH 2019

Preliminary

| | |
|--------------------|--|
| Questionnaire No. | |
| Date of interview: | |

PART I: Respondent Location and Characteristics

| | |
|----------------------|---------------------|
| County Name | |
| Sub-County Name | |
| Location | |
| Sub-Location | |
| Residence | 1=Urban 2=Rural |
| What is your gender? | [1] Male [2] Female |

1. What is your age? *[Tick only one category]*
[1] 18-34 years [2] 35-54 years [3] 55-64 years
[4] 60+ years
2. What is your highest level of formal education completed?
[1] None [2] Primary [3] Secondary [4] College/TVET [5] University
3. What is your main occupation?
[1] Farmer [2] Trader/Operate personal business [3] Employed
[4] Livestock keeper [5] Unemployed
4. What is your relationship to the household head?
[1] Household head [2] Spouse [3] Son/daughter
[4] Father/Mother [5] Other
5. What is the Martial status of the household head?
1=Single 2=Divorced/separated 3=Widowed 4=Married/living with partner
5=Don't know/refuse to answer
6. What is the total number of household members?
7. Of the total household members, how many are employed or engaged in income generating activities?
8. What is the estimated range of your annual household income? *[Tick only one]*

99=Not earning 1=0-9,999 2=10,000-14,999 3=15,000-19,999
 4=20,000-24,999 5=25,000-29,999 6=30,000-49,999 7=50,000-99,999
 8=100,000+

PART II: Land Ownership and Farming Activities

9. What is the total acreage of land owned or rented/leased by this household?

- i. Owned: acres
- ii. Rented or leased: acres

10. What are the main crops grown by this household? [List up to five crops, with the crop occupying largest share of your land being the first]

- i.
- ii.
- iii.
- iv.

11. Do you grow *Ndengu*?

- 1=Yes 2=No (Skip to Q18)

12. Of your total land, how many acres on average are usually allocated for growing *Ndengu*?

.....acres

13. Rank in order of importance the reasons why you grow *Ndengu*

| Reason | Is this applicable to your household? | Assign rank 1=Most important 6=Least important |
|---|--|---|
| i. Food/subsistence | 1=Yes 2=No | |
| ii. Selling for cash | 1=Yes 2=No | |
| iii. Exchange with other crops or goods | 1=Yes 2=No | |
| iv. Sign of wealth | 1=Yes 2=No | |
| v. Cultural reasons | 1=Yes 2=No | |
| vi. Other (Specify) | 1=Yes 2=No | |

14. In growing *Ndengu*, to what extent do you practice the following system of agriculture?

| | |
|-----------------------------|--|
| Rain fed agriculture | 1=Large extent 2=Moderate extent 3=Small extent 4=Not at all |
|-----------------------------|--|

| | |
|-----------------------------|--|
| Irrigation | 1=Large extent 2=Moderate extent 3=Small extent 4=Not at all |
| Intercropping | 1=Large extent 2=Moderate extent 3=Small extent 4=Not at all |
| Monocropping | 1=Large extent 2=Moderate extent 3=Small extent 4=Not at all |
| Use of family labour | 1=Large extent 2=Moderate extent 3=Small extent 4=Not at all |
| Use of hired labour | 1=Large extent 2=Moderate extent 3=Small extent 4=Not at all |
| Mechanization | 1=Large extent 2=Moderate extent 3=Small extent 4=Not at all |

15. What is your average yield of *Ndengu* per acre during a normal season?90kg bags [Note: Normal season refers to a season that is not adversely affected by incidences such as droughts, floods, pests or diseases]

16. Of your total harvest of *Ndengu* during a typical season, indicate the amount/ proportion you allocate for the following uses [Give the answers in percentages]

| | |
|--|--|
| i. Own household consumption & precautionary storage | |
| ii. Selling for cash | |
| iii. Exchange for other crops or goods | |
| iv. Donate to family/friends/neighbours/charity | |

17. What is the estimated cost for growing/production of *Ndengu* by your household **per acre** during a **typical season**?

| Type of Cost | Amount (KSh.) |
|--|---------------|
| i. Labour | |
| ii. Rent/lease payments for land | |
| iii. Seeds | |
| iv. Fertilizer | |
| v. Pesticides | |
| vi. Transport | |
| vii. Other consolidated costs not listed above | |

18. If your household does not grow *Ndengu*, what are the reasons? [Tick all that apply]

1=Not interested

2=Don't know where to get *Ndengu* seeds

- 3=Has low yield compared to other crops
- 4=Unfavorable weather conditions in this locality
- 5=Unfavorable soil conditions in this locality
- 6=Frequent attacks by diseases or pests
- 7=Have not tried it
- 8=Other (Specify).....

PART III: SUPPORT SERVICES AND ACCESS TO FARM-LEVEL INPUTS

19. How satisfied is your household with the following support services and inputs to the production of *Ndengu*?

| | |
|---|---|
| i. Training & extension services | 1=Very satisfied 2=Moderately satisfied 3=Not satisfied |
| ii. Access to certified seeds | 1=Very satisfied 2=Moderately satisfied 3=Not satisfied |
| iii. Access to fertilizer | 1=Very satisfied 2=Moderately satisfied 3=Not satisfied |
| iv. Access to pesticides | 1=Very satisfied 2=Moderately satisfied 3=Not satisfied |
| v. Storage facilities | 1=Very satisfied 2=Moderately satisfied 3=Not satisfied |
| vi. Access to credit facilities | 1=Very satisfied 2=Moderately satisfied 3=Not satisfied |
| vii. ICT enabled services for accessing information | 1=Very satisfied 2=Moderately satisfied 3=Not satisfied |

20. Over the last one year, has your household or neighbouring households received training on production/growing of *Ndengu*?

- 1=Yes
- 2=No (Skip to Q22)
- 99=Don't know

21. If yes, who conducted the training for your household/neighbours?

- 1=County government
- 2=National government
- 3=NGOs
- 4=Other (specify)
- 99=Don't know

22. Over the last three years, has your household attempted to borrow loan from a financial institution to support production or marketing of *Ndengu*?

1=Yes 2=No

23. If Yes, what was the amount applied for? Ksh.....

24. Was the loan application successful?

1=Yes >>>>>What amount was advanced? KSh.....

2=No

25. If the loan application was declined/rejected, what was the reason(s) for the rejection?

1=Low household income to support repayment

2=lack or inadequate collateral

3=Unpredictable weather patterns

4=Other (specify).....

26. Where do you mostly buy your farm inputs such as seeds, fertilizers and pesticides? Tick where appropriate

[1] Private dealers

[2] Cooperative marketing societies

[3] Primary agricultural cooperative societies

[4] Retail shops

[5] Other (specify)_____

PART IV: Markets

27. What is your source market for selling your *Ndengu*? [Tick all that apply]

1=Sub-County

2=County

3=National

4=Export markets

5=Local market

99=Don't grow *Ndengu*

28. Through what channels do you **mainly** sell your *Ndengu*?

1=Middlemen/brokers

2=National Cereals and Produce Board

3=Wholesalers

4=Retails

5=Consumers

6=Direct exports

99=Don't grow *Ndengu*

29. What is your typical average selling price of *Ndengu* immediately after harvest?

i. Per Kg: Ksh.....

ii. Per 90 Kg bag: Ksh.

30. Does your household buy *Ndengu* for consumption?

1=Yes

2=No (Skip to Q33)

31. If yes, what quantity of *Ndengu* does your household buy (in Kgs) per year?Kgs

32. How much is the household average expenditure on *Ndengu* over the last one year? Ksh.....

33. How do you rate the ease of access to the following aspects of the market for *Ndengu* by households in your locality?

| | |
|--|--|
| Availability of certified seeds | 1=Highly accessible 2=Moderately accessible 3=Not accessible |
| Purchase price of certified seeds | 1=Highly accessible 2=Moderately accessible 3=Not accessible |
| Selling prices by farmers | 1=Highly accessible 2=Moderately accessible 3=Not accessible |
| Purchase price for household consumption | 1=Highly accessible 2=Moderately accessible 3=Not accessible |
| Value addition/processing | 1=Highly accessible 2=Moderately accessible 3=Not accessible |

34. Is your household a member of any marketing or cooperative society that support production or selling of *Ndengu*?

1=Yes

2=No (Skip to Q36)

35. If yes above, list up to three main service you receive from the marketing or cooperative society?

a)

b)

c)

36. If not a member of a marketing or cooperative society, what is the reason(s)

1=No cooperative of group exists in the locality

2=Membership/subscription fee is high

3=Not interested

4=Not aware of any cooperative or group that supports *Ndengu* production/selling in the area

4=Other (specify)

37. What specific reforms or interventions would you like to be addressed with regards to *Ndengu* farming in this county?

i. At the community level

.....
.....
.....
.....

ii. At the county government level

.....
.....
.....
.....

iii. At the national government level

.....
.....
.....

iv. At non-state actor level e.g. NGOs, FBOs, development partners

.....
.....
.....
.....

Please help us with your contact details for future communication [*Optional*]

| | |
|------------------------|--|
| Name of the respondent | |
| Cell Phone: | |
| Email: | |

_____ *The End* _____

Annex 2: Focus Group Discussion Template

Annex 2: Guiding Questions for Focus Group Discussions

Time: Maximum 2 hours

1. Land/Farm Level Characteristics

- What are the patterns and trends of *Ndengu* production by households/farmers in this county?

Probing questions/areas

- a. What is the average land holding that farmers in this county use for growing *Ndengu*? (To capture whether small scale, medium or large scale).
- b. Describe the type of farming system practiced in this county?
 - i. Subsistence vs. commercial
 - ii. Rainfed vs. irrigation
 - iii. Intercropping vs. monocropping – If intercropping is practiced, what are the other crops do farmers grow here?
 - iv. modernization of farming equipment vs. traditional production
 - v. Household labour vs. hired labour
 - vi. Seasonal patterns - How many seasons in a year, and are there unique seasonal patterns for growing *Ndengu*?
- c. What is the estimated percentage of famers who grow *Ndengu* in this county? (i.e. in every 10 farmers in the county, how many of them grow *Ndengu*?)
- d. What is the average yield (in 90kg bags) of *Ndengu* per acre in this county?

2. Support Services And Access To Farm-Level Inputs

- What is your level of satisfaction with regards to support from the government and development partners in access to farm inputs and information for *Ndengu* production?

Probing Questions

- a. Generally, what is the **extent of training** on how to grow *Ndengu*?
 - i. If yes, what does the training entail, and who provides or supports the training?
 - ii. If no, why do you think this is the case?
- b. To what extent do farmers in this county have **access to *Ndengu* seeds**?
 - i. Where do you get *Ndengu* seeds that you use for planting?
 - ii. What is the average price of the *Ndengu* seed per bag (indicate unit e.g. 5kg bag)?

- c. Do farmers in this county **use fertilizer** for growing *Ndengu*?
 - i. If yes what type of fertilizer do they use?
 - ii. Where do they get the fertilizer?
 - iii. What is the average price of this fertilizer per 50 kg bag?
 - iv. If not using fertilizer, what are the main reasons?
- d. To what extent is challenges in accessing credit a constraint to *Ndengu* production in this county?
 - i. What are the main sources of credit for *Ndengu* production in the county? E.g. banks, SACCOs, chamas, cooperatives, government e.t.c.
 - ii. What is your take on the cost and design of credit features with regards to *Ndengu* production in this county?
- e. Apart from seeds, fertilizer (and may be credit), what **other farm inputs** do farmers in this county use for *Ndengu* production?
 - i. Where do you get these inputs from?
- e. Do you have any pests or diseases that affect the *Ndengu* crop?
 - i. If yes, mention these pests and disease that are common in your area?
 - ii. At what level do they attack? farm level or storage level or both
 - iii. What kind of pesticides do you use to prevent these pests and diseases?
- f. Do you experience post-harvest losses as a result of say pesticides, poor storage (aflatoxin etc)?
 - i. What are the main causes of the post-harvest losses?
 - ii. How do you deal with these losses?

3. Market Level/Consumption level

- a. What is your source market for selling your *Ndengu*? (who buys, where)
 - i. Are there middlemen that say come to buy the *Ndengu* at the farm level?
 - ii. What are the main sources of information (including prices) on *Ndengu* market for farmers in this county?
- b. What is the average price for *Ndengu* in this county (say per kg, 50kg bag or 90kg bag)?
- c. Do you think this price covers the cost of production and fetches a profit for the farmer? Why or why not?
- d. What proportion of farm-level produce of *Ndengu* do farmers consume in this county?
- e. Is there any value addition (processing) that is done to *Ndengu* before selling in the market?
 - i. If yes, what types of value addition?
 - ii. What opportunities exist for *Ndengu* value addition in this county?
 - iii. What are the constraints to *Ndengu* value addition in this county?

- f. Looking at the market level, do you have organised cooperatives or groupings that you use for the marketing of *Ndengu*?
 - i. If they are there, to what extent are these cooperatives meeting the needs of *Ndengu* farmers?
 - ii. If they don't exist, what are the reasons?

4. General Concerns

- b. Do you use Information, Communication and Technology (ICT) in your household for farming and/or marketing?
- c. In general, what challenges do farmers face in farming the *Ndengu* crop?
- d. What are the environmental concerns (if any) with regards to *Ndengu* farming in this county?
- e. Any other issue that you experience during *Ndengu* farming at farm or marketing level?

5. Policy Suggestions/Recommendations

- a. What specific reforms or interventions would you like to be addressed with regards to *Ndengu* farming in this county?
 - i. At the community level
 - ii. At the county government level
 - iii. At the national government level
 - iv. At non-state actor level e.g. NGOs, FBOs, development partners

Annex 3: Key Informant Interview Template

Annex 3: Guiding Questions for the Key Informant Interview (KII)

(To be administered to CEC Agriculture, Marketing/Cooperative head, Large scale farmer etc)

6. Production Levels

➤ **How much *Ndengu*, in terms of Tonnes, does this county produce?**

- i. What is the approximate acreage of land does farmers in this county grow *Ndengu*?
- ii. Of this acreage, how much is;
 - irrigated land and
 - Rain fed?
- iii. What is the average yield (in 90kg bags) of *Ndengu* per acre in this county?

7. Support Services and access to farm Inputs

- Does the county government/National government support farmers in the growing of *Ndengu*?
- If yes what type of support does the government give?
 - Types of County support (inputs, training fertilizer etc)
 - Types of National government support (credit, marketing etc)
- iv. Do you have any policy/Legislation/regulations or institutions that specifically supports the production of *Ndengu* either at the county level or national government level?

8. Market Level/Consumption level

- g. What is the source market for selling *Ndengu*? In this county? (who buys, where)
 - i. Are there middlemen that say come to buy the *Ndengu* at the farm/county level?
 - ii. Where does the farmers get information (including prices, pest control, credit access etc) on *Ndengu* in this county?
 - iii. Do you think the price at which farmers sell *Ndengu* covers the cost of production and fetches a profit for the farmer? Why or why not?
- h. What proportion (tonnes) of *Ndengu* is consumed in this county/neighbouring counties?
 - a. Do farmer have an opportunity to do value addition (processing) to *Ndengu* before sale?
 - i. If yes, what types of value addition exists/is practiced?
 - ii. What further opportunities exist for *Ndengu* value addition in this county?
 - iii. What are the constraints to *Ndengu* value addition in this county?

9. Opportunities for expanding *Ndengu* production

- a. What initiatives are there in the county to promote *Ndengu* farming, consumption and trade by:
 - i. County government initiatives
 - ii. Community level initiatives
 - iii. Non-state actors: Development partners, NGOs initiatives?

- b. What opportunities exists in this county with regards to:
 - i. *Ndengu* farming
 - ii. *Ndengu* consumption
 - iii. *Ndengu* value addition
 - iv. *Ndengu* trade and benefits to the county residents.

- c. What challenges exist in:
 - i. Production
 - ii. Consumption and
 - iii. Trade in *Ndengu* in this county (e.g. Access to land, inputs, information, cultural, policy etc)

- d. What policy recommendations would you suggest in order to promote:
 - i. *Ndengu* farming
 - ii. Consumption
 - iii. Value addition and
 - iv. Trade with regards to supporting the governments Big Four Agenda?

The End