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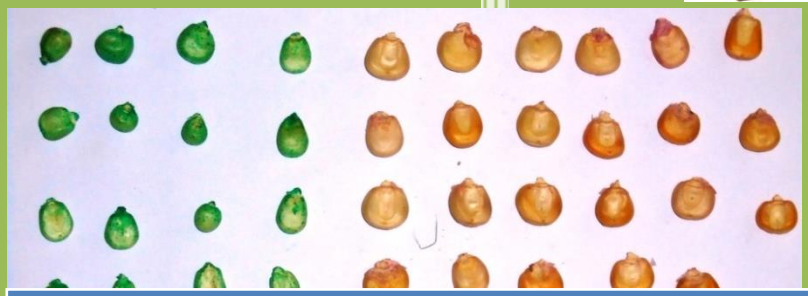

2014

Seed Security Assessment in the South-Eastern livelihood Zones of Kenya

EUROPEAN COMMISSION

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The Assessment Team

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ACRONYMS

AEZ	Agro-ecological Zone
AGRA	Alliance for a Green Revolution in Africa
ASAL	Arid and Semi-Arid Land
ASDS	Agricultural Sector Development Strategy
CBO	Community Based Organization
CGA	Cereal Growers' Association
COMESA	Common Market for Eastern and Southern Africa
CPF	Country Program Framework
EABL	East African Breweries Limited
EAC	East African Community
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
FGD	Focus Group Discussion
GDP	Gross Domestic Product
ICRISAT	Crops Research Institute for the Semi-Arid Tropics
ISFM	Integrated Soil Fertility Managements
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspectorate Services
KII	Key Informant Interview
MALF	Ministry of Agriculture, Livestock and Fisheries
MAM	March-April- May Season
MIDO	Malindi Integrated Development Organization
NGO	Non-Governmental Organization
OND	October-November-December season
PCPB	Pest Control Product Board
SACCO	Saving and Credit Cooperative Organizations
SSA	Seed Security Assessment
SSCF	Seed Security Conceptual Framework
VICOBA	Village Community Banking

EXECUTIVE SUMMARY

Kenyan farmers depend on both the formal and informal seed systems, with the later accounting for over 80 percent of total seed used in the country and even a much higher percentage in ASAL. Increasing agricultural productivity of small and medium scale famers requires a well-functioning seed system. In the ASAL, recurrent drought and crop failure have been frequently cited as source of seed insecurity, and this has contributed to repeated seed aid in the area over the last ten years. Efforts by the government and humanitarian actors to improve the availability and access to quality seed of adapted crop varieties by marginal farming households have been focusing on providing seed of maize and other crops such as pigeon peas, cowpeas, beans, green grams, sorghum and bulrush millet. Although this is widely appreciated, very limited effort has been put in understanding the impact that different forms of stresses including drought may have on seed insecurity of the target population. Understanding the dynamics of seed security in any emergency requires assessment that informs programming and subsequent seed intervention. This report is a step in this direction. The main objective of the assessment was to examine and analyze the current seed security situation in Makueni, Kuitu and Thraraka-Nithi Counties, and provide practical recommendations.

This seed security assessment used a combination of primary and secondary data collection techniques in the three Counties. A total of 11 sub-counties were purposively selected to represent five agro-ecological zones which have been receiving seed aids over the years. A total of 345 households, 72 local grain/seed traders, 43 agro input dealers and 26 key informants were interviewed (KII). In addition, 20 focus group discussions (FGD) were held with members of the communities. Data relating to households (HH) and local grain seed traders were collected using structured questionnaires while data were obtained from other sources using semi structured questionnaires. Statistical summaries of frequencies (counts)/percentages, averages, STDEV etc. for household and local market data were generated using pivot table analysis, which is an analytical tool within the Microsoft Excel Programme.

Crop production is an important livelihood activity for nearly all the households in the three counties, and the major crops cultivated in October/November 2013 season included cowpea by 87.2 percent of the households, followed by maize (79.4%), green grams (69.9%) pigeon pea, beans, sorghum, bulrush millet, local and exotic vegetables. The production of green grams responded to a growing guaranteed market while the area under sorghum increased because of market speculation pertaining to East African Breweries Limited (EABL) although farmers planted less sorghum during the current season (Oct/Dec 2014) due to uncertainty of the market. The major crops are used mainly for food (73 %), income (25%) and fodder (2%). Green grams is considered an important income crop by over 70 percent of the households.

Area and method of cultivation: Crop production in the assessed area is predominantly rain-fed, and the average land area cultivated ranges from 1.8 acres (0.73Ha) to 5.5 acres (2.2Ha). Animal traction is used by 77% of the households and is the predominant method of land preparation in the three counties. This is followed by hand tools (18%) while tractors are used by a minimal 5% of households. However, the continuous use of ox- plough is contributing to the formation of hard pans in some counties and thus limiting the growing of cassava and sweet potatoes.

Seed rates: The seed rates vary considerably, with famers using 4.7 kg/acre of maize on average, and 4.5 to 5.2kg/acre for pulses such as green grams, cowpea and pigeon pea. For bean, the average seed rate is 7.0kg/acre with Makueni farmers using significantly higher seed rates (13.7kg/acre) than the overall average. Similarly, farmers in Makueni are using significantly lower sorghum seed rates (2.0kg/acre) and higher than bulrush millet seed than the average. Seed rates for all the crops were lower than the recommended rates due to predominant mixed cropping practices where the majority (75 %) of crops was planted as mixed crops. However, no common spatial arrangement of the cereal: legumes crop was observed.

Soil and water management practices: The use of inorganic fertilizer is still very minimal (9% overall) for field crops in most areas with the exception of Mbooni (28%) and Maara (61%). Many farmers argued that inorganic fertilizers damage the soils, while others claimed that the soils are fertile enough and do not need fertilizers. The subsidized fertilizers provided by the National Cereal Board (NCB) is not benefiting the resource poor famers due to the bureaucratic process involved. Use of organic manure, particularly animal manure was however very common. Availability of animal manure in areas where most households have livestock normally presents an opportunity for improving soil structure, nutrients and water holding capacity. Uptake and use of Zai pit technology, a soil and water conservation technology is slowly taking roots, and contributing to improved productivity in the area.

Harvest and multiplication rates- Overall, slightly above 50 percent of the farmers considered the harvest of 2013 OND rains as poor while some 32 percent considered it good and only 15 percent rated the harvest as good. Though the OND (short rains) is normally considered as more reliable, the year 2013 was not the best compared to 2014 OND rains which most farmers have hope in. Although the majority of the famers considered the harvest of 2013 OND season as poor, the multiplication rates for all the crops were above 20, and indication that seed could still be available from own production if saved. Even as the harvest and crop performance for the 2013 OND season look poor and fair from the farmer's point of view, ideally adequate amount of seed could have been obtained from the harvest.

As expected the poor crop performance in 2013 OND season in the three counties was primarily attributed to drought. Other challenges faced by the famers included field and storage pests, and occasional flash floods in some areas. Response to these challenges has been mainly through encouragement of famers to plant the early maturing and drought tolerant crops and/varieties as well as promote soil conservation and water harvesting practices (Zai pit technologies) in order to address drought incidences. County government, NGOs and FBOs continued to distribute directly distribute over 500 tons of assorted crop seeds in the last two years on assumption that the drought have caused seed insecurity. The seed security based on the elements of availability, access, quality and suitability of varieties revealed just pockets of seed insecurity that doesn't warrant any direct seed distribution.

Seed sources - Farmers sourced the bulk of their seed from informal sources - own production (42.2%-42.2%) and local market (33.9% -34.2%), with agro-input dealers (formal sector) contributing 16.6% and 14.2% of the amount of seed planted by the famers in 2013 and 2014 OND season, respectively. Seed aid contributed just 3.8 and 4.7 percent in 2013 and 2014, respectively while social network contributed 2.8 and 2.2 percent of the seed in 2013 and 2014, respectively. However, considerable amount of maize seed (37.9% and 42.5%) were from the agro-input dealers. Between 2013 and 2014, there was an overall increase in the quantity of seed planted by the famers by 2 percent in 2014 although quantity of bulrush millet significantly increased by 25 percent.

Seed availability - Irrespective of the seed source, over 85 percent of the farmers got their seed before or at the start of the planting season, therefore availability of seed at the time of planting was not a key issue in the area assessed. Apart from own saved seed, which was readily available to the farmers, about 30 percent of them considered the local markets and agro-input dealers as not within easy reach. Overall, over 80 percent of the farmers who planted in 2013 and 2014 OND season indicated that enough seed were available from most sources. There was however concern by 72 percent of those who received seed aid that quantity provided were not sufficient.

Seed access – The major concern relating to seed security was the issue of access, which was mostly linked to high prices of seed sold by the agro-input dealers and to some extent the local market. Over 80 percent of the farmers going to the agro-input dealers considered the prices high while some 55-67 percent of farmers considered the prices from the local market equally high. Farmers however tend to adopt or cope with the high prices by using multiple seed sources in order to meet their seed demand. Although there was considerable concern about the expensive seed prices charged by the agro-input dealers and local markets, over 85% of the farmers still got seeds through these sources and purchased them on a cash basis. It should be noted that farmers generally tend to complain about the price of seed, especially those who have become dependent on repeated seed aid.

Seed quality - Generally, seed from the agro-input dealers and seed aid were considered by 98 percent of the farmers as clean while some 34-39 percent of the farmers considered seed from the local market and own saved seed as fairly clean. Germination of important crop seeds, from all sources, was considered generally good by over 90 percent of the farmers in the area visited. Closer interaction with the agro-input dealers however revealed there were fake maize seeds (Duma 43 variety) in the market in 2014 OND season which prompted some farmers to forward their complaint to the agro-input dealers. However, nothing much was done to help the farmers. There was also a concern expressed by the farmers about impurities and some mixed varieties in the local markets. Interviews with some county agriculture officers, particularly in Kibwezi East and Kilome sub-counties pointed to serious storage pest problems, particularly those of the Lager Grain Borer (LGB) on maize. This did not only affect food security but also raised concern about availability of own saved seed. In a number of focused group discussions, the participants echoed similar sentiment regarding the problem of storage pests and indicated that own saved seed is sometimes sold off to avoid the pest problems.

Varietal suitability - Generally farmer in the three counties are growing both improved and local varieties. About 60 percent of the varieties grown are improved varieties, with green grams, beans, cowpea and sorghum making more than 60 percent improved varieties. Surprisingly, just slightly above 50 percent of maize varieties being cultivated by the farmers are improved and yet the bulk of the seed sold by agro-input dealers is maize, with over 10 varieties in the market. The relatively “low” uptake of improved maize varieties could be strongly linked the prices of certified maize. The recent flooding of agro-input market with fake maize seed, notably the popular Duma 43, could have forced some farmers to look for alternative sources. The majority of the famers (90%) indicated that most varieties are well adapted to their agro-ecologies with the exception the white sorghum variety (*Gadam*) currently being promoted by the government and its development partners as an alternative income generating crop. The *Gadam* is considered highly susceptibility to bird attack, and in some areas yield loss of up to 100 percent have been reported.

The functional seed systems in the three counties offer diversified seed sources, crops and varieties to the famers in the ASAL. In the event that own saved seed is limited due to recurrent drought or storage pests, the local grain/seed market and the agro-input dealers which are well spread provide the famers

with reliable though relatively costly seed of both improved and local varieties. The resource-poor farmers, especially in the marginal environments, normally depend on local (grain) markets for their seed requirements. Even after disasters the local markets are normally resilient as evidenced in post disasters in a number of countries. However challenges such having fake and poor quality seed, high seed price, poor seed storage and handling, inadequate information sharing and unsuitable varieties on the market need to be addressed holistically.

In conclusion, the assessment revealed that despite the drought experienced in the OND rains during 2013, there was no acute seed insecurity in South Eastern livelihood zones of Kenya, especially in terms of seed availability. The quantities of seed used by farmers have remained stable between 2013 and 2014 and farmers had multiple seed sources where they obtained seed, and the major ones being own saved seed, local market and agro-input dealers, particularly for maize seed. Social network and seed aid contributed just less than 5 percent of the overall seed planted by the farmers. Generally seed was available from one or more of seeds sources; however access to seed, especially certified seeds from agro-input dealers, was limited by the high prices. On the whole, there is no justification for continuous seed distribution being undertaken by the government and development partner. Therefore, humanitarian actors should consider limiting or phasing out as much as possible the practice of Direct Seed Distribution (DSD), as currently there is no acute seed insecurity that warrants DSD.

As a way forward, the following measures could be considered in the short term: As a way of improving access seed companies should package seed in smaller units of 1kg that are demanded by the farmers; there is a need to review and enforce regulation on seed packaging and strengthen measures to reduce fake seed. Where possible, all seed companies should adapt the use of transparent packaging or use packaging material in which a portion or entire contents are visible to the customer; the government should eliminate unauthorized sales of agro-inputs in premises such as pharmacies; regular and close monitoring of seed stock with the major suppliers by the KEPHIS; Seed Companies offering certified seed to be held accountable for any problems or defects detected; It is important for the government to recognize the significant roles played by the grain traders in providing grain as seed to the farmers - prompt inspection and testing the quality of their grain/seed just before planting season could help to achieve some minimum quality standards as required as well as training the traders in management and storage of seed; where an emergency response is envisaged, market-based vouchers could be used, and in areas where the farmers are bit far from the local markets and/or agro input dealers, seed fairs should be used; Emerging and new agro-input dealers, particularly those at lower level locations (sub-counties) need to be capacitated in seed handling and storage; promotion of appropriate storage facilities such as metal *Silos* by FAO need to be encouraged; government needs to decentralize and put in place mechanism that improve access to subsidized fertilizers by resource poor famers.

In the medium to long term: The research institutions need to develop acceptable and less susceptible crop varieties; test efficacy and efficiency of some commonly used storage pesticides; test and identify the best cereal : legumes intercrop spatial arrangement for up-scaling. KALRO and other seed companies to continue supporting seed multiplication; support to community-based seed production and supply need in areas with limited contract seed growers. Technologically, use Zai-pit technology for water and soil conservation need to be up-scaled in a number of places; in addition, introduction *Magoye* rippers on a cost recovery basis to the farmers who use animal traction need to be promoted as a way of helping them break the hard pans for increased productivity; and introduction and promotion of peal millet and finger millet in areas less suitable for maize could go a long way in improving food and seed security. The above technologies could be up-scaled and promoted using Farmer Field School (FFS) approach.

1.0 INTRODUCTION

1.1 Background

Agriculture is the major contributor of the Kenyan economy. It is the leading economic sector, accounting for 25 percent the gross domestic product (GDP) and 65 percent of Kenya's total exports. About 75 percent of Kenyan population depends on agriculture as source of livelihood, which accounts for about 18 percent of the wage employment. Kenya's agriculture is mainly rain-fed and dependent on the bimodal rainfall in most parts of the country. It's predominantly small-scale farming mainly in the medium and high-potential areas accounting for 75 per cent of the total agricultural output and 70 per cent of marketed agricultural produce. More than 80 percent of the country is arid and semi-arid land (ASAL) with an annual rainfall ranging from 400 – 600 mm. Droughts are frequent and crops fail in one out of every three seasons. With increasing population pressure in high and medium potential areas, the future of agriculture is in ASALs where large land remains underutilized.

The Kenyan farmers depend on both the formal and the informal seed system. Formal seed sector is considered one of the most vibrant in the eastern and central Africa, with over 60 seed enterprises. However, the informal sector still accounts for over 80% of the total seed used in the country (L. Sperling et al., 2011; Joseph M.W, 2012), with its contribution being even much higher in ASALs. The national requirement of certified seed ranged from 28,000 to 35,000 metric tons, with maize accounting for over 80% of the total volume of certified seed.

Achieving FAO Kenya country programming framework (CPF) outcome 2 of increasing agricultural productivity of medium and small scale producers will require a well-functioning seed system. A well-functioning seed system is one that uses the appropriate combination of formal and informal channels to efficiently meet farmers' demands for quality seeds of suitable crop varieties. While the seed industry in Kenya is better developed compared to other countries within the region, high cost of seed relative to other inputs, coupled with the inability of the formal seed system to meet the demand by farmers have been cited as bottlenecks to the seed industry (Nyoro and Ariga, 2004). In the Arid and Semi-Arid Land (ASAL), recurrent drought and crop failure have been frequently cited as source of seed insecurity. In addition, poor legislative and regulatory framework in the seed industry adversely affects access to improved seed and planting materials by farmers, particularly those in the ASAL. Since the liberalization of the seed industry in 1996, private sector participation has increased, with a number of private seed companies being registered to produce seed, thus reducing the monopoly that the Kenya Seed Company has enjoyed for a long time (Miltone W. A and David L.T, 2006). While it was widely expected that this would lead to improved accessibility to quality seed and hence increased efficiency, agricultural productivity has generally been low and shown declining trends (Miltone W. A and David L.T, 2006; KFSSG, 2014).

Efforts by government and humanitarian actors to improved availability and access to quality seed of adapted crop varieties by marginal farming households have been focusing on providing maize seed and seed of other traditional high value crops such as pigeon peas, cowpeas, beans and some other legumes in the ASAL regions. Though this is widely appreciated, very limited efforts is normally put in understanding the impact of such interventions and elements and magnitude of seed insecurity of the target population.

1.2 Rationale for Seed Security Assessment

According to FAO (2008) seed security is defined as "Access by farming household's members (men and women) to adequate quantities of good quality seed and planting materials of adapted crop varieties at all times in both good and bad cropping seasons" OR "When quality seed is physically available to households at the right time and place and when households have access to quality seed and planting materials of preferred/suitable crop and varieties". Understanding the dynamics of seed security therefore requires regular assessment for better seed and food security programming.

Larger part of the southern marginal agricultural livelihood cluster of Kenya falls mostly in the Arid and Semi-Arid lands (ASALs), with a shorter crop growing period and recurrent drought problems. Over the past 8 years, seed aids has been repeatedly distributed by a number of humanitarian organizations including the ministry of agriculture without clear understanding of the impact of such crisis on the elements of seed security – availability, access, quality, varietal suitability and the resilience of the system. It's against this background that FAO Kenya, with support from ECHO funded Global Food Security Capacity building through FAO Sub-regional Emergency Office for East and Central Africa (REOA) jointly conducted a Seed Security Assessment (SSA) in the area.

The Southeastern Marginal Agriculture Livelihood cluster comprises of five counties namely; Makueni, Kitui, Tharaka-Nithi, Meru (North) and Embu (Mbeere). It covers an area of 47,348 square kilometers and has an estimated population of 3,032,460 persons (KNBS 2009). The cluster livelihood zones could be broadly classified into two: - a) marginal mixed farming livelihood zone representing 65 percent of the population, and b) mixed Farming livelihood zone representing 26 percent of the population. The main sources of income for the cluster include; Crop production which accounts for 40 percent of the total household income, Livestock production accounting for 35 percent and off-farm employment at 25 percent. The target counties for the assessment are Makueni, Kitui and Tharaka-Nithi. The counties have been classified into a number of agro-ecologies.

1.3 The Assessment Area

The Southeastern Marginal Agriculture Livelihood cluster has a number of agro-ecological zones which are characterized by altitudes, precipitation and length of rainy season. The characteristics of the agro-ecologies tend to define the type of crops and the farming system in place. In general, the area experiences two rainy seasons, with the most reliable being from October to December referred to as short rains (SR or OND season) and the March-April-May (MAM season) known as long rains which is erratic and unreliable for crop production. The MAM season is estimated to contribute about 30 percent of the annual crop production in the marginal areas. The assessment was however conducted in the marginal agro-ecological zones (Table 1.1) which are perceived to have seed security related challenges, and over the years received repeated seed aids assistance. The assessment has taken place during the 2014 OND season.

Table 1.1. Characteristics of the assessed agro-ecological zones

Agro-ecological zone	Characteristics
LM3 (low-midland, Level, 3)	• *Altitude:* 800-1300m above sea level (asl) • *Temperature:* Warm, annual mean temp. 21-24^{o}C. Mean min. > 14^{o}C. • *Crops* - Sorghum, pearl millet, French beans, kales, tomatoes, maize, beans and fruit trees such as mangoes and citrus.

LM4 (Lower Midland, Level 4)	• *Altitude:* 800 -1300m asl in Eastern Kenya • *Temperature:* - Warm, annual mean temp. 21-24^{o}C. Mean min > 14^{o}C. • ***Cropping season*****-** Short to very short season, with crop growing period (rainfall) 75 – 104 days • *Crops:* - Beans, dolichos lablab, pigeon peas, pumpkins, sunflower, early maturing maize, cowpeas, sorghum, cotton, cassava, sweet potato. • ***Soils fertility* -** low soil fertility
LM5 (Lower Midland, level 5)	• Semi-arid: annual average precipitation at least 25-40% of potential evaporation. Growing periods at least 45 days in 6 out of 10 years. • *Cropping season* – Very short to short season, with crop growing period (rainfall) of 40 – 74 days. Runoff-water harvesting are crucial for crop and livestock production • *Crops*– millet – dwarf sunflower, cowpeas, bulrush millet, green grams, sorghum, beans and sisal. Cotton, pumpkin and watermelon are grown too in this agro-Ecological zone. • *Temperature:* Annual mean temp:21.6 - 24.0 ^{0}C • ***Soil types*****-** shallow and or stony soils with low fertility
UM3 (Upper Midland, level 3)	• *Altitude:* - 1300-1800m asl. • *Temperate:* - annual mean temp. 18-21^{o}C. Mean min.11-14^{o}C; • *Humidity:* - Semi-humid; annual average precipitation at least 50-65% of potential evaporation. • *Crops:* – Marginal coffee, maize, beans, cabbages, kales, banana, French beans, pawpaw
IL5 (Intermediate – Lowland, level 5)	• Altitude: 800 m asl. • Temperature: Hot, annual mean temp > 24^{o}C. • Semi-arid; annual average precipitation at least 25-40% of potential evaporation. Growing periods at least 40 days in 6 out of 10 years. • *Soils* – low soil fertility due erosion plain soils • *Crops:* – pearl millet, sorghum, green grams, finger millet and pigeon peas with pumpkin and watermelon grown as a as cash crops.

1.4 The Objectives

The main objective of the assessment was to examine and analyze current seed security situation and provide recommendations that will help in developing the seed sector in the Southern Marginal Agricultural Livelihood cluster. The specific objectives of the assessment were to;

a) Critically and constructively review past emergency and development seed related activities in the three counties with a view of documenting lessons learnt.

b) Assess the current seed security situation (availability, access, quality , varietal suitability and resilience) among farming households within the target agro-ecological zones in the three counties

c) Provide a comprehensive information base (report) on which to design appropriated seed system support interventions linked to promoting agricultural growth and seed security.

2.0 THE ASSESSMENT METHODOLOGY

2.1 The Assessment Counties and Participating Organizations

The seed security assessment was conducted in the Kitui, Makueni and Tharaka-Nithi Counties of the South-eastern Marginal Agriculture Livelihood cluster. This was a joint assessment conducted by FAO Kenya in collaboration with the County Agricultural Department, Kenya, Plant Health Inspectorate Services (KEPHIS) and NGOs with technical and financial support from the ECHO Capacity building project through FAO REOA. The methodology for the assessment was based on the revised seed security conceptual framework (SSCF) which looks at four elements – availability, access, seed quality and varietal suitability at community levels. It also looks at the factors that contribute to the resilience of the seed system within the assessed areas.

2.2 SSA Training

A two and half day training was conducted at the Garden Hotel in Machakos, from 11th to 12thNovember 2014. A total of 12 participants (3 from FAO; 6 from county government department of agriculture, 1 from KEPHIS and 2 from NGO) attended the training. The objective of the training was to provide sufficient skills to the participant in conducting seed security assessment. The training focused on both theoretical and practical understanding of the basic concept of the seed system; the revised seed security assessment conceptual framework (SSCF); the steps for conducting seed security assessments; data collection tools such as key informant interview (KII) guides, household and market questionnaires, focus group discussion (FGD) guide, Agro-input dealers interview and seed growers interviews. The tools were adapted and pretested before being used in the field. During the training, the participant were able to identify the agro-ecological zones which are perceived to be most seed insecure, some of which have been receiving repeated seed aid. Three sub-teams were formed to cover the three counties during data collection.

2.3 Data Collection

Data collection commenced immediately after the training and the three sub-teams took nine days, from 14th -21st November 2014, covering the 11 sub-counties purposively selected to represent all the agro-ecological zones identified. Primary data was collected using various data collection techniques, while secondary data was obtained through reviews of project and assessment reports, and other existing literature. During primary data collections, a total of 345 households (HH), 72 local grain/seed traders (LMS), 43 agro input dealers (Agro-I) and 26 key informants were interviewed (KII). In addition, the research teams held 20 focus group discussions (FGD) with members of the communities (Table 2.2). The primary data from households (HH) and local grain seed traders (LMS) was collected using structured questionnaires while data from other sources was collected using semi structured questionnaires

Table 2.2. Sample size

County	Sub-county	AEZ	HH	FGD	LMS	Agro-I-Dealers	KII
Kitui	Kitui Central	LM4	28	2	3	3	6
	Kitui South	LM5	54	3	16	8	5
	Mwingi North	IL5	36	2	6	3	4
	Sub-total		***118***	***7***	***25***	*14*	*15*
Makueni	Kibwezi–East	LM5	9	1	3	4	2
	Kilome	LM4	32	2	4	3	3
	Makueni	LM3	34	2	13	5	5
	Mbooni	UM3	39	2	7	5	6
	Sub-total		***114***	***7***	***27***	*17*	*16*
Tharaka-Nithi	Chuka I-gamba Ng'ombe	LM4	34	2	6	4	0
	Maara	UM3	9		3	2	2
	Tharaka North	LM5	39	2	5	2	2
	Tharaka South	LM4	31	2	6	4	1
	Sub-total		***113***	***6***	***20***	*12*	*5*
Grand Total			345	20	72	43	26

Key informant interview (KII): These were done using a standard KII interview guide which focuses on understanding the general agricultural context; the activities of agro-input dealers and seed production activities; access to seed policy and other relevant agricultural documents; disasters and impact on seed security; and insight into food and nutrition security from an expert point of views. The key informants included; a)County, sub-county and ward agricultural officers, b) NGO and CBOs Programme/project officers, c) sub-county chiefs and d) Cereal growers association (CGA) and Seed Bank

Household surveys (HHS): Household surveys were conducted in 11 sub-counties, purposely selected to represent the 5 agro-ecologies of interest. Two sub-locations were then identified within the wards representing each agro-ecological zone. The enumerators then sampled the farming households within

the sub-location; each enumerator systematically sampling and interviewing 4-7 households along transect. The household survey questionnaire focused at demographic and livelihood characteristics; crop/seed system profile; and seed channels/sources in reference to the SSCF, and on seed aid with respect to accountability principles.

Focus group discussions: In each sub-location, focus group discussion (FGDs) was held with a group of 6-12 members of the community, immediately after or during the household interviews, to provide additional information on farming and seed security of the community. The focus groups provided additional qualitative information on the seed security situation.

Seed grower's interview – Few individual seed growers contracted by Kenya Agricultural and Livestock Research Organization (KARLO) were interviewed using a semi-structured questionnaire to establish the nature of the group, understand their production activities, capacities (skills and resources at hands); their major challenges; and investment plan.

***Agro-input dealer's interviews* –** The interview with agro-input dealers aimed at understanding the inputs they are selling, particularly crop and vegetable seeds as well as fertilizers. The interview investigated the demand and supply of the various seed; feedback mechanism, with respect to accountability principles; key challenges and areas for improvement; especially in support to poor farmers.

Local market survey (LMS): local market survey was done using a structured questionnaire. A total of 72 grain/seed traders were interviewed across the three counties. The LMS focused on those who normally sell grain/seed to the farmers during the planting season. It also looked on the demand and supply of the various seed types, seed storage and conditioning.

2.4 Data management and Analysis

Household and local market survey data were entered into an excel data sheet for management and analysis. Data was checked and cleaned using data filtering application in excel, while statistical summaries of frequencies (counts)/percentages, averages, STDEV etc. were generated using pivot table analysis.

3.0 KEY FINDINGS AND DISCUSSION

3.1 Household Demographic and Livelihood Characteristics

3.1.1 Household gender, level of education and size

Generally about 77 percent of the households are male headed, though most agricultural activities as observed by the assessment are done by women. Of the three counties, Makueni had a higher number of heads of households who have attained secondary (42.1%) and tertiary (14.0%) level of educations (Table. 3.1) compared to the other two counties.

The household size ranges from 1 to 15 with an average household size of 6.1 across the three counties. Children below 5 years make between 6-10% of the farm household size, while the young persons (5-17 years) makes up about 27-36 percent of the population. The productive age groups (youth and adults) makes up about 50 percent of the household size (Table 3.1; Fig. 3.1), and they provide most of the required household labor force in the livelihood system which is predominantly subsistence agro-pastoral. Over 90 percent of the households in the three counties have been practicing agriculture for over five years. The percentage range of household members involved in agriculture was 46% - 57%, with Makueni County having the lowest number (45.9%) and Kitui the highest (57%) (Table 3.1)

Table 3.1 Household gender, education and size

House demographic	Kitui (N=118)	Makueni (N=114)	Tharaka-Nithi (N=113)	Overall (N=345)
Gender of head of household				
a) Male	69.8%	75.9%	85.8%	77.1%
b) Female	30.2%	24.1%	14.2%	22.9%
	100.0%	100.0%	100.0%	100.0%
Education level of head of household				
a) No formal education	30.5%	6.1%	31.9%	22.9%
b) Primary	52.5%	37.7%	48.7%	46.4%
c) Secondary	14.4%	42.1%	13.3%	23.2%
d) Tertiary	2.5%	14.0%	6.2%	7.5%
	100.0%	100.0%	100.0%	100.0%
Household Size				
a) Average size	6.6	6.1	5.7	6.1
b) Range	1-15	1-12	1-13	1-5
Percent of households members involved in agricultural activities				
a) Number	3.8	2.8	2.8	3.2
b) Percent	57.7%	45.9%	51.2%	52.0%

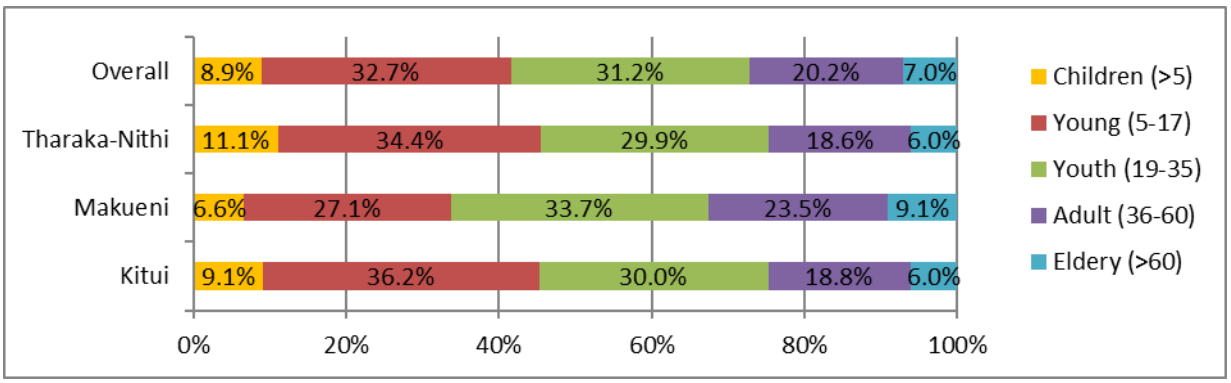


Fig. 3.1. Structure of the population

3.1.2 Livestock resources

In the three counties visited, over 94 percent of farm households keep a number of different types of livestock, with the majority (85%) having poultry, followed by goats (70%) and 63 percent being cattle (Fig 3.2). The average number of animals per household varies from one animal to another and from location to location Kibwezi East and Tharaka South have significantly higher number of cattle, with an average of 6.1 and 5.1, respectively while Tharaka North have significantly higher number of goats and sheep's with an average of 15.7 and 43, respectively (Table 3.2).Livestock plays an important role in the livelihoods of the agro-pastoral communities in these counties. Animal traction is a common practice for cultivation in most of the areas visited. It is used for cultivation as well as weeding of the crops, particularly row planted ones. Animal manure is widely used to augment the soil fertility as well as in soil and water management of crop resource. In a number of focus group discussions, farmers pointed out that the issue of hard pan was hindering growing of root crops such as cassava and sweet potato, and this was attributed to the continuous use of mouldboard ploughs.

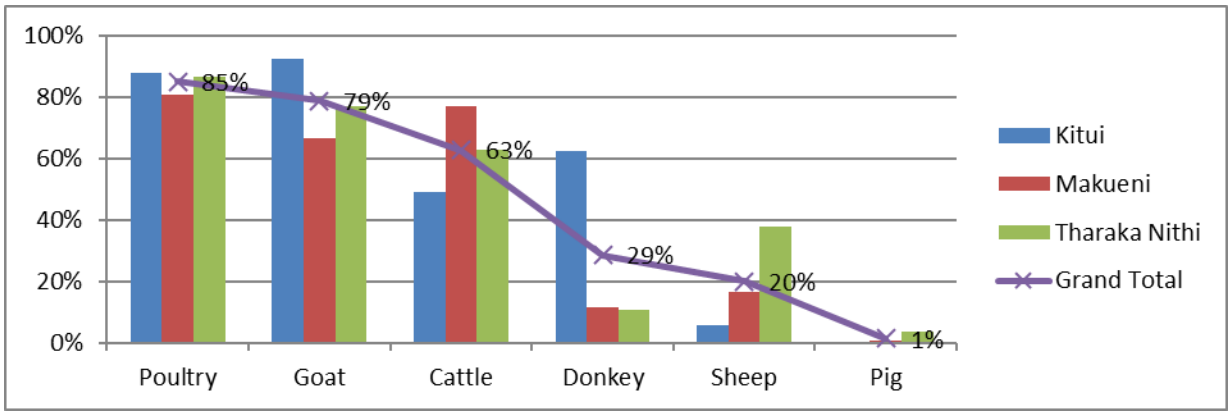


Fig. 3.2 Percent of households having different types of animals

Table 3.2. Average number of livestock among livestock keepers

County	Sub-county	Cattle	Sheep	Goat	Donkey	Poultry	Pig
Kitui	a) Kitui Central	4.7		7.4	1.4	13.8	
	b) Kitui South	2.5	3.5	6.9	1.5	12.4	
	c) Mwingi North	3.2	7.8	9.2	2.0	9.9	
	Kitui-average	*3.3*	*6.6*	*7.7*	*1.7*	*12.1*	
Makueni	d) Kibwezi -East	6.1	5.3	6.8		9.4	
	e) Kilome	3.5	3.6	7.8	1.0	13.6	
	f) Makueni	3.4	3.0	6.0	1.2	13.7	
	g) Mbooni	3.5	4.0	6.3	1.0	20.1	3.0
	Makueni-average	*3.7*	*3.8*	*6.5*	*1.2*	*15.6*	*3.0*
Tharaka-Nithi	h) Chuka I-gamba Ng'ombe	3.2	4.0	8.3	1.0	7.2	
	i) Maara	1.6		3.5		9.6	1.5
	j) Tharaka North	4.4	15.7	43.0	2.6	13.2	
	k) Tharaka South	5.1	5.0	7.2	1.0	15.0	3.0
	Tharaka-Nithi average	4.0	11.0	21.5	2.3	11.9	2.3
Average		3.7	8.6	11.8	1.7	13.1	2.4
STDEV		1.2	3.9	10.5	0.5	3.3	0.7

3.1.3 Sources of income

Overall, over 60 percent of the farmers considered crop production as their major source of income while 11 percent considered livestock as their major source of income, however in Tharaka-Nithi County up to 18 percent considered livestock as their major source of income (Fig. 3.3a). Among the farmers that consider crop production as their major source of income, the second most important source of income is livestock, with about 38 percent of farmers. Others sources of income among the top three are trade, agricultural and non-agricultural labor (wages), remittances and formal employment (Fig. 3.3b). Other minor sources of income include, pension, bee keeping, *boda boda* riding, carpentry and joinery work, renting out oxen for cultivation, sale of fodder, grain milling and table baking also known as Village Community Banking (VICOBA).

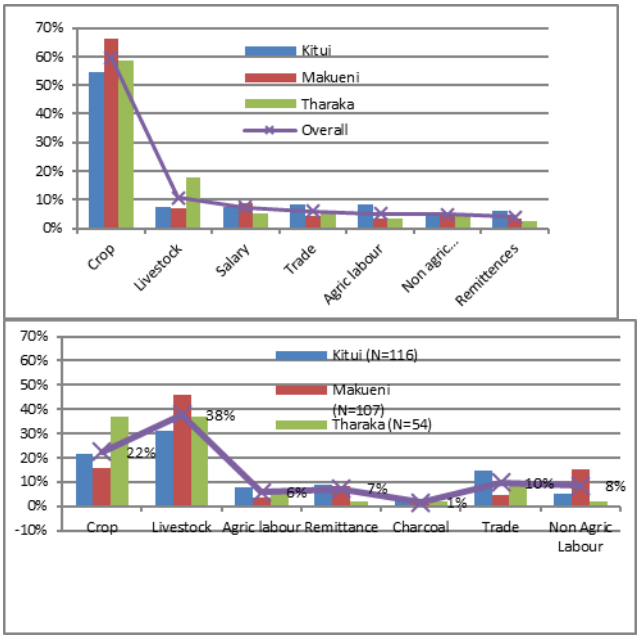


Fig 3.3.a) 1st major sources of income; b) 2nd Major sources of income

3.1.4 Savings and access to credit

A saving culture appears to be taking roots in most areas visited with over 60 percent of the households saving parts of their income earned from various sources, particularly from sales of crop and livestock (Fig. 3.4a). The majority of the households (38%) prefer to save their money in the table banking also referred to as village community banking (VICOBA). The wide spread of bank branches across the three counties offers opportunity to save by 29 percent of the households, with a significantly higher percentage (41%) in Kitui saving their money in the commercial banks. Savings at home and use of saving and Credit Cooperative Organizations (SACCO) are also common, with some 16 percent and 18 percent of the farmers using this form of banking respectively (Fig. 3.4b). In areas where saving culture is well practiced by the farmers, stress related to access to inputs and other service could be minimal.

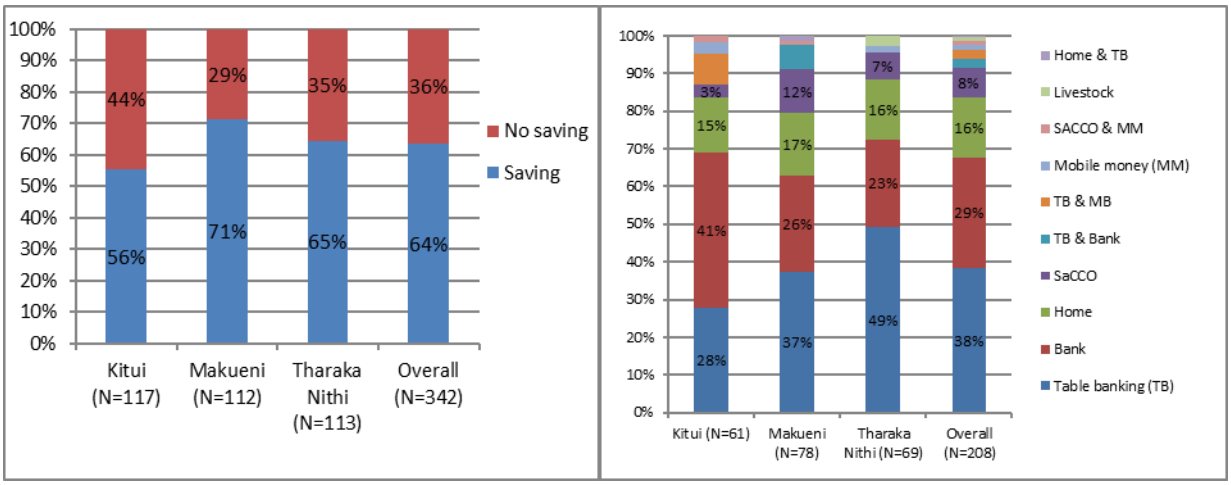


Fig. 3.4a) percentage of farmers saving their earnings; and b) place of saving

Overall, access to credit appeared more difficult than savings, with only 47 percent of the respondent indicating that they can access credit, however in Makueni sub-county significantly higher percentage (62%) of the farmers indicated access to credit (Fig. 3.5a). Most common source of credit is from table banking or VICOBA (41%) followed by commercial bank (21%) and SACCO (15%). Other sources of credit include social networks and micro-finances.

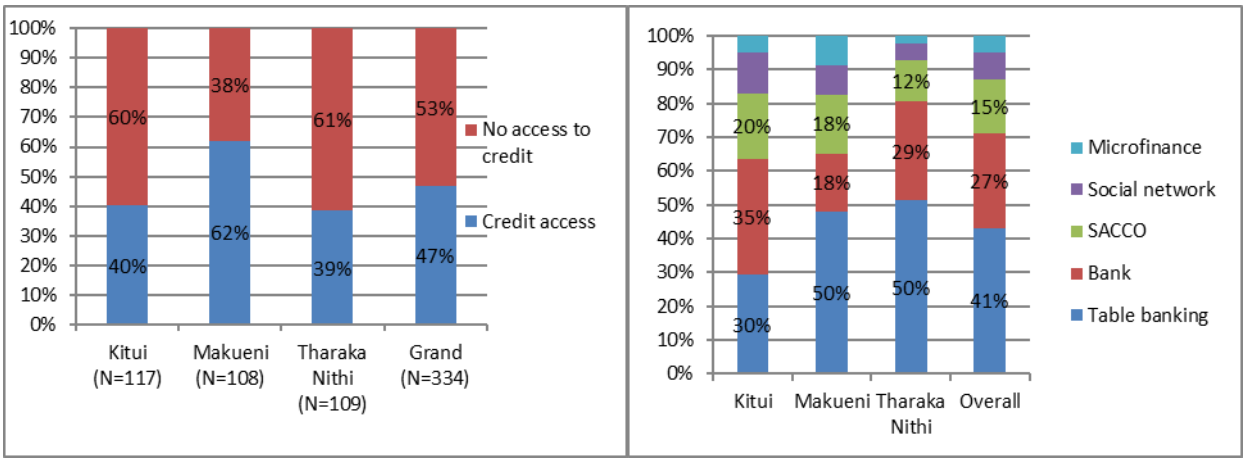


Fig. 3.5 a) access to credit and b) sources of credit

3.1.5 Food consumption and nutrition

Generally, about 77 percent of the adult eat three meals a day (breakfast, lunch and supper) while some 22 percent reported on two meals day (Fig. 3.6a). Children on the other hand eat more frequently (3-4 times) than the adults, and 61 percent of those with children give them at least three meals a day while 32 percent of the households with children give up to four meals a day (Fig 3.6b).

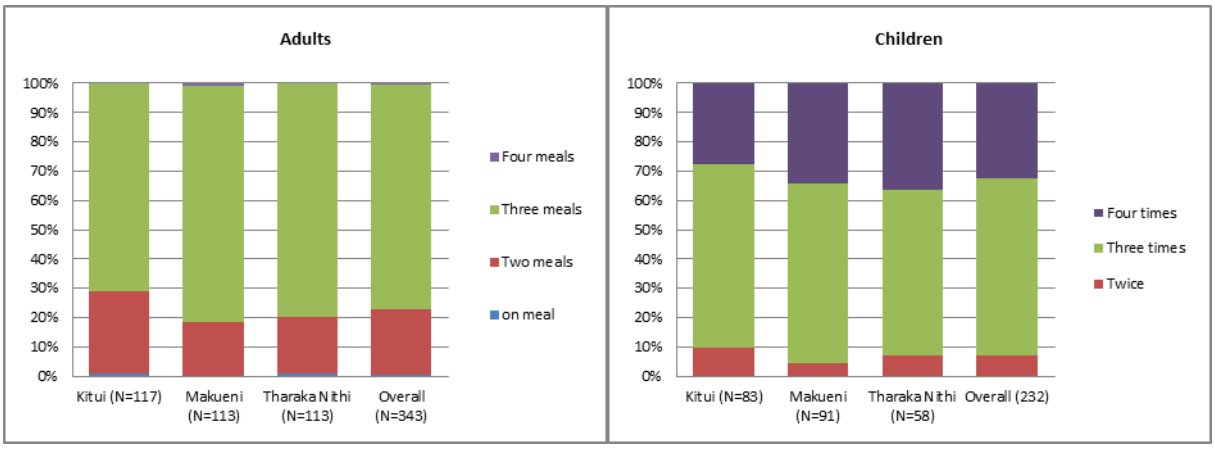


Fig. 3.6. Number of times a) adult and b) children ate in November

On average, within 7 days in November, legumes, pulses and sugars were eaten in six out of seven days; oil, fat, milk and dairy products eaten five times a week, while vegetables are were eaten in four times a week. Fruits were eaten only twice a week while meat is eaten only once a week, and in Kitui county very small fraction of respondent households eat meat, fish or egg in the last seven days (Table 3.3). In consideration of the number of times members of the household ate the different food groups, food availability could be considered good, although consumption of protein sources such as meat and fish is limited, probably due to lack of means to buy them. From the key informant, nutritional problem is attributed to inadequate food intake, narrow or lack of diversity, knowledge, behavioral and cultural attitudes.

Table 3.3. Food group and number of days eaten within the last 7 days (weeks)

Food group	Counties			Overall
	Kitui	Makueni	Tharaka-Nithi	
a. Cereals	7.0	6.7	6.9	7.0
b. Pulses/legume	5.7	5.9	6.0	5.9
c. Sugars/sweets	6.1	5.2	6.1	5.8
d. Oil/fat/ghee	5.6	3.6	6.0	5.1
e. milk/dairy product	5.4	4.0	5.9	5.1
f. Vegetables	3.9	4.9	3.2	4.0
g. Fruits	1.3	2.0	2.1	1.8
h. Meat/fish/eggs	0.6	1.3	1.0	1.0

3.1.6 Poorer households in the community

Access to credit, saving culture, food and income are sometimes linked to the status of the households as viewed by other members of the community. The community perceives the following as poor and most vulnerable to the recurrent climate shocks within the counties;

- Farmers who do not have or owns only a few heads of livestock. Those who own animals are considered wealthy and are more resilient.
- Special groups are as follows; jobless widows, Child-headed households, and households with disables, elderly and HIV positive adults, or children to support but don't have reasonable assets or source of income.
- Farmers who show recurrent inability to buy certified seeds among other vital inputs, and haven't benefited from any recent assistance.

3.2 Crop/Seed System and Practices

Crop production is an important livelihood activity for nearly all the households in the three counties, and the major crops cultivated in October/November 2013 season included; cowpea cultivated by 87.2 percent of the households, this is followed by maize (79.4%), green grams (69.9%) pigeon pea, beans sorghum, bulrush millet, local and exotic vegetables (Fig. 3.7). Therefore the system in the ASAL could be best described as Cereal-Legume based cropping system.

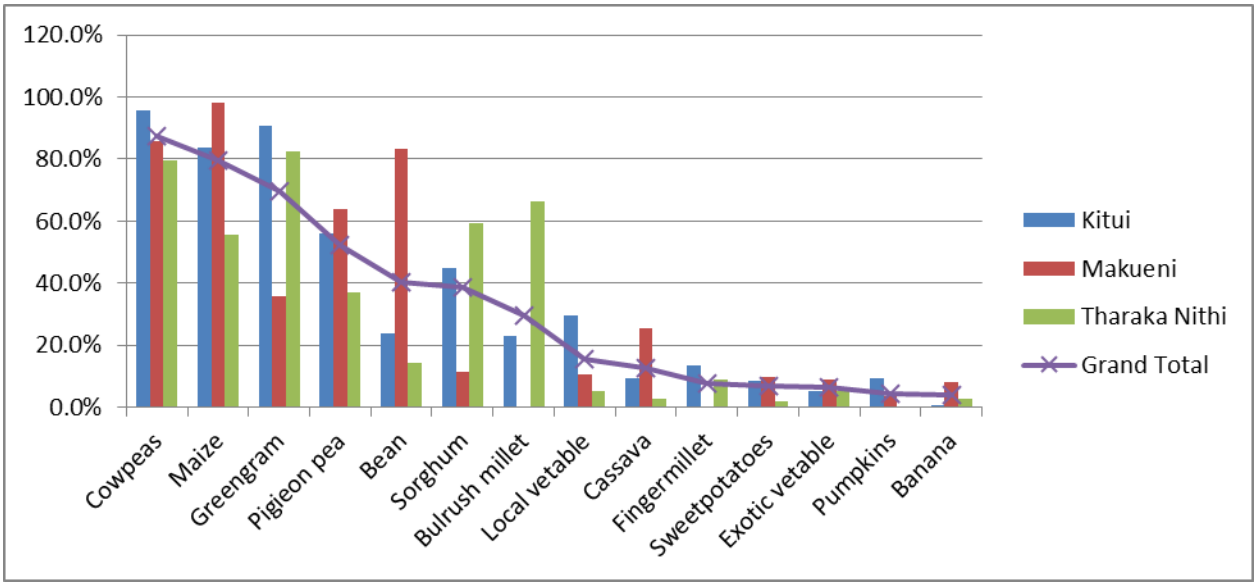


Fig. 3.7. Crops grown by farming households Kitui, Makueni and Tharaka - Nithi

In Makueni County, the popularly gown crops in the assessed agro-ecologies (LM3, LM4, LM5 and UM2) are maize, cowpea, broad beans and pigeon pea. Other crops are grown by less than 40 percent of the farming households in the area. From the focus group discussion, many farmers preferred to have short maturing crop varieties of these crops. Mixed cropping and use of animal manure was very common with the farmers. Harvesting of rain water both for domestic and small scale irrigation was well

practiced. Predominantly, farmers use animal traction for cultivation and this has led to development of hard pans in some areas.

In Kitui County, the most popular cereals are maize and sorghum while the major pulses were cowpea, green grams and pigeon peas. These are mainly grown in the LM4, LM5 and IL5agro-ecological zones. From the focus group discussions farmers observed significant increase in the area planted with green grams and Sorghum in some areas of Kitui South Sub-county.

In Tharaka-Nithi County, the most popular cereals were bulrush millet and sorghum, while the commonly cultivated pulses were green grams and cowpea. These are commonly grown in the LM4, LM5 and UM3 agro-ecological zones. Bananas were also noted to be commonly grown in Maara sub-county. Other minor crops were vegetables under irrigation. From the focus group discussions, production of green grams was noted to be increasing and this was attributed to market assurance. Farmers also picked interest in white sorghum in 2013, and the area under sorghum increased due speculated market with East African Breweries limited (EABL). However, during the current season (Oct/Dec 2014), farmers reported decreasing planting trend due to uncertainty in the market and lack of accountability on pricing and quantity delivered last season. Respondents also reported an increasing trend in adoption of improved varieties especially of green grams (N26) and cowpeas (KVU-27-1), improved maize hybrids varieties as well as bulrush millet and sorghum.

3.2.1 Crop diversity at household level

As discussed earlier, a wide range of crops were being grown in the three counties with 47 percent and 38 percent of the households cultivating between 3-4 and 5-6 crops, respectively. However, the households in IL5, LM4 and LM3 livelihood zones have more diversified crops (5-6) than the overall average compared to the other two (Fig. 3.8). High diversity in crops acts as a cushion to the recurrent drought hence some level of resilience in the face of a number shocks.

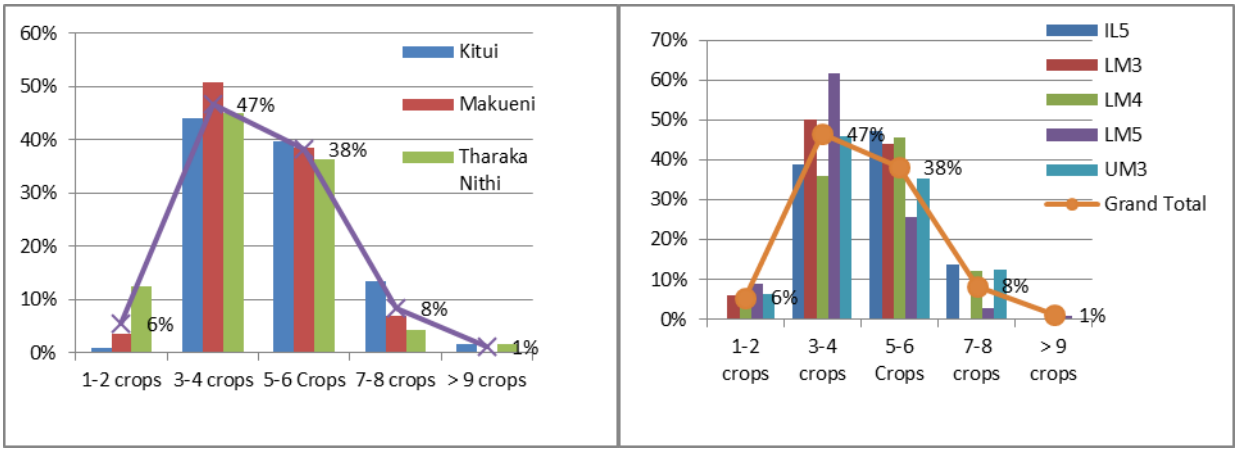


Fig. 3.8. Crop diversity per household based on a) geographic location and b) livelihood zone

3.2.2 Major Crops and their uses

Among the three most important crops cultivated by the households (Table 3.4), maize is the most popular with 66 percent of the households indicating it as one of the three most important crops.

Makueni County had the highest percentage of farming households (96%) who regard maize as one of the important crops. This is followed by cowpea (64%), especially in Kitui County where 75 percent considered it as one of the important crops. Other important crops include green grams, pigeon pea, beans and bulrush millet. Sorghum and finger millets are considered important by 16 percent and 4 percent, respectively. The dominance of maize, which has experienced repeated crop failures due to drought in the last decade. This is one of the reasons of the vulnerability of the cropping system in Eastern Kenya. The cultural importance of maize, its high yield potential and marketing value are among the reasons for the predominance of maize.

Table 3.4. Major crops cultivated

Crops	Kitui (N=118)	Makueni (N=114)	Tharaka-Nithi (N=113)	Overall (N=345)
Maize	60%	96%	40%	66%
Cowpea	75%	58%	59%	64%
Green grams	83%	22%	69%	58%
Pigeon pea	25%	46%	16%	29%
Beans	10%	62%	10%	27%
Bulrush millet	15%	1%	57%	24%
Sorghum	20%	2%	25%	16%
Finger millet	8%	0%	4%	4%

All the major crops grown in the three counties are mainly used as food by 73 percent of the farming households, while some 25 percent and 2 percent consider these important crops as sources of income and fodder, respectively (Fig. 3.8). However, green grams, especially the KS20 (*Angle*) variety, is considered as an important income crop by over 70 percent of the farmers who grow it. Other crops considered income earners are sorghum (31%) and pigeon pea (24%). These findings were equally echoed by the farmers during a number of focus group discussions.

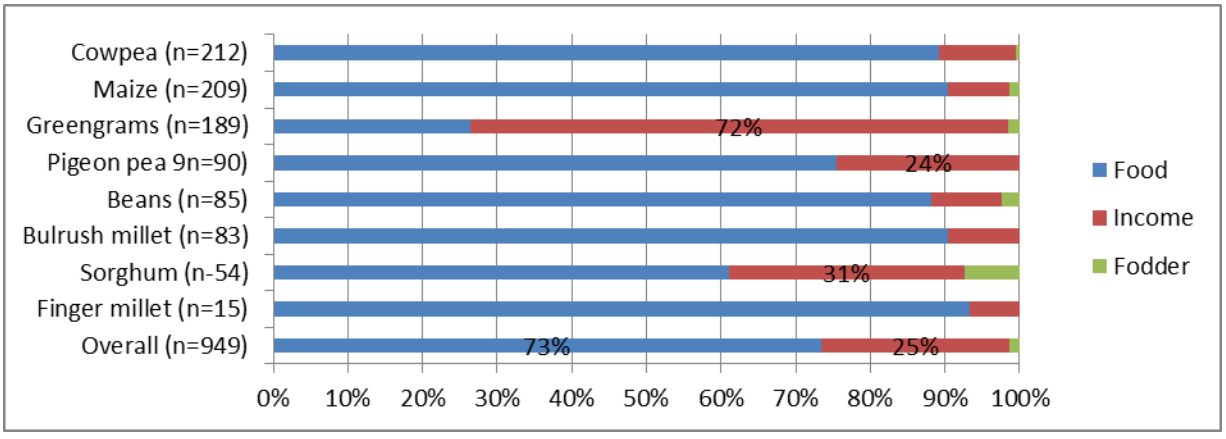


Fig. 3.8 Main uses of cultivated crops

Research in Kenya and elsewhere has shown that sorghum (Sorghum bicolor L. Moench) has the potential to end severe food insecurity in ASALs due to its tolerance to drought and ability to thrive under a wide range of soils (R. Mwadalu and M. Mwangi, 2013). In recent years, the Kenya Agricultural Research and Livestock Organization (KARLO), in collaboration with East African Breweries Ltd. (EABL) has been promoting the use of high quality sorghum variety such as *Gadam*, in beer production. This

development has spurred renewed interest in the commercial production of sorghum, as it offers farmers prospects for higher returns (Kilambya D and Witwer M., 2013).

Kenya's agricultural sector is guided by the Agricultural Sector Development Strategy (ASDS), 2010-2020, which aims to increase agricultural productivity, commercialization and competitiveness of the sector's commodities and enterprises to achieve national food security, increase exports for foreign exchange earnings and create employment opportunities. The ASDS classifies sorghum as one of Kenya's main food crops, along with maize, rice, wheat, potatoes, cassava, vegetables and beans, and puts forth several broad based strategies for increasing production, productivity and marketability of these crops. Before the ASDS was developed, agricultural policy mainly focused on cash crops rather than staple food crops, and even among staple food crops, more attention was paid to maize than other cereals.

The pricing and marketing for sorghum and all other cereal crops are liberalized, except for maize, which the government continues to regulate through the National Cereals and Produce Board (NCPB). Despite the policy focus on staple food crops in recent years, many of these commodities, including sorghum, continue to face non-tariff trade barriers, such as roadblocks, multiple county taxes and levies, which hamper their competitiveness both domestically and regionally (Chemonics, 2010). Although no tariffs are levied on food crops traded among East African Community (EAC) and Common Market for Eastern and Southern Africa (COMESA) countries, tariffs are levied on some food crops traded with Southern Africa Development Community (SADC) countries and the rest of the world (Chemonics, 2010). In Kenya, sorghum imports from SADC countries and the rest of the world are subject to a 25 percent tariff.

Despite the no tariff policy on sorghum produced locally, the production of white sorghum has not been taken up, particularly in Makueni and parts of Kitui and Tharaka Counties, as expected due the challenge of heavy birds' attacks, especially when planted early in the season. Though early planting could be the best options for most crops in the area, early planted sorghum (*Gadam*) mature first before the grass and thereby making it the only abundant food source for the birds. From the focus group discussions, maize is still considered an income crop if the harvest is good and this highly depends on the rainfall and its pattern.

The majority of the farmers in the assessed agro-ecological zones depended on the rain for production of these major crops though some limited irrigations were reported in some areas, particularly along the river banks. As observed in the field, some farmers who grow vegetables (not considered by most farmers as major crop) do irrigate their crops, and this is becoming more and more feasible (though with challenges) through the promotion of water harvesting techniques in the lower midland areas.

3.2.3 Area cultivated and cultivation practices

The average Land area cultivated ranges from 1.8 acres in Maara and Chuka I-gamba Ng'ombe to 5.5 acres in Tharaka North sub-counties. The cultivated land size varies from 0.5 acre to 20 acres. In Chuka I-gamba Ng'ombe, Mara and Kilome sub-counties, the average areas cultivated are significantly smaller than the overall average. However, in Tharaka North and South sub-counties the area cultivated are significantly larger than the overall average. In 2013, 91 percent of the households were able to plant the entire area they cultivated in October/December 2013 rainy season (Table 3.5). The few who did not plant all the areas cultivated sited reasons such as lack of enough labour, lack of enough seed, delayed onset of rains.

Table 3.5.Average total area of land cultivated and planted in October/December 2013 rainy season

County	Sub-county	Area (acres) of land prepared			All planted	
		Average	Minimum	Maximum	No	Yes
Kitui	Kitui Central	3.6	1	20	4%	96%
	Kitui South	4.0	1	10	28%	72%
	Mwingi North	4.5	1	18	19%	81%
	Sub-overall	***4.0***	***1***	***20***	***20%***	***80%***
Makueni	Kibwezi –East	3.7	2	7	0%	100%
	Kilome	2.1	0.25	7	0%	100%
	Makueni	3.1	0.5	18	15%	85%
	Mbooni	2.9	0.5	10	0%	100%
	Sub-overall	***2.8***	***0.25***	***18***	***6%***	***94%***
Tharaka-Nithi	Chuka I-gamba Ng'ombe	1.8	0.5	5	3%	97%
	Maara	1.8	0.75	3	0%	100%
	Tharaka North	5.5	1	13	0%	100%
	Tharaka South	5.0	1	13	0%	100%
	Sub-overall	***3.9***	***0.5***	***13***	***1%***	***99%***
Overall		***3.6***	***0.5***	***13***	***9%***	***91%***
	STDEV	1.3				

The predominant method of land preparation in the three counties is use of animal traction. Overall, 77 percent of the households (no significant difference between the three counties) use animal traction, particularly oxen as the major mean for preparing seed bed. Animal traction is also commonly used for weeding maize crop. Other methods of seed-bed preparation include use of the hand tools (18%) and very minimal through mechanized method (tractor) and conservation practices such as zero tillage makes less than 5 percent. From the focus group discussion, continuous tillage using ox- plough has led to formation of hard pans in some counties, hence hindering the growing of tuber crops like cassava and sweet potatoes as well as curtailing potential yields for most of annual crops. This was evidenced from the sample of sweet potato found in local markets such as Mbumbani (Mbooni sub-county), Kibwezi (Kibwezi East sub-county) and Sultan Hamud (Kilome sub-county) in Makueni County.

On average the farmers are using 4.7 kg/acre of maize, though those in Tharaka-Nithi County are using slightly above the average. The average seed rates (kg/acre) for cowpea, green grams and pigeon pea were 4.5, 4.8 and 5.2, respectively, with no significant difference between the county averages. The average seed rate for bean is 7.0kg/acre with Makueni farmers using significantly higher seed rates (13.7kg/acre) than the average (STDEV=4.0). Similarly, farmers in Makueni are using significantly lower sorghum seed rates (2.0kg/acre) and higher than bulrush millet seed than the average (Fig. 3.9a). Seed rates for all the crops were lower than the recommended rates due to predominant mixed cropping practices (Fog. 3.9b). About 75 percent of the area planted is mixed cropping and this is more pronounced with maize and pulses. The common practice of intercropping is mixing cereals, particularly maize with 2-3 pulses (cowpea, beans, green grams and/or pigeon pea). There was however no common spatial arrangement of the crops (cereal: legumes) in the field to give maximum yield advantage.

Studies by IITA has shown that row-to-row planting patterns of 2:4cereal: cowpea planting pattern is widely accepted by famers in West Africa and it enhances intensive cultivation cowpea within the strips, optimizes usage of fertilizer through selective application, and the spraying of insecticides on cowpea (Ajeigbe H.A. *et al.,*2010). Such practices could be piloted and tested for promotion in the ASAL.

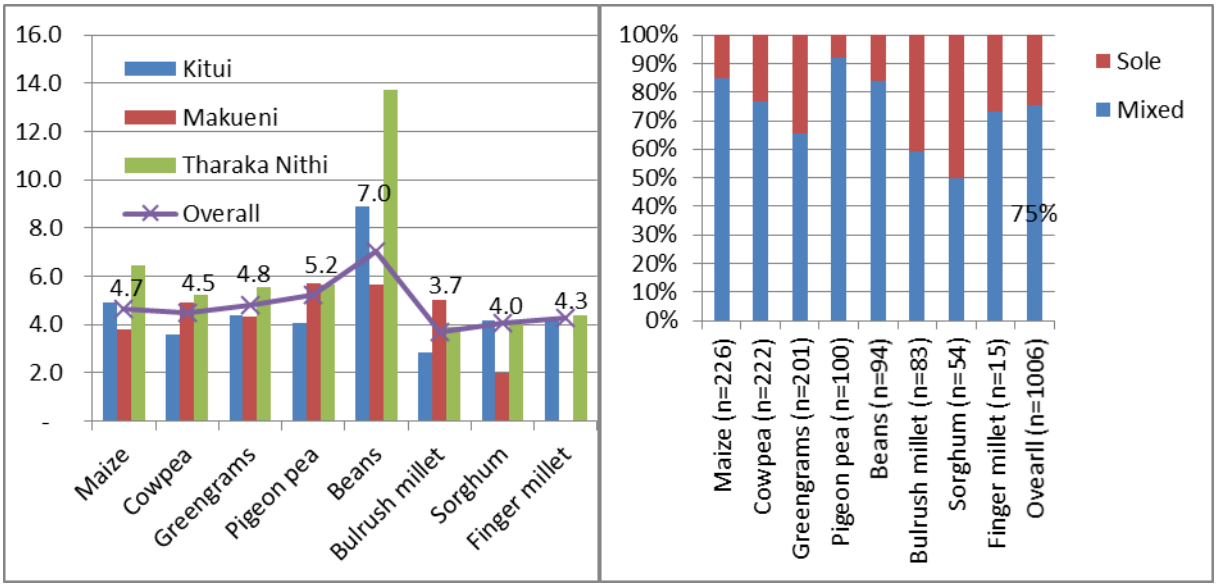


Fig 3.9 a) average seed rates and b) cropping practices (right)

3.2.4 Use of inorganic fertilizers and organic manure in the ASAL

Although inorganic fertilizers such as NPK, Urea and DAP were commonly found with the agro-input dealers across the three counties, only nine percent of the major crop fields had inorganic fertilizers applied. However, significant number of crop fields in Mbooni (28%) and Maara (61%) had organic fertilizer amendment (Fig. 3.10a). From a number of the focus group discussions held, many of the farmers argued that inorganic fertilizers spoil the soils, while others claimed that their soil are fertile enough and not to warrant the investments (additional cost of production) in fertilizers.

In areas where rainfall is low and erratic, and irrigation is less extensively used, application of inorganic fertilizer can be detrimental to plant growth. From the Focus Group Discussions (FGD), unreliable rain was cited as one of the reasons why many farmers do not use inorganic fertilizers fearing their scorching effects on the crop. Moreover, farmers consider the process of buying subsidized fertilizers offered by the government is so tedious, bureaucratic and at the end not be cost effective particularly to resource poor farmers located far from the National Cereal Board (NCB) deports where fertilizer is stored and obtained from. From the household data Mbooni and Maara sub-counties (which are in the medium potential areas) receive better rainfall, hence have better chances of using inorganic fertilizers. In all the locations visited, use of organic manure, particularly animal manure was very common (Fig. 3.10b). Application of both inorganic and organic (manure) is well proven to boost crop productivity (yields) while the organic one improves soil texture and the water holding capacity, subsequently improving food and seed security.

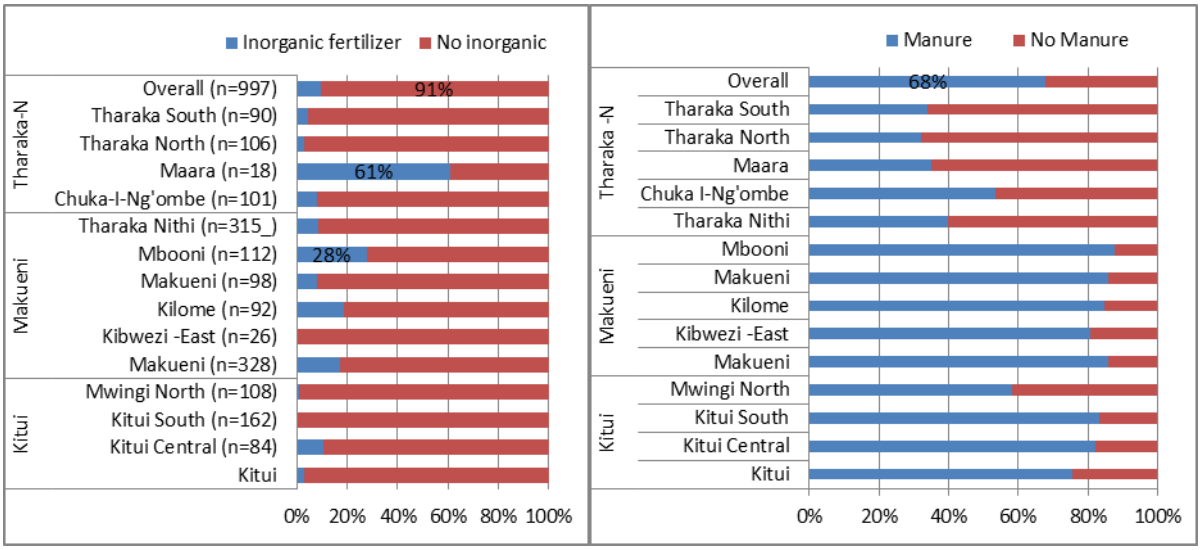


Fig. 3.10a. Use of a) inorganic fertilizers and b) organic manure

The need for sustainable intensification of agriculture in Sub-Saharan Africa has gained support, in part because of the growing recognition that farm productivity is a major entry point to break the vicious cycle underlying rural poverty. Given the low levels of fertilizer use and poor soils in Sub-Saharan Africa, Integrated Soil Fertility Managements (IFSM) must increase if the region is to reverse the current trends of low crop productivity and land degradation. There are renewed efforts to raise fertilizer use in Sub-Saharan Africa from the current 8 kg to 50kg nutrients per ha by improvement of the marketing, policy, and socio-economic environment to increase fertilizer availability at prices affordable to smallholder farmers. Since fertilizer is very expensive for most smallholder farmers in SSA, the Alliance for a Green Revolution in Africa (AGRA) has adapted ISFM as a framework for boosting crop productivity through combining fertilizer use with other soil fertility management technologies, adapted to local conditions. Approaches of ISFM include; maximizing the use efficiency of fertilizer and organic inputs; combine use of fertilizer and improved germplasm and adaptation of ISFM practices to local conditions.

3.2.5 Soil and water conservation practices in the ASAL

Availability of animal manure in areas where most households have livestock normally presents an opportunity for improving soil structure, nutrients and water holding capacity. The agricultural sub-county/ward offices and some NGOs such as Ziduka Africa, Kenyan Red Cross, Action Aids International-Kenya, and World Vision, among others, have tapped into this opportunity in some areas and are promoting Zai-pit technology (Fig. 3.11a) for soil and water conservation. According it ICRISAT the minimum rainfall requirement for maize is 250 mm per season (Fig. 3.11b), and adopting a water conservation technology that reduces amount of rainfall required from 250mm to 200mm increases the chance of growing maize from 52 percent to 80 percent during the short rains (OND) and from 25 percent to 35 percent during the long rains (MAM). A number of farmers

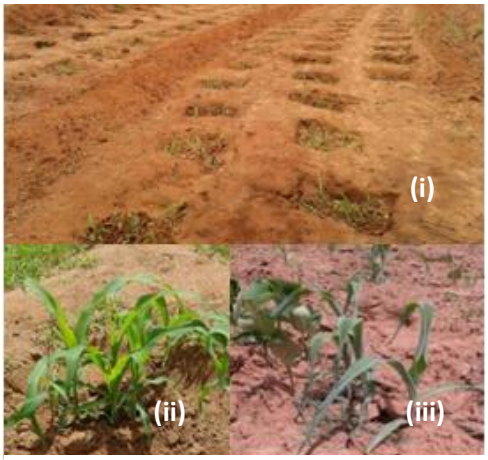


Fig. 3.11a. Zai Pit Technology. (i) field set-up, (II) good maize crop in the pit and (ii) wilting maize in normal field

confirmed this technology as having saved their crops during the period of erratic and unreliable rainfall. Zai-pit is a 2''x2'' x 2'' pit filled with decomposed animal manure mixed with some top soils.

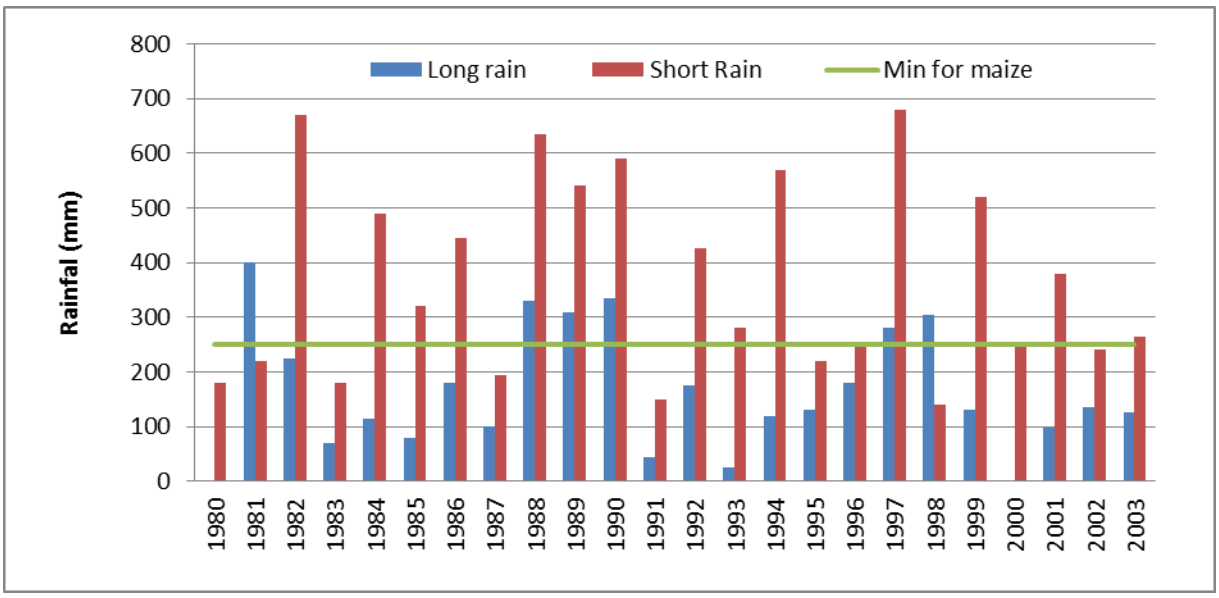


Fig. 3.11b. Long (MAM) and short (OND) rainfall amount (mm) for Kibwezi East County.

3.2.6 Crop performance in 2013 – OND season

Yields - The average yield of maize was 330kg/acre across the three counties, with yields in Mbooni and Maara being significantly higher than the overall average, while Mwingi North and Tharaka North being significantly lower than the overall average (Table 3.6). The high yields of maize in Mbooni and Maara could be attributed to the fact that these counties are in the upper midland (UM 2 & 3) areas with much better rainfall than the areas in lower midland areas. It should however be noted that yields of the crop are lower than what is expected due to the high tendency of mixed cropping by most famers.

Generally, Cowpea appeared to perform poorly with overall average yield of 175kg/acre. Makueni yields were significantly higher than the average while Maara and Tharaka South performed poorly compared to others. Though yields of cowpeas appeared to be quite low, it is important to note that cowpeas are many times consumed as vegetable, and the common harvest practice of plucking the leaves from the plant or uproot the whole plant tends to reduce either their photosynthetic area or the overall plant population, which subsequently results into reduced yields even under normal circumstances. In areas with relatively higher rainfall, cowpea tends to produce more of vegetative materials than the seed. Higher rainfall during flowering stage contributes to high rates of flower abortion. Relatively low amount of rainfall (20mm/decade) is required during flowering and fruiting stages of cowpea, while occasional showers with high temp (36^{o}C) are required for ripening and drying of good quality seed (Adetay A.O, 2006).

Yields of green grams varied from one sub-county to another with Kilome sub-county (Makueni) having significantly higher yield (460kg/acre) than the overall average of 107kg/acre. Pigeon pea performed much better in Kitui Central (250kg/acre), though not significantly higher than the overall average of 191 kg/acre. The performance of beans in Chuka I-Ng'ombe (600kg/acre) was significantly higher than the overall average of 232kg/acre and poor in Kibwezi east. The performance of bulrush millet in Tharaka

South and Makueni sub-counties were significantly higher than the overall average of 133kg/acre, while sorghum performance in Tharaka South sub-county was significantly higher than the overall average 174kg/acre.

Table 3.6.Yields (kg/acre) of major crops in in 2003 OND season

County	Sub-county	Maize	Cowpea	Green grams	Pigeon pea	Beans	Bulrush millet	Sorghum	Finger millet
Kitui	Kitui Central	401	115	105	252	206		270	
	Kitui South	104	139	106	90		25	172	
	Mwingi North	107	169	93			117	101	312
	Kitui average	***221***	***145***	***101***	***168***	***206***	***112***	***141***	**312**
Makueni	Kibwezi–East	196	108	113	80	40			
	Kilome	371	130	460	111	229		270	
	Makueni	268	226	169	264	96	300	360	
	Mbooni	651	169	17	229	243			
	Average – Makueni	***430***	***175***	***184***	***222***	***216***	***300***	***315***	
Tharaka -Nithi	Chuka I-Ng'ombe	167	84	43	26	600	108	85	87
	Maara	574	30		223	367			
	Tharaka North	20	78	69			114	88	
	Tharaka South	206	47	171	138	70	252	420	
	Average (Tharaka-N	**263**	**74**	**93**	**140**	**361**	**136**	**193**	**87**
	Overall Average	***330***	***132***	***107***	***191***	***232***	***133***	***174***	**237**
	STDEV	200	57	124	87	184	103	129	159

Overall, slightly above 50 percent of the farmers considered the harvest of 2013 OND rains as poor while some 32 percent considered it good and only 15 percent rated the harvest as good. In fact what farmers considered as fair are yields far above the overall average (Fig. 3.11). Though the OND (short rains) is normally considered as more reliable, the year 2013 was not the best compared to 2014 OND rains which most farmers have hope in.

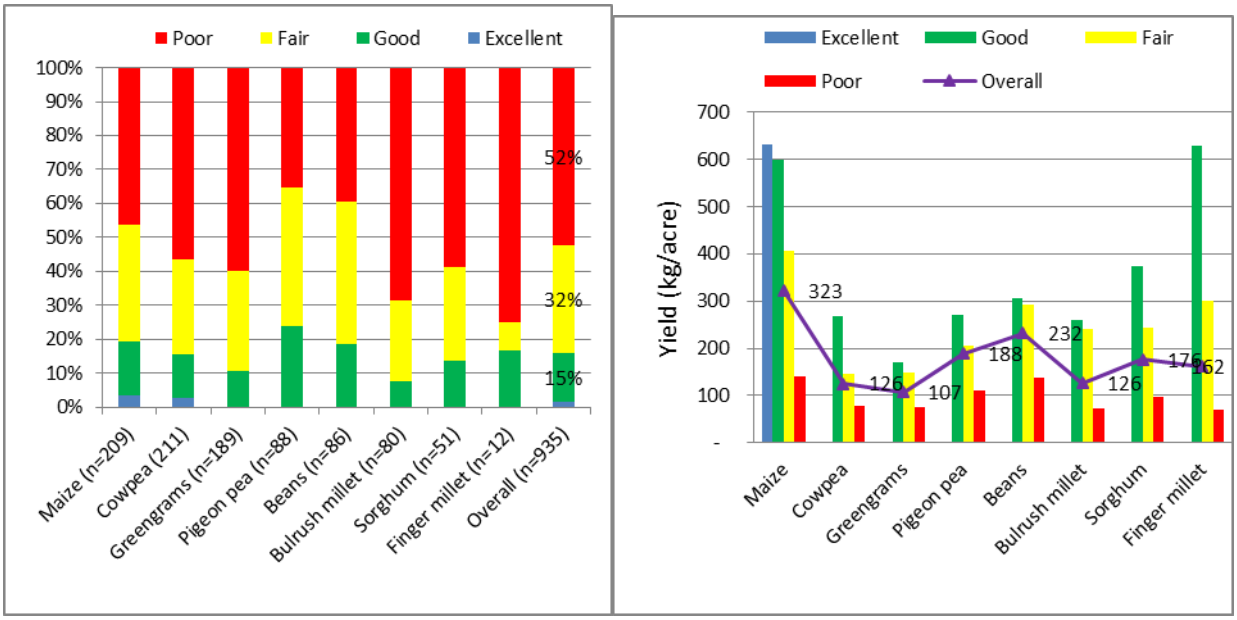


Fig. 3.11.Rating of crop performance by farmers

Multiplication rates - Multiplication rates[1]for bulrush millet and sorghum in Makueni were significantly higher than the overall average. In Tharaka-Nithi County, the multiplication rate of maize, cowpea, pigeon pea and beans were significantly lower than their overall averages (Table 3.7). Lower multiplication ratio for any crop is a sign of poor performance and could mean low availability of seed, especially where farmers depend on own saved seed as the preferred source of seed.

Even as the harvest and crop performance for the 2013 OND season looks poor and fair from the farmer's point of view, ideally adequate amount of seed could have been obtained from the harvest. What is probably needed from the government and the development partners is to have in place mechanisms that help famers safely keep the seed until the next planting season (MAM).

Table 3.7. Average seed multiplication rates (MR) for 2013 OND season.

Crop	Kitui	Makueni	Tharaka-Nithi	Overall	STDEV
Maize	119	308	**47**	197	135
Cowpea	69	52	**28**	51	21
Green grams	35	33	26	31	5
Pigeon pea	57	49	28	47	15
Beans	78	81	60	78	11
Bulrush millet	43	60	52	50	8
Sorghum	34	180	66	54	77
Finger millet	73		32	59	29

[1] Multiplication rare is an in increase in quantity of harvest compared to quantity of seed planted. It is a ratio of quantity harvested to quantity planted.

3.2.7 Major disasters/crisis in ASAL

Drought: The poor crop performance in the three counties is primarily attributed to drought. It disrupts the farming/seed system as well as causes loss to livestock. The terms of trade is also affected by reduced prices of livestock species and high prices of seeds in the local market and those from social networks. Experiences from the famers showed that severe drought is always experienced after every three years.

Field and Storage Pests: Storage and field pests were also reported as major constrains to food and seed security. Heavy bird attack on *Gadam* sorghum has discouraged many from adapting this variety. Squirrel not only removes the planted seeds but also feed on the mature seeds in the field. Efforts by farmers in guarding their fields at critical stages have increased their cost of production. Storage pests are a big concern in some areas where farmers could not save their own seed. Some farmers reported that the previously effective dressing chemicals are no longer effective in protecting the stored seeds for the indicated periods. Some claim that these are only effective for just a month and yet they need to store their grain/seed for 3-6 months before the next planting season or harvest.

Flash floods: To a small extent, flash floods are also considered a disaster in some areas. The main problems attributed to this include soil erosion, which sometimes cover the germinating seeds or wash away the planted seeds.

3.2.8 Response and disaster (drought) mitigation measures

There are efforts by different actors and communities to mitigate and/or manage the adverse effects of droughts. Farmers are normally encouraged to plant the early maturing and drought tolerant crops and/varieties as well as promote soil conservation and water harvesting practices in order to address drought incidences. Irrigation is also practiced by vegetable farmers and those with farms near permanent water source such as rivers. County government, Non-profit organizations and Faith-based organizations occasionally distribute seeds to the most vulnerable farmers.
The seed relief assistance in Kenya started way back in 1992 as an effort to provide seeds to communities faced with acute food and seed shortages following long, recurrent droughts. During the1990s, most of the seed aid followed a centralized tender and distribution system to the affected areas, with little participation by the target groups. In eastern Kenya, two kinds of seed-provision mechanisms were implemented, Direct Seed Distribution (DSD) and Seed Vouchers and Fairs (SV&F), to tackle emergency situations. Many government and nongovernmental organizations followed the DSD approach until the year 2000.

From 2000 to 2001, CRS used the Seed Voucher and Fair (SV&F) approach to distribute seeds to needy households. A large number of households (117,369) benefited from the DSD approach during the 2000–2002 periods, compared with the SV&F approach (41,583 households) during the same period. The wider coverage of the DSD program was due to its implementation in the region for nearly 10 years, compared with the relatively new, alternative approach, SV&F (Makokha *et al.,* 2005). According to Makokha *et al.* (2004), since 1992, 32 percent of the total amount spent on seed distribution has been spent in eastern Kenya alone. In addition, farmers also got seeds from local, weekly open-air markets and retail grain shops during or after disasters.

The Traditional High Value Crops (THVCs) Programme which started way back in 2007 has continued to provide the drought prone population in the ASAL with a number of drought tolerant crops and varieties. Most crops being provided include green grams, cowpea, beans, pigeon pea sorghums, bulrush millet and to some limited extend finger millet and cassava. The program works closely with KARI, now KARLO in seed bulking where they have formed seed development units mainly in eastern region of Kenya. The groups produce seed under the KARI license while KEPHIS does the seed certification. The seed bulking groups are common interest groups, social groups with a common interest. A common interest group (CIG) is a self-managed, independent group of farmers with a common shared goal and interest. The members work together to achieve this goal jointly developing an enterprise development plan, learning together but individually implementing the lessons learnt, they then pool their produce in order to market/process together but the resulting benefits are individual. Once the seed is bulked it's processed by KARI and packaged for sale. Most seed bulking farmers who make about 2500 groups have benefited immensely from the venture.

- *Seed distribution mechanism*: Under the THVC program, the seed is also distributed to resource poor farmers who are identified by stakeholder fora after meeting set criteria. The farmers are given seed on a loan basis where they retrieve twice what they receive for onward distribution to secondary beneficiary. The groups go through series of trainings on good agricultural practices, seed bulking and production as well as seed bulking and commercialization of these crops.

- *Stakeholders and their roles:* The counties and sub counties have stakeholder forums that are involved in the identification of the beneficiaries. There are also local committees at the ward level that ensure that the beneficiaries retrieve seed issued and support the groups in establishing seed banks although this is not viable when there is severe drought in two to three subsequent dry seasons and the farmers go back to whatever seed is available when the rains come.

- *Significance of the Programme.* A number of centers were supported to produce drought tolerant seed as a business venture there by availing seed near the farmers. Some seed companies such as the Kenya Seed Company, fReshco seed company, Dryland Seed Company and Leldet Seed Company among others now selling drought tolerant seed in eastern region and other regions. This ensures farmers can walk into an Argo dealers shop and procure the seeds unlike previously. Some counties, since devolution came into place is already committing funds for purchase of these seeds and even supporting the commercial villages in seed bulking.

Currently, there are a number of seed aid providers within the region. Both international and local NGOs, including government program are actively providing seed aid to the drought prone farming communities. Key among which are NGOs such as Ziduka Africa, Kenyan Red Cross, Action Aids International-Kenya, AAIK, CARITAS, SASOL, and World Vision. County Government through the THVCs program has continued to provide tons of assorted crop seeds and varieties across the three counties. Between 2013 and 2014 over 500 MT of assorted seed have been distributed in Kitui and Tharaka Nithi, with the county Government of Kenya (GoK) contributing over 80 percent of the seed distributed (Table 3.8).

Table 3.8. Quantity (tons) of seed distributed in Kitui and Tharaka-Nithi Counties in 2013/2014

			Seed aid organization				
Year	County	Crop	County GoK	Good Samaritan	SASOL	FAO/AAIK	World Vision
2013	Kitui	Seed (kg)	215,500	1,510	2,200	3,600	-
		Beneficiaries	117000	736	1080	-	-
	Tharaka-Nithi	Seed (kg)	21,160	-	-	-	-
		Beneficiaries	2623	-	-	-	-
2014	Kitui	Seed (kg)	216,900	-	-	19,920	1,690
		Beneficiaries	57000	-		3,320	420
	Tharaka-Nithi	Seed (kg)	40,00	-	-	10,0800	-
		Beneficiaries	11,223				
Total quantity of seed			493,560	1,510	2,200	33,600	1,690
Percent contribution			92.7%	0.3%	0.4%	6.3%	0.3%

The major challenge in seed aid is that a fund has to be available to give seed to affected households so often. Sometimes farmers sell their produce immediately after harvest to avoid post-harvest losses and to meet their immediate family financial needs, hence limiting availability of own saved seed and social network seed.

3.3 Seed Security at Household and Community Levels

3.3.1 Major seed sources/channels

In the three counties about 44.9 percent of the seed planted in 2013 OND season were from farmer's Own Saved Seed (OSS), 33.9 percent from the local market seed (LMS), 16.5 percent from the agro-input dealers. The social network (SN) and the seed aid (SAS) contributed to just 1.8 percent and 2.3 percent, respectively of the seed planted in October/Dember2013 season (Table 3.8). Overall, the informal seed sector contributed to over 80 percent of the overall seed needs of the farmers while the formal seed sector provided the remaining 20 percent in the marginal south eastern agricultural livelihood zones of Kenya. This finding is similar to the finding of SSA conducted in 2010 in Makueni and Tharaka (L. Sperling, 2011), which found that about 13.9 percent of seed came from the agro input dealers while some 5.8 percent from the seed aid sources. There seemed to be progress by the formal seed sector in providing certified seed to the farming households as their overall contribution had increased from 13.8 percent to 16.6 percent and to 18.3% in 2011, 2013 and 2014, respectively.

- *Own save seed:* - As mentioned above, it contributed to highest volume of seed planted by the farmers. In both 2013 and 2014 it contributed significantly higher amount of beans, 66.8%and 66.0%, respectively but the quantities of sorghum and finger millet planted from this source were significantly lower than the average in both years.

- *Local market contribution*:-In both 2013 and 2014 OND season, local market contributed significantly higher amount of finger millet, 76.9% and 78.9%, respectively. There was also significant amount of sorghum (55.3%) from this source in 2014. This was attributed to poor performance of *Gadam* due to its high susceptibility to birds and lack of reliable market. Farmers opted for local varieties from the local market.

Table 3.9.Percent Contribution of quantity of seed planted by source in OND 2013 and 2014 Season

Row Labels	OSS		LMS		Agro-I-Dealer		SN		SAS	
Year	**2013**	**2014**	**2013**	**2014**	**2013**	**2014**	**2013**	**2014**	**2013**	**2014**
Maize	34.5	32.8	25.4	22.5	37.9	42.5	1.6	1.6	0.7	0.7
Green grams	44.1	34.6	45.8	54.0	6.9	5.6	0.9	2.4	2.3	3.4
Beans	66.8	66.0	24.1	24.8	1.0	3.8	6.9	4.6	1.1	0.8
Cowpea	49.1	42.5	37.8	36.7	5.9	10.8	4.2	4.7	3.0	5.3
Bulrush millet	55.4	49.3	41.9	43.7	0.0	0.0	1.8	3.0	0.9	3.9
Pigeon peas	53.6	65.7	37.3	29.4	0.0	0.0	7.3	4.9	1.9	0.0
Sorghum	14.3	18.8	34.4	55.3	37.9	4.7	1.8	7.1	11.7	14.1
Finger millet	20.9	21.1	76.9	78.9	2.2	0.0	0.0	0.0	0.0	0.0
Overall	**44.9**	42.2	**33.9**	34.2	**16.5**	18.3	**2.9**	3.0	**1.8**	2.3
STDEV	17.9	18.1	16.5	19.0	16.5	14.2	2.8	2.2	3.8	4.7

- *Agro input dealers:* - This has progressively been the major source maize seed and secondary for other crops over the years. In 2013 and 2014 farmers obtained 37.9% and 42.5% of maize seed, respectively from this source. These figures are even more pronounced than what was obtained during a seed security assessment of 2011 where by agro-input dealers contributed only 26.7 percent of the seed planted (Sperling L. *et al.,* 2011). Although agro input dealers contributed significantly higher quantities of sorghum planted (37.9%) in 2013, this contribution fell to 4.7 percent in 2014. In 2013 there was a movement to promote white sorghum variety (*Gadam*) as an alternative income generating (IGA) crop for beer brewing. Government advertised this variety a lot in 2013, and as result many dealers opted to stock the varieties. Although the government advertised this, it also opted to distribute the varieties free in a number of locations, and this left many agro-dealers with a lot of stock as farmers went for seed (sorghum) aid from the government and other development partners. In 2014 many dealers opted not to stock this sorghum variety, and due to the bird problem experienced by the farmers and to poor market, many farmers abandoned the variety. Today, agro-input dealers are a very limited source of sorghum seed, comparable to the level of 2011 where it contributed only 3.7 percent of the seed planted by the farmers (Sperling L. *et al.,* 2011). .

- *Social network:* - Although social network source provides just 3 percent of the overall quantities of seed planted in 2013 and 2014 OND season, it contributed significant quantities of beans, cowpea and pigeon pea planted in 2013 and sorghum planted in 2014 compared to other crops.

- *Seed aid:* -The contribution of seed aid is extremely limited, with about 2 percent of the overall seed planted by the farmers; with some significant contribution to the quantity of sorghum planted (11 and 14%) compared to the overall average all seed from this source. Although only 2 percent of the farmers received seed aid in 2013 OND season, over 50 percent have received

seed aid in the last five years, some receiving it twice, thrice or five times. The government seed aid program is normally provided on a recovery basis whereby farmers who received the aid are required to pay back twice the amount they have received. However, sometime the seed come in late (Box 3.1) while the recovery of the seed is somehow very low, sometimes less than 10% of the seed provided is recovery. In 2013 for instance, nearly all the farmerswho received the seed in Kilome sub-county could not refund the seed because of the crop failure (Sammy .M Kimuyei personal communication).

Box 3.1: Untimeliness of seed aid

"I received 4kg of sorghum (KatMP3) and also 4kg of green gram N26 (Angle) from the agricultural office. This time around, they brought in seed late when I had already planted all my fields using my own seed. I am keeping the seed I got for the next season. I will refund them with what I had planted" Susan Musyoki from Kilome Sub-county.

3.3.2 Overview of seed used by farmers between 2013 and 2014

Between 2013 and 2014 about 21 percent of the famers decrease the quantity of the seed planted, 27 percent increase the amount while 52 percent had no change in the quantity of seed planted (Fig. 3.12). Overall, there was an increase in the quantity of seed by just 2% in 2014. The quantity of bulrush millet planted in 2014 significantly increased by 25 percent. Other crops in which the quantity of seed planted increase insignificantly (3% to 6%) include sorghum, pigeon pea and maize (Table 3.10). Crops that had overall reduction (1% to 7%) in the quantity of seed planted include beans, cowpea, green grams and finger millet. This situation points to a quite stable or even dynamic situation, which seems in contradiction with qualitative information that tends to associate lack of seed or "seed insecurity" to successive crop failures in the ASAL.

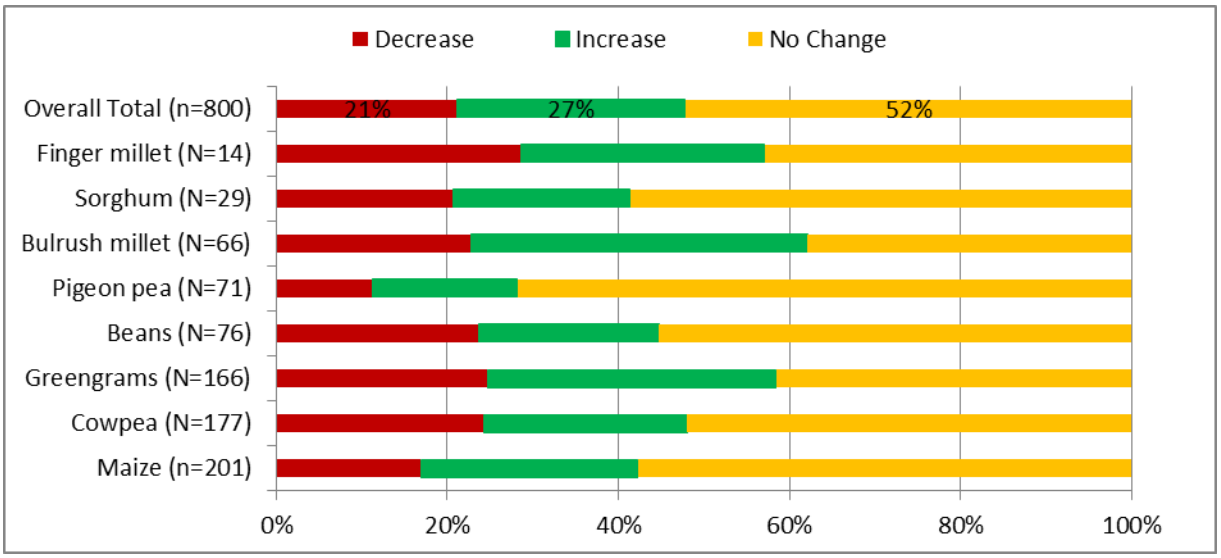


Fig. 3.12. Increase, decrease or no change in the quantity of seed planted in 2014 compared to 2013.

Some of the reason for decreasing the amount of seed is attributed to limited access to land, lack of labor for cultivation and poor access to seed. On the other hand, access to more land, affordability and access to free seed from aid contributed to more use of seed by those who increased the amount of seed planted in 2014.

Table 3.10. Change in seed quantity used by the famers in 2013 and 2014

Crop	Decrease	Increase	Overall change (-/+)	%Change
Bulrush millet	-2.57	4.75	1.29	25%
Sorghum	-1.42	2.67	0.26	6%
Pigeon pea	-2.56	3.08	0.23	5%
Maize	-6.01	5.25	0.32	3%
Beans	-8.72	8.88	-0.20	-1%
Cowpea	-2.99	2.63	-0.10	-2%
Green grams	-5.85	3.80	-0.16	-2%
Finger millet	-4.25	2.75	-0.43	-7%
Overall	**-4.84**	**4.31**	**0.13**	2%
STDEV	2.42	2.12	0.53	10%

3.3.3 Availability of seed from various sources

Seed availability denotes farmers' seed supply from all sources regardless of the variety or quality of seed. The most critical indicators of seed availability are having seed within close proximity to the farm household at the time of planting, and this should be adequate enough to plant the desired area of land that meet the interest (food, income and or fodder) of the farming household.

Timing and proximity of the seed to the faming households: Irrespective of the seed source, over 85 percent of the farmers normally get their seed before or at the start of the planting season, therefore availability of seed at the time of planting is not normally a big problem in the area assessed. Apart from own save seed which in most cases considered within farmers reach, about 30 percent of the farmers considered the sources of seed a bit far, and this was more with agro-input dealers or the formal seed sector seed (FSS) and seed aid seed (SAS) considered far away by about 43 percent of those who sourced seed from these sources in 2014 OND season (Fig. 3.13b). Some farmers indicated that they have to travel over 50 km to get certified seeds. Most of them use own saved seeds or buy local varieties from the local market. Therefore, the providers of the seed need to device ways of bringing seed closer to the beneficiaries. The government and development partners also need to encourage agro-input dealers to take their services closer to the farmers.

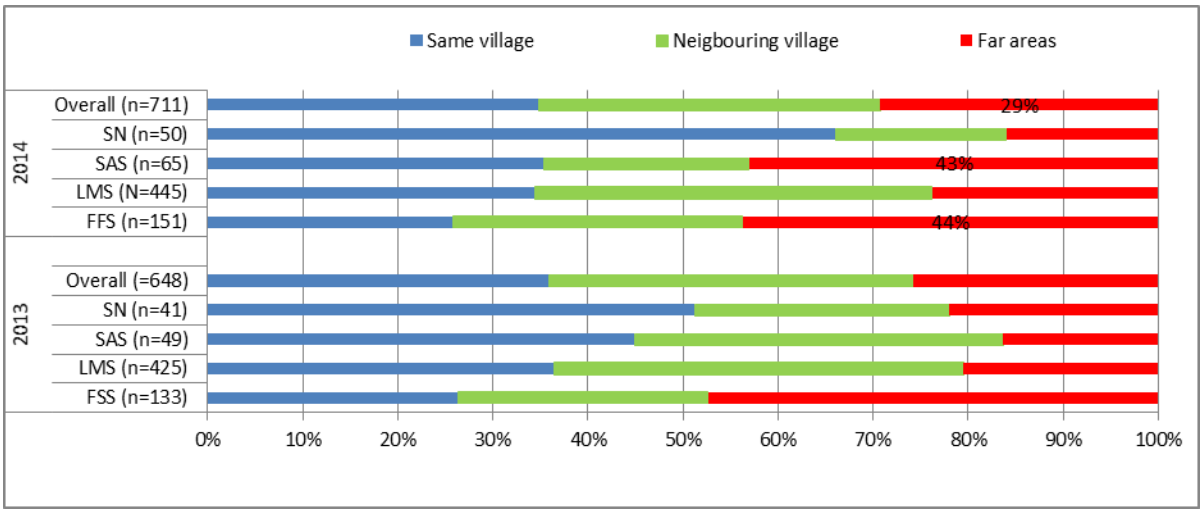


Fig. 3.13a) Proximity of the seed source to the farmers.

Availability of adequate quantity of seed -Overall, over 80 percent of the farmers who planted in 2013 and 2014 OND season indicated that there was enough seed available from the various sources though over 72 percent were concerned that the seed provided by the seed aid oragnizations were not enough (Fig. 3.13b).From the result, seed aid has the least average quantity of seed used by the farmers compared to other seed sources (Table 3.11).

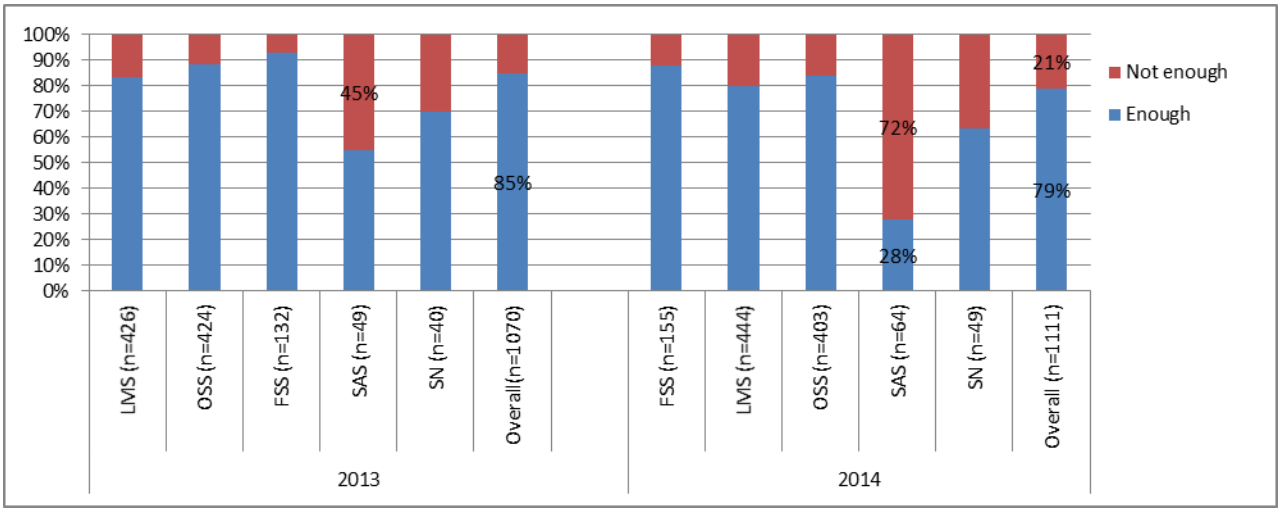


Fig. 3.13b.Availability of adequate quantity of seed from various sources

Table 3.11 Average seed quantities (kg)used byfamers in 2013 OND season

Crops	Seed sources (2013 OND season)					Overall Average
	FFS	OSS	LMS	SN	SAS	
Maize	9.5	12.6	9.2	9.2	2.6	10.0
Green grams	8.1	8.8	7.2	3.7	3.3	7.2
Cowpeas	-	4.8	4.0	3.9	2.6	4.6
Bulrush millet	-	6.5	4.4	3.2	2.9	5.1
Beans	12.5	16.2	9.1	10.2	3.7	12.8
Pigeon peas	-	4.0	4.7	4.5		4.2
Sorghum	3.0	4.8	3.2	3.0	2.6	3.3
Finger millet		7.5	4.7			5.1

3.3.4 Seed access by farming households

The major concern was the high prices of seed with the agro-input dealers or the formal seed sector seed (FSS) and the local market. Over 80 percent of the farmers going to the agro-input dealers considered the prices high while some 55-67 percent of farmers considered the prices from the local market equally high (Fig. 3.14a). However, farmers tend to adopt or cope with the high prices by using multiple seed sources in order to meet their seed demand. The prices of seed from agro-input dealers are relatively high compared to the prices of same but uncertified varieties found in the local market. The price of maize seed from the agro-input dealers varies from 170 to 280 shillings per kilogram depending on the variety while the price of local maize varieties ranges from 40-60 shillings per kilogram in the local market. This price difference appears quite normal considering the difference of seed quality between local market and input dealers. From the local market, the prices of maize grain sold for food were much cheaper than that sold as seed (28-35 shilling per kilo compared to seed price of 40-60 shillings per kilogram).

Prices of most pulses from agro-input dealers ranges from 200 to 250 shillings per kilogram, compared to the local market which charges between 60 to 150 shillings per kilogram depending on the crop and variety. Strategically, farmers who could not afford to buy all the certified seed they need from the agro-input dealers tend to top up by buying from relatively cheaper sources (Box 3.2), mainly the local market and to some limited extend from the social networks. Although there was considerable concern about the seed prices from the agro-input dealers and local market as being expensive, still over 85% of the farmers who got seeds through these sources purchase them on a cash basis (Fig. 3.14b). Generally, high prices tend to limit the quantities of seed bought, thereby limiting access to the quantities of certified seed obtained by farmers from agro-input dealers. It

Box 3.2. Seed access and quality

"Farmers can access seeds from local markets because prices are comparably cheaper than that from agro-input dealers. However seed purity is always compromised" Janet Mutinda, a women farmer from Mwingi North).

should however be noted as very common for farmers to complain about the price of seed, especially those who have developed dependency syndrome due to repeated seed aid.

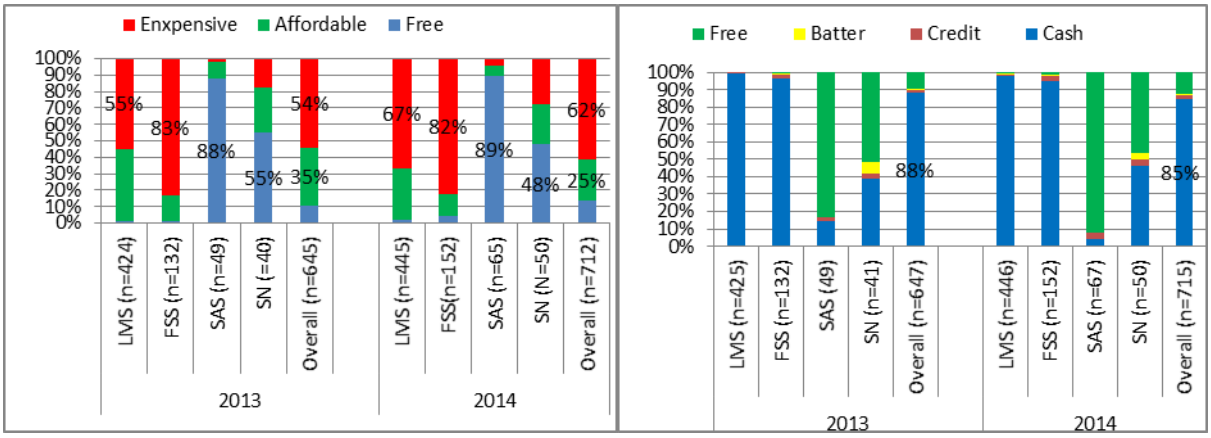


Fig. 3.14.a) Price and b) mean of acquiring seed by farmers

Most seed aids are still being provided directly (DSD) and free of charge by the organizations supporting the famers. Considering the well established presence of agro-input dealers as well as the vibrant local grain/seed markets in the three counties, programme to improve access to quality seeds of improved varieties should focus at providing seed subsidies and use of voucher rather than direct "free" distribution.

3.3.5 Seed quality

Generally, seed from the agro-input dealers and seed aid were considered by 98 percent of the farmers as clean[2] while some 34-39 percent of the farmers considered seed from the local market and own saved seed as fairly clean[3] (Fig. 3.15a). Germination of important crop seeds, from all sources, was considered generally good by over 90 percent of the farmers in the area visited (Fig. 3.15b). Closer interaction with the agro-input dealers however revealed there were fake maize seeds (Duma 43 variety) in the market in 2014 OND season which prompted some farmers to forward their complaint to the agro-input dealers. However, nothing much was done to help the farmers. The fake Duma 43 had poor germination, probably due to evidently high percentage of broken and/or shriveled seeds. A number of famers equally raised their concerns on Duma during the focus group discussions. There was also a concern about impurities and some mixture varieties from the local market (Box 3.2) from the famers. Interview with some county agriculture officers, particularly in Kibwezi East and Kilome sub-counties pointed to serious problem of storage pest problem, particularly the Lager Grain Borer (LGB) on maize. This not only affects food security but also raised concern about availability of own saved seed. In a number of focused group discussions participants echoed similar sentiment on the storage pests, and indicated own saved seed are sometimes sold off to avoid the pest problem.

[2] Clean seed is considered where there is no impurities/debris, and no physical or pest damage.
[3] Fairly clean seed is where there is some impurities but no damage

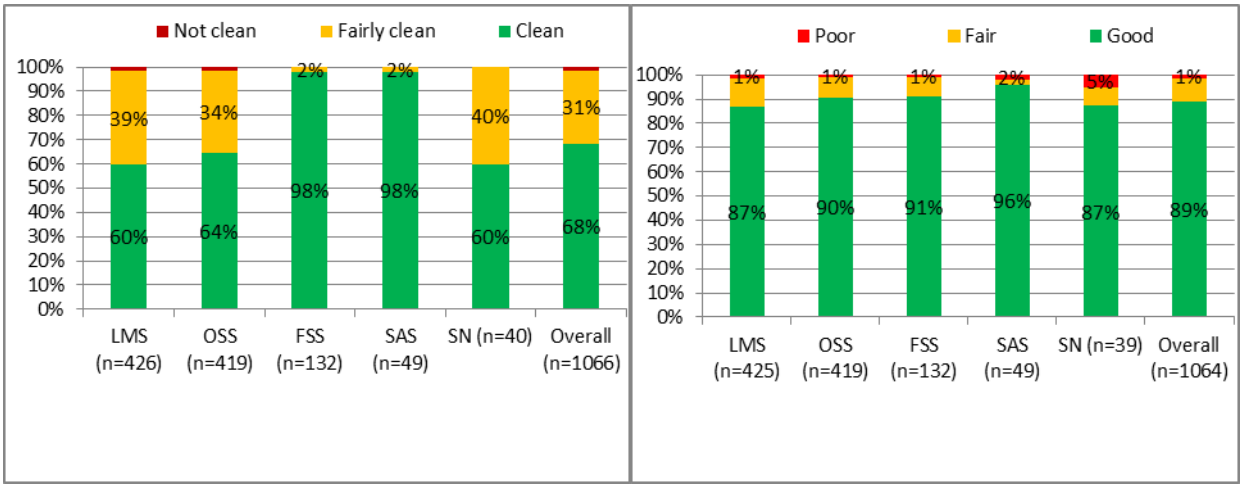


Fig. 15.a) Physical cleanliness and b) germination seed from various seed sources

Some farmers who use own saved seed still hang maize cobs above the fireplace as a way of preserving seeds for next planting season. Some of them are slowly abandoning such traditional practices for modern seed dressing and treatment techniques. However, there are still concerns about effectiveness of common dressing chemical, *Actellic Super*. A number of famers reported that the chemical is only effective for a month. Efforts to market *Actellic Gold* is on-going and the effectiveness of this formulation is yet to be realized.

3.3.6 Crop varieties and their suitability

Generally farmer in the three counties are growing both improved and local varieties. About 60 percent of the varieties grown are improved varieties, with green grams, beans, cowpea and sorghum making more than 60 percent improved varieties (Fig. 3.16). High use of improved varieties could be attributed to the effort of the Traditional High Value Crops (THVCs) program run by the Ministry of Agriculture and NGO/UN programme to promote/distribute drought tolerant crops such as cowpea, beans, green grams and sorghum. In addition, Kenya Agricultural and Livestock Research Organization (KALRO), formerly Kenya Agricultural Research Institute (KARI - Katumani), and ICRISAT is supporting seed bulking in a number of places within the Arid and Semi-Arid Lands (ASALs). Other Private seed companies such as Kenya Dry-land Seed Company Limited has also been contracting some farmers to produce some crop seeds. All these efforts contributed to the diffusing of some of the improved varieties from the formal sector. Moreover, agro-input dealers also provide more diffusion channels for the improved varieties.

Despite having many improved varieties of pulses and sorghum, few farmers planted improved finger millets (7%) and bulrush millet (33%). Surprisingly, just slightly above 50 percent of maize varieties being cultivated by the farmers are improved and yet the bulk of the seed sold by agro-input dealers is maize, with over 10 varieties in the market. As observed earlier, the “low” use of improved maize varieties could be strongly linked the prices of certified maize. The recent flooding of seed market with fake maize seed, notably the popular Duma 43, could have also discouraged more farmers from buying seed from the agro-input dealers.

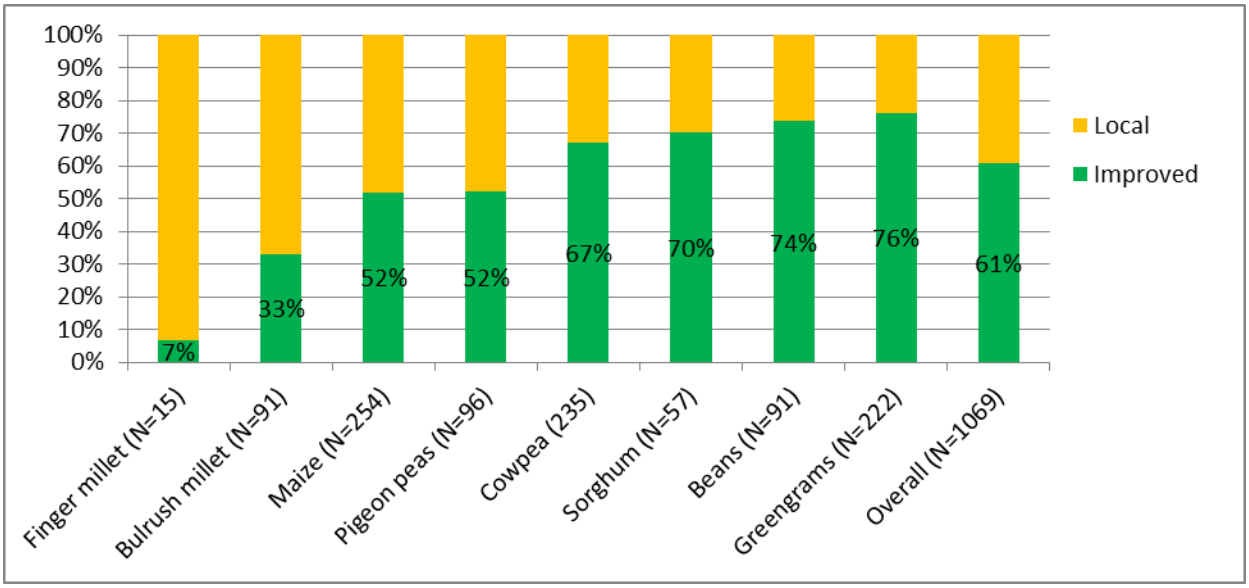


Fig. 3.16. Percent of improved and local varieties cultivated by the farmers.

Adaptability of varieties - In general, over 90 percent of the farmers indicated that varieties of the major crops they have done well in their agro-ecologies except the white sorghum variety (*Gadam*) currently being promoted by the government and its development partners as an alternative income generating crop. Although the promotion of this variety started way back in 2005, many farmers are reluctant to grow this crop mainly due to the high susceptibility of the variety to bird attack, and in some areas yield loss of up to 100 percent have been reported. Many farmers received this variety as part of the seed aid package; however, some don't plant it but instead feed them to chicken. Being a treaded seed, it can affect the food chain.


Fig. 3.17. Stock of Gadam in agric store in Kasikeu ward, Kilome sub-county

It was also noted that only few farmers who received *Gadam* actually adopted it. There is perception that farmers are being forced to adopt it (Kilome agriculture officer, Nov 2014).The sub-county agriculture office in Kilome also noted that other varieties of sorghum such as *Serena* and *Seredo* have also been tried at a small scale and are preferred by farmers in the area as compared to *Gadam*.

Beans varieties: The three counties have well diverse beans varieties (both local and improved) that are considered well-adapted to the local agro-ecological conditions. The most popular variety being Kat bean 1 (22%), an improved variety from KARLO Katumani followed by *Mwitemani* (18%), another improved and *Katumbuka* (13%) a local variety. Other varieties are as indicated in Figure 3.17. Although there are other improved varieties such as *Nyayo* and Kat X56, they are not appreciated by about 33 percent of those who have planted them.

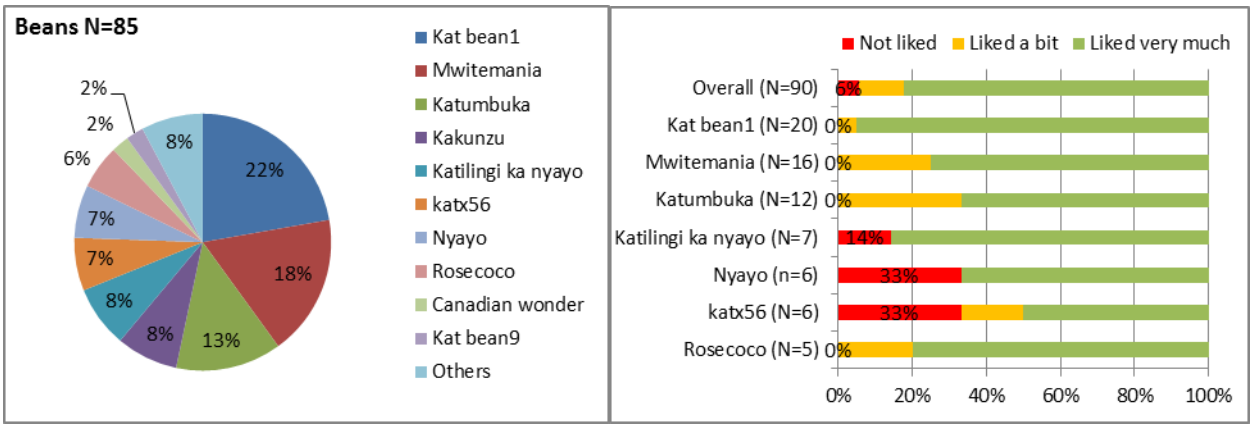


Fig. 3.17.Popular bean varieties and their preferences by the famers

Cowpea varieties: This is one of the most popular pulses grown by the farmers in the three counties. It has a wide range of varieties, but the most popular ones are the improved varieties making 67 percent of the varieties cultivated by the farmers. The most popular varieties are M66 (34%) and K80 (19%) both are improved varieties. There are quite a number of other local and improved varieties being grown by the farmers (Fig. 3.18a). Though over 80 percent of the farmers like the varieties, some 17 percent of the farmers interviewed did not like *Kang'au*, a local variety (Fig. 3.18b).

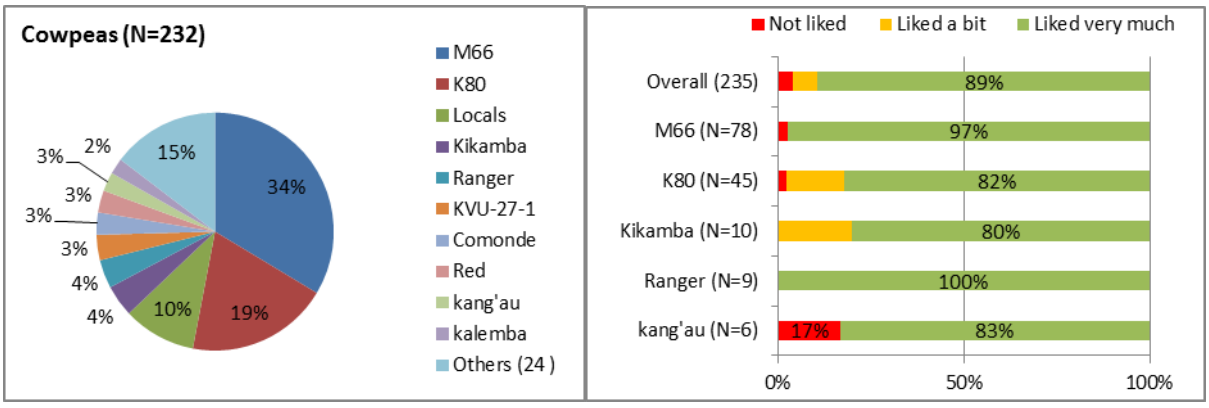


Fig. 3.18. Popular cowpea varieties and their preferences

Green gram varieties: Though green gram is one the most important income crop, it has limited diversity in the varieties being grown by farmers. Over 70 percent of the green gram varieties are improved varieties, with the most popular one being N26 (54%), locally knowm as Nylon (because of the glitering testa), followed by KS20 (23%) also known as angle (Fig. 3.19). Although KS20 reportedly cooks better than N26, a number of farmers grow Nylon because its weight per unit of volume is higher than that KS20, a desirable attributeas a commercial variety. There was however no clear difference in the perference of thes two varieties by the famers for their own use.

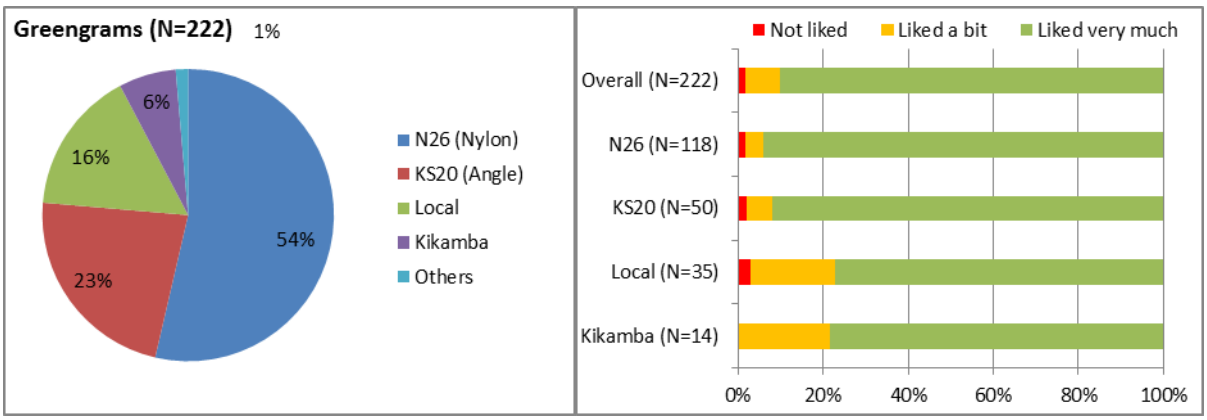


Fig. 3.19.a) Popular green gram varieties and b) their preferences

Maize varieties: Maize is considered the staple food for most households in Kenya. It is widely cultivated across the three counties, with the most popular variety being Duma 43, an improved variety. This is followed by *Kikamba* (27%) also refered to as *Kinyanya* in some areas (Fig. 3.20). Both *Duma* 43 and *Kinyanya* are considered drought tolerant and the latter is also considered a high yielding variety. *Kinyanya* is, however, considered less susceptible to storage pests and less prone to aflatoxin contamination. Another relatively popular improved variety is DH02 (13%). Other improved varieties include *Katumani,* DH04, *Pioneer* and DK8031. It is important to note that pioneer is normally prefered in medium rainfall areas and/or by the farmers who irrigate their crops hence its unpopularity within the sampled sub-counties. Overall, about 75 percent of the farmers like the varieties they grow, a significant number of the famers also like the other local varieties; though to a small extent. DH04 seemed not liked by 33% for the farmers who planted it though the sample size is quite small (n=3), andmay not have given a statistically reliable measure of its preference.

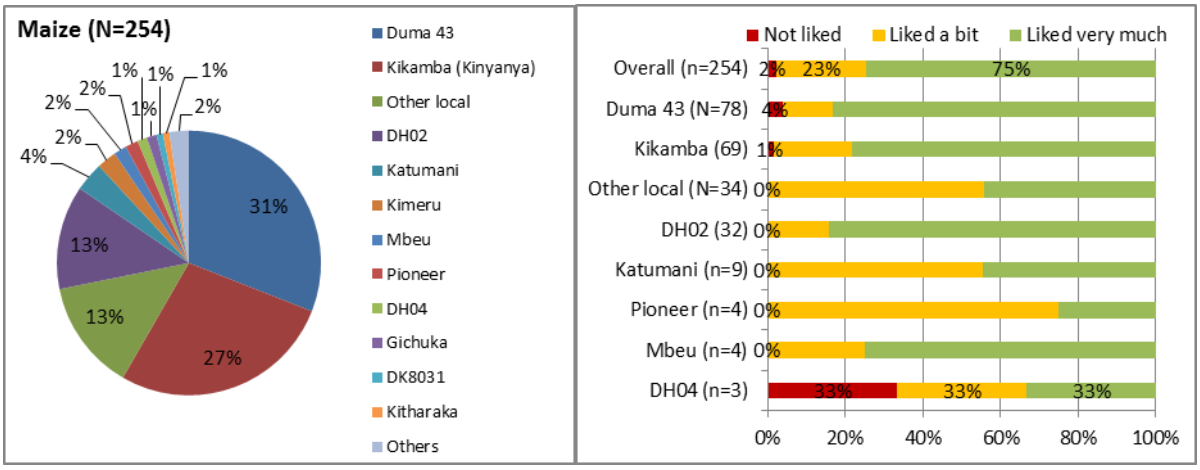


Fig. 3.20. Popular maize a) varieties and b) their preferences

3.4 Local Market Seed Supply and Demand

Local grain markets provides about 34 percent of the overall quantity of seed planted in 2013, with the source providing above 50 percent of finger millet, sorghum and green grams seed planted in 2014 OND season. The local market is vibrant across the three counties, providing farmers with relatively cheaper seed compared to certified seed from agro input dealers.

In the ASAL region of Kenya, there are both daily and weekly markets in each of the sub-counties visited. Even in daily market places, there are certain days that are normally more visited within a week and these are known to both farmers and traders. Traders are knowledgeable about the varieties that are normally demanded by the farmers at the start and during the planting season. For the OND season traders normally start stocking the seed as early as August, but many prefer to stock in September/October when farmers start asking for specific varieties for planting. The importance of local markets for the supply of seed is a component that has been largely underestimated so far and requires more attention in seed policies.

3.4.1 Grain Traders and business profile

Grain trade is done by both male and female, with varying levels of education ranging from informal (7%) to tertiary (12%) level of education with the majority of the grain traders having attained secondary level (46%) of education. Significantly higher number of grain traders in Tharaka-Nithi had only attained primary education (63.2%) and 67 percent in Makueni had attained secondary education (Table 3.11). The majority of the traders (63%) have been in the seed/grain business for over 5 years while some 20 percent have done it for 3-4 years and over 85% of them do it as a full time business.

Table 3.11. Grain trader's business profile

Profile	Kitui (n=24)	Makueni (n=27)	Tharaka-Nithi (n=19)	Overall (n=72)	STDEV
Gender (%)					
a) Female	48.0%	56.0%	57.9%	53.6%	5.3%
b) Male	52.0%	44.0%	42.1%	46.4%	5.3%
Education level					
a) No formal education	12.5%	8.3%	0.0%	7.5%	6.4%
b) Primary	33.3%	12.5%	63.2%	34.3%	25.5%
c) Secondary	41.7%	66.7%	26.3%	46.3%	20.4%
d) Tertiary	12.5%	12.5%	10.5%	11.9%	1.1%
Years in business					
a) <1year	4.0%	11.5%	5.0%	7.0%	4.1%
b) 1-2 years	12.0%	11.5%	5.0%	9.9%	3.9%
c) 3-4years	28.0%	7.7%	25.0%	19.7%	11.0%
d) >5 years	56.0%	69.2%	65.0%	63.4%	6.8%
Time in business					

Non full time	4%	4%	15%	7%
Full time	96%	96%	85%	93%

There are big (>500 bags), medium (100-400 bags) and small scale (<50 bags) grain traders who serve as part and parcel of source of seed to the farming households. Grain trade is normally done by three types of sellers:

a) *Grain stores:* There are a number of grain stores within the many trading centers across the counties/ few of which also sell certified maize seed. Some of the grain store owners are themselves farmers or those who started selling what they initially produced in their farms.

b) *General shops:* This type of traders sell mixed items including some grains in few bags (1-6 bags). Sometimes they bring few packets (10-40) of certified seed for sales. They are more spread across as they tend to operate even in rural areas.

c) *Individual farmers:* These are farmers who bring their grains and planting materials on specific market days. They tend to bring smaller quantities (10-50 kg) of grains, sometimes different types.

The majority of the traders use cars (53%), followed by motorcycles (19%) and some heavy trucks (13%) to transport the seed to the market locations (Fig. 3.21a). Other transport means used by the traders include donkey, animal drawn carts bicycles and trucks. Only 24 percent of the traders own the cars they use, while some 45 % of those who use the truck actually own them and about 38% of the traders own motorcycle (Fig. 3.21b).

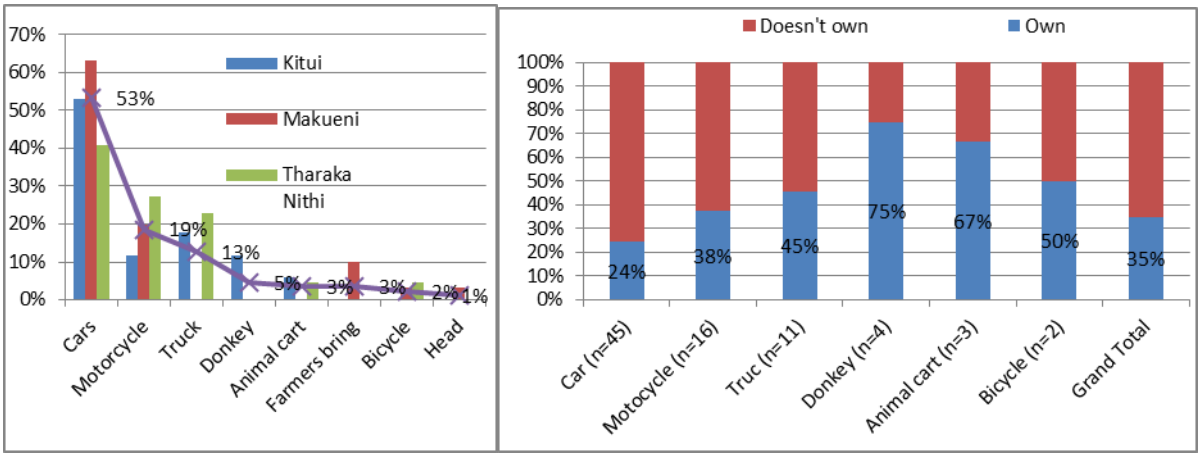


Fig. 3.21.a) Means of transport and b) ownership.

3.4.2 Types of grains/seed and varieties on the market

The local grain traders sell mostly uncertified local and improved varieties of 2nd, 3rd and 4th generations. A few however bring in certified seeds, particularly popular maize varieties such as Duma 43, DH02 and DH04. In general, over 70 percent of the traders sell maize, cowpea and green grams while some 40-65 percent sell beans, pigeon peas and sorghum. Higher number (95%) of the traders in Tharaka-Nithi sells sorghum (95%), Cowpea (90%) and finger millet (35%) compared to average. In Makueni, a higher number of traders are selling beans (93%), while lower number sell green grams (48%) and sorghum

(4%) compared to traders in other counties (Fig 3.22). Finger millet was not found with the traders in Makueni and Kitui counties while bulrush millet was not available with the traders in Makueni county.

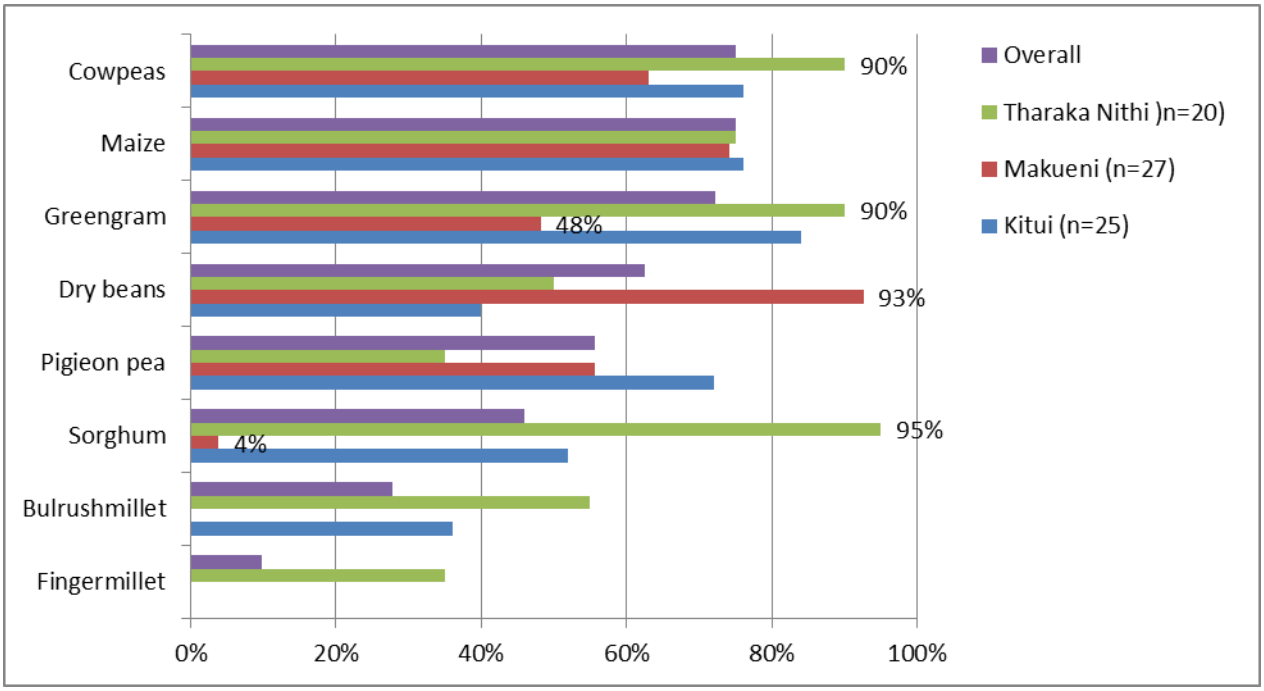


Fig. 3.22. Percent of traders selling different grain/seed types

3.4.3 Availability and Demand of seed from the grain traders

Traders tend to stock more seed for October-November- December (OND) season rains compared to March-April-May (MAM) season. About 50 percent of the traders recognize October as the month in which they sell more of their grain as seed though some farmers start buying in September which could extend up to November. Although, the second planting season (MAM) is normally around March, the demand for seed is lower than the demand during the OND season (Fig. 3.23), the reason being, the first rains normally give better harvest, hence the farmers could save their seed for MAM Season. Seeds are exclusively bought by individual farmers, mostly women. Women are considered more knowledgeable about seed quality than men and normally within a given households women are given the responsibility of buying the seeds. On average, most farmers buy 4-6kg at a time, but they sometimes have to come twice or three times in order to get the quantities of seeds they need for planting their fields. This however is an indication of a stressful access to seed which requires attention.

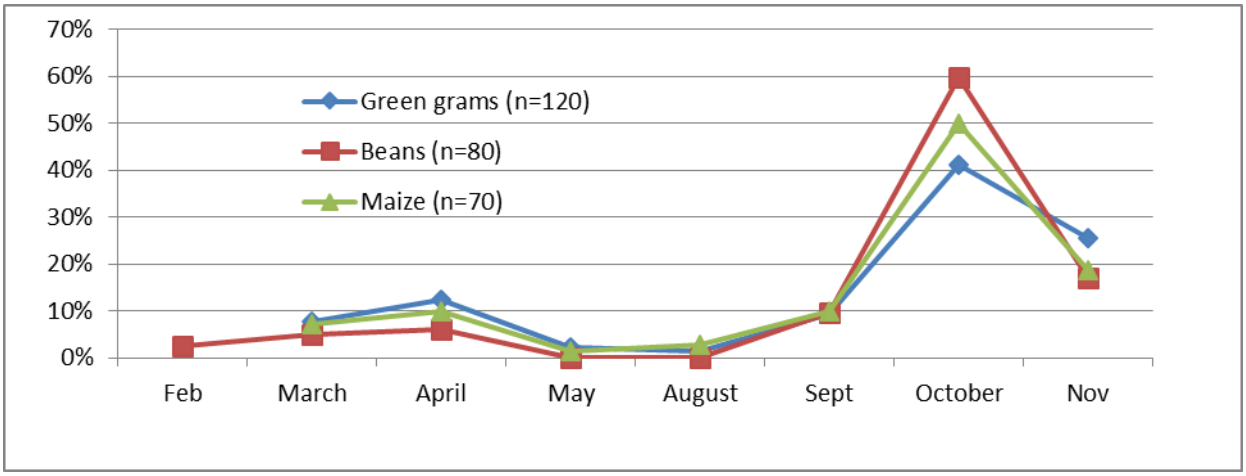


Fig. 3.23. Month of high seed demand/sales

Beans varieties in the local market - Popular bean varieties commonly sold by the traders are Kat bean 1, *Mwitemania, Wairimu and Saitoti,* also referred by the farmers as *Katilingi-ka-Nyao*. These are the same varieties being cultivated by the farmers as well. From the traders, interviewed about 80,000kg of beans (both food and seed) were sold by the sampled traders in October, the beginning of the OND season and the month in which farmers start planting their beans (Fig. 3.24a). Prices of beans vary from variety to varieties and with time. As the planting season progresses, the prices increase up from an average of 75 to 85 shilling per kilogram between September and November (Fig. 3.24b). Traders however project decline in price in December due to low demand from farmers.

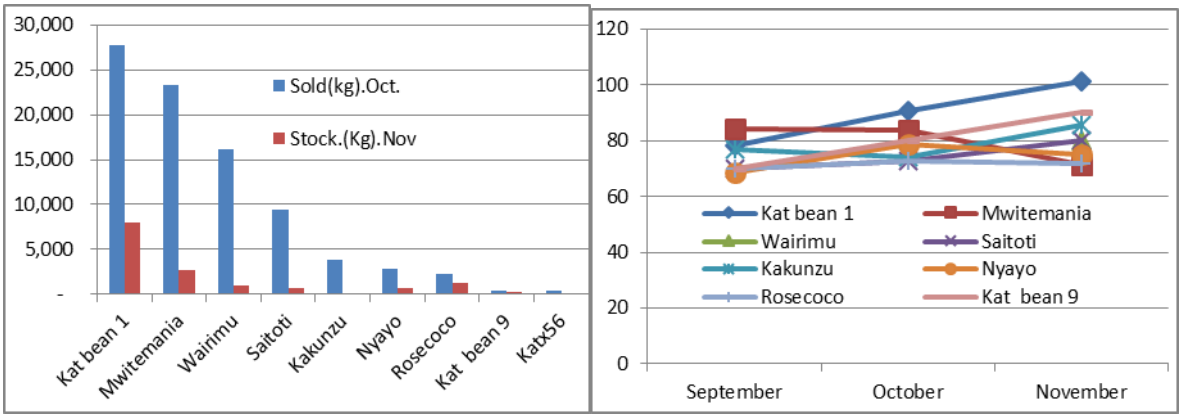


Fig 3.24. a) Quantity of beans sold/in stock and b) prices between September and November 2014

The majority (79%) of traders sell their bean on cash though some were willing to provide credit to farmers (Fig. 3.25a), mostly those they know and trust. Credit durations range from few days to about a month, depending on the trust between the trader and the customers.

Generally the majority of the beans on the market are considered fairly clean (62%) while some 35 percent are considered clean (Fig. 3.25b). About 4% of the beans are considered not physically clean due to high levels of impurities and damage which are either broken or damaged by storage pest such as weevils. Although the total average quantity of bean planted using seed from the local market is about 9kg, farmers tend to buy either about 6 kg but sometimes have to come twice as much so as to meet their planting needs.

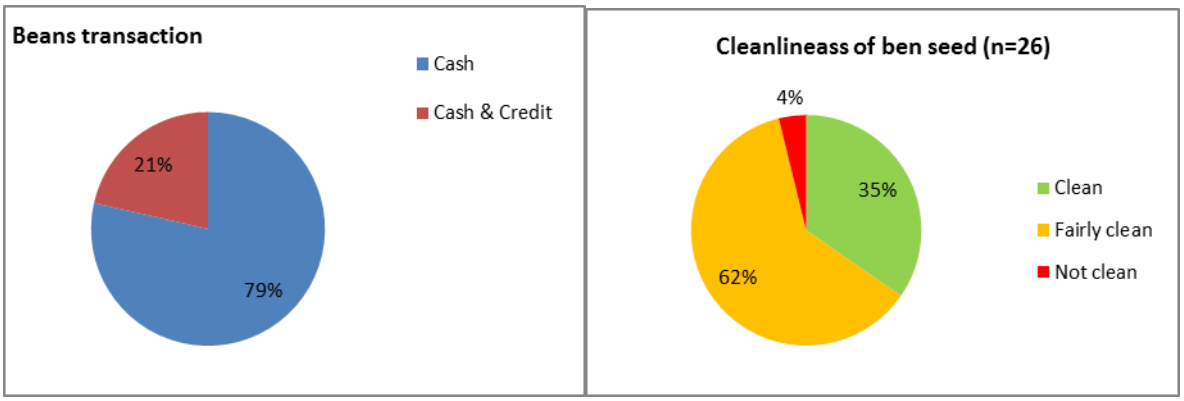


Fig. 3.25.a) Means of transaction and b) physical quality (cleanliness) of beans seed

Green grams: -In October 2014, the traders sold over 120 tons of green grams with N26, an improved variety, representing more than 50 percent of the volume sold. By November 2014 most traders had run out of stock of green grams (Fig. 3.26a), and due to this the prices of green gram increased from an average of 127 Ksh/kg in September 2014 to about 160 Ksh/kg in November 2014, with some traders selling as high as 180 Ksh/kg (Fig. 3.25b). Like beans, traders are supplied with green grams mostly by the farmers (78%) and some by few traders (Fig. 3.27a). About67 percent of the grain comes from within the sub-county (Fig. 3.27b) though some are sourced from other sub-counties within the county or other counties. The fact that the green grams comes from either within or nearby countries validate the finding that farmers using varieties that are adapted to the local agro-ecological conditions.

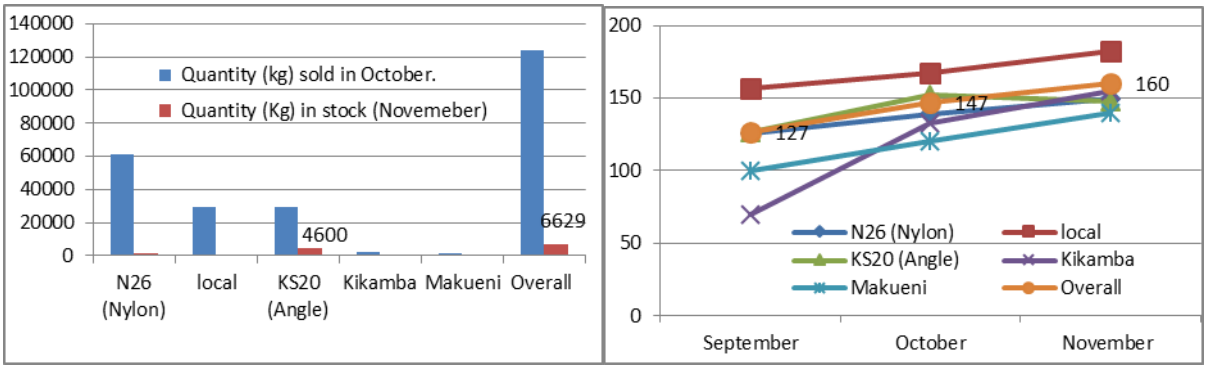


Fig 3.26.a) Quantity(kg) and b) average prices (Ksh/kg) of green gram sold by the traders

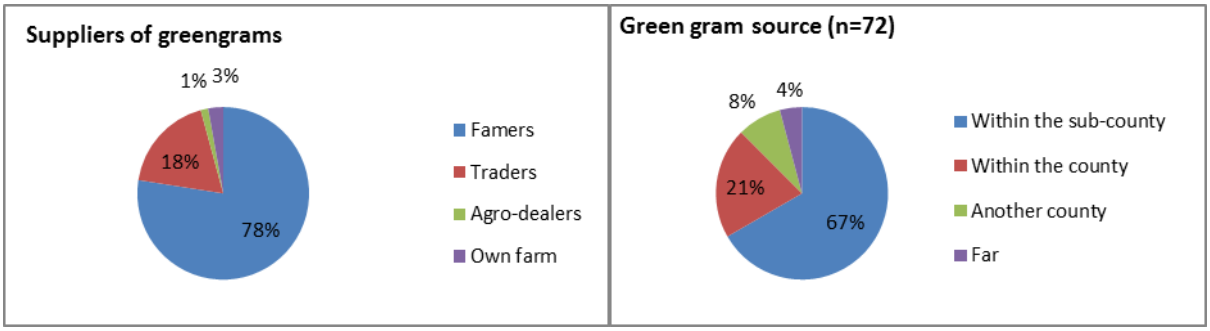
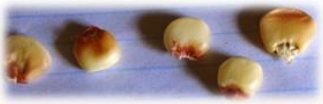


Fig. 3.27.a) Means of transaction and b) physical quality (cleanliness) of green grams seed

Maize- Local market contributes about 20-25 percent of the maize seed planted by the farmers. In 2014 OND seasons, approximately72 traders were able to sell 32,000 kilogram of maize and, with about 10,000kg still in stock by November (Fig. 3.28a). The highly demanded maize seed variety on the local market is the *Kikamba* (Box 3.3) also referred to as *Kinyanya* by some farmers.

Box 3.3 Local Maize demand and Supply



"This 6kg of maize (Kikamba) I have bought from here (PEKILLO) is enough to plant the area I have prepared, and the quality is good. It is cheaper than seeds from Agro-input dears. By buying from here, I am able to save 900 Kenyan shillings" Said, ***Leonard Masongi****, a Farmer from Kathonzweni*

"I also buy grain from them during harvest and store them. It is a win win situation". Said, Peter Killonzo, the proprietor of PEKILLO Store

The price of maize tends to vary with the variety as well as with time. The 2nd and 3rd generation of *Katumani,* an improved variety from KARLO Katumani tends to be higher than the price of other local varieties in the month of September and at the beginning of planting (October). These prices tend to drop in November as the growing season progresses (Fig. 3.28b). Maize seed are normally sourced from within the sub-counties, and mainly supplied by farmers and some by few traders (Fig. 3.29a). Physical qualities of the maize seed were considered clean and/or fairly clean (Fig. 3.29b).

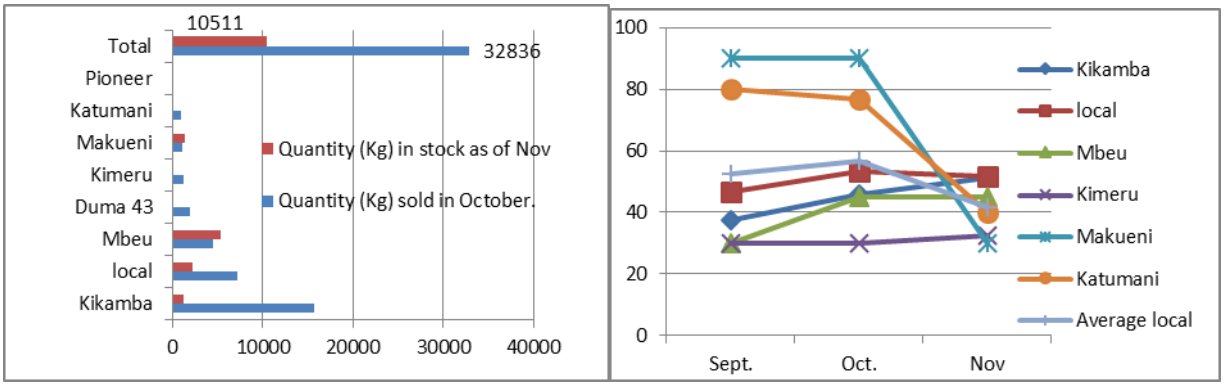


Fig 3.28.a) Quantity (kg) and b) average prices (Ksh/kg) of maize sold by the traders

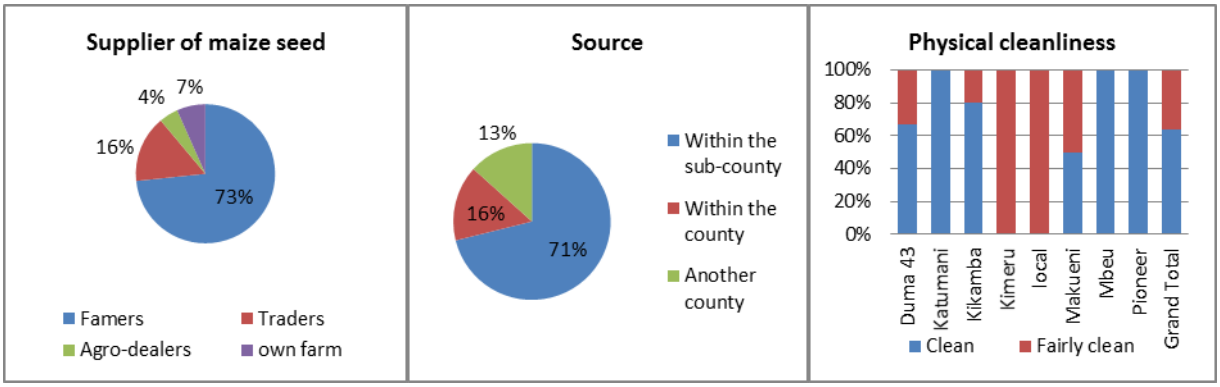


Fig 3.29.Maize a) supplier, b) source, and c) physical quality

Cassava and sweet potato - Though not widely cultivated, cassava and sweet potato are considered by a few farmers as part of their three major crops. While it is rare to find planting materials being sold in an open market, the trade in planting materials is was witnessed in Mbooni and Kibwezi East sub-counties (Fig. 3.30). It's common during the start or mid of the season. Apparently, the prices for the planting materials were as follows; 10 shilling per 10 cuttings for cassava and 10 shillings per 15-20 for sweet potato vines. Sweet potato varieties sold in Mbooni includes *Okwasi* (purplish vines), *Kauthilu* (creamy vine) and *Kilungu*.

Fig.30. Sweet potato vines being off-loaded for sale in Kibwezi Market

3.4.4 Seed/Grain storage and conditioning

Over 60 percent of the traders keep/store their grain/seed within the market stalls while some 30-40 percent keeps them in other storage facilities outside the market place. About 50 percent of these facilities are rented by the traders (Fig. 3.31). Most market structures have floors which are well cemented, and the majority (82%) of the traders place grain/seed bags on pallets while over 88 percent of traders use polythene bags for keeping their grains (Fig. 3.32 a & b). Most of the seed/grain stores were observed to have good ventilation.

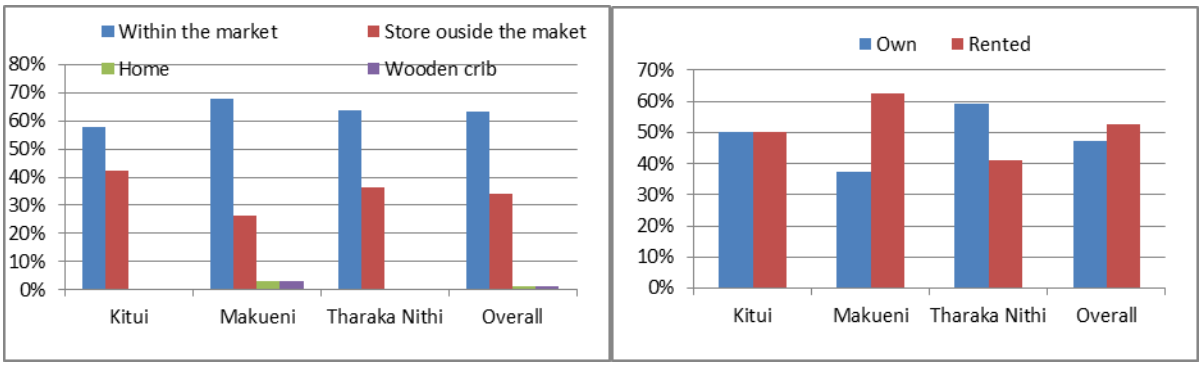


Fig. 3.31 Storage facilities and ownership

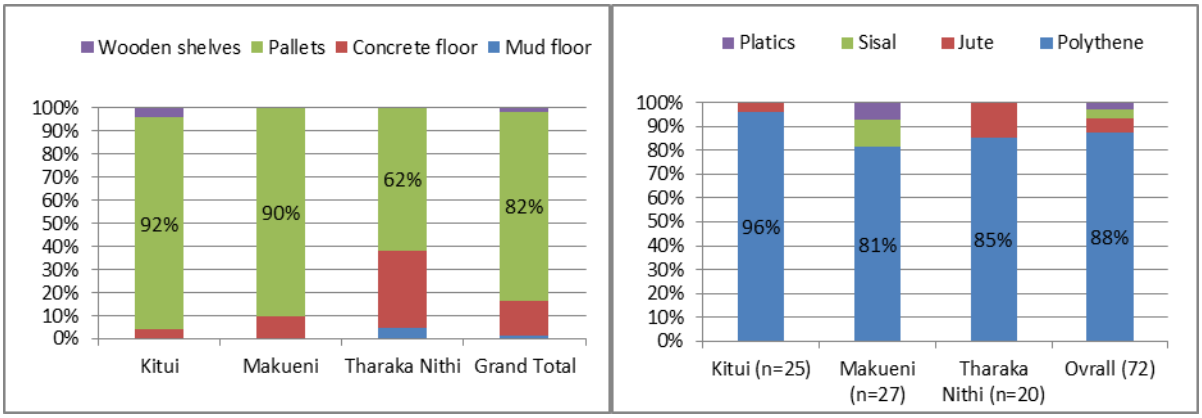


Fig. 3.32 a) seed bagging materials and b) bag placement

Seed Conditioning: Traders undertake some limited efforts to improve the commercial value of their grain/seed. These include the followings

a. Buy only well dried and clean grains/seed – common practices of testing the dryness is by biting the seed

b. Drying and re-drying: where necessary, and when the traders noticed that the grains are not well dried, an extra effort is put in re-drying the grain/seed to avoid damage in store.

c. Cleaning of maize and beans using locally fabricated cleaners (Fig. 3.33) is a common practice

d. Treatments of seed/grains with *Actellic Super* and *Skana Super* for long duration storage, especially when they buy seed 3 to 4 months before the planting time.

e. Display of fresh and old products. Some traders distinguish clearly old and fresh grains, and indicate that old and damaged seeds are comparatively cheaper.

Fig. 3.33. Mr. Boniface - poses near the locally fabricated manual grain/seed cleaner

f. Sell grain and seed separately – this is only with maize where what is sold as seed is clearly distinguished from grain and the price is 30-100% higher than the price of grain sold as food.

The resource-poor farmers, especially in the marginal environments, normally depend on local (grain) markets for their seed requirements (Cromwell *et al.,* 1993) and Nagarajan and Smale, 2005),. The local markets are active and resilient even after disasters, as evidenced by markets in Rwanda during 1994–1995. There are several positive instances of the local market. For instance nearly 25–50 percent of the farmers in Rwanda, Kenya, and Somalia sought local markets for their seed and diversity needs once their own saved stocks went down (Sperling 1997; Sperling 2002; Longley et al. 2001). Sperling (1998) also observed that the local markets in Rwanda had sufficient supplies of preferred bean and sorghum varieties (mostly grains but suitable for seed), but the major problem was that many farmers did not have adequate resources to purchase them from the markets. Though local markets meet the existing demand, the quality of the materials supplied is often questionable and compromised, as the distinction between grain and seed is very thin in many cases.

3.4 Formal Seed Sector Operation in the ASAL

Formal seed system denotes a chain of demand and supply of seed which normally starts with plant breeding activities, through release of varieties, multiplication and certification, seed conditioning and the distribution (marketing) of the seed to the target farmers within a given agro-ecological or farming system. Formal seed sector players within the three counties include Kenya Agricultural and Livestock Research Organization (KALRO)–Katumani; Kenya plant Health Inspectorate Services (KEPHIS); the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); Kenya seed company (KSC); Dry-land Seed Company Limited; Seed distributors (Suppliers); Agro-input dealers and the contracted seed growers (Fig. 3.34).

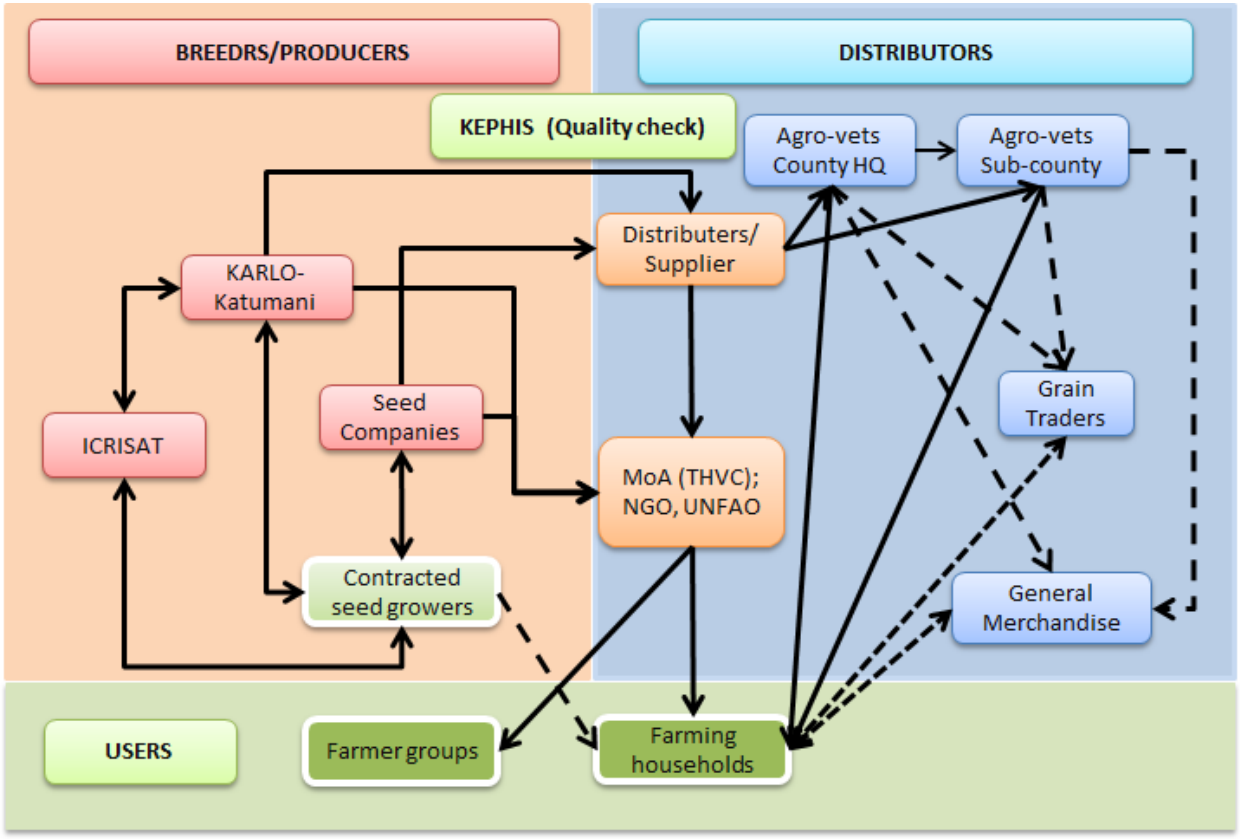


Fig. 3.34 Formal seed sector operation in Kenya

3.4.1 Breeder/Producers (multiplication)

Many development projects implemented in the arid and semiarid regions of Kenya have used community-level seed production as the major entry point for commercial seed development since late 1990s (IFRI, 2010). For instance, the government of Kenya in collaboration with Danish International Development Agency (DANIDA) launched community-based seed bulking programs in the arid and semiarid regions during1997–1998 to address farmers' needs for quality seeds. Improved varieties of grain legumes and cereals, officially released by the MoA were distributed to farmers for further reproduction for their own use and sales. The major players as far as plant breeding is concerned are

KALRO-Katumani, KSC and ICRISAT. KALRO-Katumani and Dryland Seed Company have been supporting small to medium scale seed growers in the three counties to multiply a range of varieties of crops such as maize, green grams, pigeon pea, cowpea and dry beans, and to some limited extend cassava.

Makueni County seed production activities - Small scale seed producers, such as Madam Grace Meteti (Fig. 3.35) of Kilome sub-counties are producing seed on 5-8 acres of land. Grace has a contract agreement with KALRO-Katumani and produce maize and pulses such as beans (Kat bean 1 and Katx56), green grams (N26 and KS20) cowpea (KVU) and pigeon pea (Kat 60/8). In 2013, Grace was able to produce 1200 kg of maize, 1200kg of beans and 200kg of green grams. In Kwale Sub-location, Kasekeu Wards, there are over 60 small-scale seed producers such as Grace, most of them are trained on seed production by the contracting organization or company. Three years ago they were contracted by Dry-Land Seed Co. Ltd and when the company introduced the use of fertilizers, farmers resisted and they found solace with KALRO-Katumani. The seed growers saw no reason for incurring additional expense in using fertilizers when actually they were getting "good' yields and have the opportunity to use organic (animal) manure. Seed inspection is mainly done by KEPHIS officials who come once or twice in a season to inspect and certify what is being produced by the seed growers. The harvest is normally sold to KALRO seed unit or other Seed Agents. However, some limited amount is sometimes sold directly to the farmers who need the seed from within the location. The major challenges of the seed production in the area are a) poor rainfall – amount and distribution and, b) lack of labor force for large scale production.

Fig.3.35 Madam Grace in her newly planted Maize multiplication field

Kitui County seed production activities-Community seed bulking is an initiative by some community based organizations (CBOs) and NGO such as Danish International to increase availability and access to seeds, especially by the poor farmers within the community. Some of the groups interviewed however reported challenges with the quality control. Though not confirmed, some group claimed that, through barter system, they exchange the substandard collections with relatively better quality for replanting. Foundation seed of green gram and pigeon pea are normally obtained from KALRO–Katumani. The seed from this initiative is normally sold to farmers. Seed production is also being done by some community based seed groups and ATC (Agricultural Training Centre) in Kitui under contract agreement with KARLO-Katumani. The most commonly multiplied crop seeds include green grams, cowpeas and sorghum for use within or sold to neighboring counties.

Tharaka-Nithi seed production activities:-There were a few seed producing individual farmers in Tharaka south sub-county. The seed multiplication programme that had been started by KARLO in Tunyai sub-location, Tharaka-Nithi County ended a few years ago, without a notice probablydue to seed adulteration by some of small scale farmers. The process has since reverted to few large scale farmers and some of small scale farmers. Gakia seed bank SHG in Kamwathu sub-location, Gatunga ward, Tharaka-North sub-county have been involved in collection, treatment and storage of member's local and improved seeds in a community store through the support of Intermediate technology group in the initial stages and currently through support of RIDEP (Local NGO) which organizes seed exhibition and competition. The group has a limited involvement in purchase and marketing of the seeds to their

members and other community members. The group had been previously used by the Ministry of Agriculture in seed bulking and banking where they used to return twice the amount of seed provided in grain from the harvest.

3.4.2 Distributors/suppliers

Certified crop seeds are available in all the locations visited, mainly with agro-vet (agro-input dealers). Most agro-input dealers sell maize and vegetable seeds; pesticides, fertilizers and animal drugs. A few agro-inputs dealers stock animal feeds. There are four types of agro-input of dealers in the area surveyed.

i. *Agro-Input shops* –agro – input dealers are well spreads across the three counties, and mostly concentrated within the county headquarters (15-30) and at the sub-counties headquarters and major trading centers (2-10)
ii. *Pharmacies/Input dealers* – This is not very common and about 1-2 can be found per market location visited.
iii. *Grain traders* – A few grain traders/store also sell certified seed, particularly popular maize varieties such as Duma 43 and DH02.
iv. *General shops* – Some general merchandise shops, particularly those in smaller trading centers where agro-vets are absent sell both grain and certified seeds in limited quantities

3.4.3 Demand and supply of certified seed and fertilizers

Over 10 different varieties of maize are on the market with agro-input dealers with the most popularly and highly demanded varieties being Duma 43 (all locations), DH02 (in Makueni) and DH04 (in Tharaka-Nithi). The main vegetable seeds sold were kales (Collards, thousand headed), water melon (Sukari F1, sugar baby), tomatoes (Rio Grande& Cal J), spinach (Swiss chart- Fordhook Giant), Onions (Bombay red) and butternut. Although the demand for legumes such as green grams & cowpeas were reported by agro-input dealers, there was little stock of these varieties with the agro-input dealers visited. It was however noted that most local market had a number of varieties of legumes. This signifies the importance of diversified seed sources in enhancing seed security.

Stocking of maize seed is normally done in July –August in preparation for October /December rains and February for March/April rains. The sales for maize seeds are highest in October /November followed by February /March depending on the onset of the rain. However, in irrigated farming, the demand for maize seeds, particularly pioneer variety, is good throughout the year. Similarly, the demand for vegetable seeds was fairly uniform throughout the year as they were mainly grown under irrigation. Few cases of limited supplies of specific crop varieties were reported during the peak season. Overall, the supplies of most varieties were considered adequate with the suppliers, and their orders could be replenished within 1-2 days of ordering. The exceptional case was in Tharaka-North, where the supply could be delayed due to poor road access.

Prices of certified maize seed vary from location to location and even some from one agro-input dealer to another. The prices ranges from 350 to 550 Kenya shilling per 2 kg package (Table 3.12). Each of the Agro-input dealers sells between 200 and 4,000 packages of maize, depending on their location and capacity. Other certified crop seed found with agro-input dealers included green grams (N26 and KS20), Beans (Kat bean 1 and Rosecoco), and cowpea (KVU 27-2, M66 and K80).

Table 3.12. Crop and varieties found with agro-input dealers in the three counties

Crop	Varieties	Demand	Price/2kg
Maize	Duma 43	High (1st in all locations	420-450
	DH01	Low	380 -
	DH02	High (2nd in Makueni)	350 – 400
	DH04	High (2nd in Tharaka-Nithi)	360 – 400
	Pioneer 3253	Low	350 – 550
	Pana M49	Low	450 -
	DK8031	Medium	420 – 450
	DK8089	Medium	420 – 450
	KDV1	Medium	350 – 380
	KDV2	Low	350 – 380
	KDV4	Low	380
Green gram	KS20 (Angle)	High	420 – 450
	NS26 (Nylon)	Medium	420 – 450
Beans	Kat bean 1	Medium	420 – 450
	Rosecoco	Low	420 –450
Cowpea	KVU – 27-1	Medium	420
	K80	Low	420
	M66	Medium	420
Pigeon Pea	Mbaazi 1	Low	450

Fewer agro-input dealers stock/sell pulses such as beans, green grams, cowpea and pigeon pea compared to maize. This is attributed to the fact that quite a number of local grain traders stock the same seed at lower prices (120-360/2kg) compared to agro-input dealers prices of 420-450/2kg. Besides, lower priced seed from the grain traders, seed aid from project/program such as the THVCs programme, Department of Agriculture, Ministry of Agriculture and through other development agencies have been providing famers with these seed on recovery basis and /or through seed bulking approach since 2007. In addition, most of the pulses can be recycled for 4 -6 seasons before they lose their true to type characteristics, hence there is limited demand from farmers so agro-input dealers do not maintain large stocks of these crops.

Although there are a number of hybrid maize varieties with the agro-input dealers, only 5-30 percent of the farmers who buy maize seed also buy inorganic fertilizers to use with maize. The majority of those who buy fertilizers normally buy for use in their vegetable gardens. The low use of inorganic fertilizers on maize crop is attributed to a number of factors, some of which are associated with socio-cultural perceptions of the farmers. The followings are some of the perceptions and factors resulting in the low purchase and use of fertilizers by famers;

a) Some farmers consider their soil fertility good enough
a) Most farmers use organic (animal) manure in their field

b) High cost of fertilizers. Many poor farmers consider the cost of fertilizers as being prohibitively high.
c) Lack of knowledge on usefulness of fertilizer in boosting crop yields
d) Tedious and bureaucratic process of acquiring government's subsidized fertilizers

Though the government, through the cereal board, is currently providing inorganic fertilizers on subsidized rate (Table 3.13), resource poor households are not benefiting from the subsidies due the bureaucratic process of accessing it. It has been noted that the distribution points for these fertilizers are highly centralized (only 2-3 per county), and the process of getting clearance through chains of commands within the county makes it difficult for the farmers. In order to access the fertilizer, a farmer needs to first have recommendation from the local chief. This recommendation goes to the agriculture extension office which then gives recommendation to the cereal board. The cereal board, after validating the recommendation from the extension officer, advices the farmer to make payment to the bank and then the farmer brings the payment slip to the cereal board before the fertilizer is released. In addition, fertilizers are sold only in 50kg packaging which makes it very expensive for poor farmers. In reality it is the better off famers who benefit from the fertilizer subsidy rather than the poorer farmers who would need it most.

Table 3.13. Types, prices and sources of inorganic fertilizers on the market

Fertilizer type	Agro-vet prices		Subsidized prices
	Ksh/kg	Ksh/bag	Ksh/bag
NPK	70 – 80	3200 – 3600	2000
DAP	70 – 80	3200 – 3800	2000
CAN	55 – 60	2300 – 2500	1500

Most resource-poor households buy 5-10 kg of fertilizers at a time. The agro-input dealers are preferred by the poor farmers for supplying fertilizer since they are much closer to them than the cereal board outlets. Notwithstanding bureaucratic process of acquiring subsidies fertilizers, the farmer will definitely incur additional cost of transportation of the fertilizer, meals and sometimes accommodation from the centralized point to his/her farm.

Most of the agro-input dealers in the counties and sub-counties are being supplied by bigger agro input dealers (Suppliers) such as Nduki and Nikifarm at Makueni County, Kithimani in Kitui county and East end chemist in Chogoria in Tharaka-Nithi County.

3.4.4 After-sales services by agro input dealers

A number of agro-input dealers provide after sale services to their customers, in the form of advice, extension services and demonstrations. Some also keep record of who buys what when in order to get genuine feedback from the farmers

- **Extension advice:**
  - Farmers are advised to retain a small sample in the original package and keep it for future reference. However, those who came back complaining are rarely assisted as stockists don't get required feedback from seed companies.
  - Some stockists also keep records of who buy what, when and their contact.

- Suitability of the different varieties available to agro-ecologies where the farmers come from – e.g. pioneer variety for irrigated land or in area with adequate rains
- Agronomic practices - spacing, weeding regime, and harvest time
- Pests and disease control using pesticides- required chemicals, application rates.
- Fertilizer applications - Use DAP during planting and CAN for top dressing.

- **Extension visit and follow up**
  - Some agro-vets have extension officers who visit the farmers with problem
  - In addition, farmers who buy new introductions (varieties) are closely followed for feedback

- **Demonstrations and field days**
  - Setting up demonstration along the main roads for farmers to see
  - Holding of field days at demonstration sites to educate the farmers on the varieties

- **Transport services**
  - There were also other who provide transport to nearest centers especially where they supply small agro-vets in within their marketing area

Overall, there is adequate supply of certified seed with the agro – input dealers within the three counties. Limited supply of legumes by the agro-vet is mainly due to demand for the same from the local market (grain) traders who offers the seed at lower prices.

3.4.5 Feedback from the farmers

During the 2014 OND season, both positive and negative feedbacks were been given to the Argo-input dealers by the farmers. The major complaint from the famers was about fake "certified" maize seed (Duma 43) on the market. Farmers first noted change in seed dressing color from green (what they are used to) to purple, and this was claimed by some agro-input dealers as a counter strategy by the seed company to minimize the likely chances of counterfeit seeds on the market. This change was however, not effectively communicated to the farmers in time, and even so it would have compromised sales of the old stock of genuine Duma 43 that were still with some agro-input dealers. Farmers also reported high percentage of broken seed, smaller seed size and poor performance. This was further confirmed by the seed assessment team during the field visit (Fig.3.36). Although over 50 percent of the agro-input dealers received this complain from the farmers, they were unable to assist the affected farmers.

Fig. 3.36.Sample of fake (green) and genuine (purple) Duma 43

Similar complaint was raised on Panar 4m19, another variety of maize, in the March-April-May (MAM) 2014 season. Some farmers complained to Tazama Agro-vet in Wote (Makueni) about its poor germination. The company also tested the seed and confirmed the problem. No compensation was however made to the farmers who suffered losses. Apart from the two maize varieties, famers also complained about vegetable seeds, particularly related to some tomato varieties.

- *Wrong packaging of farmers' preferred tomato variety-Onex*. In some cases, after planting, they found a different variety.

- *Poor Germination of Rio-Grande:* This is a common problem with the Rio-Grande variety. Farmers were only compensated the sale value of the seed.
- *Poor performance of collards:* In Kibwezi east, the agro-input dealers received complaint of poor performance of Collards (*Gorgia*) from EA-Seed Company compared to that from Simlaw Seed Company.

3.4.6 General observations

Other general observation made during the assessment is the lack of accountability on the side of the seed companies.

a) The defensive disclaimers by the seed producers on the seed packages imply that the entire responsibility on the seed quality is left to the farmer, the final entity in the seed value chain. The disclaimers on most vegetable seed package show no warranty to the farmers, and their liability being limited to the purchase price of the seed (Box 3.3).

b) 

Box 3.3. Lack of accountability from seed companies

"We provide no warranty, expressed or implied, as to purity, description, quality, productiveness or for any other matter for the seed we sell and will not in any way be responsible for the outcome. Our liability is limited to purchase price". A disclaimer on vegetable seed package

If life of the seed – Most vegetable packaging have no production or expiry dates. This practice exposes farmers to dishonest traders who might sell over-stayed seeds to unsuspecting farmers.

c) *Limited capacity of agro-input dealers:* Some agro-vets, especially new ones, have limited capacity in handling seed and other agricultural inputs

d) *Poor Storage:* Some agro-input premises, especially those at sub-counties, have poor ventilations and/or no heat proof ceiling –, hence inappropriate for seed storage.

e) *Ineffectiveness of Actellic super*: There were complains about the ineffectiveness of the chemical in controlling storage pests.

f) Some agro-input shops are not only stocking the agro-inputs but also pharmaceutical products and this poses risk to the potential consumers. Moreover, there are chances that the personnel attached to the stores have only medical, veterinary or agricultural (crop) background. In such cases, the reported technical advices to the farmers may be substandard.

3.4.7 Key Challenges to the agro-input businesses

Although agro-input business seems to be well established within the three counties, and offering fairly good services to the farmers, they are never-the-less faced with a few challenges. The followings were some of the key challenges faced by the agro-input dealers.

a) Erratic and poorly distributed rainfall and poor weather forecasting which lead to poor sales. Sometimes dealers stock seed but end up not selling it because of rain failures.

b) Advertising of specific varieties such as Duma43 affect sales of other varieties
c) Damages/losses due to poor seed handling where some packages are broken during transportation
d) Farmers always complain of the high seed prices. Agro-vet seeds (certified) prices are 2-4 times higher than the price of uncertified seed from the local market. This makes sales of especially pulses very low.
e) Being a seasonal business, agro-input dealers are always cautious not to overstock. Occasionally, the highly demanded seed varieties cannot be supplied; notably the KS20 variety of green gram and maize varieties H513 and H614. Some suppliers attribute this to the rupture of supply with the seed companies.
f) Most dealers from remote parts of Kitui and Tharaka North reported poor road infrastructure as a challenge to the seed business. This raises the cost of transporting seeds to distant areas.
g) Some dealers also mentioned low capital and poor access to credit; hence inability to stock enough seeds at any given time.
h) Inability of suppliers to provide responses on farmers complaints,
i) A few agro-input dealers reported a lack of information sharing on seed distribution and subsidized fertilizers by the government and /or various organizations negatively affect their business plan as they are unable to predict the actual demand, which sometimes leaves them with carry over stock.
j) Unhealthy competition from non-registered traders including shopping keepers and open market traders. This was for both seeds and pesticides and animal drugs.
k) Many levies- professional fees, association fee, PCPB, business fee.
l) The large packing of maize seeds for small holder poor farmers

3.4.8 Support to agro-input dealers

Generally, there has been no project supporting agro-input dealers along the value chain until this year when agrochemical association of Kenya in collaboration with Pest Control Product Board (PCPB) and Ministry of Agriculture staff commenced mopping up pesticides containers by providing disposal bags to selected agro-input dealers. The sensitization process was still on-going for the farmers to be surrendering the used pesticide containers to the selected stockists.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This assessment reveals that despite the drought experienced in the OND rains 2013, there is no acute seed insecurity in South Eastern livelihood zones of Kenya, especially in regards to seed availability. In consequence, there is no justification for continuous seed distribution being undertaken by the government and development partner. Quantities of seed used by farmers have remained stable between 2013 and 2014. Farmers have multiple seed sources through which they obtain seed, and the major ones being own saved seed, local market and agro-vets particularly for maize seed. Social network and seed aid contribute just less than 5 percent of the overall seed planted by the farmers. Generally seed was available from one or more of seeds sources; however access to seed, especially certified seeds from agro-input dealers, was limited by the high prices. From the seed security conceptual points of views, the followings conclusions can be made.

Availability: –Though some few farmers complain about limited own-saved seed, seed was generally available from the local market and agro-vet shops, with some limited contribution from the social network. At the onset of the October – November – December (OND) 2014 season, both the agro-vets and local grain/traders had adequate stock of seed in store. Even one month after the onset of the OND rains, a number of agro-vets dealers still had stock of popular "certified" maize varieties. Uncertified, local and improved varieties of green grams, cowpea beans, pigeons, bulrush millet and sorghum were still available with the grain traders. With the exception of some famers complaining of the distance of agro-input dealers and local grain/seed traders and some limited quantities of some varieties of maize and green grams there is very insignificant concern about seed supply or availability despite the poor performance of the previous OND 2013 season.

Access to certified seed – Access was the major factor contributing to pockets of seed insecurity, particularly among some resource poor farming households within the community. Key concern among the farmers was the high price of certified seed, which pushed some to buy seed in bits and did not allow timely planting their crops. This particularly was a problem where some households had to provide their labour during the onset of the rainy season in order to get money to buy seed. Others went for relatively cheaper and uncertified seed of either improved and/or local varieties in the local market. In general, the prices of seed from agro-input dealers were 2 (green grams, cowpea, beans) – 4 (maize) times higher than the price of the same seeds from the local grain vendors. Many agro-input dealers however noted that their customers would prefer to have 1kg packs instead of the 2kg packs of seed.

Seed Quality: -Overall, the famers considered the germination of the crop seed good (98%) while the physical purity rated at 68 percent with a bit more concern on the purity of the own-saved seed and local market seed. More specific concern was however on poor quality of popular maize variety- Duma 43 which was compromised by sales of fake Duma 43 – done by packaging fake seed in the similar packaging used by the company. There were cases of poor germination of certified maize and vegetable seed. Serious concern was about the quality of own-saved seed due to high level of storage pest, particularly of Lager Grain Borer (LGB) which contributed lack of availability of own saved seed. There were other concerns about the usual storage pesticides (*Actellic Super*); some farmers claimed it could no longer protect the seeds until the next planting season.

Varietal suitability: There are a range of varieties being grown by the famers, both improved and local. The majority of the famers are satisfied with the adaptability of most varieties they are currently growing and most of these are preferred varieties. Pocket concerns were however on some improved varieties such as *Gadam* and performance (adaptability) of some kale varieties.

Resilience: Much as food security of the farming households appear to be wanting due to the recurrent droughts in the ASAL, seed system is fairly resilient with multiple seed sources, including functional and well established agro-vets and local market providing alternative sources depending on the capacity of the farmers. There are also a wide range of crops varieties from both the formal and informal seed sector.

4.2 Recommendations

4.2.1 Short term recommendations

a) Improving access to quality seed and fertilizer by poor famers

i. Humanitarian actors should consider limiting or phasing out as much as possible Direct Seed Distribution (DSD) which tends to undermine normal functioning of the seed market (formal and informal). Currently, there is no acute seed insecurity that currently warrants DSD. Only on exceptional cases in the near future, where no market exists, should such approach be implemented

ii. Smaller seed (1kg) package: - From the agro-input dealer's interviews, many indicated that farmers request for 1kg of the different seed types and yet the standard packing is 2kg. Therefore seed companies could play a significant role in improving access by just simply packaging the seed in smaller units (e.g.1kg) that are demanded by the farmers.

iii. Seed packaging policy to minimize fake seed: - In order to minimize fake seed in the market, there is a need to review and enforce regulation on seed packaging and strengthen measures to reduce fake seed. Where possible, all seed company should adapt use of transparent packaging or packaging where a portion or entire contents are visible to the customer. This creates some level of transparency and trust as the farmers will be able make judgment on the quality of what is in the packs. It also protects the small agro-input dealers from counting losses resulting from having stock pile of fake seed. Strict policies and harsh punitive actions to the culprits of fake seeds' production and circulation to be enforced.

iv. Law enforcement on non-registered agro-input shops to eliminate unauthorized sales of agro-inputs in premises such as pharmacies. The county authorities need to be empowered to carry out such functions other depending solely on KEPHIS to enforce such laws. Selling of certified seeds and pesticides in the open market by unregistered traders should be comprehensively addressed through existing legal framework and also by strengthening the appropriate legal framework. The PCPB should consider delegating its legal authority on inspection and arresting power, as it is to public health, to County agricultural officers, who shall be held accountable in case of illegal sales within their jurisdiction.

v. Regular and close monitoring of seed stock with the major suppliers by the KEPHIS- Most agro-input dealers, especially small ones in the countryside get fake seed from major suppliers which are the potential sources of the vice. Periodic check of quality of seed from these suppliers will minimize such incidences and or timely intervene before wider circulation into the marketing chain.

vi. Enforcement of proper accountability by the seed company: – Companies offering certified seed should be held accountable of the problem or defect when discovered with their seeds. Government should make it a policy for all seed companies to provide clear packaging and expiry date dates on the packages; as this helps to reduce the chances or risk of farmers buying expired or poor quality seed. In addition, seed Company's liability should not limited to price alone but should extend to overall quality of the seed. Seed companies should also timely and clearly communicate changes in seed dressing or packaging in order to alert the farmers without compromising sales existing stocks exhibiting previous features.

vii. Support to local market seed dealers – Grain/seed traders still play an important role in providing 2nd and 3rd generation of improved varieties of OPV to farmers who cannot afford to buy from agro-input dealers. It is important for the government to recognize the significant roles played by the grain traders in providing grain as seed to the farmers. Therefore there is need to work closely with the grain traders in improving their skills and knowledge of the quality of what they sell as seed as provide some support to buy adequate equipment

   a. Prompt inspection and testing the quality of their grain/seed just before planting season could help to achieve some minimum quality standards as required.

   b. Identifying grain traders (who are themselves farmers) and giving them basic training in management and storage of seed is a step towards supporting integrated seed sector development

viii. Seed Voucher and fairs: - Considering that the seed market is well established in the area assessed, where an emergency response is envisaged, market-based vouchers could be used. In area where the farmers are bit far from local market and/or agro input dealers, seed fair should be used and is highly recommended. There is no justification why government, UN and NGOs should continue distributing assorted crop seed to beneficiaries in areas where availability is not a big concern. For the upcoming season (MAM 2015) there is no need to undertake such intervention.

b) Capacity building and technology up-scaling

ix. Emerging and new agro-input dealers, particularly those at lower level locations (sub-counties) need to be capacitated in seed handling and storage.

x. Promotion of appropriate storage facilities such as Metal Silos by FAO need to be encouraged through training of artisans. In addition, appropriate seed storage bags such as the triple bags need to be encouraged.

xi. Subsidized fertilizers - Government need to decentralize the process of fertilizer subsidies if poorer farmers are to access it. In addition, mechanism and the bureaucratic process in accessing the fertilizers should be reviewed, streamlined and simplified.

4.2.2 Medium to long term

a) Research for development (R4D) agenda

i. Development of acceptable crop varieties – Additional efforts need to be put in place by research institutions to develop and provide acceptable varieties, particularly of sorghum, finger millet and bulrush millet which are less susceptible to bird attack.

ii. Development of maize varieties less susceptible to storage pests could give some milestone in not only improving food security, but also seed security especially where the varieties are open pollinated varieties (OPV).

iii. Testing efficacy and efficiency of some commonly used storage pesticides – a proper study need to be instituted to examine the complaint by farmers on the effectiveness of some of the storage pesticides on the market and come up with appropriate recommendations.

iv. Testing and identifying the best cereal : legumes intercrop spatial arrangement for up-scaling: There is need for research to identify the best intercropping pattern that gives the best yield advantage.

v. Efforts by KARI and other seed companies in contracting farmers to multiply seed within the various agro-ecologies need to be further scaled up in a number of places within the counties.

vi. Supporting community-based seed production and supply - Where limited contract seed growers exists – community can be capacitated to produce/multiply, store and market seed of desired crops and varieties

b) Technology up-scaling using FFS

i. Up-scaling of Zai-pit technology: -Zai pit technology has been proven as effective in addressing soil water conservation and increasing productivity of crops. This needs to be further up-scaled in areas where it's limited or where farmers are not yet exposed to, particularly in Tharaka North and Mwingi North. Limited use of inorganic fertilizer could be improved when mineral fertilizers are incorporated with organic manure for use in Zai pit.

ii. Introduction *Magoye* rippers on a cost recovery basis to the farmers who use animal traction. This will help the farmers breaking the hard pans, and hence enhanced production of root crops as well as productivity of other crops and increases the water holding capacity of the soils. This has to come with sensitization of the farmers on the benefits of breaking the hard pans.

iii. Crop diversification – introduction and promotion of peal millet and finger millet in areas less suitable for maize (e.g.LM5 agro-ecological zone), could go a long way in improving food security

The above technologies could be up-scaled using Farmer Field School (FFS) approach.

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