TEGEMEO INSTITUTE OF AGRICULTURAL POLICY AND DEVELOPMENT

Kenya Baseline Study

Report Prepared for:

The Alliance for a Green Revolution in Africa

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ACRONYMS AND ABBREVIATIONS

AGMARK	Agricultural Marketing Development Trust AGRA Alliance for a Green Revolution in Africa
AKAFEMA	Association of Kenya Animal Feed Manufacturers
ARM	Athi River Mining Co. Ltd
ASAL	Arid and Semi-arid Land
ASDS	Agricultural Sector Development Strategy
BAT	British American Tobacco
CAADP	Comprehensive Africa Agriculture Development Programme
CAVS	College of Agriculture and Veterinary Sciences
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Research Centre
CMA	Central Millers Association
CNFA	Citizens Network for Foreign Affairs
CRF	Coffee Research Foundation
DFID	Department for International Development
EAGC	Eastern Africa Grain Council FAK Fertiliser Association of Kenya
FAO	Food and Agriculture organisation
FGD	Focus Group Discussions
GDP	Gross Domestic Product
GoK	Government of Kenya
ICRAF	International Centre for Research in Agro-forestry
IDF	Import Declaration Fee
ISFM	Integrated Soil Fertility Management
ISTA	International Seed Testing Association
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KACE	Kenya Agricultural Commodity Exchange
KALT	Kenya Animal Health Technicians
KAPP	Kenya Agricultural Productivity Programme
KARI	Kenya Agricultural Research Institute
KBP	Kilimo Biashara Packages KEBS Kenya Bureau of Standards
KEFRI	Kenya Forestry Research Institute
KEMFRI	Kenya Marine and Fisheries Research Institute
KENADA	Kenya National Association of Distributors and Agro-dealers
KENFAP	Kenya National Federation of Agricultural producers
KEPHIS	Kenya Plant Health Inspectorate Services
KESREF	Kenya Sugar Research Foundation
KFSN	Kenya Food Security and Nutrition
KIPPRA	Kenya Institute of Public Policy and Research Analysis
KMDP	Kenya Maize Development Programme
KPSK	Kilimo Plus Starter Kits
KTDA	Kenya Tea Development Agency

M&E	Monitoring and Evaluation
MCC	Millennium Challenge Corporation
MFIs	Micro-finance Institutions
MIAD	Mwea Irrigation and Agricultural Development
MICs	Market Information Centres
MIPs	Market Information Points
MIS	Market Information Systems
MoA	Ministry of Agriculture
MRCs	Market Resource Centres
MT	Metric Ton
MTP	Medium Term Plan
NAAIAP	National Accelerated Agricultural Input Access Programme
NARL	National Agricultural Research Laboratories
NCPB	National Cereals and Produce Board
NEPAD	New Partnership for Africa's Development
NGO	Non-governmental organisation
NMK	Njaa Marufuku Kenya
OECD	Over Seas Economic Cooperation and Development
PBAK	Plant Breeders Association
PCPB	Pest Control and Poisons Board
PCPB	Pest Control and Poisons Board
RATES	Regional Agricultural Trade Expansion Support
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SACCO	Savings and Credit Cooperative
SFM	Soil Fertility Management
SILIDA	Siaya Livestock Development Association
SMEs/MSE	Small and Medium Scale Enterprises
SMS	Short Text Message
SPSS	Statistical Package for Social Scientists
SRA	Strategy for Revitalizing Agriculture
STAK	Seed Traders Association of Kenya
TRF	Tea Research Foundation
TSBF	Tropical Soil Biology Foundation
UoN	University of Nairobi
US$	United States Dollar
VAT	Value Added Tax
WAC	World Agro-forestry Centre
WARDA	West African Rice Development Association
WFP	World Food Programme
WRS	Warehouse Receipt Scheme/System

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While the Baseline study was conducted on behalf of AGRA, the opinions expressed in the document are the authors' and do not necessarily represent AGRA's views.

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Executive Summary

Tegemeo Institute was contracted by the Alliance for a Green Revolution in Africa (AGRA) to conduct a study whose objective was to establish a baseline against which AGRA's interventions in its three programmatic areas would be monitored and evaluated. The design adopted for the study was a multi-dimensional and multi-faceted one integrating various approaches and methods intended to capture and synthesise information from various sources. Baseline surveys were conducted at the various segments along the agricultural value chain in Kenya namely, at the farm household, input market, output market and institution level.

AGRA defined "bread basket" areas as those with high but unexploited agricultural potential and that are predominantly under the small-scale production system. The areas AGRA identified were Western Kenya (Kakamega – Kisumu – Uganda border) and the Central Highlands. AGRA's focus in these areas is on increasing productivity and development of markets for staple crops. Staples that are predominantly produced by small scale farmers are maize, sorghum, millet, rice, sweet potatoes, cassava, beans, pigeon peas, cow peas, bananas and groundnuts. Within the areas identified, the selected districts were those with high inclusivity of staple crops. In the central highlands, four districts were identified namely while the western region was divided into Western and Nyanza with four and three districts respectively.

The baseline results related household crop farming activities and practices refer to the 2008/2009 cropping calendar. All other results are in reference to the year 2009 starting January to end of December.

The farm households were headed by persons with a mean age of 52 years and for majority of them, the highest education attained was primary level of education. The average land holding was three acres while the value of physical assets owned was US$ 2,376 but varied across the regions. Majority (96%) of the households keep at least one type of livestock with a mean value of US$425.

There was high inequality in incomes among the households but the mean annual income for the households was US$ 1,892. Farm enterprises (crops and livestock) constituted 65% of the

household income with the share of income from crop enterprises being 48% while that from livestock enterprises was 17%. On average, the households cultivated 3.4 acres of own land without a title (42%) while 32% was own land with a title. Some households (19%) cultivated leased parcels of land. Majority (85%) of the households do not practise irrigation.

While majority of the households were aware of most of the soil fertility management practices (SFM), smaller proportions practised them. Use of farmyard manure and inorganic fertilisers was most common (70% of the households), while terracing, crop rotation and use of grass strips were practised by just over half of the households. Half of the farmers perceived themselves to be proficient in the application of the SFM technologies.

Maize and common beans were the most commonly grown staples among the households in over 95% of the households while bananas, sweet potatoes, cassava and cow peas were other less commonly grown staples . The average annual production was 9 tonnes, 1.4 tonnes, 0.3 tonnes, 3 tonnes and 0.08 tonnes for industrial crops, fodder crops, cereals, vegetables and pulses respectively. The yield of maize averaged 923 kg/acre while that of beans averaged 175 kg/acre. Across the regions, maize yields were 1,053 kg/acre in Nyanza region, 786 kg/acre in Central and 946 kg/acre in Western regions.

On livestock production, approximately 96% of the sample households had at least one livestock of whatever kind, with chicken and cattle being the most widely kept of all livestock. The number of livestock units kept by a household averaged 12, with chicken often kept in the largest numbers. The value of all livestock units owned averaged US$ 425, with the value highest in Nyanza region and lowest in Western region. The proportion of households that produced cow milk was 55%, with the proportion highest in Central region (62%) and lowest in Western region (51%). The annual milk production by a household averaged 1,165 litres, with households in the Central region registering the highest volume of milk production way above this average, owing to the dominance of improved cattle breeds in the region relative to the other regions.

Over 69% of the households used inorganic fertilisers while 77% used organic fertilisers. Approximately 43% of the households used a combination of inorganic and organic fertiliser. The proportion of cultivated area with fertiliser was 61%, 52%, and 48% for inorganic, organic and combination of both fertilisers respectively. Application rate of inorganic fertiliser averaged

37 kg/acre while the dose rate averaged 81 kg/acre. The most popular inorganic fertilisers used by the households were DAP and CAN. Over 98% of the households were aware of at least one fertiliser type. The most widely known fertiliser types were manure, DAP, CAN and Urea.

On improved seed varieties, 88% of the households were conversant with at least one variety of maize, while only 27% were familiar with at least one variety of common beans. Adoption of improved varieties among the households was highest for maize (65% of households) while the remaining staples registered adoption rates of between 0% and 6%. Maize had the biggest range of improved varieties planted with the most common improved maize varieties being H513, WS505, H614, Pioneer and DH4. The proportion of cultivated area planted with improved maize varieties was 57% and was lowest in Nyanza region (22%).

Families/friends, fellow farmers and extension workers were the main sources of information on soil fertility management technologies while the main sources of information on improved varieties were fellow farmers, agro-dealers and extension workers. On input prices, the main providers of information to the sample of households were agro-dealers, fellow farmers and family members and friends in that order. Personal communication was the dominant mode for acquiring information about fertilisers, improved seed varieties and input prices. Households purchased fertilisers and improved seed varieties from outlets located further than those nearest to them.

Only 11% of the households sought agricultural credit although the success rate was high (86%) for those seeking credit. The main providers of the agricultural credit were neighbours (25%), NGOs/MFIs (18%), relatives/friends (14%) and commercial banks (13%).

On average, 27% of the households had membership in agricultural producer groups. The services offered to group members were mainly training, marketing, inputs acquisition and financial services. Women constituted 46% of the groups' membership and 25% of the groups' management committees.

Between 2% and 16% of the staples produced by the households was marketed. Market orientation was higher for groundnuts, bananas, soybeans, sweet potatoes and millet where over 10% but less than 16% of the total production reached the market. It was lowest for cowpeas,

Irish potatoes, sorghum and cassava. Buyers of the staples were mainly small traders and consumers, indicating lack of organized marketing arrangements for the commodities. Highest prices were received from pulses (Dolichos (*njahi)*, soybeans, cowpeas and groundnuts in that order) while the least prices were received for the tubers (cassava, sweet and Irish potatoes) and bananas.

Maize, sorghum millet, beans and groundnuts were stored for less than three months before sale while the rest of the staples, except cowpeas, were stored for less than one month before being sold. Approximately 37% of the households had grain stores majority of which were rooms in the main house or traditional stores. The average storage capacity was 2.6 tonnes while the largest volume stored by households was 0.7 tonnes of maize (highest among the stored grains). Storage losses were minimal for most of the grains. Although 14% of the households were aware of cereal banks, less than 2% used these facilities. Only 5% of the households were aware of the Warehouse Receipt System and none had used the system.

Information on commodity prices, commodity availability in the market and potential market/buyers for commodities were provided mainly by commodity buyers, family members and friends, fellow farmers, local markets and market information points in that order. Personal communication was the dominant mode of acquiring information on commodity prices and availability and potential market/ buyers for commodities.

On gender, the results have revealed that 24% of the households were headed by women, majority of whom were widows. These households had fewer assets and earned lower incomes compared to those headed by males. In addition, the level of adoption of productivity enhancing technologies such as inorganic fertilisers and improved varieties in staple production was lower.

Soil Health

Soil quality analysis is a pre-requisite to good soil fertility management. Kenya has a number of soil testing laboratories in the universities, national research organisations, international research organisations and fertiliser manufacturers. Although the Kenya Agricultural Research Institute (KARI) is the main provider of soil analysis services to the public, the institute has closed some of the regional laboratories due to lack of equipment, equipment breakdown among other

reasons. In addition, some of the regional laboratories that are open were found to be operating below capacity and lacking equipment for some types of analysis.

The fertiliser market which was liberalized in early 1990s has attracted over 10 importers, 500 wholesalers and 7,000 retailers. Fertiliser use has increased following the liberalization of fertiliser market with the total annual consumption rising from a mean of 250,000 MT in the 1990s to over 400,000 MT in the 2007/8 period. All key informants indicated that demand for fertiliser as a whole and for different fertiliser types has grown tremendously over the last two years. So has demand for new fertiliser types such as blends and foliar feeds. The off-take for fertiliser blends in 2008/9 was 60,000 MT (MoA). The use of DAP, the most popular planting fertiliser, has grown from 100,000 MT in the 2001/02 season to over 160,000MT in the 2008/9 season. The volume of other planting fertilisers (NPK's and SSP) has not been more than 20,000 MT. Use of topdressing fertilisers has also increased from around 85,000 MT in 2001/02 season to over 120,000 MT in 2008/09 season. Calcium Ammonium Nitrate (CAN) is the most commonly used topdressing fertiliser and its use has grown from around 45,000 MT in 2001/02 season to over 90,000 MT in 2008/09 season. On the other hand, the use of the topdresser UREA has not changed and remains at about 30,000 MT. Up to 2005/06 season, the use of specialized fertiliser fluctuated highly partly because of the low use of fertilisers by smallholder farmers due to the high cost against low output prices.

Almost all fertilisers used in Kenya (90%) are imported due to lack of raw materials for local factories and the high costs of importation of the raw materials. Only 10% of this fertiliser used is locally made and in this case, single super phosphate (SSP). Growth in manufacturing has been inhibited by lack of primary raw materials within the country. There are two fertiliser blending companies in Kenya, namely, Athi River Mining LTD and MEA LTD. The total volume of fertiliser blends produced in the country in the last 12 months was 50,000MT. The fertiliser blends currently available in the market are Mavuno basal, Mavuno top dress and NPK blends. These fertilisers are tailored for certain crops such as tea, coffee, pyrethrum and rice and are used by large-scale farmers. About 10% - 20% of farmers use fertiliser blends in Kenya and most small scale farmers use the conventional fertilisers like DAP and CAN.

The two laboratories producing biological fertiliser using Rhizobium inoculums are the University of Nairobi, Department of Soil Science laboratory and the Kenya Forestry Research

Foundation laboratory. Since January 2010, one of the fertiliser companies has embarked on production of biological fertiliser.

The Kenya Bureau of Standards (KEBS) is mandated to set fertiliser standards and carry out inspection and quality control mainly at the port of entry. According to KEBS, there is usually over 90% compliance to the standards of the mainstream and officially traded fertilisers. Most of the imported fertiliser (70%) arrives as bulk cargo (not bagged), the greatest challenge is therefore in adulteration and sale of underweight fertiliser which mainly occurs during bagging and re-bagging. Some 20 – 25% of fertiliser that leaves the port is re-bagged mainly at the retailer level due to the high demand of fertiliser in smaller units. Enforcement of measures by the Weights and Measures Department was rated by players in the chain as lax.

Agro-dealers are the direct suppliers of fertiliser to the farmers. Some 3,826 agro-dealers have been licensed by KEPHIS (KEPHIS, 2008) while 5,800 agro-dealers have been registered under the CNFA/AGMARK agro-dealer project. The distance that small holder households travel to access fertiliser has been declining over the last decade. It declined from 8 kilometres in 1997 to 3.4 kilometres in 2007.

Agro-dealers serving farmers who are located at an average radius of 5.5 kilometres. Many agro-dealers selling fertiliser also sold seeds, animal feeds, farm implements while a small number also sold foodstuff, non-farm hardware and other household goods. The main suppliers of the fertiliser to agro-dealers were wholesalers located between 10 and 60 kilometres away. In turn agro-dealers sold fertilisers to farmers who were located on average between 3 to 7 kilometres away and the months of largest sales were March and April. Some 38% of the agro-dealers sought credit and most of them received credit averaging at about US$ 12,930. Most of the credit was from fertiliser suppliers, microfinance institutions and commercial banks with an average repayment period was of months. The main constraints facing the fertiliser agro-dealers were inadequate supply during peak season, fluctuating prices and fluctuation in fertiliser demand. The initial capital for starting an agro-dealer business was estimated to be US$ 942 and the major source of capital was own savings followed by profits from other businesses. Some 35% of agro-dealers had undertaken investment in the past 12 months to expand their businesses.

Only a few agro-dealers (13%), indicated they were members of the Kenya National Agro-dealer Association (KENADA), which was registered in 2009.

Women mainly operate at the stockist level and none were identified at the importer and manufacturers' level and very few are distributers. Among the 80 agro-dealer respondents, 39% were females. Gender disaggregation of the owners indicated that 70% of them were male and 30% were females.

There are two government fertiliser subsidy schemes designed to increase resource poor household's fertiliser use and to protect them from high fertiliser prices. The National Accelerated Agricultural Input Access Programme aims to promote input use by improving access, affordability and incentives for poor small scale farmers who own land but cannot access inputs. In the cropping year 2008/2009 the number of targeted farmers was 92,000. Under this programme poor farm households were offered a free package (100% subsidy) comprising of one 50 kg bag of DAP and another of CAN. Another subsidy scheme was instituted by the government in 2008 to cushion farmers from the sharp increase in fertilizer prices. It involved a subsidy level of 34% for DAP and 42% for CAN fertilizers.

The general view of all the key chain players apart from farmers is that the direct subsidy to the farmers is the most non- supportive government policy that has been enacted in the fertiliser industry. The subsidy scheme is said to have been initiated without consultation with the players in the industry and hence not well structured and deemed to be injurious to the importers and the other players in the fertiliser supply chain.

Seeds

Maize seed dominates the formal seed sector with 97% of the market share. About 27,078 tonnes of certified maize seed was produced in 2008. Kenya Seed Company, the largest local seed company, accounted for about 90% of the formal seed in the 2008 planting season. Over the past 5 years, a total of 128 new varieties of staple crops were released in Kenya.

Distribution of seed is by agro-dealers. Maize and sorghum are the major crops for which agro-dealers stock seeds. However, seeds for beans, millet and green grams were stocked by very few agro-dealers. Nearly 87% of the maize seed purchased by agro-dealers was from wholesalers who are on average located 43 km away. The average distance to the nearest maize seed buyer was 6 km. The months of the largest sale were March and April in all the regions while October

sales were significant in the Central region.

Seed loss incurred by agro-dealers was overwhelmingly due to spillage during transportation (83.3%) while pest damage during storage was also important (66.7%). The maize seeds that are most susceptible to loss while on storage are SCDUMA 41, WS 505, DK 8031, KS 513, KS 6210, SCDUMA 43, and SIMBA 61. Seredo was reported in Nyanza as the sorghum variety that is most susceptible to loss while on the shelf.

Seed merchants obtain market information from various sources. Information related to source, quality, demand and suitability of seed in specific growing areas was mainly obtained from KARI and KEPHIS. Seed merchants also carry out market surveys in order to determine the demand for new improved seed or crop variety. Most agro-dealers in Central and Nyanza regions depended on the seed companies to get information about seed suppliers while their counterparts in the Western region depend on other seed stockists. Additionally, other seed stockists are an important source of information on seed suppliers in Nyanza province. Information on demand

for the seeds was mostly got from farmers' feedback. The two important sources of information on pricing are other seed stockists and seed companies. Information on the correct seed to sell is mainly got from the extension workers while farmer feedback is also an important source in Western and Nyanza regions. Agro-dealers get information on new seed varieties in the market largely from the seed companies but other seed stockists and radio are also important sources. Seed companies and farmer feedback are the two most important sources of information on seed quality.

Some 31% of the agro-dealers sought credit and 74% of them obtained credit of an average amount of US$ 1,988. The major sources of credit were commercial banks in the Central region and Microfinance institutions in Nyanza and Western regions. In the Central region, seed suppliers are an important source of credit for agro-dealers. Most of the agro-dealers and particularly in Central and Western regions pointed out that they had easy access to short term credit for their business. Only a few had easy access to long term credit. All the agro-dealers agreed that credit helps their seed businesses to grow.

The main constraints faced by seed merchants in running the seed business include a highly regulated sector, bad debts, difficult logistics, lack of capital for marketing and promotion of seeds. Constraints facing seed agro-dealers are inadequate seed supply, low demand due to seasonality of production and lack of capital.

Seed merchants indicated that when setting the selling price of seed, they consider the cost of production, margins, value to farmer, profitability and competitors' prices. The agro-dealers base their selling price on the buying price, profit margin, transport cost and rent charged.

Overall, only 13.5% of the agro-dealers indicated that they belong to an association. 50% of the agro-dealers belong to the Kenya Association of Agro-dealers (KENADA) while the rest belong to region specific associations.

There are two seed subsidy schemes both under the MoA namely, the National Accelerated Agriculture Inputs Access Programme (NAAIAP), and the Orphaned Crops Programme. Under NAAIAP, the government gave free maize seeds in 2009/2010 amounting to 750 tons (10 kgs of seed to 75,000 farmers). The Orphaned Crops Programme is aimed at diversifying sources of

food through promotion of indigenous crops that are drought tolerant namely, cow peas, pigeon peas, green grams, cassava, sweet potatoes, millets, and sorghums. Under this programme, the government through the Ministry of Agriculture and KARI has been spending US$ 3.88 million every year in production and distribution of seeds. Agro-dealers who participated thought that the process was too tedious and time consuming, too complex, that it took so long to process vouchers, it brought conflicts between them and their customers and there was uncertainty over whether payments would be made. This notwithstanding, delivery of seeds was timely and the agro-dealers benefitted since they were able to sell a higher volume of seeds.

Market Access

The most common markets for staples were the local markets which maybe: open-air markets, markets with perimeter wall and simple sheds and limited storage facilities or permanent enclosed markets which have basic infrastructural facilities and are operational all year-round. In addition to these market places, the NCPB buys and sells grains such as maize, wheat, beans, rice, millet and sorghums and also offers drying and other services related to grain marketing. The World Food Programme's Purchase for Progress programme is also a relatively new market outlet which farmers can use for staple crops.

Smallholder farmers mainly marketed their staple crops as individuals, the positive attributes of collective marketing notwithstanding. However, the few who were organized in groups were able to sell their staples to the WFP and to large processors such as the East African Breweries.

Pulses (beans) fetched the highest price followed by the cereals (led by finger millet, sorghum and maize). Roots and tubers (cassava) fetched the lowest price. Compared with wholesale prices prevailing in the respective regional markets, the price spread in western was lowest for maize followed by ground nuts and bananas. It was highest for sorghum followed by sweet potatoes, cassava and then beans. In Nyanza, the price spread was lowest for sorghum followeed by cassava and then maize. It was highest for beans, millet and sweet potatoes. In central, the price spread was lowest for cassava, followed by cowpeas, bananas and then maize. It was highest for millet, followed by dolichos, irish potatoes and sweet potatoes.

Market information services were provided by the Ministry of Agriculture and KACE. The volumes of inquiries made at KACE were much higher than the inquiries made at the MoA market information service points. The internet was the most frequently used mode for accessing information from MoA while short text messages was the most frequently used mode of acquisition information from KACE.

On storage, cereal banks have been initiated in 23 districts across Kenya under the NAAIAP programme and there is only one Warehouse Receipt System facility operating which is located in Nakuru. The NCPB is proposing to initiate a Warehouse Receipting System. It has over 110 warehouses with a storage capacity of over 1.8 million metric tonnes spread out throughout the major staple food producing regions.

In commodity trading, KACE has franchised MIPs and MICs to four pilot market resource centres (MRCs) which are located in Western Province of Kenya. In addition, KACE is also piloting a virtual trading floor through the use of a local FM radio station (West FM Radio Station) which integrates the MIS components of MRCs, SMS, and radio to concurrently provide timely market information and facilitate trade.

Products made from processing of staples were mainly flour and animal feeds. Maize was the main staple being processed. Grain flour millers sourced maize grain mainly from farmers, traders and the NCPB. The level of agro-processing of other staples (other than maize and rice) was minimal or non-existent in many areas. Processing of roots and tubers was mainly carried out by informal small and micro-enterprises owned by individuals or small groups. The product range included: cassava chips used in making flour for porridge and Ugali and composite flours. A similarly picture was observed in Nyanza, where groups are processing cassava, rice, maize, groundnuts, soya bean, amaranth, bananas, sweet potatoes, sorghum, and millets. In the central region cereals were milled and combined to make composite flours comprising millets, sorghum and grain amaranth.

Animal feed processors had an installed capacity ranging from 1,200 MT to 52,560 MT per annum while the utilized capacity ranged from as low as 1% to 60%. Grain flour millers had an installed capacity ranging from 394 MT to 39,420 MT per annum and the utilization ranged

between 5 to 72%. Maize germ and wheat bran were the most commonly used raw material amongst animal feed processors.

Among the staples that were used as raw materials, millet was the most highly priced at US$ 0.8 followed by sorghum, soya bean and cassava. Maize grain was the cheapest at US$ 0.33 to US$ 0.34 per kg. The margin or price spread for maize was small (US$ 0.01) while that for cassava and millet was large (US$0.35 & 0.3 respectively). The price spread when sorghum was purchased by a grain miller was US$ 0.43.

Agro-processors mainly purchased their raw materials from traders who in turn relied on the spot market sales from farmers and small traders in local and regional wholesale markets. Traders and agro-processors normally require elaborate systems (assemblers) and spend lengthy periods in aggregating the small volumes of staples purchased from individual farmers and small traders to large volumes for processing. Most processors provided their suppliers with credit to purchase raw materials and/or transport to ferry the raw materials from source to factory gate. They also had similar marketing arrangements with buyers of products Most of the processors had limited storage capacity for raw materials and hence processed the raw materials as they were purchased with implications on utilized capacity and costs of raw materials.

The value-added (as indicated by price spread) through processing of staples was: US$ 0.71 to 0.78 for sorghum, US$ 0.54 to 0.61 for millet, US$ 0.34 to 0.48 for maize, and US$ 0.41 to 0.61 for cassava.

Most of the processors (61%) of interviewed had sought for credit mainly from the bank and all of them had received. The amounts received ranged from US$ 1,940 to 51,720 for the animal feed processors and US$ 3,879 to 10,991 for grain flour millers. The interest rate ranged between 13 to 24%. Most of the agro-processors had a positive perception about accessibility to credit, the terms of credit and its effect on their agro-processing business.

The source of start-up capital was savings from the owners. The initial start-up capital for agro-processors was US$ 1,293 to US$ 387,900 for animal feed processors and US$ 453 to US$

15,516 for grain flour millers. All had invested further in their agro-processing businesses within the last one year. The source of such funds was retained earnings and loan/credit and the investments made were worth between US$ 582 to US$ 122,835.

Agro-processors source technical information on type of staples to process and quality control of products from technical experts and the regulatory bodies. Market information on supply, demand and pricing was obtained from other players in the market place.

On the operating environment for agro-processing constraints on the supply side are: lack of a government policy on agro-business and agro-processing to guide the development of the sub-sector; lack of legislation to enforce standards in the food industry (Food Sanitation Act); and lack of standards for use in manufacturing products from the relatively newer staples in agro-processing (cassava, sorghum, millets, pulses etc); the highly dispersed and small agricultural production units which increase the costs of acquiring raw materials; seasonality and reliance on rain-fed agriculture such that most firms operate at low capacity; poor rural road network and poor communication which constraints the search and collection of raw materials for processing, marketing and distribution of products; unreliable supply of water, energy and other inputs which constraints the manufacturing operations and increases costs; high and rising costs of repair and maintenance, energy, skilled labour, transportation and raw materials. On the demand side, agro-processing was constrained by low sales price due to the limited purchasing power.

PART I INTRODUCTION

1.0 BACKGROUND

1.1 Country Background

1.1.1 Kenyan Economy

Kenya lies along the equator bordering the east African coast to the east, Somalia, Ethiopia and Sudan to the north, Uganda to the west and Tanzania to the south. The country covers an area of about 587,000 square kilometres, out of which 11,000 square kilometres is under water. The country is currently divided into eight administrative regions (provinces) which are further divided into smaller regions known as districts. Each district is divided into smaller units starting with the divisions, locations, sub-locations and then villages - the smallest administrative unit. Individual household therefore belong to one of the numerous villages that are spread across the country.

Kenya's population is estimated at 38.6 million (Republic of Kenya, 2010)and is characterized by a large proportion of youth[1] (84%). Kenya's education index is ranked low (Kenya Economic Survey, 2008). The bulk of the population (84%) have just the basic level of education (primary level) and only 25 per cent have secondary level education while an even lower proportion (1.2%) has university level of education. A large proportion depends on the existing natural resource base for their livelihood.

Until 2007[2], Kenya had made remarkable improvement in economic performance. Between 2005 and 2007, the economy grew at more than 5% hitting a record high of 7.1% in 2007 (CBS, 2009). Investments and savings also showed a remarkable growth.

[1] Kenya's labour force has been growing at the rate of 3 per cent p. a. and is indicative of the rate at which employment opportunities need to be created.
[2] Since then, Kenya's economic performance was greatly affected by the post election crises and world economic crises.

The dependence of the Kenyan economy on agriculture cannot be overemphasized and is well portrayed by the relationship between the performance of the sector and that of the overall Kenyan economy (Figure 1.1).

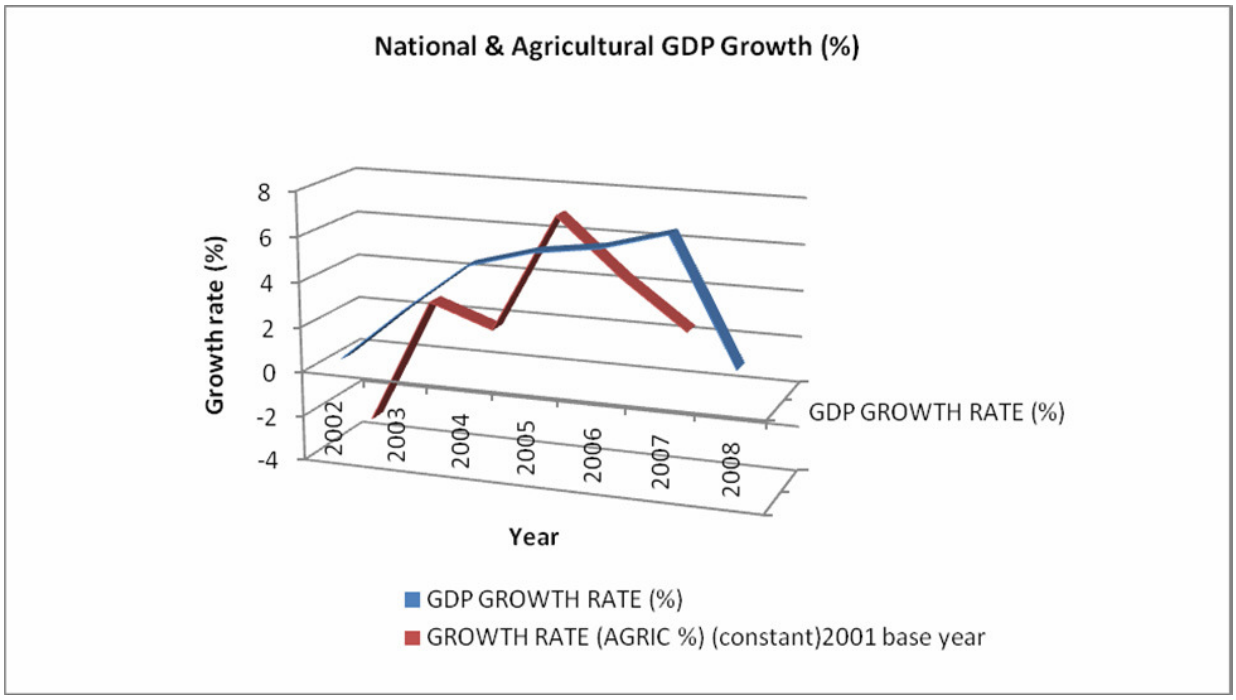

Fig. 1.1: Growth Rate (%) in National and Agricultural GDP

Generally, in the years when the agricultural sector has shown impressive growth, so has the national gross domestic product (GDP); when the sector has slipped, so has GDP. Currently, the agricultural sector is directly contributing 24 per cent of the GDP and an additional 27 per cent through linkages with manufacturing, distribution and service sectors. The sector provides 19 per cent of formal wage employment and 60 per cent of all Kenyan households are engaged in farming. Over 80 per cent of the population residing in the rural areas mainly depends on agriculture and fisheries for their livelihood. Food processing is one of the two major sub-sectors in manufacturing[3]. Informal trade in agricultural goods provides most of the employment opportunities in the country that are well distributed across all regions, all income groups and education status.

[3] The manufacturing sector contributes 10 per cent of the GDP

In-spite of the impressive economic growth registered before 2008, the country continues to grapple with two major challenges of poverty and food[4] insecurity. Although poverty levels have been declining over the years, approximately 46 per cent of the Kenyan population (and 50% for rural population) still live below the poverty line. In addition, substantial inequality exists across regions and between the rich and poor households. For example, the rural farming community constitutes 87 per cent of all poor households in Kenya. Further, only about two-thirds of the Kenyan population can be said to be currently food secure (KFSN Draft Policy). The growing problem of poverty, food and nutrition insecurity in Kenya has been linked to the disappointing growth in agricultural production (ASDS, KFSN). Although food insecurity is relatively high in the low agricultural potential areas, some of the hungry are smallholder farm households in the relatively well-endowed districts in terms of agricultural potential. The food shortage experienced in the last two years and the resulting high food prices are behind the rising inflation experienced within that period.

The agricultural sector's sub-optimal performance over the last three decades in terms of employment opportunities created, household income, regional inequalities and food insecurity (Kenya Economic Survey, 2009) is therefore of major concern.

1.1.2 Kenyan Agricultural Sector

The Kenyan Agricultural Landscape

Only 16 per cent of Kenya's landmass is of high and medium agricultural potential with adequate and reliable rainfall. The rest (84%) of the country is arid and semi-arid land (ASAL) with low and erratic rainfall that is categorized as unsuitable for farming under rain-fed conditions. The country has seven ecological zones that are suited to different agro-economic activities namely: Tropical Alpine, Upper Highland, Lower Highland, Upper Midland, Lower Midland, Lowland and Coastal Lowlands. The country could also be divided into three main production zones on the basis of rainfall.

i) The high rainfall zone, which receives more than 1,000 mm of rainfall annually which occupies less than 20% of the productive agricultural land and carries approximately 50%

[4] Inflation rate but has been increasing, an increase which has been mainly fuelled by increasing food prices.

of the country's population. Most of the food and cash crops as well as livestock are produced in this zone under semi-intensive and intensive systems.

ii) The medium rainfall zone, which receives between 750 mm and 1,000 mm of rainfall annually and occupies between 30 per cent and 35 per cent of the country's land area and carries about 30% of the population. A significant proportion of migrants from high rainfall zone move to the medium rainfall zone.

iii) Low rainfall areas, which receive 200-750 mm of rainfall annually. It is home to about 20% of the population, 80% of the country's livestock and 65% of the country's wildlife.

Kenya's agriculture is rain-fed with two cropping seasons which follow a bimodal rainfall pattern (except the high altitude areas with one long rainy season). Farming is predominantly under small-scale farmers with farms averaging at 0.2 to 3 hectares. Small-scale farming accounts for 75% of the total agricultural output and 70% of marketed agricultural produce. There is great potential for increasing productivity in smallholder production system because even though they produce over 70% of maize and over 95% of other food crops, adoption rates of improved seed, fertilisers and other technological advancements in crop protection and post-harvest handling is low.

Medium scale farms range from 3 to 49 ha and the farmers in this category are receptive to technology, invest in inputs, marketing of produce as well as borrowing credit for farm development. Large-scale farming is practised on farms averaging about 50 hectares for crops, where tea, coffee, maize, and wheat are grown and as well as keeping commercial livestock is reared. Productivity is high due to use of improved technologies and better farm management.

As is expected, the performance in rain-fed agriculture varies greatly between the production zones. Productivity is highest in the humid, higher altitude areas and low in the medium altitude, moderate rainfall areas with a relatively high risk of crop failure due to increased frequency of dry spells and an uneven rainfall distribution. The semi-arid and arid areas are characterized by frequent droughts and crop failure (one out of every three seasons). It is expected that productivity in medium potential areas can be increased through better selection of crops, adoption of improved technologies and better crop husbandry. In the semi-arid and arid areas

growing crops that are better suited for the rainfall regime will greatly increase productivity. Sustainability of agricultural production across all the production zones is undermined by, changing patterns of human settlement due to population pressure, poor and in some cases unsustainable land use systems and soil management practices.

Constraints to the Agricultural Sector

The major challenges that may explain the poor performance by the Kenyan agricultural sector are:

i) Low *Productivity:* Productivity levels for many crops are below potential, and yield and value over a five-year period have either remained constant or are on the decline.

ii) *Un-exploited potential:* Land remains under-exploited for agricultural production both in the high and medium potential areas as well as in the arid and semi-arid lands (ASAL). Moreover, much of the available crop land remains under-utilized with smallholders utilizing only 60 per cent of their land for agricultural production.

iii) *Access to lucrative Markets:* Inefficiencies in the supply chain resulting from limited storage capacity, lack of post-harvest services and poor access to input markets have constrained productivity of the agricultural sector. Due to this, the GoK Vision 2030 calls for proactive efforts to maintain existing markets and create new ones, and to increase Kenya's bargaining power in global agricultural markets.

iv) *Low Value addition:* There is limited value-addition to agricultural produce, coupled with high production costs. About 91% of Kenya's exports are in semi-processed form.

v) *Gender-related poverty*: Lessons learned from previous agricultural and other rural development projects show significant resource gaps between women and men. Although women are active in agriculture and development project activities, their capacity to accumulate resources, retain income and have a voice in decision-making bodies has been termed as low (KAPP). The impact of this gender discrepancy on economic growth has also been recognized in the GoK Vision 2030, the Agricultural Sector Development Strategy (ASDS) and its Medium Term Plan (MTP) 2009-2014.

vi) *Low budgetary allocation*: Table1.1 shows that in spite of the large contribution made by the agricultural sector, (24% of GDP), to the Kenyan economy, the sector only received 5% of the total budget in the 2008/9 financial year. The agricultural ministry under which staple food crops fall received only 3% of the budget. Insufficient budgetary allocation to the agricultural sector has been a key constraint by reducing the human resources and service delivery by government institutions. This has impacted negatively particularly on the staple food crops which have traditionally been served by government institutions. Kenya and other African countries committed under the Maputo Declaration to allocate 10% of their government's budget to agriculture.

Table 1.1: Contribution to GDP and Expenditure on Agriculture

Country Level Monitorable Indicators	**Baseline 2008/9**	
	Expenditure (Billion US$)	**Proportion of Public Expenditure (%)**
Gross Value of Agricultural Output - GDP	6.36	24
Share of public expenditure on agricultural sector	0.33	5
Share of public expenditure on agriculture ministry	0.20	3
Share of R & D in public expenditure on agriculture	0.01	0.15

vii) *Poorly developed rural infrastructure*: Rural areas where agricultural production occurs are characterized by poor rural roads and other vital physical infrastructure. Moreover, electricity is often not available or expensive. This translates to high transport costs for agricultural inputs and products and reduced investment especially in cold storage facilities, irrigation, and processing of farm produce.

viii) *Social Challenges*: There are serious social challenges which unless addressed, are likely to impact negatively on the development of the agricultural sector. These are: the high poverty afflicting a large number of Kenyans (46% fall below the poverty line) and agricultural producers are the single largest group among the poor (ASDS, 2009); the low education index for the rural population (it is lower than the national average); the aging rural population; and insecurity in the rural areas. The first three limit investments required for a modern and productive agricultural sector and hence agricultural productivity, competitiveness and innovativeness while the latter discourages investment.

1.2 Overview on AGRA

1.2.1 Background

The previous initiatives in sub-Saharan Africa to end hunger, raise the agricultural productivity, improve livelihoods and contribute to development as a whole have fallen short of their goal largely because technologies focused on a limited range of large cropping systems and irrigation, which were poorly suited for Africa's diverse agro-ecologies and rain-fed farming. In addition, the private sector and market forces have not risen to fill the gaps created by liberalization as was expected. Smallholder farmers were: without support from government institutions, unable to afford farm inputs, lacked access to extension, and experienced unstable prices for their farm products. The result is a structural decline of Africa's agricultural system that has led to massive poverty across rural areas. Africa has gone from being a net food exporter to a net importer. Per capita food production has declined as population growth rate of 3% a year has outstripped the 2% annual increase in food production. In 2003, Africa imported 43 million tonnes of cereals, including 25% of maize and 45% of rice consumed on the continent, at a cost of $7.5 billion. Africa is the only region in the world where food security has declined and poverty increased over the last 15 years (Bell *et al.*, 2008). Until recently, government and international support for agricultural development had declined.

The Alliance for a Green Revolution in Africa (AGRA) is a partnership of The Rockefeller Foundation and The Bill and Melinda Gates Foundation and the UK Department for International Development (DFID) working with African governments, other donors, NGOs, the private sector and African farmers to reduce hunger and poverty in Africa through agricultural development. In particular, AGRA responds to and strongly endorses the CAADP[5] initiative.

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[5] African leaders have recognizing that increased economic growth driven by agriculture is essential and will not be achieved and sustained through fragmented and isolated interventions formed the Comprehensive Africa Agriculture Development Programme (CAADP), an Africa owned and led initiative to boost agricultural productivity. Developed in 2002 by the AU's New Partnership for Africa's Development (NEPAD), CAADP presents a powerful vision for change and calls for "agricultural knowledge systems delivering profitable and sustainable technologies that are widely adopted by farmers resulting in sustained agricultural growth." Overall, CAADP's goal is to eliminate hunger and reduce poverty through agriculture. To do this, African governments have agreed to increase public investment in agriculture by a minimum of 10 per cent of their national budgets and to raise agricultural productivity by at least 6 per cent. CAADP integrates vulnerable populations into the mainstream development agenda and provides a framework for Africans to assist famine-prone countries tackle the root causes of hunger.

AGRA attributes Africa's entrenched and deepening poverty to the fact that millions of small-scale farmers, majority of whom are women working on farms smaller than one hectare, cannot grow enough food to sustain their families, their communities, or their countries. The challenges confronting these farmers extend across the entire agricultural value chain, from seeds, soil health, and water to markets and agricultural education. Most African farmers can neither access nor afford basic farm inputs. High quality seeds, organic and mineral fertilisers needed to replenish depleted soils, and simple water management systems that allow farmers to deal with erratic rains are largely beyond reach. Small-scale farmers also need the support of government policies that promote sustainable and productive agriculture and that ensure access to strong markets, extension services, and financial systems.

AGRA envisions that ending the poverty and hunger of hundreds of millions of Africans requires a clear focus on improving the lives of small scale farmers. Solutions which improve the productivity, biodiversity, and nutritional quality of food crops; practise sound agro-ecosystem management across different environments; support mixed crop-livestock farming systems; and consistently promote equity. Such solutions must be pro-poor and pro-environment. Therefore, AGRA aims to design programmes that provide practical solutions to significantly boost farm productivity and incomes for the poor while safeguarding the environment.

AGRA is therefore working to break the cycles of hunger and poverty in Africa through a comprehensive set of initiatives that will provide small-scale farmers with the tools and opportunities they need to boost their productivity, increase their incomes, and build better lives. It envisions working in areas that address the main aspects of a functional, sustainable food production system in Africa namely: Developing better and more appropriate seeds; Fortifying depleted soils with responsible use of soil nutrients and better management practices; Improving access to water and water-use efficiency; Improving income opportunities through better agricultural input and output markets; Developing local networks of agricultural education; Understanding and sharing the wealth of African farmer's knowledge; and Encouraging government policies that support small-scale farmers.

In AGRA's view, investments in African agriculture must focus on the continent's high-potential breadbasket areas. These are areas with large concentrations of smallholder farmers, relatively

good soil, rainfall, and infrastructure, and therefore, have the potential to transition rapidly from areas of chronic food scarcity to breadbaskets of abundance. AGRA's investments will support the millions of smallholder farmers who grow the majority of Africa's food, nurture the diversity on their farms, and bring about comprehensive change that strengthens the entire agricultural system.

AGRA is building a robust network of partnerships to help catalyze an African Green Revolution. It works with partners to fund and implement programmes, disseminate technologies, share knowledge and information and incorporate a rich diversity of approaches into their work. To date, AGRA partners include: NEPAD (CAADP); African National Government Institutions; Consultative Group on International Agricultural Research (CGIAR) and its research centres; National African Research Organisations; National affiliates of the U.S. Government's Millennium Challenge Corporation (MCC) in Ghana, Mali, Burkina Faso, and Mozambique; African National Universities; and African Financial Institutions.

1.3 Description of AGRA's Programmes

The primary goal of AGRA is to increase the productivity and profitability of small-scale farming using technological, policy and institutional innovations that are environmentally and economically sustainable. In pursuit of its goal, AGRA operates across four programmatic areas that are aimed at developing practical solutions to significantly boost farm productivity and incomes for the poor while safeguarding the environment. The four programmatic areas are the: Seeds, Soil health, Market Access and Policy and Partnerships. These are expected to work in an integrated manner with other crosscutting issues such as water, extension, and gender incorporated into the four programmes.

1.3.1 The seeds programme

The seed programme funds agro-ecology based crop breeding by national and local research programmes; coordinates with the CGIAR system to rapidly disseminate existing improved seed varieties; fosters the development of a vibrant, competitive seed sector; supports the development of national agro-dealer networks- village retailers who get farm inputs to remote farmers; partners with African universities to train the next generation of African agricultural

scientists; and advocates for seeds regulatory frameworks that make high quality, affordable seed available to smallholder farmers.

1.3.2 The soil health programme

The soil health programme focuses on rapid dissemination of locally adapted and environmentally sound integrated soil fertility management (ISFM) practices and water management. It funds and collaborates on a continent-wide project to map Africa's soils using advanced satellite and other technologies; develops fertiliser supply chains; funds training and extension programmes and advocates for soil health regulation.

1.3.3 The market access programme

The objective of the market access programme is to increase incomes and reduce poverty by promoting efficient, well functioning markets that will create market linkages for millions of smallholder African farmers. The assumption made is that markets are important because increases in agricultural productivity without corresponding market access improvements, drive down farm-gate prices due to localized gluts; this reduces farm incomes and makes farmers abandon new technologies and sometimes production thereby leading to low production. The programme therefore expects to address the staple crops market through interventions which will: reduce transaction costs for smallholder farmers; increase value addition in food usage; increase demand for food staples through alternative usage of these food items and promote an enabling environment for local and regional trade of food staples.

The market access programme is investing in: Direct Procurement (DP) i.e. facilitating linkages between farmer groups and top of supply chain players and/ or SMEs (e.g. WFP, Millers, large traders etc.); Market Development (MD) i.e. facilitating access to credit via guarantee funds, investment funds, and product development, MIS, Small medium agro-processing; Storage and Services (SS) i.e. increasing available storage capacity, particularly in main production zones and training farmers, traders and processors on structured trade systems e.g. warehouse receipts and commodity exchanges.

1.3.4 The policy and partnerships programme

This programme engages national governments and donors to establish an enabling environment for triggering a green revolution in Africa. This work includes strengthening national policy institutions; advocating for seeds, fertilisers and market policies at national and regional levels; and building national policy hubs to develop policies that will accelerate the access and adoption of new technologies by farmers.

1.4 AGRA's Monitoring and Evaluation (M & E) Strategy

1.4.1 AGRA's Expected Impact

AGRA is working to achieve a uniquely African Green Revolution: one that puts smallholder farmers first while protecting biodiversity, promoting sustainability and advancing equity. AGRA's strategy is a living strategy, whose implementation will be informed by its partners, from farmers' organisations to African governments, and whose effectiveness will be rigorously monitored to track results, and make adjustments as necessary to ensure that the benefits flow toward those with the greatest need. AGRA has three main goals it expects to achieve by 2020 through its interventions: reduce food insecurity by 50 percent in at least 20 countries; double the incomes of 20 million smallholder families; and put at least 30 countries on track for attaining and sustaining growth. Through its development programmes, AGRA expects the following impacts: expanded agricultural output; decreased rural hunger; increased rural household income; increased employment opportunities in rural areas; gender empowerment; and improved welfare of smallholder farmers, women, and their families.

Table 1.2 indicates AGRA's principal expected outcomes and their corresponding indicators at the four levels of apex reporting.

Table 1.2: AGRA's Apex Monitoring Report: Expected Outcomes and Preliminary Indicators[6]

Outcomes	Indicators
Portfolio 1 – Country[a] Level	
Functional National Agricultural Policy Hub	Quality of policy analysis, review and dialogue to advance CAADP agenda
High share (10% or more) of public expenditure devoted to agriculture including rural infrastructure and R&D	Share of public expenditure on agriculture Share of R&D in public expenditure on agriculture Share of outlays on rural infrastructure in public expenditure on agriculture
Domestic terms of trade that are neutral or favourable to agriculture	Level of disprotection/protection of agriculture sector
Sharply increased agricultural production	Change in agriculture GVO (gross value of output) Change in production of food-staples (tons) by crop
Portfolio 1 – Breadbasket Level	
Three to fivefold increase in output of food-staples	Food-staples production in tons by relevant crop(s) and annual percentage change
New and sustainable forms of farmer organisation	Number, type and age distribution of farmer organisations Proportion of women members in farmer organisations
Increased use of improved crop varieties/cultivars	Sales of improved seed (tons) Sales of inorganic fertiliser
Greater use of inorganic fertiliser by smallholders	Proportion of cropped area with improved soil health (organic matter content & moisture retention)
Extensive improvement in soil health	Price spreads by crop
Reduced transaction costs on crop inputs and outputs for smallholders	
Portfolio 1 – Smallholder Level	
• Awareness of improved technologies (esp. seed and ISFM) • Adoption of improved technologies • Sharply higher crop yields • Greater marketed surplus • Reduction in malnutrition among rural children	• Farmer knowledge of key elements of improved technologies by gender • Smallholder adoption rates of improved technologies by gender • On farm crop yields for relevant crops by gender • Average proportion of harvest sold (by crop) • Incidence of child malnutrition by gender
Portfolio 2 (Countries)	
• Demonstrated high level political commitment to agricultural development • Readiness for graduation to Portfolio 1 • Effective and synergistic AGRA Programme achievements in seeds, soils and markets	• Projected level and share of public expenditure on agricultural development in government medium term budget outlook or five year plan, • Tangible evidence of improving agricultural policy and sector management • Increased sales of improved seeds • Rising soil health • Improving market access and market information

[6] The activities, inputs and expected outputs that underlie these outcomes are fully described in AGRA's main strategy.

1.5 Objectives of the Baseline Study

A baseline study is an initial assessment which describes the current state of livelihood resources or the "capital" base from which different production processes are derived for each reference site. A good baseline is important because it can enable future assessments to answer the question: What would have happened to households/farms/organisations had AGRA not intervened?

Tegemeo Institute of Agricultural Policy and Development was contracted to undertake a baseline study for AGRA's interventions in Kenya. The baseline study was expected to provide an initial assessment of the situation in each reference site prior to AGRA's interventions Benchmarks were to be set against which subsequent evaluations of interventions will be pegged in order to determine whether the direction of influence and the magnitude of change are as envisioned or planned over time and among beneficiaries.

Terms of Reference (TORs) for Baseline Study

Tegemeo Institute and other contracted firms in the region were expected to design and conduct a multi-dimensional baseline study. The study included both qualitative and quantitative approaches with a variety of primary and secondary data sources including participatory methods. The data sources included data banks and monitoring and evaluation reports, interviews, focus groups, desk-top analysis, historical data and trends to cover all dimensions of AGRA. The contracted firms were expected to utilise documentary sources of information where these are available for statistical data. The consultants were also expected to liaise with Government information systems and those of other development partners in obtaining some of the already available data. In summary, the consultant was expected to:

- Design a multi-dimensional baseline study in collaboration with the AGRA Monitoring and Evaluation (M&E) Team;
- Conduct the baseline study in any or several of the 13 countries in collaboration with the AGRA Management Team and the Programme Officers;
- Develop an electronic database to store relevant data from the baseline study;

- Establish systems for analysing the data and for drawing up summaries readily, and
- Provide a tool-kit for AGRA M&E unit to conduct on-going and future baselines.

Specific activities:

- Design a comprehensive baseline study for AGRA and methodologies (giving special emphasis to the participation of the AGRA Management Team and Programme staff);
- Develop data collection techniques, formats and guidelines which will require significant participation of AGRA Management Team and Programme staff;
- Conduct the comprehensive base line study utilizing the tools and methods developed;
- Compile, analyse and validate the data collected for the baseline study and produce an analytical report;
- Design and develop an electronic database and appropriately store the study data in an easily accessible and interactive electronic format;
- Develop a tool-kit and guidelines manual on conducting baseline studies for future use by AGRA and its guarantees

1.6 Methodology

1.6.1 Approach

The methodological approach adopted was guided by the terms of reference (TORS) for the baseline study. AGRA works with different players/partners (government, research institutes, private sector, farmer organisations and legislators) to cause change across different types of players (processors, household, farm, institutions, organisation, government) and at various levels (regional, national, local, household and farm). The outcomes or changes due to AGRA's interventions are therefore expected to cut across these different players and levels. The design for this study was therefore multi-dimensional and multi-faceted, intergrating various approaches/methods in order to capture and synthesise information from the various sources.

Household level indicators

Farm household surveys were necessary to determine the welfare effects at the household level. The data needs for the proposed assessment were met using mainly a structured questionnaire. The instrument used was designed to capture the situation in agricultural production and socio-economic status of smallholder farm households. The design of the survey instrument allowed data capture at the plot, individual, household levels.

Market level indicators

In addition to establishing a baseline at the farm household, market and institutional levels, this study also established the behaviour, attitudes and power relations between households, organisations, institutions and markets.

Market studies were undertaken to establish the current situation in the selected input and output markets. The situation in the market was assessed using a combination of methods given the wide spectrum of players involved. For example, the seed industry comprised of research institutes and breeders, regulatory bodies, seed merchants, agro-dealers and farmers. The same can be said of the fertiliser industry and the output markets. Information for the input market was captured through reviews of secondary documentation, analysis of secondary data, and interviews with key players along different segments of the marketing chains. A formal survey of agro-dealers who operate close to the farmers was carried out in order to assess their current situation. The baseline for the output market was established through: 1) review of secondary documentation and analysis of secondary data; 2) case study approach of key players in the traditional and newly introduced markets and market related services for staples. For agro-processing, a review of secondary documentation, and case studies of staple crop processors was undertaken to establish the types, sources, volumes and value-addition to staples (raw materials).

Service provision

The capacity for research in soil health and crop breeding and in the provision of quality control service in soil health and in the seed industry was assessed through reviews of secondary documentation and key informant interviews. The current state of policy environment and

legislative and regulatory framework for seed, fertilisers and markets was established through reviews of documentation and key informant interviews.

1.6.2 Sampling Strategy and Sample Sizes

Sampling Strategy & Sample Sizes for Household Survey

AGRA has defined "bread basket" areas as those with high but unexploited agricultural potential and that are predominantly under the small-scale production system. In Kenya, AGRA has identified Western Kenya (Kakamega – Kisumu – Uganda border) and the Central Highlands as representing such bread basket areas. AGRA's focus in these areas is on increasing productivity and development of markets for staple crops. In Kenya, the staples that are predominantly produced by small scale farmers are maize, sorghum, millet, rice, sweet potatoes, cassava, beans, pigeon peas, cow peas, bananas and groundnuts.

The Kenyan baseline study was conducted within the identified breadbasket areas (Figure 1.2). Tegemeo Institute selected districts with high inclusivity of the staple crops. Selection of such districts was informed by the Ministry of Agriculture's annual reports (provincial and district levels). In the central highlands, four districts were identified namely: Muranga South, Tigania South, Mukuruweini and Kirinyaga East. The western region was further divided in two namely Western and Nyanza. In western Kenya, four districts were selected namely, Kakamega North, Teso North, Butula, and Bungoma West. Three districts were selected in Nyanza namely, Ugenya, Nyando, and Ndhiwa.

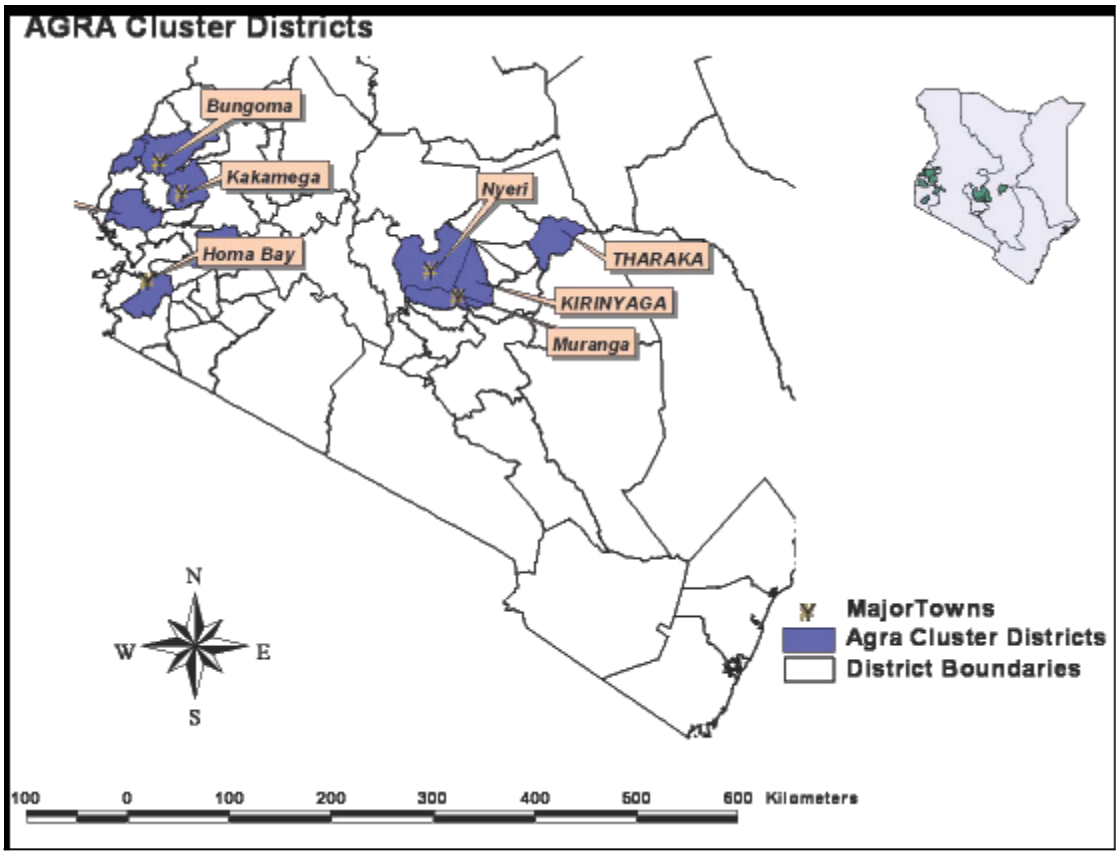


Fig. 1.2: Areas covered under AGRA Baseline Study

In each district, one or two divisions were selected based on their importance in production of the staple crops and in each of the selected divisions, two locations were randomly selected. A sub-location was similarly selected from each of the selected locations. In Butula and Mukurweini[7] districts, 2 sub-locations were selected in each of the selected locations. 2 villages were randomly picked in each of the selected sub-locations.

A listing of all the households in each of the selected villages was prepared by the Tegemeo team in conjunction with village elders and Assistant Chiefs. From these lists, a total of a 1,001 farm households were randomly picked. A population proportion to size (PPS) technique was applied in determining the number of farm households to be included in the survey in each administrative unit i.e. at the district, division and village level. The sample drawn for AGRA's baseline household survey is as shown in Table 1.3. It gives the sampled districts, the number of locations, sub-locations, villages and the total households in each district.

[7] Mukuruweini and Butula districts are yet to be divided into divisions and it is expected that the current locations will form the divisions.

Table 1.3: Sampled Districts and the Sample Size

Region	District	No. of divisions	No. of locations	No. of sub-locations	No. of villages	No. of households
Central highlands	Muranga South	2	4	4	8	100
	Tigania West	1	2	2	4	50
	Mukurweini	1	2	4	8	95
	Kirinyaga West	2	4	4	8	101
	Sub-total	6	12	14	28	346
Western Kenya	Nyando	1	2	2	4	50
	Ndhiwa	2	4	4	8	99
	Ugenya	2	4	4	8	103
	Kakamega North	2	4	4	8	105
	Butula	1	2	4	8	103
	Bungoma West	2	4	4	8	97
	Teso North	2	4	4	8	98
	Sub-total	12	24	26	52	655
Total		18	36	40	80	1001

Household level survey was augmented with information from the community which was collected using focus group discussions (FGD). The discussions were held at the sub-location level and elicited views from opinion leaders and farmers. Four FGD were held in central region and three in each of Western and Nyanza regions respectively.

Sampling Strategy & Sample Sizes for Agro-dealer Survey

For the agro-dealer survey, the Tegemeo team first established the registered or certified agro-dealers in Kenya. From these lists, agro-dealers falling within the division/location/sub-locations included in the baseline survey (see Table 1.3) were identified. In addition, a team from Tegemeo visited the study areas and listed the agro-dealers found at the division/location and sub-location levels.

Within each division, agro-dealers were sampled at the various administrative units i.e. division, location, sub-location and village level. The sample at higher administrative levels was drawn proportional to size i.e. divisions/locations with more agro-dealers had a proportionately larger number interviewed.

There was a special interest in agro-dealers closest to the households i.e. at the local trading centres. Therefore in all study areas, the sample at the administrative unit closest to the farmers (sub-location and village level) comprised of all agro-dealers.

Sampling Strategy and Sample Sizes for Seed Merchant Survey

A list of 78 seed merchants from the Kenya Plant Health Inspectorate Services (KEPHIS) was used by the research team to identify (with the help from KEPHIS) 25 merchants who produce or sell seed for staple crops. Tegemeo Institute contacted all the 25 merchants/companies via email and follow-up telephone calls. The seed merchant instrument was posted to each merchant via email and follow-up visits were made to their establishments. In-spite of the efforts made only a few merchants responded.

Sampling Strategy and Sample Sizes for Output market survey

MIS Sample

The MIS instrument was sent to the various institutions that provide market information services in Kenya namely, the Ministry of Agriculture, Kenya Agricultural Commodity Exchange (KACE) and KenCall. Two out of the three provided some information.

Warehousing

Preliminary search by the research team established the existence of only one functional warehouse. The Ministry of Agriculture has established cereal banks in 22 districts. Tegemeo Institute approached the two institutions with the request for information and made followed-ups to such requests by sending the instrument for warehousing/Cereal banks.

Agro-processors survey

Firstly, associations and institutions that are involved in agro-processing were approached with an aim of inventorising processors of staple crops. Lists[8] were received from the following organisations/institutions:

- The Cereal Millers Association (CMA)
- Small Millers Association
- The Association of Kenya Animal Feed Manufacturers (AKAFEMA) –
- Provincial Directors of Agriculture

[8] Contained in the database

- Ministry of agriculture – marketing and agribusiness department
- Tegemeo's listing of small and medium agro-processing firms in areas of study

Manufacturers using cassava for industrial use were obtained from secondary documentation and from internet resources. The two manufacturers identified are yet to respond to our request for information.

The second step was to select from these lists, the firms which process staple crops and to draw a sample that was representative in terms of size (by scale/capacity), staples processed and products. The instrument for agro-processing was then sent by email to the selected firms and follow-up calls made to book appointments for face to face interviews. Tegemeo also approached the associations for agro-processors for assistance in getting information. In-spite of these efforts, the response was low.

Local markets survey

Regional markets located in study areas were visited during the month of March 2010. The markets visited are: Meru, Embu, Murang'a, and Karatina in Central region and Kisumu, Kakamega and Bungoma in Western region.

Sampling Strategy for Key Informants in Seed and Fertiliser Industries

Lists were drawn, of institutions and offices (see appendices) which Tegemeo deemed conversant and authoritative enough to provide the relevant information on the various aspects in the two sub-sectors as detailed in the instrument for key informants. The instruments were shared with key informants via emails and wherever possible face to face interviews were held.

Sampling Strategy for Audit/Inventory

Lists were drawn of the institutions and offices to be approached for the information. The specific institutions were determined by the information needs as detailed in the instrument for inventory/audit and the discussions held during the harmonisation workshop. The institutions from which specific information was obtained are provided in the annex.

1.6.3 Baseline Data Sources and Data Collection

The following are the data/information sources and collection methods used in generating a baseline for AGRA's interventions:

- *Review of documentary evidence*
- *Collation and analysis of secondary data*

    - Time series data held in the Ministry of Agriculture, Statistical abstracts, multilateral organisations (FAO statistics), and research institutes like Tegemeo and KARI as well as data from regulatory bodies such as KEPHIS.

Collection of primary data

- ***Farm household surveys:*** a structured questionnaire was administered by enumerators in a face to face interview.

- ***Agro-dealer survey:*** a structured questionnaire was administered by enumerators in a face to face interview.

- ***Focus group discussions***: A semi-structured questionnaire/listing of issues was used as a guide for the moderator during discussions with the group.

- ***Case studies*** for agro-processing, seed merchants, warehouse/cereal banks and MIS: a structured questionnaire was posted to all that were selected. Face to face interviews were held wherever possible.

- ***Key informant interviews*** in the seed and fertiliser industry: The semi-structured questionnaires were to a large extent administered in face to face interviews or telephone interviews. The questionnaires were also posted to some of the key informants.

1.6.4 Data Management and Analysis

Primary data collected from households and agro-dealers were entered, cleaned, analysed and stored using the Statistical Package for Social Scientists (SPSS). Descriptive methods of analysis were used showing the frequencies, proportions, means and where necessary the mode and the

spread. Statistics were generated for each region and gender thus making it possible to make comparisons across regions and gender. Statistics for the entire sample are also provided to give the overall picture in these bread basket areas. Values and prices are reported in US$ using an exchange rate of US$ 1 to Ksh. 77.34. The exchange rate is an annual average for 2009 computed from average daily rates reported by the Central Bank of Kenya.

Primary data collected from other sources were entered, analysed and stored in Microsoft Excel. Given the limited number of cases (data points) due to non-responses/refusals, these data do not lend themselves to analysis or interpretation similar to that under the household or agro-dealer survey. The statistics obtained are therefore indicative and may not be generalised to the whole population.

1.7 Limitation of study

Despite the great success in implementing this baseline study, a few limitations/obstacles are worth mentioning to allow the results of this study to be interpreted within these confines. The main limitations of this study stem from the low response rate from the industry. There were many cases of unwillingness to participate, non-response or delayed response to requests for information by players in the seed, fertiliser and output markets. The small sample of respondents in agro-processing and seed merchants do not allow us to draw generalities on the current situation. Cases of incomplete or missing information were common while in some cases some of the secondary data was found to differ between data sources (e.g. seed production figures from Ministry of Agriculture (MoA) and Kenya Plant Health inspectorate Service (KEPHIS). Consequently, the respective sections of this document are by no means complete or exhaustive, but we have done our best to ensure that the data provided is reliable and serves the purpose well. It is also important to mention that some of the information that are relevant to the AGRA programs, for instance information on capacity building and agro-processing, could be best provided by the grantees implementing various projects/programs.

For sections that the research team was able to get sufficient primary data, namely the farm household and agro-dealer surveys, the results presented in this report fairly represent the situation on the ground and can be adequately generalized.

The study team did not assess the chemical and physical status of soils which required techniques that were beyond the resources available for this study.

PART II FARM HOUSEHOLD LEVEL BASELINE

2.0 BACKGROUND

The purpose of the household baseline survey was to capture information on farm households' status in terms of agricultural production, socio-economic, livelihood conditions and behavioural patterns, to form the basis for future monitoring and evaluation of the impacts of AGRA's interventions. It is expected that outcomes of AGRA's interventions at the household level will be manifested in the following ways. Improved soil health in small farms will be through greater use of inorganic fertiliser by smallholders, increased adoption of appropriate ISFM technologies by smallholder farmers, higher standards in applied soil and water management, and an enabling policy environment for ISFM adoption. Improved access to better seed by smallholder farmers will be through increased use of improved varieties and increased adoption of locally adapted new varieties of staple food crops. From improved market access, it is expected that there will be: reduced post-harvest losses, reduced transaction costs for farmers especially smallholders, greater use of Market Information Systems, significant increase in value addition by food processing industries, increased demand for food staples for alternative uses especially as animal feed. Access to markets and greater benefits derived from markets will have an effect on farm and individual behaviour thereby affecting productivity through technology adoption, greater input use, crop choice, and through increased labour productivity on and off-farm.

As indicated earlier section, farm household surveys were deemed necessary for laying a baseline upon which the effects/impacts of interventions at the household level will be monitored and evaluated. The survey was conducted within specified bread basket areas in Western Kenya (Western and Nyanza provinces) and Central Kenya. The following paragraphs highlight the main staple crops and other agricultural enterprises practised in these areas.

In Western Kenya, Kakamega North, Teso North, Butula, and Bungoma districts were the survey areas. In Kakamega North District, maize is the major staple food crop, with its production largely small-scale. Other important food crops are beans and cassava. The major livestock enterprises are cattle, poultry and bee keeping with the most important livestock enterprise being dairy cattle. The major staple crop enterprises in Teso District are sorghum, finger millet, groundnuts, cassava, maize, beans and sweet potatoes. Maize is grown as a commercial crop, but in small scale. Other cash crops include tomatoes and onions and tobacco. Indigenous poultry

and dairy are the most important livestock enterprises. In Butula District, the major staple crops are cassava, maize, beans, sweet potatoes, sorghum, finger millet and, groundnuts. Horticulture is also practised as a commercial enterprise. Livestock enterprises include zebu cows, indigenous poultry, dairy, goats and bee keeping. Maize, beans, sweet potatoes, finger millet and cassava are the most important staples in Bungoma North District, with maize leading. Sugar cane, tobacco cotton and sunflower are the main cash crops in the district. The district also has a high potential for production of horticultural crops. The most important horticultural crops are bananas, tomatoes, onions and chilies.

Ugenya, Nyando, and Ndhiwa districts were the survey districts in Nyanza province. The major staple food crops in Ugenya District are maize, beans, cassava, sweet potatoes, sorghum and finger millet. Rice is also produced in small quantities in some parts of the district. Livestock enterprises include zebu cows, indigenous poultry and goats. In Nyando District, the most important food crops are maize, beans, sorghum and rice. For the purpose of this survey, areas where rice production is dominant were selected. The most important livestock enterprise is cattle, which are kept mainly for dairy. Majority of the cattle kept are indigenous. Poultry is also an important enterprise and indigenous poultry are the dominant. In Ndhiwa District, maize, beans, millet, sorghum, groundnuts, and sweet potatoes are the main staple crops. Indigenous cattle and poultry are also kept by majority of the households.

The central Kenya districts where the household survey was conducted are Tigania West, Mukuruweini, Kirinyaga West and Muranga South. The main staples produced in Tigania West District are maize, beans, millet, pigeon peas, sorghum, cowpeas, sweet potatoes and Dolichos (*njahi).* Dairy cattle enterprises as well as poultry keeping are also practised. In Mukurweini District, the there are two zones; the coffee zone and the marginal coffee zone. The coffee zone is dominated by coffee production while the marginal coffee zone is active in the production of staples. The main staples produced are maize, beans, cowpeas, cassava and sweet potatoes. The survey focused on the marginal coffee zone where production of these staples is widespread. The dominant livestock enterprises are dairy cows and goats. In Kirinyaga West District, the main staples grown are sweet potatoes, pigeon peas, sorghum, maize and beans. Dairy production is also an important enterprise. Maize, beans, pigeon peas, cassava, sorghum and bananas are the

main staple foods grown in Murang'a South District. Dairy production is also an important enterprise.

A structured survey instrument was used to collect the following information, among others, on the sample of households:

- Agricultural production systems
- Agricultural marketing
- Demographic characteristics of household members
- Input use and technology adoption
- Access to and use of information and credit
- Food security
- Access to infrastructural facilities and public goods
- Ownership of productive resources
- Non-farm income generating activities.

Part II of the report discusses results of the descriptive analyses of household baseline survey data. Households' socio-economic and demographic characteristics are discussed as so are the households' agricultural production activities and their participation in agricultural markets. In addition, adoption of agricultural technologies by the sample households and their awareness of the various technologies are also examined. Households are also compared on the basis of gender of the household head in order to provide information on gender differences with respect to asset endowment, agricultural technology adoption and decision making mechanisms.

2.1 Household Socioeconomic Characteristics

This section describes the various characteristics that define the households that were interviewed. The socio-economic characteristics include household size and composition, age, gender and education of the household head, household asset endowment and household income and income sources. This section also includes information on quality of life indicators; food security, condition of the main house, water and sanitation and sources of cooking and lighting energy. In addition, access to infrastructural facilities and agricultural productive services are also explored.

2.1.1 Demographic Characteristics

The average household size was 5.7 members, with the number of adult equivalents[9] averaging 4.7 (Table 2.1) Households were largest in Western and least in central. The dependency ratio[10] averaged 1.2.

Table 2.1: Selected Household Demographic and Economic Characteristics

	Western	Nyanza	Central	Overall
Size and composition				
Household size	6.4	5.6	4.8	5.7
Adult equivalents	5.3	4.6	4.1	4.7
Dependency ratio	1.3	1.2	0.9	1.2
Gender of head				
% of female household heads	16.7	36.5	23.0	23.9
Age of household head (years)	49.9	52.8	53.0	51.7
Education level of head				
None	11.2	21.4	10.3	13.5
Primary	52.6	56.7	56.0	54.8
Village polytechnic	0.2	0.0	0.9	0.4
Secondary	30.4	17.1	24.1	24.9
College	5.5	4.8	7.5	6.0
University	0.0	0.0	1.1	0.4
Off-farm employment status of head				
% with businesses	35.9	29.8	17.5	28.0
% in informal labour employment	16.7	12.3	21.3	17.2
% in formal labour employment	13.2	10.7	10.1	11.5

Approximately 24% of the household heads were female, with the percentage highest in Nyanza (37%) and lowest in Western (17%). The mean age of the household head was 52 years, with heads in Central and Nyanza being slightly older (53 years) than their counterparts in Western (50 years). Over half of the household heads had primary level of education while 25% had secondary level of education. Less than 1% of the household heads had university education. Approximately 14% of the household heads had no formal education, with the proportion being highest in Nyanza. On off-farm employment, 28% of the household heads engaged in businesses while 17% and 12% respectively engaged in formal and informal labour employment.

[9] The number of adult equivalents was computed from the conversion factors in Annex 1.
[10] Dependency ratio is the ratio of the number of household members aged below 15 and above 64 years to the number of members aged 15-64 years.

2.1.2 Asset Endowment

Size of household land holding and value of physical assets and livestock are presented in Table 2.2. On average, a household owns 2.9 acres of land, with households in Central having smaller land holdings compared to their counterparts in Western and Nyanza. The value of household physical assets averaged US$ 2,376, with households in Central having the highest physical asset values significantly above this average. The value of all livestock units owned averaged US$ 425, with the value highest in Nyanza and lowest in Western.

Table 2.2: Mean Size of Household Land, Value of Physical Assets and Value of Livestock

	Western	Nyanza	Central	Overall
Land size (acres)	3.3	3.1	2.3	2.9
Value of physical assets (US$)	1365	1957	3854	2376
Value of livestock (US$)	360	472	465	425

2.1.3 Income

Household income is an indicator commonly used to gauge household welfare. Household annual income was computed as the aggregate of net crop income (value of crop production less cost of purchased inputs); net livestock income (sale of live animals plus value of products less purchased livestock inputs); net income from businesses run by all household members; wages received from informal labour activities by all household members; net salaries earned by all household members from formal labour employment; and remittances received by all household members. In order to get household income per capita, the annual income was divided by the number of household members.

The mean annual income for the households was US$ 1,892, with households in Western having slightly higher average income levels than those in Nyanza and Central (Table 2.3). However, annual per capita income was lowest in Western and highest in Central. In the overall, farm enterprises (crops and livestock) constituted 65% of the household annual income while activities off the farm accounted for the remaining 35%. Across the regions, farm activities constituted over 66% and 69% of household income in Western and Nyanza regions respectively, while in Central region the contribution of farm enterprises to household income was 60%. Disaggregating sources of on-farm income further reveals that crop enterprises are more important than livestock enterprises in terms of their share in on-farm income. On the off-

farm income sources, businesses are the most important. These results indicate the importance of agricultural enterprises to the livelihoods of the sample households.

Table 2.3: Household Means Annual Income and Income Composition by Activity

	Western	Nyanza	Central	Overall
Total household annual l income (US$)	1912	1880	1879	1892
Household annual per capita income (US$)	359	472	519	443
On-farm income				
Crops income	909 (51%)	902 (55%)	610 (39%)	803 (48%)
Livestock income	272 (15%	260 (14%)	331 (21%)	290 (17%)
Off-farm income				
Income from business	319 (17%)	356 (17%)	292 (14%)	319 (16%)
Income from informal labour	50 (5%)	20 (2%)	107 (11%)	62 (7%)
Income from formal labour	306 (9%)	285 (8%)	443 (10%)	348 (9%)
Remittance	56 (3%)	58 (4%)	95 (5%)	70 (4%)

In order to provide an indication of the of the distribution of income across households, the sample households were grouped into five classes (i.e. quintiles) based on their annual income levels, with each class comprising of approximately 20% of the sample. The mean annual income for the households in the highest quintile was 18 times higher than for those in the lowest quintile, suggesting high inequality in incomes among the sample households (Table 2.4). It is also observed that lowest quintile households have the lowest income across all the income components.

Table 2.4: Household Income Distribution

	Income quintile				
	Lowest	**2**	**3**	**4**	**Highest**
Total household annual l income (US$`)	277	727	1237	2000	5224
On-farm income					
Crops income	172	332	599	875	2038
Livestock income	17	169	322	430	510
Off-farm income					
Income from business	42	98	141	311	1004
Income from informal labour	30	70	82	69	60
Income from formal labour	3	33	62	212	1432
Remittance	14	26	30	103	179

2.1.4 Quality of Life Indicators

The quality of life indicators presented in this sub-section relate to food security and access to amenities. Specifically, vulnerability to and coping mechanisms against food insecurity, condition of housing, sources of water for domestic use, and access to infrastructural facilities and agricultural production services are explored.

2.1.4.1 Vulnerability to Food Insecurity and Coping Mechanisms

The mean number of months in the year during which a household had adequate food from own production is presented in Figure 2.1. On average, the sample households had adequate food from own production for eight months. This figure was lowest for Central (7.5 months) and highest for Nyanza (8.5 months).

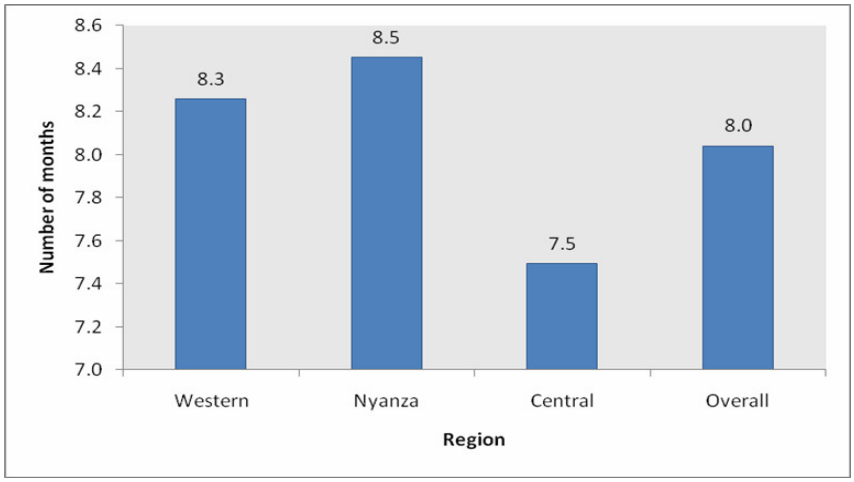


Fig. 2.1: Mean number of months of adequate food from own production

On average, 29% of the sample households reported having adequate food all year round from own production, with the remaining 71% having to resort to various strategies during some months in order to meet the shortfall of food from own production (Table 2.5). The first mechanism reported was reliance on mainly purchases (70% of the households). Less than 6% of the households relied on donations or relief.

Table 2.5: Coping Mechanisms against Food Deficits

	Western		Nyanza		Central		Overall	
	No. of hh	**% of hh**	**No. of hh**	**% of hh**	**No. of hh**	**% of hh**	**No. of hh**	**% of hh**
HH with adequate food from own production	95	23.7	81	32.1	111	31.9	287	28.7
Coping mechanisms								
1st mechanism								
Purchases	296	73.8	170	67.5	234	67.2	700	69.9
Donations	10	2.5	1	0.4	1	0.3	12	1.2
Relief	0	0.0	0	0.0	2	0.6	2	0.2
2nd mechanism								
Purchases	3	0.7	1	0.4	2	0.6	6	0.6
Donations	31	7.7	11	4.4	17	4.9	59	5.9
Relief	3	0.7	2	0.8	45	12.9	50	5.0
3rd mechanism								
Purchases	1	0.2	0	0.0	0	0.0	1	0.1
Donations	0	0.0	0	0.0	1	0.3	1	0.1
Relief	1	0.2	1	0.4	1	0.3	3	0.3

2.1.4.2 Access to Amenities

The condition of the main house for the sample households and the type of toilets they use are presented in Table 2.6. Majority (72%) of the households had iron-roofed houses while 27% had grass thatched houses. Approximately 67% of the households had houses with mud walls while 20% had walls constructed with bricks/stones. For floor material, 76% had earthen floors while 23% had cemented floors. Approximately 97% of the households used pit latrines.

Table 2.6: Condition of Main House and Type of Toilet

	Western		Nyanza		Central		Overall	
	No. of hh	**% of hh**	**No. of hh**	**% of hh**	**No. of hh**	**% of hh**	**No. of hh**	**% of hh**
Condition of main house								
Roofing material								
Iron sheet	216	53.9	180	71.4	328	94.3	724	72.3
Grass /makuti	184	45.9	71	28.2	19	5.5	274	27.4
Tiles	1	0.2	0	0.0	1	0.3	2	0.2
Plastic	0	0.0	1	0.4	0	0.0	1	0.1
Wall material								
Mud	340	84.8	215	85.3	111	31.9	666	66.5
Bricks /stones	43	10.7	24	9.5	132	37.9	199	19.9
Wood	0	0.0	0	0.0	94	27.0	94	9.4
Plastered	18	4.5	11	4.4	4	1.1	33	3.3
Iron sheet	0	0.0	2	0.8	7	2.0	9	0.9
Floor material								
Earth	339	84.5	196	77.8	230	66.1	765	76.4
Cement	62	15.5	56	22.2	115	33.0	233	23.3
Wood	0	0.0	0	0.0	3	0.9	3	0.3
Type of toilet								
Pit latrine	399	99.5	222	88.1	345	99.1	966	96.5
Bush	2	0.5	29	11.5	0	0.0	31	3.1
Flush	0	0.0	1	0.4	3	0.9	4	0.4

The distance to water sources and sources of water for domestic use and for irrigation are presented in Table 2.7. On average, households travel 0.5 km during the dry season to fetch water for domestic use. This distance reduces to 0.2 km during the wet season. During the dry season, most (34%) of the households get water for domestic use from streams/rivers.

Table 2.7: Distance to and Main Sources of Water for Domestic Use and Irrigation

	Western		Nyanza		Central		Overall	
Distance to water source								
Dry season (km)	0.4		0.5		0.7		0.5	
Wet season (km)	0.3		0.1		0.1		0.2	
Water sources	No. of hh	% of hh	No. of hh	% of hh	No. of hh	% of hh	No. of hh	% of hh
Dry season								
Stream /river	79	19.7	74	29.4	187	53.7	340	34.0
Well	100	24.9	61	24.2	59	17.0	220	22.0
Borehole	75	18.7	64	25.4	35	10.1	174	17.4
Protected spring	92	22.9	20	7.9	9	2.6	121	12.1
Unprotected spring	48	12.0	24	9.5	3	0.9	75	7.5
Piped into compound	2	0.5	8	3.2	39	11.2	49	4.9
Piped outside compound	2	0.5	1	0.4	8	2.3	11	1.1
Pond	2	0.5	0	0.0	3	0.9	5	0.5
Roof catchments	0	0.0	0	0.0	3	0.9	3	0.3
Lake	1	0.2	0	0.0	1	0.3	2	0.2
Water tankers	0	0.0	0	0.0	1	0.3	1	0.1
Wet season								
Roof catchments	132	32.9	154	61.1	238	68.4	524	52.3
Well	85	21.2	22	8.7	21	6.0	128	12.8
Stream /river	42	10.5	19	7.5	46	13.2	107	10.7
Borehole	41	10.2	24	9.5	10	2.9	75	7.5
Protected spring	57	14.2	8	3.2	3.0	0.9	68	6.8
Unprotected spring	39	9.7	13	5.2	3.0	0.9	55	5.5
Piped into compound	1	0.2	10	4.0	21	6.0	32	3.2
Piped outside compound	2	0.5	0	0.0	4	1.1	6	0.6
Dam /sand-dam	2	0.5	1	0.4	0	0.0	3	0.3
Pond	0	0.0	0	0.0	2	0.6	2	0.2
Water vendors	0	0.0	1	0.4	0	0.0	1	0.1
Irrigation								
No irrigation	373	93.0	177	70.2	296	85.1	846	84.5
Stream /river	20	5.0	56	22.2	43	12.4	119	11.9
Well	3	0.7	5	2.0	5	1.4	13	1.3
Unprotected spring	4	1.0	7	2.8	0	0.0	11	1.1
Piped	0	0.0	3	1.2	3	0.9	6	0.6
Lake	0	0.0	3	1.2	0	0.0	3	0.3
Pond	1	0.2	0	0.0	1	0.3	2	0.2
Protected spring	0	0.0	1	0.4	0	0.0	1	0.1

Approximately 22%, 17% and 12 % of the households got water from a well, borehole and protected spring respectively. During the wet season, over half of the households got water for domestic use from roof catchments while 13% and 11% respectively got water from well and streams/rivers respectively. On irrigation, 85% of the households reported having not been practising irrigation. Approximately 12% of the households got irrigation water from streams/rivers.

Virtually all households used forest products as source of cooking energy; 97% used firewood while 2% used charcoal (Table 2.8). On type of lighting, over half of the households used tin lamp while 41% used lantern, indicating that kerosene is the main source of lighting energy for the majority of the households. Only 3.2% of the households, and majority of them in Central region, had electricity in their houses.

Table 2.8: Household Cooking Energy Sources and Type of Lighting

	Western		**Nyanza**		**Central**		**Overall**	
	No. of hh	**% of hh**	**No. of hh**	**% of hh**	**No. of hh**	**% of hh**	**No. of hh**	**% of hh**
Cooking energy source								
Firewood	397	99.0	244	96.8	334	96.0	975	97.4
Charcoal	3	0.7	7	2.8	5	1.4	15	1.5
Gas	1	0.2	1	0.4	7	2.0	9	0.9
Paraffin	0	0.0	0	0.0	1	0.3	1	0.1
Solar power	0	0.0	0	0.0	1	0.3	1	0.1
Type of lighting								
Tin lamp	287	71.6	134	53.2	93	26.7	514	51.3
Lantern	106	26.4	106	42.1	195	56.0	407	40.7
Solar power	4	1.0	3	1.2	35	10.1	42	4.2
Electricity	2	0.5	7	2.8	23	6.6	32	3.2
Pressure lamp	2	0.5	2	0.8	2	0.6	6	0.6

Distances from the sample household's to various infrastructural facilities and agricultural production services are presented in Table 2.9. The distances can explain the ease with which households are able to access the facilities and services in question. On average, the sample households travel 0.2 km to reach a motorable road. However, the distance to tarmac/tar road is further (6.3 km), with households in the Western and Central regions travelling the longest and shortest distances respectively to reach a tarmac/tar road. Distance to electricity source and piped

water averaged 1.8km and 3.8km respectively. Primary and secondary schools appear to be in close proximity to majority of the households; 0.8km and 1.5km respectively. Health facilities and public telephone services are situated 2.3 and 3.8 km away, with the average distances varying among the regions. While permanent shopping centres are situated less than 2km away from the sample households in all the regions, permanent market centres are located approximately 3.3km away, with the distances shortest in Nyanza and longest in Central.

Table 2.9: Mean Distance (in km) to Infrastructural Facilities and Agricultural Production Services

	Western	Nyanza	Central	Overall
Infrastructural facilities				
Motorable road	0.2	0.3	0.2	0.2
Tarmac/tar road	8.7	5.9	3.8	6.3
Electricity source	2.4	2.0	1.0	1.8
Piped water source	4.2	4.4	2.8	3.8
Primary school	0.7	0.8	1.0	0.8
Secondary school	1.6	1.4	1.5	1.5
Health centre	2.4	2.4	1.9	2.3
Public telephone service	4.5	3.8	2.9	3.8
Permanent shopping centre	1.9	1.9	1.7	1.8
Permanent market centre	3.2	2.5	4.0	3.3
Agricultural production services				
Fertiliser seller	4.2	4.8	2.2	3.7
Improved seed seller	4.1	4.8	2.2	3.6
Extension service provider	5.3	5.8	5.3	5.4
Veterinary service provider	3.1	4.4	3.3	3.5

For agricultural production services, the distance to the nearest fertiliser and improved seed sellers respectively averaged 3.7 km and 3.6 km. These distances were highest in Nyanza region and more than double those in Central region. The distance to extension service providers averaged 5.4 km while that to veterinary service providers averaged 3.5 km. Again, Nyanza region has the longest distances to these services.

2.1.4.3 Gender Empowerment

One of AGRA's strategic objectives is "to develop and disseminate technologies that rapidly increase agricultural productivity in ways that are environmentally friendly and empower smallholder farmers, the majority of whom are *women"*. It is, therefore, important to understand the current position of the different gender with respect to their varied demographic and socio-

economic characteristics as well as decision making mechanisms in their respective households. This sub-section provides results of a comparative analysis between male and female headed households with respect to selected characteristics.

Female headed households were smaller in size and had more aged heads than their male headed counterparts (Table 2.10). A higher proportion of female (38%) than male (6%) household heads had no formal education. Approximately 37% of female heads compared to 60% of male heads engaged in off-farm employment activities.

Table 2.10: Selected Characteristics of Male and Female Headed Households

	Male	**Female**
Size and composition		
Household size	6.0	4.5
Adult equivalents	5.0	3.7
Dependency ratio	1.1	1.2
Age of head (years)	49.8	57.8
% of heads with no education	5.9	37.7
% of heads with off-farm employment	59.8	36.8
Land size (acres)	2.9	2.8
Value of physical assets (US$)	2,597	1,670
Value of livestock (US$)	457	321
% of households keeping livestock		
Any livestock	96.3	92.9
Cattle	73.5	61.5
Sheep and goats	50.0	43.5
Chicken	85.8	82.4
Other livestock	14.7	7.5
Number of livestock units		
All livestock	13.1	9.5
Cattle	2.2	1.9
Sheep and goats	1.7	1.5
Chicken	8.4	5.8
Other livestock	0.8	0.3
Household total income (US$)	2,129	1,136
% of hh with adequate food from own production all year round	30.3	23.4
No. of months of adequate food from own production	8.2	7.7
% of hh using inorganic fertiliser	74.2	52.7
% of cultivated area under inorganic fertiliser	61.4	58.8
% of hh planting improved varieties for staples		
Maize	71.6	44.5
Sorghum	5.8	1.2
Millet	1.8	0.0
Beans	2.4	0.9
Pigeon peas	0.0	0.0
Soya beans	5.6	0.0
Dolichos (njahi)	0.0	12.5

Table 2.10: Selected Characteristics of Male and Female Headed Households

	Male	Female
Cowpeas	0.7	2.1
Groundnuts	0.6	0.0
Cassava	1.9	0.0
Sweet potatoes	1.6	2.2
Irish potatoes	1.3	3.1
Bananas	6.4	2.6
Productivity (kg/acre) of staples		
Maize	934	890
Sorghum	350	336
Millet	342	733
Beans	183	148
Pigeon peas	133	37
Soya bean	172	99
Dolichos (njahi)	40	87
Cowpeas	65	93
Groundnuts	317	292
Cassava	861	549
Sweet potatoes	1,716	1,849
Irish potatoes	1,745	1,854
Bananas	1,338	750

Female headed households had lower asset endowment compared to their male headed counterparts, as observed in the value of physical assets and livestock. In addition, a lower proportion of female headed than male headed households own different livestock types and also own fewer numbers of these livestock. However, it is observed that the difference in the proportion of female and male headed households owning chicken and the small ruminants (sheep and goats) is smaller compared to the difference in the proportions owning cattle, suggesting that female headed households are more active in chicken and small ruminant enterprises than in cattle.

It is observed that female headed households had annual mean income that was just above half that for their male headed counterparts. Also, a lower proportion of households headed by females than those headed by males had adequate food all year round from own production.

On technology adoption, it is observed that a lower proportion of female than male headed households used inorganic fertilisers. Likewise, the proportion of households adopting improved varieties for most of the major staples was lower among female than male headed households.

Productivity levels of majority of the staples were also lower among households headed by females than among male headed households.

The decision making mechanisms in the households headed by respective gender are presented in Tables 2.11 and 2.12. Household land ownership and decisions regarding farm inputs are presented in Table 2.11. Three observations are made. Firstly, ownership of household land among male headed households is dominated by the male heads. Secondly, decisions concerning input use in these households seem to be made jointly between the male heads and spouses, with spouses assuming increasing roles in decisions concerning type of fertilisers and seeds to use as well as farm operations and timing of the operations. Thirdly, in households headed by females, ownership of land and all the decision making responsibilities on input use are heavily vested on the female heads. This probably could be due to the fact that the female heads do not have spouses. Some (87% of the female heads were widows while 7% were either divorced, separated from husbands or had never been married).

Table 2.11: Land Ownership and Main Decision Makers on Agricultural Activities by Gender

Household headship	Resource/Decision	Head	Spouse	Children	Head & spouse	Head, spouse & children	Household non-members	Total
		% of households						
Male	Ownership of land	76.8	0.4	0.0	19.8	1.0	2.0	100.0
	Renting-in land	54.7	5.0	0.4	38.6	0.5	0.8	100.0
	Renting-out land	55.6	4.1	0.5	37.9	0.5	1.3	100.0
	Type of fertiliser to use	40.0	15.7	0.7	42.5	1.0	0.0	100.0
	Type of seed to use	37.8	16.9	0.8	43.4	1.0	0.0	100.0
	Farm operations and timing	33.7	17.2	0.5	47.6	0.9	0.0	100.0
Female	Ownership of land	90.0	1.3	2.1	1.7	1.3	3.8	100.0
	Renting-in land	91.2	0.4	4.2	2.1	1.3	0.8	100.0
	Renting-out land	89.5	0.8	5.4	2.1	1.3	0.8	100.0
	Type of fertiliser to use	87.0	2.1	5.4	2.5	2.5	0.4	100.0
	Type of seed to use	87.4	2.1	5.9	2.1	2.1	0.4	100.0
	Farm operations and timing	90.4	1.3	3.3	2.1	2.1	0.8	100.0

Decision making on production, marketing and use of income from five most important enterprises to households is presented in Table 2.12. In male headed households, these decisions are mainly made in consultation between the male heads and their spouses. On the other hand,

females shoulder almost all production, marketing and income use decisions on the important enterprises in the households they head. Again this could be due to the majority of the females being without spouses with whom to share decision making responsibilities.

Table 2.12: Main Decision Makers on Production and Marketing of Five Most Important Enterprises in Households

Decision on	Decision maker	Household headship		
		Male	Female	Overall
		% of responses		
Production	Head	35.9	92.7	48.5
	Spouse	21.6	1.2	17.1
	Children	0.6	2.9	1.1
	Head & spouse	41.4	0.4	32.3
	Head, spouse & children	0.4	2.1	0.8
	Household non-members	0.0	0.7	0.2
	Total	100.0	100.0	100.0
Marketing	Head	29.9	94.4	44.2
	Spouse	23.8	0.7	18.6
	Children	0.5	3.2	1.1
	Head & spouse	45.5	0.4	35.5
	Head, spouse & children	0.3	1.4	0.5
	Total	100.0	100.0	100.0
Income use	Head	26.6	95.6	41.9
	Spouse	14.3	0.4	11.3
	Children	0.2	2.1	0.6
	Head & spouse	58.5	0.4	45.6
	Head, spouse & children	0.4	1.5	0.6
	Total	100.0	100.0	100.0

The enterprises mentioned among the five most important to the sample households are presented in Table 2.13. Maize, beans and cassava in that order top the list of these enterprises both among the male and female headed households. These are followed by sweet potatoes, cattle and sorghum among the male and sorghum, cattle and groundnuts among the female headed households. Targeting improvement in production and marketing of maize, beans, cassava and sorghum among the small holder farmers in the Western, Nyanza and Central

regions can be a double-edged sword in promoting food security and general welfare for both the male and female headed households in these regions.

Table 2.13: Frequency Distribution of Enterprises Mentioned among the Five Most Important to Households

Enterprise	Household headship		
	Male	Female	Overall
	Frequency (%)		
Maize	23.3	24.6	23.6
Beans	16.1	17.1	16.3
Cassava	5.5	7.1	5.9
Sorghum	3.6	6.4	4.3
Cattle	4.5	5.1	4.6
Groundnuts	3.3	4.4	3.6
Bananas	2.5	4.1	2.8
Sweet potatoes	4.7	4.0	4.5
Rice	1.5	2.6	1.8
Chicken	1.8	2.2	1.9
Others	33.2	22.4	30.8
Total	100.0	100.0	100.0

In summary, households headed by women, majority of who are widows, are more constrained in resource endowment and have lower incomes than their male headed counterparts. Their level of adoption of productivity enhancing technologies, specifically inorganic fertilisers and improved varieties of staple crops is also lower. The women headed household heads also shoulder the largest share of decision making responsibilities concerning household agricultural production and marketing decisions. These facts suggest that the need for empowering women engaged in agriculture cannot be overemphasized.

2.2 Production System

In this section, we present analysis results of agricultural production system of the sample households. Land tenure systems, soil fertility management practices and crops and cropping patterns are explored.

2.2.1 Land Tenure Systems

On average, the sample households cultivated 3.4 acres of land, with little variation across the regions. Majority of the cultivated land parcels were owned either without title deeds, with the exception of Central region in which 38% of the cultivated parcels were owned with titles. Approximately 19% of the cultivated parcels were rented, with the proportion highest in Western region and lowest in Central region (Table 2.14).

Table 2.14: Household Cultivated Land Size and Tenure Systems

	Western		**Nyanza**		**Central**		**Overall**	
Cultivated land size (mean acres)	3.2		3.4		3.4		3.4	
Tenure system (% of hh and mean acreage)	%	acres	%	acres	%	acres	%	acre
Owned with title	23.4	2.7	35.3	1.8	38.2	2.8	31.7	2.4
Owned without title	49.3	2.4	40.5	1.8	33.3	2.1	41.5	2.2
Leased	0.5	4.9	0.4	0.6	0.6	1.3	0.5	2.4
Rented	21.6	1.3	19.3	1.2	16.4	1.3	19.2	1.3
Owned by parent/relative	5.3	1.5	4.4	1.6	11.2	1.5	6.8	1.5
Owned by government			0.2	1.0	0.2	1.0	0.1	1.0
Communal/customary					0.2	2.0	0.1	2.0
Cooperative								

2.2.2 Soil Fertility Management Practices

Households' awareness and practice of various soil fertility management (SFM) technologies are presented in Table 2.15. While majority of the households are aware of most of the soil fertility management technologies, a lower proportion of the households actually practise them. It is only farmyard manure and inorganic fertilisers that are used by over 70% of the sample households, while terracing, crop rotation and use of grass strips are practised by just over half of the households. Use of lime and inoculums is very low, with less than 1% of the households practising the technologies.

On level of knowledge about the SFM technologies, in over half of the cases the farmers perceive themselves to be proficient in the application of the technologies (Figure 2.2). In 43% of the cases the farmers feel they have just some knowledge on the use of the technologies. Farmers' perception on their knowledge about application of individual SFM technologies is presented in Table 2.16.

Table 2.15: Percentage of Households Aware of and Practising Various Soil Fertility Management Technologies

Soil fertility management practice	Western		Nyanza		Central		Overall	
	% aware	% practising	% aware	% practising	% aware	% practising	% aware	% practising
Use of farm yard manure	93.5	69.3	91.3	61.1	99.7	92.5	95.1	75.3
Use of inorganic fertilisers	98.0	71.8	96.0	46.8	98.3	87.1	97.6	70.8
Terracing	89.8	58.6	75.8	42.1	91.7	57.2	86.9	53.9
Crop rotation	87.5	75.8	84.5	52.8	64.7	24.7	78.8	52.2
Grass trips	77.1	47.6	57.1	20.6	95.1	79.9	78.3	52.0
Wind breaks	62.8	38.9	63.1	26.2	65.5	42.0	63.8	36.8
Contour farming	56.4	38.9	70.2	38.9	51.4	27.3	58.1	34.9
Cut-off drains/soil bounding	67.1	42.6	65.9	48.0	45.4	12.1	59.2	33.4
Composting	84.0	46.4	56.7	25.4	53.4	13.5	66.5	29.7
Mulching/cover crop	68.1	38.7	71.4	21.4	66.4	19.0	68.3	27.5
Fallow	70.8	31.7	92.5	50.0	47.4	5.5	68.1	27.2
Afforestation	58.6	27.9	64.7	21.0	61.5	21.0	61.1	23.8
Agro forestry (other trees)	33.7	12.2	25.8	4.8	65.5	50.3	42.8	23.6
Growing legume crops	24.9	17.5	39.3	29.8	20.1	10.3	26.9	18.1
Slash and burn	67.3	20.7	77.8	26.6	39.7	4.3	60.3	16.5
Water pans/planting basins	11.5	7.0	35.3	17.9	16.1	6.3	19.1	9.5
Use of green manure fertilisers	33.7	12.2	20.2	6.0	25.9	6.6	27.6	8.7
Minimum tillage	17.7	6.0	43.7	11.5	23.6	4.3	26.3	6.8
Agro forestry (legume trees	27.2	11.5	29.8	3.6	10.1	2.0	21.9	6.2
Gabions/storm bands	33.9	3.2	39.7	5.2	45.1	3.2	39.3	3.7
Use of lime	9.2	1.2	6.7	0.0	8.6	0.9	8.4	0.8
Use of inoculums	1.7	0.2	1.2	0.0	0.6	0.0	1.2	0.1

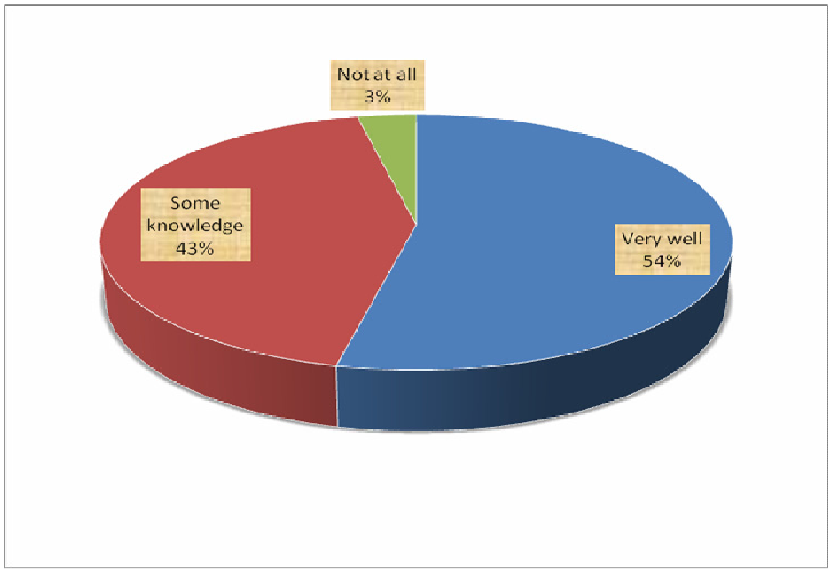


Fig. 2.2: Perception of farmers on their level of knowledge on soil fertility management technologies

Table 2.16: Perception of farmers on their level of knowledge on individual soil fertility management technologies

SFM technology	Very well	Some knowledge	Not at all	Total
Use of lime	28.6	50.0	21.4	100.0
Use of inoculums	33.3	41.7	25.0	100.0
Growing legume crops	52.8	45.0	2.2	100.0
Slash and burn	47.5	48.8	3.6	100.0
Use of farm yard manure	75.3	24.5	0.2	100.0
Use of green manure fertilisers	56.9	40.6	2.5	100.0
Use of inorganic fertilisers	58.3	37.8	3.9	100.0
Composting	54.1	43.2	2.7	100.0
Fallow	57.8	41.1	1.2	100.0
Cut-off drains/soil bounding	49.9	45.9	4.2	100.0
Gabions/storm bands	24.4	54.7	20.9	100.0
Agro forestry (other trees)	42.8	53.0	4.2	100.0
Agro forestry (legume trees	38.4	52.5	9.1	100.0
Afforestation	44.8	52.1	3.1	100.0
Grass trips	61.6	37.2	1.1	100.0
Water pans/planting basins	58.1	37.2	4.7	100.0
Crop rotation	56.1	42.6	1.3	100.0
Contour farming	50.9	46.7	2.4	100.0
Wind breaks	49.0	48.8	2.2	100.0
Minimum tillage	38.0	54.4	7.6	100.0
Mulching/cover crop	52.9	45.0	2.0	100.0
Terracing	57.5	40.2	2.3	100.0
Overall	53.6	43.0	3.4	100.0

2.2.3 Crops and Cropping Patterns

The percentage of households producing various crop categories and average area under the crops are presented in Table 2.17. Three observations were made from the table. First, cereals and pulses dominate the categories of crops produced by the sample households; over 90% of the

households produced them. Secondly, apart from cereals, pulses and tubers which were important food crops to the majority of the households, fruits and vegetables were the high value crops produced by over 70% of the households. Finally, fewer households produced various crop categories in the short season than in the main season.

Table 2.17: Percentage of households producing and acreage under various crop types

Crop type	Western			Nyanza			Central			Overall		
	No.	%	acres	No.	%	acres	No.	%	acres	No.	%	acres
Main season												
Cereals	393	98.0	1.3	251	99.6	1.6	347	99.7	1.3	991	99.0	1.4
Pulses	365	91.0	1.1	243	96.4	1.2	337	96.8	1.2	945	94.4	1.2
Tubers	296	73.8	0.6	130	51.6	0.5	185	53.2	0.7	611	61.0	0.6
Fruits	345	86.0	0.7	191	75.8	0.8	338	97.1	1.0	874	87.3	0.8
Vegetables	295	73.6	0.4	170	67.5	0.6	169	48.6	0.8	634	63.3	0.6
Industrial crops	147	36.7	1.4	37	14.7	1.3	150	43.1	0.8	334	33.4	1.1
Fodder crops	119	29.7	0.4	19	7.5	0.5	273	78.4	1.0	411	41.1	0.8
Other crops	27	6.7	0.4	16	6.3	0.8	47	13.5	0.6	90	9.0	0.6
Short season												
Cereals	236	58.9	0.8	224	88.9	1.2	335	96.3	1.3	795	79.4	1.1
Pulses	280	69.8	0.7	188	74.6	1.0	329	94.5	1.3	797	79.6	1.0
Tubers	122	30.4	0.4	42	16.7	0.3	71	20.4	0.8	235	23.5	0.5
Fruits	6	1.5	0.7	2	0.8	0.6	2	0.6	0.8	10	1.0	0.7
Vegetables	278	69.3	0.4	116	46.0	0.3	115	33.0	1.0	509	50.8	0.5
Industrial crops	4	1.0	1.2	0	0.0		0	0.0		4	0.4	1.2
Fodder crops	4	1.0	0.8	1	0.4	0.7	7	2.0	1.2	12	1.2	1.0
Other crops	1	0.2	0.1	0	0.0		1	0.3	0.5	2	0.2	0.3
Annual												
Cereals	395	98.5	1.8	252	100.0	2.6	347	99.7	2.6	994	99.3	2.3
Pulses	381	95.0	1.6	245	97.2	2.0	343	98.6	2.4	969	96.8	2.0
Tubers	326	81.3	0.7	140	55.6	0.5	191	54.9	1.0	657	65.6	0.7
Fruits	345	86.0	0.7	191	75.8	0.8	338	97.1	1.0	874	87.3	0.8
Vegetables	363	90.5	0.6	181	71.8	0.7	189	54.3	1.3	733	73.2	0.8
Industrial crops	150	37.4	1.4	37	14.7	1.3	150	43.1	0.8	337	33.7	1.1
Fodder crops	119	29.7	0.4	19	7.5	0.5	273	78.4	1.0	411	41.1	0.8
Other crops	28	7.0	0.4	16	6.3	0.8	48	13.8	0.6	92	9.2	0.6

The mean quantity produced and value of production for various crop types are presented in Table 2.18. In the overall, production quantities for industrial crops and fodder, which seen to be bulkier than the other crop types, were highest in the households' annual crop production. These were followed by cereals, vegetables tubers, and fruits. With regard to value of production, industrial crops and cereals constituted the highest proportion of total value of production (TVP) of 29% and 27% respectively. This pattern is mirrored across the regions. In Nyanza region, however, the contribution of cereals to the total value of household's annual crop production is exceptionally high compared to other regions.

Table 2.18: Mean quantity and value of production for various crops

Crop type	Western			Nyanza			Central			Overall		
	Quantity (Kgs)	Value (US$)	% of TVP	Quantity (Kgs)	Value (US$)	% of TVP	Quantity (Kgs)	Value (US$)	% of TVP	Quantity (Kgs)	Value (US$)	% of TVP
Main season												
Cereals	354	85	35.6	439	135	40.4	371	74	32	383	94	35.6
Pulses	103	61	11.9	54	34	9.7	87	54	11.6	83	50	11.2
Tubers Fruits	302	48	9.3	207	24	5.5	171	22	6.1	244	35	7.5
Vegetables	181	15	7.1	165	14	6.4	252	19	6.6	202	16	6.8
Industrial	239	33	6.8	238	30	5	418	74	9.4	285	43	7
Fodder crops	22,506	906	31	18,230	789	34.7	413	147	25.3	9,353	456	28.8
Short season	1,255	20	3.5	2,773	48	8.2	1,466	34	5.6	1,465	31	5.1
Cereals												
Pulses	203	55	15.6	276	95	25.6	153	42	12.8	203	61	17.3
Tubers Fruits	96	59	11.5	70	49	9.6	65	41	9.7	78	50	10.3
Vegetables	423	38	6.2	508	46	6.2	145	20	4.7	353	34	5.7
Industrial	1,152	220	9.2	1,600	453	54.5	5	2	0.4	947	197	12.2
Fodder crops	266	33	5.7	362	53	5.2	448	105	9.8	325	52	6.5
Annual	1,978	256	20.4			0			0	1,978	256	20.4
Cereals	939	12	2.3	1,267	106	56.6	1,423	13	4.1	1,250	27	7.9
Pulses												
Tubers	312	77	28.2	380	121	33.4	287	61	22.6	322	83	27.4
Fruits	100	60	11.7	61	40	9.6	77	48	10.6	81	50	10.8
Vegetables	329	46	8.4	262	28	5.7	165	22	5.7	268	35	7
Industrial	187	17	7.1	168	15	6.7	252	19	6.6	205	17	6.8
Fodder crops	251	33	6.3	285	39	5.1	429	85	9.6	301	47	6.8
	22,017	891	30.7	18,230	789	34.7	413	147	25.3	9,293	455	28.7
	1,244	20	3.5	2,630	53	10.7	1,465	33	5.6	1,459	31	5.2

2.2.4 Livestock Production Activities

Approximately 96% of the sample households had at least one livestock of whatever kind (Table 2.19). Chicken and cattle were the most widely kept of all livestock, with 85% and 71% of the households respectively keeping them. The number of livestock units kept by a household averaged 12, with chicken often kept in largest numbers. The number of cattle kept by a household averaged 2 while the number of sheep and/or goats kept also averaged 2 per household.

The value of all livestock units owned averaged US$ 425, with the value highest in Nyanza region and lowest in Western region. The value of cattle averaged US$ 351, with the value highest in Nyanza region and lowest in Western region. It should be noted that although the number of cattle owned by a household was lowest in Central region, the value of those cattle was very high relative to the other regions because most of these cattle were improved breeds, either grade or cross. The value of goats and sheep averaged US$ 43 while chicken's value per household averaged US$ 26.

The proportion of households that produced cow milk was 55%, with the proportion highest in Central region (62%) and lowest in Western region (51%). The annual cow milk production per household averaged 1,165 litres. Households in the Central region registered the highest milk production volume which is way above this average. This is due to the dominance of improved cattle breeds in the region relative to the other regions.

Table 2.19: Proportion (%) of households keeping livestock, mean number and value of livestock units kept and volume of cow milk produced

	Western	Nyanza	Central	Overall
% of households keeping livestock				
Any livestock	98.0	93.3	94.3	95.5
Cattle	67.3	69.8	75.0	70.6
Sheep and goats	41.4	46.8	57.8	48.5
Chicken	91.5	81.3	80.2	85.0
Other livestock	14.2	11.9	12.4	13.0
Number of livestock units				
All livestock	14.3	11.8	10.3	12.3
Cattle	2.0	3.2	1.7	2.2
Sheep and goats	1.3	1.9	1.8	1.6
Chicken	10.4	6.4	5.8	7.8
Other livestock	0.7	0.4	0.9	0.7
Value of livestock (US$)				
All livestock	360	472	465	425
Cattle	295	398	381	351
Sheep and goats	25	46	60	43
Chicken	35	22	20	26
Other livestock	5	6	3	5
% of households producing cow milk	50.9	52.8	62.1	55.2
Volume of cow milk produced (litres)	999	1,052	1,390	1,165

2.3 Production of Staples and Use of Productivity Enhancing Technologies

Households' staple production activities, including yield and production volumes and adoption of productivity enhancing inputs are presented in this section. Household's awareness of productivity enhancing technologies is also explored.

2.3.1 Production and Productivity (Yields)

Maize and common beans are the most popular staples among the sample households; over 90% of the households produced them during the 2008/09 cropping year (Table 2.20). Other staples produced by a considerable percentage of the households were bananas, sweet potatoes, cassava and cow peas. The popularity of the staples varies across regions, but maize and common beans are the two staples that are most widely grown in all the regions. The area under individual staple crops is generally less than one acre of land and this is reflected across all the regions. This indicates that most of the sample households are small holders in production of staples. It is worth mentioning that inter-cropping of staples, especially of maize and common beans, is the

norm rather than exception among most of the sample households, emphasizing that landholdings are quite small. Maize yield averaged 1,015 kg/acre (about eleven-90 kg-bags per acre) while that of beans averaged 175 kg/acre. Across the regions, yields in Nyanza are above while in Central they are below the average for most of the staples. Yields for most of the staples in Western region are near the sample averages.

Table 2.20: Percentage of households producing, mean yield (Kg/Acre), area (Acres) under and production volume (Kg) of various staples

Staple	Western				Nyanza				Central				Overall			
	% of hh	Area	Yield	Prod	% of hh	Area	Yield	Prodn	% of hh	Area	Yield	Prodn	% of hh	Area	Yield	Prodn
Maize	98.5	0.8	946	1,021	99.2	0.8	1,053	1,242	99.7	0.9	786	773	99.1	0.9	923	990
Sorghum	27.9	0.4	312	103	56.3	0.5	406	164	6.0	1.0	53	42	27.5	0.5	346	130
Millet	27.2	0.4	327	114	7.5	0.5	1,144	726	3.2	1.0	52	14	13.9	0.5	422	190
Beans	90.5	0.8	205	217	89.3	0.8	132	125	98.0	0.9	172	170	92.8	0.9	175	177
Pigeon peas	0.2	0.5	20	10	0.4	0.1	900	90	10.3	1.0	91	110	3.8	1.0	107	107
Soya bean	8.7	0.4	173	43	4.8	0.4	81	23	0.6	1.1	285	57	4.9	0.5	154	39
Dolichos (Njahi)	0.0				0.0				6.9	0.9	52	31	2.4	0.9	52	31
Cowpeas	31.7	0.3	98	16	52.4	0.5	63	20	23.3	1.0	55	27	34.0	0.5	74	20
Groundnuts	33.2	0.5	368	113	40.9	0.7	249	138	0.3	0.6	8	5	23.7	0.6	311	123
Sweet potatoes	61.3	0.3	1,849	440	41.3	0.2	2,177	413	17.5	0.9	568	214	41.1	0.4	1,744	400
Irish potatoes	1.0	0.3	624	182	1.2	0.5	2,123	412	30.5	0.6	1,816	211	11.3	0.6	1,777	215
Cassava	58.4	0.5	872	323	38.5	0.4	952	178	21.3	0.8	315	218	40.5	0.5	794	269
Bananas	56.4	0.6	1,327	403	52.4	0.6	1,310	339	86.2	0.8	1,033	513	65.7	0.7	1,194	438
Rice	0.2	0.2	263	75	20.6	1.1	1,409	1,588	2.6	1.1	885	898	6.2	1.1	1,308	1,461

2.3.2 Adoption and Intensity of use of Fertiliser and Improved Seed

The percentage of households using inorganic, organic and combination of inorganic and organic fertilisers, as well as the percentage of cultivated area under each of the categories of fertilisers are presented in Table 2.21. In the overall sample, 69% of the households used inorganic fertilisers while 77% used organic fertilisers. Approximately 43% of the households used a combination of inorganic and organic fertiliser. The pattern is reflected across the regions where a higher proportion of households used organic than inorganic and a combination of both fertilisers. However, the use fertiliser is more extensive in Central region than in Western and Nyanza regions. In Nyanza region, 47% of the sample households used inorganic fertilisers while 58% used organic fertilisers. The percentage of cultivated area[11] under inorganic, organic and a combination of both fertiliser were 61%, 52%, and 48% respectively. Regionally, Central leads while Nyanza lags in the percentage of cultivated area fertilized. Application[12] rate of inorganic fertiliser averaged 37 kg/acre while dose[13] rate averaged 81 kg/acre. Again, these rates were lowest in Nyanza and highest in central. The most popular inorganic fertilisers among the sample households were DAP, CAN, Urea, NPK (23:23:0) and NPK (17:17:0) in that order (Table 2.22).

[11] Cultivated area in the three regions is 3.2, 3.4 & 3.4 acres in Western, Nyanza and Central respectively

[12] Application rate refers to the amount of fertiliser applied per acre for all the cultivated land by the households that reported use of inorganic fertiliser during the cropping year.

[13] Dose rate refers to the amount of fertiliser applied per acre for fertilized plots only during the cropping year.

Table 2.21: Percentage of households using fertiliser and intensity of use

	Western			Nyanza			Central			Overall		
	Fertiliser type											
	Inorganic	**Organic**	**Inorganic & organic**	**Inorganic**	**Organic**	**Inorganic & organic**	**Inorganic**	**Organic**	**Inorganic & organic**	**Inorganic**	**Organic**	**Inorganic & organic**
% of hh using	70.9	75.1	35.1	46.8	58.3	18.3	83.2	92.2	71.1	69.1	76.8	43.3
% of cultivated area under fertiliser	52.6	37.3	31	47.3	38.4	30.7	74.6	72.8	60.1	60.9	52.3	47.5
Application rate (kg/acre)	31			26			48			37		
Dose rate (kg/acre)	61			56			112			81		

Table 2.22: Popularity of inorganic fertiliser types (% of households using)

Fertiliser type	Western	Nyanza	Central	Overall
DAP	50.5	57.7	19.7	36.5
CAN(26:0:0)	26.5	6.1	31.6	26.4
NPK (17:17:0)	5.4	0.3	14.7	9.2
UREA (46:0:0)	13.9	25.5	0.9	9.1
NPK (23:23:0)	-	0.3	17.8	8.6
Mavuno	-	1.4	6.4	3.3
Liquid fertiliser(foliar feeds)	3.4	3.2	2.3	2.8
NPK (20:20:0)	-	-	4.9	2.4
NPK (21:0:0)	-	5.2	-	0.7
NPK (20:10:10)	-	-	0.5	0.3
NPK (23:23:23)	-	-	0.7	0.3
Compound C	-	0.3	-	-
Lime	0.1	-		-
MAP	-	-	0.1	-
MOP	-	-	0.1	-
NPK (25:5:+5S)	-	-	0.1	-
NPK 22:6:12	-	-	0.1	-

The percentage of households planting improved varieties and the intensity of adoption of the varieties for various staple crops are presented in Table 2.23. Three observations are made. First, adoption of improved varieties is highest for maize (65% of households), while the remaining staples register adoption rates of between 0% and 6%. Secondly, adoption rate of improved maize varieties is very low in Nyanza; less than 30% of the sample households reported having planted improved maize varieties. Finally, the proportion of cultivated area with improved varieties is in most instances lower than the percentage of households planting the varieties, suggesting a lower intensity of varieties' adoption.

Table 2.23: Percentage of households using improved seed varieties and intensity of use on staples

Staple	Western		Nyanza		Central		Overall	
	% of hh	% of area	% of hh	% of area	% of hh	% of area	% of hh	% of area
Maize	77.0	70.1	29.6	21.8	77.2	67.3	65.1	56.9
Beans	1.7	1.3	1.3	1.2	2.9	1.7	2.0	1.4
Sorghum	2.7	2.7	4.2	4.2	14.3	11.9	4.4	4.2
Millet	1.8	1.8	0.0	0.0	0.0	0.0	1.4	1.4
Bananas	1.8	1.8	0.8	0.8	10.4	8.5	5.5	4.6
Cowpeas	1.0	0.9	0.0	0.0	2.5	2.1	1.1	0.9
Irish potatoes	0.0	0.0	0.0	0.0	1.9	1.4	1.8	1.3
Cassava	1.3	1.3	3.1	3.1	0.0	0.0	1.5	1.5
Groundnuts	0.0	0.0	1.0	0.6	0.0	0.0	0.4	0.3
Sweet potatoes	1.2	0.9	1.9	1.4	3.3	3.3	1.7	1.4
Pigeon peas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolichos (*njahi*)	0.0	0.0	0.0	0.0	4.2	4.2	4.2	4.2
Soya beans	5.7	5.7	0.0	0.0	0.0	0.0	4.1	4.1

The specific improved varieties planted by the sample households are presented in Annex 2. Maize had the highest number of improved varieties planted; 68 in the whole sample. The five most common improved maize varieties were H513, WS505, H614, Pioneer and DH4. The number of improved seed varieties reported was far much fewer for the other staples.

2.3.3 Awareness of and Sources of Information about Fertiliser and Improved Seed Varieties

While households are using particular fertilisers and/or improved seed varieties, they probably would be having knowledge of other types of fertilisers and/or improved seed varieties available in the market. The percentage of households that are aware of at least one fertiliser type is presented in Figure 2.3. On average, over 98% of the households are aware of at least one fertiliser type, with the percentages varying minimally across the regions.

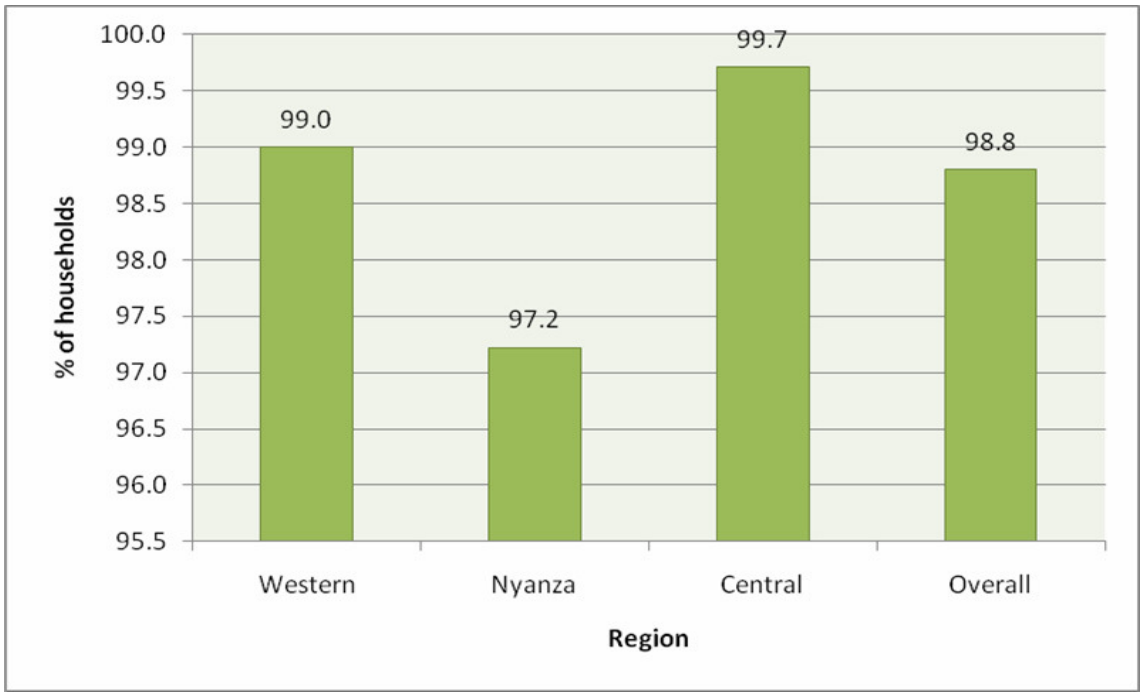


Fig. 2.3: Percentage of households aware of at least one type of fertiliser

The most widely known fertiliser types among the households are manure (which is organic), DAP, CAN and Urea (Table 2.24). Other fertilisers known by a considerable proportion of households are compost, NPK compounds, Mavuno (which is a blend of various fertiliser types) and foliar feeds. Less than 1% of the sample households reported knowledge of lime as a fertiliser.

Table 2.24: Percentage of households aware of various fertiliser types

Fertiliser type	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Manure	341	85.0	217	86.1	300	86.2	858	85.7
DAP	349	87.0	142	56.3	297	85.3	788	78.7
CAN(26:0:0)	291	72.6	69	27.4	299	85.9	659	65.8
UREA	184	45.9	114	45.2	61	17.5	359	35.9
Compost	169	42.1	49	19.4	34	9.8	252	25.2
NPK (23:23:0)	4	1.0	0	0.0	234	67.2	238	23.8
NPK (17:17:0)	15	3.7	0	0.0	222	63.8	237	23.7
NPK (20:20:0)	14	3.5	1	0.4	189	54.3	204	20.4
UREA (46:0:0)	81	20.2	9	3.6	76	21.8	166	16.6
Mavuno	45	11.2	19	7.5	95	27.3	159	15.9
Liquid fertiliser(foliar feeds)	48	12.0	12	4.8	58	16.7	118	11.8
NPK	78	19.5	3	1.2	0	0.0	81	8.1
NPK (20:10:10)	0	0.0	0	0.0	40	11.5	40	4.0
SA (21:0:0)	2	0.5	26	10.3	2	0.6	30	3.0
ASN(26:0:0)	3	0.7	3	1.2	18	5.2	24	2.4
NPK (23:23:23)	0	0.0	0	0.0	17	4.9	17	1.7
SSP	13	3.2	0	0.0	3	0.9	16	1.6
MAP	8	2.0	0	0.0	5	1.4	13	1.3
TSP	8	2.0	1	0.4	2	0.6	11	1.1
GREEN MANURE	11	2.7	0	0.0	0	0.0	11	1.1
Lime	6	1.5	0	0.0	2	0.6	8	0.8
DSP	2	0.5	1	0.4	4	1.1	7	0.7
MOP	0	0.0	1	0.4	5	1.4	6	0.6
NPK (25:5:+5S)	0	0.0	0	0.0	6	1.7	6	0.6
NPK (18:14:12)	1	0.2	0	0.0	3	0.9	4	0.4
NPK 17:17:17	2	0.5	0	0.0	1	0.3	3	0.3
NPK (15:15:15)	0	0.0	1	0.4	1	0.3	2	0.2
NPK 22:6:12	0	0.0	0	0.0	2	0.6	2	0.2
Compund C	0	0.0	1	0.4	0	0.0	1	0.1
Compund D	1	0.2	0	0.0	0	0.0	1	0.1
Kero green	0	0.0	1	0.4	0	0.0	1	0.1
NPK 18:18:18	0	0.0	0	0.0	1	0.3	1	0.1
NPK 14:14:20	1	0.2	0	0.0	0	0.0	1	0.1

On improved seed varieties, 88% of the households are conversant with at least one variety of maize, while 27% are familiar with at least one variety of common beans (Table 2.25). Awareness of improved varieties for the other staples is very low among the households. This is also reflected in the low adoption rates of the varieties for the staples among the households.

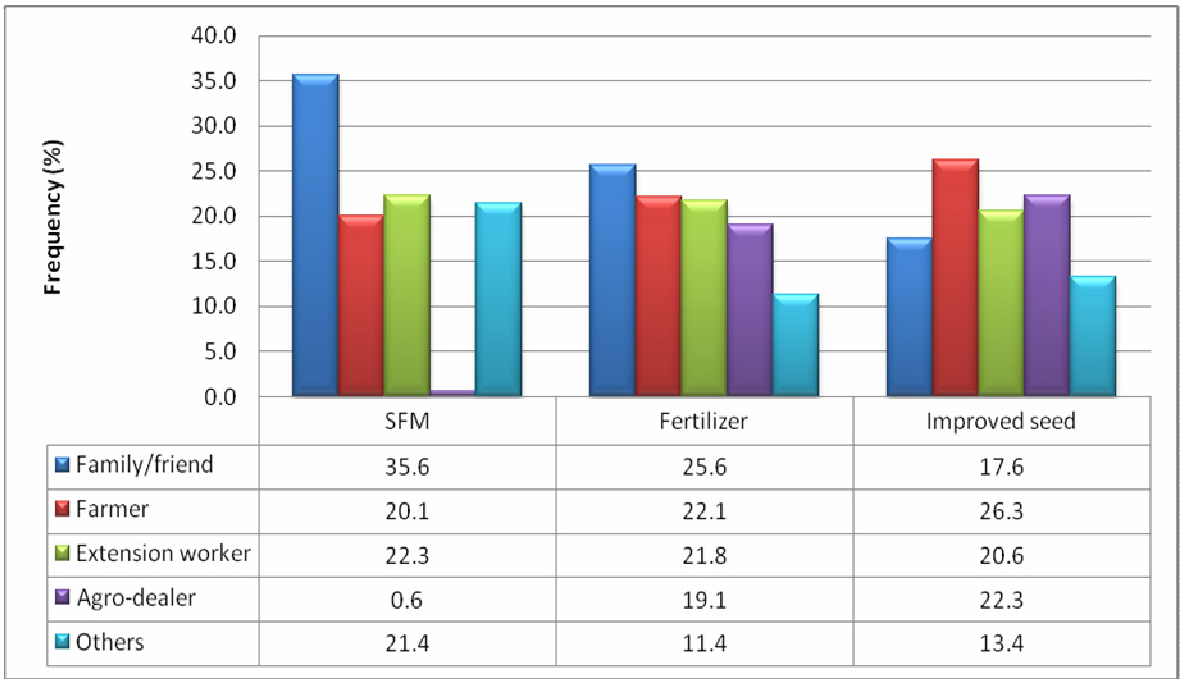
Table 2.25: Percentage of households aware of at least an improved variety for staples

Staple	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Maize	367	91.5	171	67.9	346	99.4	884	88.3
Sorghum	5	1.2	22	8.7	8	2.3	35	3.5
Millet	2	0.5	0	0.0	0	0.0	2	0.2
Rice	4	1.0	49	19.4	20	5.7	73	7.3
Beans	81	20.2	50	19.8	140	40.2	271	27.1
Cowpeas	1	0.2	0	0.0	2	0.6	3	0.3
Soya bean	2	0.5	0	0.0	0	0.0	2	0.2
Cassava	25	6.2	3	1.2	3	0.9	31	3.1
Sweet potato	5	1.2	5	2.0	15	4.3	25	2.5
Irish potato	0	0.0	0	0.0	18	5.2	18	1.8
Banana	13	3.2	3	1.2	106	30.5	122	12.2

The frequency distribution of particular improved seed varieties for staples of which households were aware is presented in Annex 3. Again, the number of improved varieties known is highest for maize (133). The most widely known five maize varieties are H513, Pioneer, H614, WS505 and SCDUMA41, in that order.

The sources of information about soil fertility management (SFM) technologies in general, fertilisers and improved staple crop varieties are presented in Figure 2.4. It is observed that families/friends, fellow farmers and extension workers are the main sources of information about SFM technologies and fertiliser to the farming households. On improved varieties, the main sources of information are fellow farmers, agro-dealers and extension workers in that order. The overall pattern in sources of information is also observed across the regions (Table 2.26).

Concerning input prices, the main providers of information to the sample of households are agro-dealers, fellow farmers and family members and friends in that order (Figure 2.5).



	SFM	Fertilizer	Improved seed
Family/friend	35.6	25.6	17.6
Farmer	20.1	22.1	26.3
Extension worker	22.3	21.8	20.6
Agro-dealer	0.6	19.1	22.3
Others	21.4	11.4	13.4

Fig. 2.4: Sources of Information about SFM, fertilisers and improved seed varieties

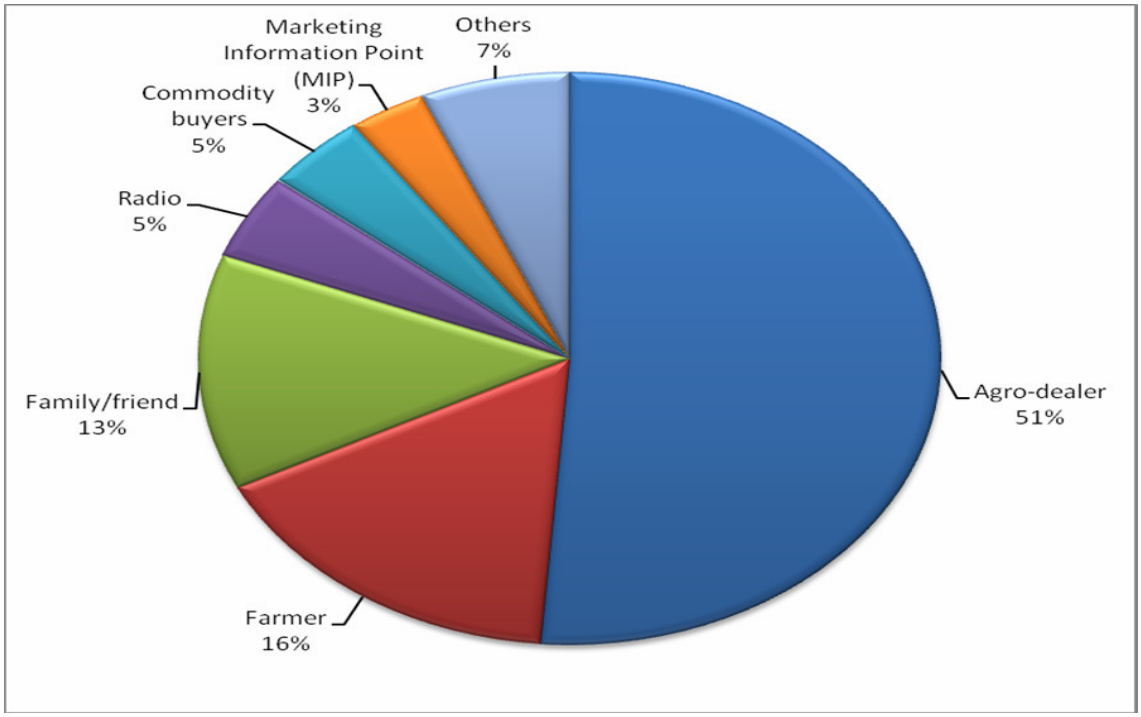


Fig. 2.5: Sources of information for households on input prices (% of Households Using Source)

Table 2.26: Sources of Information about SFM, fertilisers and improved varieties across regions

Information source	Western			Nyanza			Central			Overall		
	SFM	Fertiliser	Improved seed	SFM	Fertiliser	Improved seed	SFM	Fertiliser	Improved seed	SFM	Fertiliser	Improved seed
	Frequencies (%)											
Family/friend	29.6	33.2	24.1	41.0	33.0	15.2	37.1	16.8	13.3	35.6	25.6	17.6
Farmer	16.4	20.5	25.4	19.2	26.3	27.9	23.6	22.0	26.4	20.1	22.1	26.3
Extension worker	33.4	17.9	13.0	13.6	17.4	20.6	18.9	26.5	26.3	22.3	21.8	20.6
Agro-dealer	1.1	15.0	20.8	0.1	11.0	17.1	0.4	25.3	24.9	0.6	19.1	22.3
Others	19.5	13.4	16.8	26.1	12.2	19.2	19.9	9.3	9.0	21.4	11.4	13.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

On modes of acquiring information about fertilisers and improved seed varieties, personal communication is the dominant mode (Figure 2.6). Other modes of information acquisition used but to a limited extent include seminars/meetings, community meetings (*baraza*), and formal training. This pattern is also observed across the regions (Table 2.27). However, radio plays quite an important role in providing information about improved seed varieties in Western relative to Nyanza and Central.

Just as in fertiliser and improved maize seed, personal communication dominates the modes of acquisition of information on input prices (Figure 2.7).

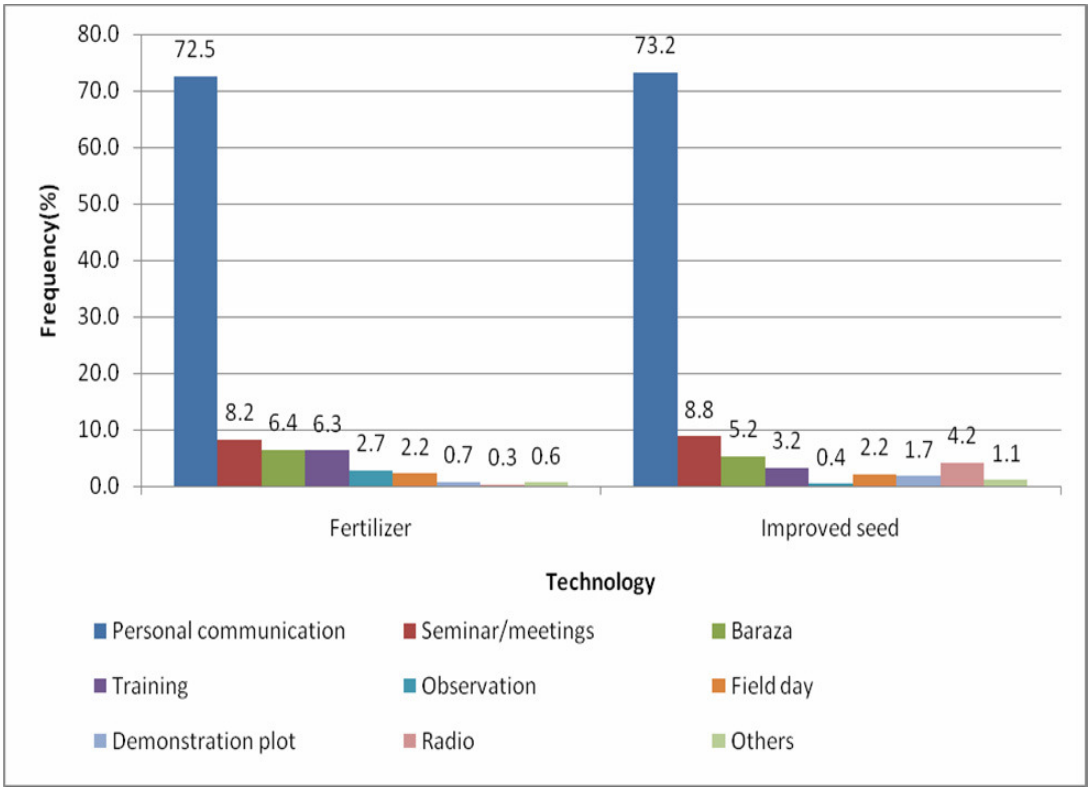


Fig. 2.6: Modes of acquiring information about fertilisers and improved seed varieties

Table 2.27: Modes of acquiring information about fertilisers and improved seed varieties across regions

Mode of information acquisition	Western		Nyanza		Central		Overall	
	Fertiliser	Improved seed	Fertiliser	Improved seed	Fertiliser	Improved seed	Fertiliser	Improved seed
Personal communication	71.5	73.1	75.3	66.6	72.5	75.3	72.5	73.2
Seminar/meetings	10.6	6.6	4.8	11.1	7.3	9.7	8.2	8.8
Local administration meeting (baraza)	5.1	5.7	7.6	7.5	7.1	4.2	6.4	5.2
Training	6.6	1.4	6.5	8.2	6.0	3.2	6.3	3.2
Observation	3.4	0.2	3.0	0.4	2.1	0.6	2.7	0.4
Field day	1.3	2.4	0.7	0.6	3.4	2.5	2.2	2.2
Demonstration plot	0.4	3.5	0.9	1.4	0.9	0.5	0.7	1.7
Radio	0.4	6.0	0.4	2.7	0.3	3.3	0.3	4.2
Promotional campaigns	0.5	1.1	0.6	0.1	0.1	0.2	0.3	0.5
Brochures/ pamphlets	0.1	0.0	0.1	0.4	0.2	0.4	0.2	0.3
SMS	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.0
Telephone	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0
Internet	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.1
Reading	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1
Work place	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

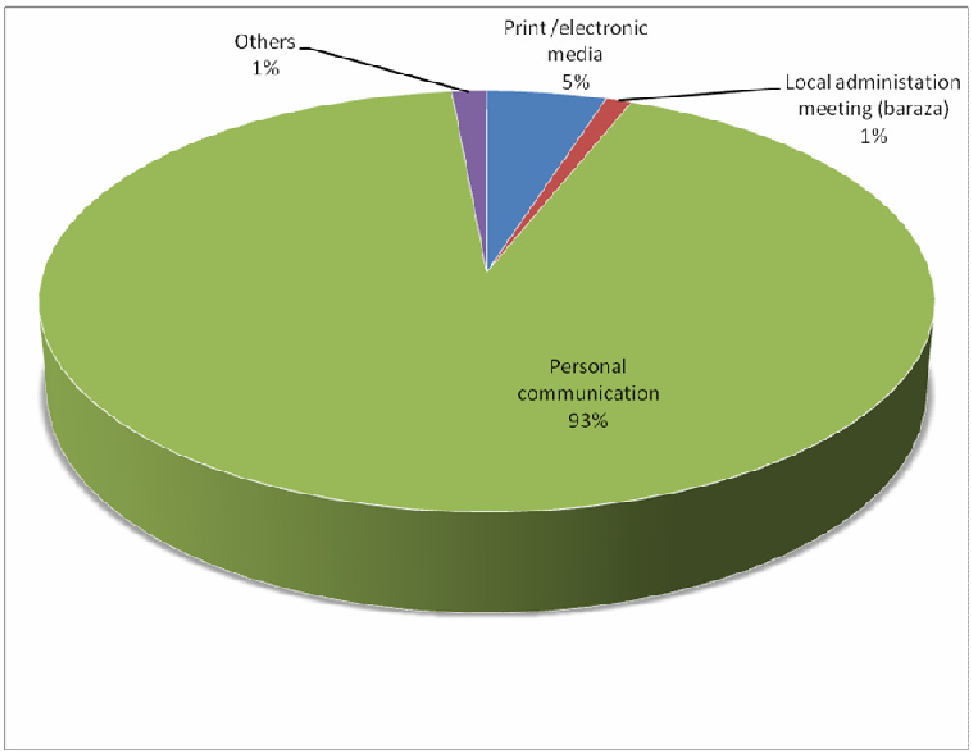


Fig. 2.7: Modes of Acquiring Information about Input Prices

2.3.4 Access to Input Markets and Financial Services

There is consensus that increased use of quality seed and fertilisers is an essential ingredient in agricultural development and food security in Africa (Rosegrant *et al.*, 2001). Accessibility to the markets for these inputs by farming communities is thus important. To undertake productive investments in agricultural technology, the farming communities require sufficient access to financial capital. Reliable rural financial services are, therefore, very important for facilitating activities that spur agricultural productivity and growth in the rural areas. In this sub-section a comparison between the distance from where farmers purchased fertilisers and improved seed varieties and the nearest sellers of these inputs is made. Households' access to financial services is also examined.

It is observed that households purchased fertilisers and improved seed varieties from markets that are farther than those nearest to them (Table 2.28). This may be an indication that the nearest markets for these inputs may not be necessarily offering these inputs to the satisfaction or expectation of the households.

Table 2.28: Distance to input markets, access to financial services

	Western	Nyanza	Central	Overall
Distance to input markets				
Nearest fertiliser seller (km)	4.5	2.5	2.2	3.2
Where fertiliser was bought (km)	5.0	3.6	4.5	4.6
Nearest improved seed seller (km)	4.0	4.6	2.1	3.2
Where improved seed was bought (km)	5.1	5.2	4.5	4.8
Access to financial services				
% of hh seeking agricultural credit	10.2	11.5	11.8	11.1
% of seekers receiving agricultural credit	80.5	86.2	90.2	85.6
Mean amount of credit sought (US$)	264	260	153	222
Mean amount of credit received (US$)	220	118	126	157
Intended uses of the credit (%)				
Input purchases	54.8	41.4	72.1	57.9
Land preparation	26.2	51.7	23.3	31.6
General agricultural production	11.9	0.0	0.0	4.4
Marketing	4.8	0.0	0.0	1.8
Weeding	0.0	6.9	0.0	1.8
Building zero grazing unit	0.0	0.0	2.3	0.9
Buying irrigation pipes	0.0	0.0	2.3	0.9
Replacement of dairy animals	2.4	0.0	0.0	0.9
Total	100.0	100.0	100.0	100.0
Sources of credit (%)				
Neighbour	21.4	31.0	23.3	24.6
NGO/MFI	33.3	10.3	7.0	17.5
Relative/friend	11.9	34.5	2.3	14.0
Commercial bank*	14.3	6.9	16.3	13.2
SACCO	0.0	3.4	18.6	7.9
Farmer group	7.1	3.4	9.3	7.0
Women group	4.8	0.0	9.3	5.3
Others	7.1	10.3	14.0	10.5
Total	100.0	100.0	100.0	100

*Equity Bank offered credit in three out of the 12 cases where source of credit was commercial banks. The remaining three cases were accounted for by Cooperative Bank.

On financial services, the households that sought credit for agricultural purposes averaged 11%, with little variations across the regions. Out of the households that sought credit, approximately 86% received, indicating high success rate in agricultural credit acquisition. The question therefore is why majority of households do not seek credit. The amount of credit sought by a household averaged US$ 222 while the amount received averaged at US$ 157. Input purchases

and land preparation in that order dominated the intended uses of the agricultural credit by the households. The main lenders of agricultural credit to the households were neighbours (25%), NGOs/MFIs (18%), relatives/friends (14%) and commercial banks (13%).

2.4 Level of Participation in Producer Organisations

Collective action or membership in producer organisations is one of the innovative ways that enables farmers to pool their resources and efforts towards accessing inputs, credit, information and output markets. In this section households' participation in producer groups is also examined.

Table 2.29 indicates that on average, 27% of the households had membership in agricultural groups, with the percentage highest in Central region (48%) and lowest in Nyanza region(16%). Majority of the groups engaged in crop (75%) and livestock (21%) production. The services the groups offered to their members included mainly training, marketing, inputs acquisition and financial services. On average, 54% of the groups' members were males, with females averaging 46%. The high number of groups' membership in Central region is due to some of the groups being cooperatives dealing in cash crops such as coffee. Although females constitute 46% of the groups' membership, they only constitute 25% of the groups' management committee members, with males making up 75%.

Table 2.29: Household membership in producer groups

	Western	Nyanza	Central	Overall
Collective action				
% of hh with membership in producer groups	16.0	15.5	48.3	27.1
Types of producer groups to which households belong (%)				
Crops production	83.6	85.0	71.1	75.3
Livestock production	7.5	10.0	27.1	21.1
Beekeeping	4.5	0.0	0.9	1.5
Crop /livestock production	4.5	2.5	0.0	1.2
Bee /dairy goat /fruit production	0.0	2.5	0.0	0.3
Seedlings production	0.0	0.0	0.4	0.3
Agro forestry	0.0	0.0	0.4	0.3
Total	100.0	100.0	100.0	100.0
Services offered by the producer groups (%)				
Training	35.4	34.5	24.8	27.4
Marketing	16.9	18.4	30.9	27.4
Input acquisition	30.0	17.2	27.8	27.1
Financial services	15.4	27.6	14.1	15.7
AI services	1.5	1.1	2.4	2.1
Value addition	0.8	1.1	0.0	0.2
Total	100.0	100.0	100.0	100
Gender composition of the producer groups				
Whole group				
Number of members	140	88	5,203	3,544
% of male members	80.7	50.0	53.8	54.0
% of female members	19.3	50.0	46.2	46.0
Group management committee				
Number of members	5	6	9	8
% of male members	51.2	42.1	83.5	75.0
% of female members	48.8	57.9	16.5	25.0

2.5 Output Marketing and Storage

Analysis results on marketing and storage of staples by the sample households are presented in this section. The extent of market participation in staple marketing by the sample households is presented and marketing arrangements explored. Information on storage facilities and storage losses incurred by the sample households is also presented.

2.5.1 Marketed Volumes and Marketing Arrangements

The mean marketed volumes and percentage of production marketed for the various staples are presented in Table 2.30. It is observed that only between 2% and 16% of quantity produced of staples among the households is marketed. Market orientation is higher for groundnuts, bananas, soya bean, sweet potatoes and millet where over 10% but less than 16% of the total production reach the market, and lowest for cowpeas, Irish potatoes, sorghum and cassava. Regionally, market orientation for most of the staples appears to be higher in Nyanza region than in Central and Western regions.

Table 2.30: Marketed volumes (kg) and percent of production marketed for staples

	Western		Nyanza		Central		Overall	
Staple	Volume (kg) marketed	% of prodn	Volume (kg) marketed	% of prodn	Volume (kg) marketed	% of prodn	Volume (kg) marketed	% of prodn
Maize	212	11.4	159	8.6	148	7.9	176	9.5
Sorghum	10	4.6	14	5.7	18	5	12	5.2
Millet	10	9.4	40	15.9	2	4.6	14	10.2
Beans	44	10.9	23	11.5	28	6.2	33	9.3
Soya bean	6	9.9	3	10.4	18	29.6	6	10.8
Dolichos (*njahi*)		0		0	8	8.4	8	8.4
Cowpeas	2	2.2	3	2.5	3	2.5	2	2.4
Groundnuts	7	7.5	41	26.6	0	0	22	15.7
Sweet potatoes	104	10	89	13.2	41	8.6	91	10.6
Irish potatoes	33	12.5	108	27.8	19	2.3	21	3.3
Cassava	20	4.7	23	9.7	7	2.8	18	5.3
Bananas	157	10.3	108	9.5	180	12.6	157	11.1

The buyers of the staples were mainly small traders and consumers (Table 2.31). Even for maize where the National Cereals and Produce Board is a market player, the main buyers were small traders and consumers. The patterns in buyer types for the staples indicate wide inexistence of organized marketing arrangements for the commodities, a scenario that leaves the smallholder farmers overly exposed to the uncertainties that surround volatile agricultural commodity markets.

Table 2.31: Main buyers of staples

Staple	Buyer (%)									
	Small trader	Large trader	NCPB	Miller	Consumer	Food processor	Farmer group	Brewer	Company	Institution
Maize	57.8	11.1	1.1	0.3	28.4	0.3				1.1
Sorghum	35.5				64.5					
Millet	55.2	3.4			37.9			3.4		
Beans	62.1	9.7	1.5	0.4	23.8	0.4	0.4			1.9
Soya bean	72.7				27.3					
Dolichos (Njahi)	25.0	25.0			50.0					
Cowpeas	42.9	14.3			35.7				7.1	
Groundnuts	81.3	2.2			16.5					
Sweet potatoes	62.2	4.4			33.3					
Irish potatoes	100.0									
Cassava	48.3				51.7					
Bananas	64.9	1.8			33.3					

The buyers for the four major staples – maize, sorghum, millet and cassava - and the proportion of the total amount marketed by the sample households sold to the buyers are presented in Table 2.32. Of all the maize sold by the sample households, 74% was sold to traders while 22% was sold to consumers. Institutions purchased 4% of the marketed maize, with NCPB and processors (which include millers) combined purchasing less than 1%. For sorghum and cassava, all the sales were to traders and consumers, with a higher proportion being bought by traders. While traders bought most of the millet sold by the sample households, about 2% of the millet sales went to processors. These results indicate the dominance of both small and large individual traders in the market for staples in Western, Nyanza and Central regions.

Table 2.32: Buyers of the four major staples

Staple	Buyer	Quantity sold to buyer	% of total quantity sold
Maize	Trader	146,918	74.1
	NCPB	700	0.4
	Processor	630	0.3
	Consumer	42,912	21.7
	Institution	7,020	3.5
Sorghum	Trader	1,735	51.9
	Consumer	1,610	48.1
Millet	Trader	1,494	78.9
	Processor	45	2.4
	Consumer	356	18.8
Cassava	Trader	3,906	53.3
	Consumer	3,416	46.7

As earlier discussed the main buyers of the staples were traders and consumers and the most common form of payments by buyers to the households was cash (Table 2.33). Other forms of payments such as cheque, promissory notes and in-kind were not common.

Table 2.33: Mode of payment for staple sales

Staple	Mode of payment (%)				
	Cash	Cheque	Promissory note	Barter system	In-kind
Maize	98.4	0.5	0.3		0.8
Sorghum	100.0				
Millet	100.0				
Beans	97.8	0.4	0.7		1.1
Soya beans	100.0				
Dolichos (*Njahi*)	75.0			25	
Cowpeas	100.0				
Groundnuts	98.9				1.1
Sweet potatoes	100.0				
Irish potatoes	100.0				
Cassava	100.0				
Bananas	100.0				

Among the staples sold, the point of sale for soya bean was the furthest (Table 2.34). On road status to point of sale, all weather roads dominated for all the staples, while the modes of transportation of majority of staples to the point of sale were mainly human and bicycles.

Table 2.34: Distance, status of road and mode of transport to point of sale

Staple	Mean distance (km)	Status of road (%)		Mode of transport to point of sale (%)						
		Tarmac/ tar	All weather	Seasonal	Vehicle	Human	Animal	Bicycle	Boat	Motor cycle
Maize	1.3	19.3	70.7	10.0	12.3	35.6	13.0	32.9		6.2
Sorghum	1.0	7.1	71.4	21.4		64.3		35.7		
Millet	2.1	13.3	73.3	13.3	6.7	53.3		40.0		
Beans	2.2	15.7	70.0	14.3	10.1	34.8	8.0	41.3		5.8
Soya bean	5.2	12.5	75.0	12.5		37.5		62.5		
Dolichos (*njahi*)	0.0									
Cowpeas	0.8	25.0	62.5	12.5		66.7	16.7	16.7		
Groundnuts	2.4	5.6	81.5	13.0		73.6		18.9		7.5
Sweet potatoes	1.2	17.4	73.9	8.7	8.7	47.8	4.3	34.8	4.3	
Irish potatoes	0.5		100.0					100.0		
Cassava	1.0	18.2	63.6	18.2		36.4	9.1	54.5		
Bananas	0.9	13.6	72.7	13.6	19.0	52.4	4.8	23.8		

2.5.2 Marketing Margins

The average prices received by the households for various staples are presented in Table 2.35. Of all the staples sold, highest prices were received from pulses (Dolichos (*njahi)*, soya bean,

cowpeas and groundnuts in that order) while the least prices were received from tubers and bananas. Regionally, there appear to be little price variations across the staples except common beans, soya bean, millet and sorghum.

The price received by farmers for the various staple crops were compared to wholesale prices in the respective regional markets (Table 2.35). In Western region, the price spread is lowest for maize followed by groundnuts and bananas. It was highest for sorghum followed by sweet potatoes, cassava and then beans. The price received for cow pea was higher than the whole sale price which means that the reported price maybe for a different market outlet. In Nyanza region, the price spread was lowest for sorghum followed by cassava and then maize. It was highest for beans, millet and sweet potatoes. The price received for cow pea and groundnuts was higher than the whole sale price which means that the reported price maybe for different market outlet. In Central region, the price spread was lowest for cassava, followed by cowpeas, bananas and then maize. It was highest for millet, followed by dolichos, irish potatoes and sweet potatoes.

Table 2.35: Mean Prices (US$/Kg) received for staples and price spread between reported and prevailing whole sale price (2009) in Regional Markets

	Priced received by farmer[a] (reported)				Price in regional wholesale markets[b]				Price spread between farm and market[c]			
Staple	Western	Nyanza	Central	Overall	Western	Nyanza	Central	Overall	Western	Nyanza	Central	Overall
Maize	0.31	0.31	0.32	0.31	0.36	0.37	0.38	0.37	0.04	0.06	0.07	0.05
Sorghum	0.29	0.35	0.33	0.32	0.52	0.36	0.42	0.44	0.22	0.01	0.09	0.12
Millet	0.51	0.44	0.50	0.50	0.66	0.62	0.73	0.65	0.15	0.18	0.23	0.16
Beans	0.56	0.58	0.64	0.60	0.72	0.78	0.79	0.74	0.17	0.20	0.15	0.15
Soya beans	0.87	0.85	0.57	0.85								
Dolichos (Njahi)			0.85	0.85	0.89	1.16	1.08	1.02			0.22	0.17
Cowpeas	0.86	0.85	0.81	0.84	0.76	0.77	0.84	0.86	-0.10	-0.07	0.03	0.02
Groundnuts	0.70	0.74	0.70	0.72	0.77	0.70	0.87	0.88	0.06	-0.04	0.16	0.16
Sweet potatoes	0.08	0.08	0.08	0.08	0.30	0.23	0.25	0.27	0.22	0.15	0.17	0.19
Irish potatoes	0.15	0.15	0.14	0.14	0.23	0.29	0.36	0.31	0.09	0.14	0.22	0.17
Cassava	0.20	0.16	0.15	0.18	0.38	0.20	0.15	0.21	0.18	0.04	0.01	0.03
Bananas	0.09	0.09	0.12	0.10	0.17	0.20	0.17	0.22	0.07	0.11	0.05	0.12

[a] reported in farm household survey;

[b] Mean of price in wholesale markets in the region: (Western = Bungoma, Kakamega; Nyanza = Kisumu; Central = Thika, Embu, Meru; Overall = Nairobi, Mombasa and all the regional wholesale markets). Source MoA, Marketing division

[c] Difference between farmer's price and wholesale price

2.5.3 Volume of Produce in On-farm Stores, Grain Banks, Warehouses and Commodity Exchanges

The number of months between harvesting and sales of staples is presented in Table 2.36. On average, maize, sorghum millet, beans and groundnuts were stored for less than three months before sales. The rest of the staples except cowpeas were stored for a shorter period (less than one month) before being sold.

Table 2.36: Number of months between harvesting and sales of the largest transaction for staples

Crop	Western	Nyanza	Central	Overall
Maize	2.4	2.2	2.3	2.3
Sorghum	1.8	2.8	9.0	2.6
Millet	2.4	2.2	2.0	2.3
Beans	2.8	2.8	2.6	2.7
Soya bean	1.0	1.5	0.0	0.9
Dolichos (Njahi)			0.5	0.5
Cowpeas	0.8	2.7	1.7	1.9
Groundnuts	3.0	2.1		2.3
Sweet potatoes	0.3	0.1	0.1	0.2
Irish potatoes	0.0	0.0	0.5	0.4
Cassava	1.1	0.1	0.0	0.7
Bananas	0.6	0.3	0.9	0.6

The households with grain stores constituted 37% of the sample (Table 2.37). Out of those with grain stores, 80% made use of them. Approximately 17% and 13% of the sample households respectively had rooms in the main house and traditional structures as stores. Only 8% of the households had improved grain stores. Improved grain stores were more common in Central region than in Nyanza and Western regions. The average storage capacity was 2.6 tonnes. Traditional stores had the lowest capacity while the rooms in other houses had the highest capacity.

Table 2.37: Percentage of households with grain stores, percent that used the stores and the store types

Storage facility	Western	Nyanza	Central	Overall
% of hh with grain stores				
Any store	42.4	25.4	38.2	36.7
Improved	2.2	3.2	17.1	7.6
Traditional	23.6	7.9	5.5	13.4
Room in main house	20.3	14.7	15.9	17.4
Room in other houses	2.98	2.78	2.6	2.80
% of hh using grain stores				
Any store	39.7	21.8	25.7	30.4
Improved	2.2	2.8	9.0	4.7
Traditional	18.1	3.6	2.0	8.9
Room in main house	20.1	13.5	13.3	16.1
Room in other houses	3.0	2.8	1.4	2.4
Store capacities (tonnes)	2.0	2.5	3.2	2.6
Any store				
Improved	2.7	3.7	3.4	3.4
Traditional	1.0	1.0	2.0	1.2
Room in main house	3.0	2.5	3.2	3.0
Room in other houses	2.8	6.5	4.5	4.2

The mean volumes of grains stored per household, duration of storage and storage losses are presented in Table 2.38. On average, a household stored 0.7 tonnes of maize, and this was largest volume among the stored grains. The general storage duration was between 6-8 months, although majority stored most of the grains for 7 months. Storage losses were quite minimal for most of the grains, except in Nyanza region where 45% of sorghum was lost in store. The main cause of storage losses were storage pests (Table 2.39).

Table 2.38: Mean volume stored, duration of storage and volume lost in store for grains

Staple	Western			Nyanza			Central			Overall		
	Volume stored (kg)	Duration of storage (no. of months)	Volume lost in store (kg)	Volume stored (kg)	Duration of storage (no. of months)	Volume lost in store (kg)	Volume stored (kg)	Duration of storage (no. of months)	Volume lost in store (kg)	Volume stored (kg)	Duration of storage (no. of months)	Volume lost in store (kg)
Maize	819	8.5	29	687	7.8	49	601	7.2	30	734	8.0	36
Sorghum	123	7.5	0	167	7.9	68	450	8.0	0	149	7.7	68
Millet	136	7.3	0	158	7.8	0				139	7.4	0
Beans	221	7.0	0	144	7.2	23	202	6.4	19	201	6.8	21
Soya bean	36	6.3	0							36	6.3	0
Groundnuts	165	8.4	0	75	6.3	28				135	7.7	28

Table 2.39: Causes of storage losses by grain

Grain	Causes of losses (%)				
	Main cause of loss	Western	Nyanza	Central	Overall
Maize	Storage Pests	66.7	100.0	100.0	85.2
	Rotting	33.3			14.8
Sorghum	Storage Pests		100.0		100.0
Beans	Storage Pests		100.0	100.0	100.0
Groundnuts	Storage pests		100.0		100.0

The sample households were asked about their awareness and use of cereal banks and ware house receipt systems. A cereal bank is a community-based institution involving a group of farmers that stocks and manages the operations of acquiring, pricing and supplying grains in a collective manner. Grain is bought from the group members and/or from elsewhere when the prices are lower (mainly just after harvest); it is stored until when prices have risen and when the demand for the grains has risen, and then sold. A warehouse receipt system, on the other hand, involves the issuing of documents, Warehouse Receipts (WR), as evidence that specified commodities of stated quantity and quality have been deposited at a particular location by a named depositor(s). Depositors may be an individual producer, a farmer group, a trader, an exporter, a processor or indeed any individual or corporate body. The issuer of the Warehouse Receipt holds the stored commodity only by way of safe custody, while the legal title remains with the depositor or bona fide holder of the Warehouse Receipt. The Warehouse operator charges for the storage costs.

Approximately 14% of the households were aware of cereal banks while less than 2% used them (Table 2.40). For the Warehouse Receipt System, only 5% of the households were aware, with no household indicating having used them. These results show that these commodity marketing innovations have not penetrated well into the rural villages in the breadbasket areas in Kenya.

Table 2.40: Percentage of households aware of Cereal Banks and Warehouse Receipt System and % that used them

	Western	Nyanza	Central	Overall
Cereal banks				
% of hh aware	15.6	16.7	11.3	14.4
% of hh that used	3.3	0.0	0.0	1.4
Warehouse receipt system				
% of hh aware	2.3	6.7	5.2	4.6
% of hh that used	-	-	-	-

2.5.4 Level of Use of Market Information Systems

Market information is one of the important ingredients in efforts aimed at agricultural development. Farmers often need clear information regarding the market conditions as well as about the ruling prices in order for them to make informed decisions that would benefit their efforts in marketing their produce. There should therefore be reliable sources of information

accessible to farmers. It is shown in Table 2.41 that the main providers of market information to the sample of households were commodity buyers, family members and friends, fellow farmers, local markets and market information points in that order.

Table 2.41: Sources of information for households on Output Markets (% of households using source)

Information provider	Commodity prices	Commodity availability in the market	Potential market/ buyers	Overall
Commodity buyers	20.3	19.1	29.6	22.9
Family/friend	20.6	25.1	21.2	22.2
Farmer	16.6	17.2	20.0	17.9
Local market	18.6	19.8	12.8	17.1
Marketing Information Point (MIP)	11.0	11.0	9.7	10.6
Radio	8.6	4.5	2.6	5.3
Commodity market	1.3	1.5	1.4	1.4
Commodity market	0.7	0.4	0.6	0.6
Agro-dealer	0.9	0.3	0.4	0.6
Brokers	0.3	0.3	0.8	0.4
Brokers	0.5	0.3	0.4	0.4
Newspaper	0.3	0.3	0.2	0.3
Farmer group	0.2	0.3	0.2	0.2
Co-operative	0.3	-	0.1	0.1
Faith based organisation	-	0.1	0.1	0.1
Seed agent	-	-	0.1	0.0
Total	100.0	100.0	100.0	100.0

On modes of acquiring information about output markets, personal communication is the dominant mode (Table 2.42). Other modes of information acquisition used but to a limited extent include print and electronic media, personal observation, community meetings (*baraza*), telephone and seminars/meetings.

Table 2.42: Modes of acquiring information about Output Markets

Mode of information acquisition	Commodity prices	Commodity availability in the market	Potential market/ buyers	Overall
Personal communication	89.5	93.1	96.0	92.8
Print /electronic media	9.2	4.7	2.7	5.7
Observation	0.2	1.1	0.1	0.5
Local administration meeting (baraza)	0.4	0.4	0.4	0.4
Telephone	0.1	0.4	0.4	0.3
Seminar/meetings	0.3	0.1	0.1	0.2
Demonstration plot	0.1	0.1	0.1	0.1
Field day	0.1	0.0	0.1	0.1
Brochure/pamphlets	0.1	0.0	0.1	0.0
Training	0.0	0.1	0.0	0.0
Promotional campaigns	0.1	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0

The use of Market Information Systems (MIS) in acquiring output market information is very minimal among the sample households; it is observed that few households have advanced to the use of MIS as indicated in Figure 2.8.

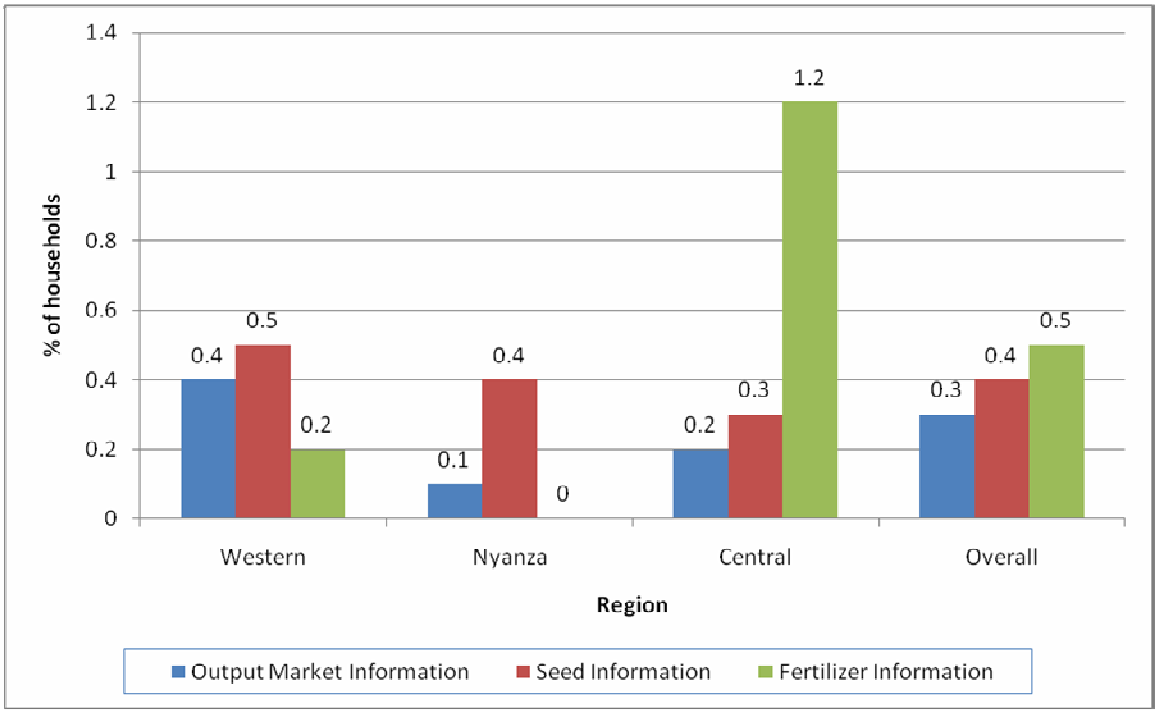


Fig.2.8: Percentage of households using MIS to acquire agricultural market information

PART III BASELINES FOR AGRA'S PROGRAMMATIC AREAS

In this Part of the report, baseline survey results for AGRA's three programmatic areas are presented and discussed. Results for soil health programme are first discussed, followed by results on the seed programme. The market access programme's results conclude this part.

3.0 SOIL HEALTH PROGRAMME

3.1 Status of Soil Health

Kenyan soils, like others in sub-Saharan countries, have continued to suffer from depletion of soil nutrients even in formerly fertile areas. Traditionally, crop production in Kenya is concentrated in the high rainfall areas that are characteristically intensively cultivated. Due to the diminishing land-holdings, many farmers in these areas cultivate the same piece of land repeatedly and in many instances they plant the same crops. Intensive cultivation practices pose a serious nutrient replenishment challenge (KARI, 2008).

Use of fertiliser is recommended as a source of essential plant nutrients added to the soil to replace or replenish the soil reserve for better and proper crop performance. Application of manure or compost whose use increases resource use efficiency is also advocated for. Soil replenishment strategies that are adopted by farmers provide a good indication of the status of soil health in Kenya. A ten-year panel household data by Tegemeo Institute spanning eight agro-ecological zones in Kenya shows that the proportion of farm households using inorganic fertiliser has been increasing over the last decade (Table 3.1). The data also shows that a considerable proportion (17%) of farmers did not apply inorganic fertiliser at all over the period. The fertiliser application rate (kg/acre) among fertiliser users is shown to have increased in most zones (Table 3.2). The average rate of fertiliser application on maize, however, is 59 kg per acre, which is still below the recommended rate[14] even in high potential areas where returns to fertiliser are comparatively high.

[14] recommended per acre for maize by the Kenya Agricultural Research Institute (KARI); 50 kg of DAP and 60 kg of CAN

Table 3.1: Percent of households using fertiliser by agro-regional zone

Agro ecological zone	1997	2000	2004	2007
Coastal Lowlands	2.7	6.8	8.0	12.3
Eastern Lowlands	35.2	48.3	56.6	56.6
Western Lowlands	5.9	11.8	15.0	30.5
Western Transitional	58.1	77.0	85.8	87.8
High Potential Maize Zone	86.1	90.5	90.5	93.6
Western Highlands	91.5	89.9	92.2	94.6
Central Highlands	99.2	99.6	97.1	97.9
Marginal Rain Shadow	27.0	35.1	32.4	54.1
Overall sample	63.9	69.9	71.9	76.3

Source: Tegemeo household panel data base

Table 3.2: Mean application rates of and percent of households applying fertiliser on maize by region

Agro ecological zone	1997		2000		2004		2007	
	% of hh	Mean kg/acre	% of hh	Mean kg/acre	% of hh	Mean kg/acre	% of hh	Mean kg/acre
Coastal Lowlands	3	11	6	5	7	3	12	7
Eastern Lowlands	28	10	34	18	49	15	56	16
Western Lowlands	2	24	5	14	7	10	12	12
Western Transitional	41	54	64	48	71	62	84	71
High Potential Maize Zone	84	65	89	67	89	74	92	75
Western Highlands	80	31	86	36	91	46	95	47
Central Highlands	93	68	92	64	93	64	91	58
Marginal Rain Shadow	8	12	14	15	11	43	16	43
Overall sample	57	56	63	55	67	60	71	59

Source: Tegemeo household panel data base

Over the last decade other advocated soil fertility management strategies like manure or compost whose use increases resource use efficiency has marginally increased in most areas except in Western highlands (Table 3.3). Use of manure or compost appears to be inversely related to use of inorganic fertilisers in most of the areas except the central highlands. Where the proportion of farmers using inorganic fertilisers is high, manure/compost use is low. Conversely, compost/manure use is higher where proportion of farmers using inorganic fertiliser is low.

Table 3.3: Proportion (%) of households using manure/compost, 2000-2007

Zone	2000	2004	2007
Coastal Lowlands	29	34	32
Eastern Lowlands	75	80	83
Western Lowlands	19	25	36
Western Transitional	44	33	44
High Potential Maize Zone	22	22	24
Western Highlands	38	35	23
Central Highlands	73	92	95
Marginal Rain Shadow	76	68	68
Overall Sample	44	47	50

Source: Tegemeo household panel data base

As a consequence of intensive cultivation and low or lack of sufficient nutrient replenishment in small holder farms, the fertility status of most soils has been declining over time such that very few areas can support crop production without supplementary nutrients through addition of fertilisers. Some of the reasons for low adoption are high costs of fertiliser against low output prices. In addition, benefits from adoption of ISFM technologies take long to be realized while some are very labour intensive.

Low and declining fertility of the land is one of the factors that continue to constrain the growth of agriculture (SRA, 2009). Consequently, soil fertility issues have been placed high in the national agenda. One of the flagship projects under Kenya's Vision 2030, is the investment in fertiliser cost-reduction as one of the key strategies for increasing productivity in the agricultural sector. Some of the ways through which the high fertiliser costs shall be addressed include: bulk importation of fertilisers; blending and local manufacture of fertilisers; capacity building of farmers; and provision of warehousing. In this strategy the government will strengthen public-partnership in order to effectively address inefficiencies and high cost of fertiliser in Kenya. The government also seeks to strengthen public-partnership in the provision of extension services by embracing a pluralistic system where both public and private service providers are active participants (Agricultural Sector Extension Policy).

3.2 Infrastructure for Soil Quality Analysis

Soil quality analysis is a pre-requisite to good soil fertility management. Soil tests measure the relative nutrient status of soils and are used as a basis for profitable and environmentally responsible fertiliser application. The accuracy of a soil test result is influenced by the laboratory analysis but may be influenced even more by the quality of the soil sample. A comprehensive soil analysis will normally include: Total Exchange Capacity (T.E.C.); Soil pH; Organic Matter (Humus) as percent; Nitrogen; Sulphate; Phosphates; Olsen value; Percent Base Saturation of Calcium, Magnesium, Potassium, Sodium and other bases; Exchangeable Hydrogen; Trace elements like Boron, Iron, Manganese, Copper, Zinc, Cobalt, Molybdenum, Aluminium; and Limestone Analysis.

Kenya has a number of soil testing laboratories both private and public (Table 3.4). Most of the soil testing laboratories are in the universities, national research organisations, international research organisations and fertiliser manufacturers.

Table 3.4: Inventory of Soil Testing Laboratories in Kenya

Universities	National Research Institutes	International Research Institutes	Private Laboratories
University of Nairobi	Coffee Research Foundation (CRF)	World Agro-forestry Centre	MEA
Jomo Kenyatta Univ. of Agriculture & Technology (JKUAT)	Kenya Agricultural Research Institute (KARI)	International Centre for Tropical Biology (TSBF)	(Athi River Mining (ARM)
Moi University	Mwea Irrigation & Agricultural Development (MIAD)		KEL chemicals
Kenyatta University	Kenya Sugar Research Foundation (KESREF)		Crop Nutrition
Egerton University	Kenya Plant Health Inspectorate Service (KEPHIS)		
	Kenya Forestry Research Institute (KEFRI)		
	Kenya Marine & Fisheries Research Institute (KEMFRI)		
	Tea Research Foundation of Kenya (TRFK)		
	National Museums of Kenya		

The Kenya Agricultural Research Institute (KARI) is the main provider of soil analysis services to the public. However, over the years, KARI has closed some of the regional laboratories due to lack of equipment, equipment breakdown among other reasons. In addition, some of the Institutes regional laboratories that have remained open are operating below capacity and still lacking equipment for some types of analysis.

The National Agricultural Research Laboratories (NARL) in KARI Kabete handles most of the soil samples collected through KARI's regional offices. The capacities of the soil testing laboratories and the areas from where soil samples for testing originate are presented in Annex 4 and Annex 5 respectively.

3.3 Training and Capacity Building in ISFM

Tackling soil fertility issues thus requires a holistic approach that integrates biological and social elements. Integrated Soil Fertility Management (ISFM) is an approach to sustainable and cost-effective management of soil fertility. ISFM attempts to make the best use of inherent soil nutrient stocks, locally available soil amendments and mineral fertilisers to increase land productivity while maintaining or enhancing soil fertility. ISFM is a shift from traditional fertiliser response trials designed to come up with recommendations for simple production increases. ISFM strategies include the combined use of soil amendments, organic materials, and mineral fertilisers to replenish soil nutrient pools and improve the efficiency of external inputs.

The data collected for the Soil Health Programme in July/August 2008 indicated that there are 64, 76 and 30 PhD holder Soil Scientists, Agronomists and Social Scientists, respectively in Kenya. Out of these, the Research Institutions account for 20 Soil Scientists, 43 Agronomists and 14 Socio Scientists, Public Universities account for 38 Soil Scientists, 28 Agronomists and 13 Social Scientists, while the NGOs involved in soil health related work account for 6 Soil Scientists, 5 Agronomists and 2 Social Scientists at PhD level. The disciplines that have the lowest number of scientists were identified as soil physics, soil microbiology and soil biology.

Initiatives aimed at strengthening the stock of soil health experts in ISFM research include the Rockefeller funded RUFORUM programme (Regional Universities Forum for Capacity Building in Agriculture), government training programmes in the various institutions, Universities and the development sector. Other initiatives in the region are ASARECA's Natural Resources Management Programme.

3.4 Overview of Fertiliser Sub-sector

Fertiliser Demand

The fertiliser market was liberalized in early 1990s. Government price controls and import licensing quotas were eliminated, foreign exchange controls removed and subsidy programmes were phased out. This attracted a private sector investment in the fertiliser supply chain that currently comprise over 10 importers, 500 wholesalers and 7,000 retailers. Fertiliser use increased dramatically following the liberalization of fertiliser marketing with the total annual consumption rising from a mean of 250,000 MT in the 1990s to over 400,000 MT in the 2007/8 period.

All key informants indicated that demand for fertiliser as a whole and for different fertiliser types has grown tremendously over the last two years. Demand for new fertiliser types, such as the blends and the foliar feed, has also increased over the same period of time. Growth in knowledge and use of blends, foliar feeds over the past three years is attributed to aggressive promotion of the different blends by the blending companies. The off-take[15] for fertiliser blends in 2008/9 was 60,000 MT. The potential to use fertiliser is said to be larger than what is currently being used.

DAP is the most popular planting fertiliser. Its use has grown from 100,000 MT in the 2001/02 season to over 160,000MT in the 2008/9 season (Figure 3.1) while the volume of other planting fertilisers (NPK's and SSP) has not been more than 20,000 MT. Use of topdressing fertilisers has increased from around 85,000 MT in 2001/02 season to over 120,000 MT in 2008/09 season (Figure 3.2). CAN is the most commonly used topdressing fertiliser and its use has grown from around 45,000 MT in 2001/02 season to over 90,000 MT in 2008/09 season. The use of UREA has not changed and remains at slightly over 30,000 MT.

[15] Volume of purchased fertiliser

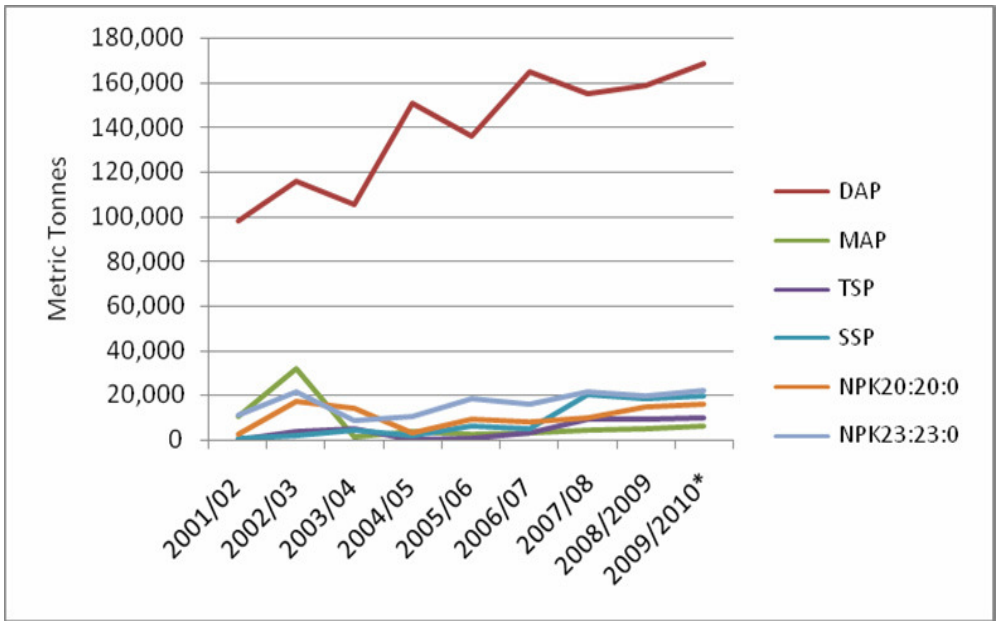


Fig. 3.1: Off-take (MT) Trends in Planting Fertiliser

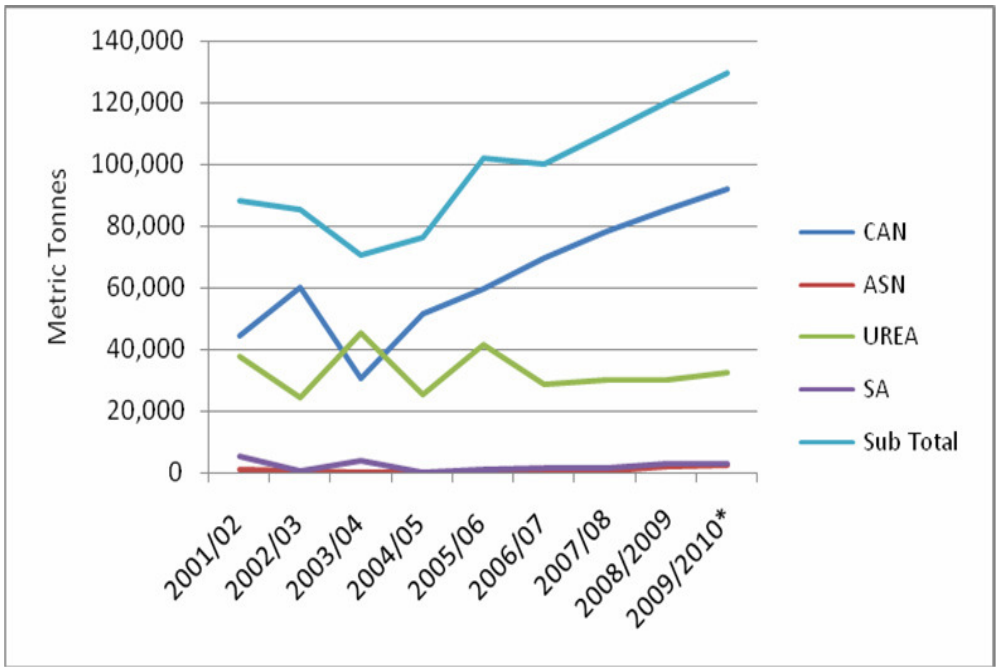


Fig. 3.2: Off-take (MT) Trends in Topdressing Fertiliser

Up to 2005/06 season, the use of specialized fertiliser fluctuated highly (Figure 3.3) but have since stabilized and shows an upward movement. MOP/SOP is the most commonly used and shows the highest increase (from 6,500 MT in 2001/02 to 9,500 MT in 2008/09).

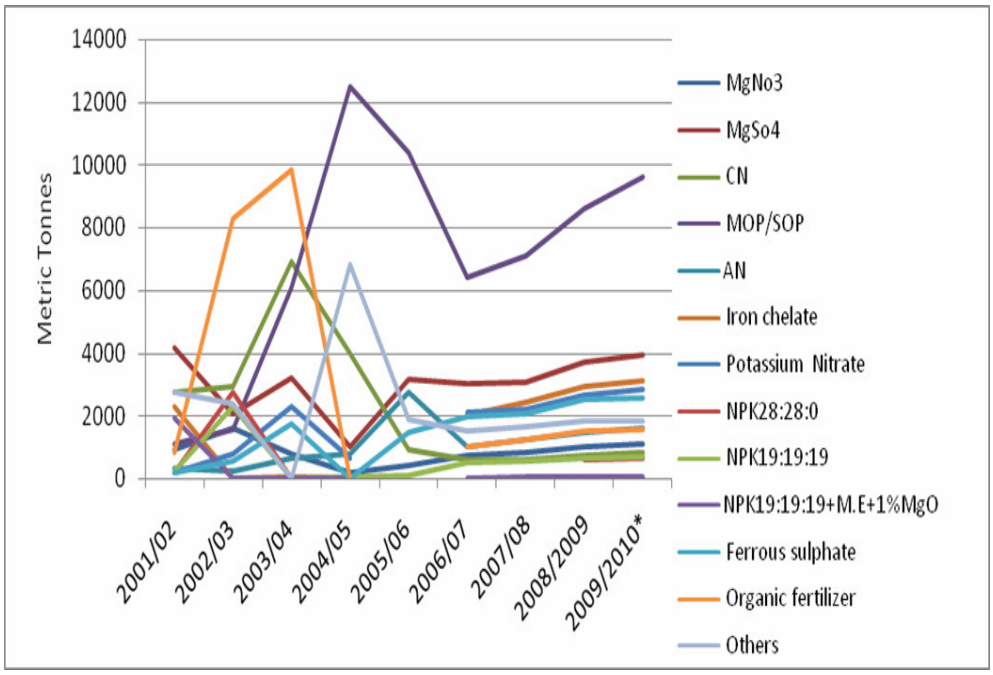


Fig. 3.3: Off-take (MT) Trends in Specialised Fertiliser

It is expected that demand for fertilisers will continue rising particularly with the expected increase in the proportion of farmers doing farming as a business as opposed to a subsistence endeavour; and as more people become aware of these new fertiliser types.

Some of the importers felt that demand for fertiliser in the country has been curtailed by the high fertiliser prices against low produce prices. Farmers response has been to plant reduce cropped acreage in order to minimize cost on fertilisers.

One of the main reasons for the low use of fertilisers among smallholder farmers is the high cost. Figure 3.4 shows an increase in price of all fertilisers during the 2007/08 and 2008/09 seasons. The planting fertilisers - DAP and MAP - are the most expensive and their prices increased from US$ 37 in January to US$ 85 in October the same year. The sudden drop in fertiliser prices towards the end of 2008 is attributed to the government's intervention. In an effort to curtail the high and rising fertiliser prices, the government imported 146,000 MT of fertiliser. This fertiliser was sold during the 2009 long rains season at a subsidized price of between US$ 26 to US$ 39 for DAP and between US$ 18 to US$ 26 for CAN.

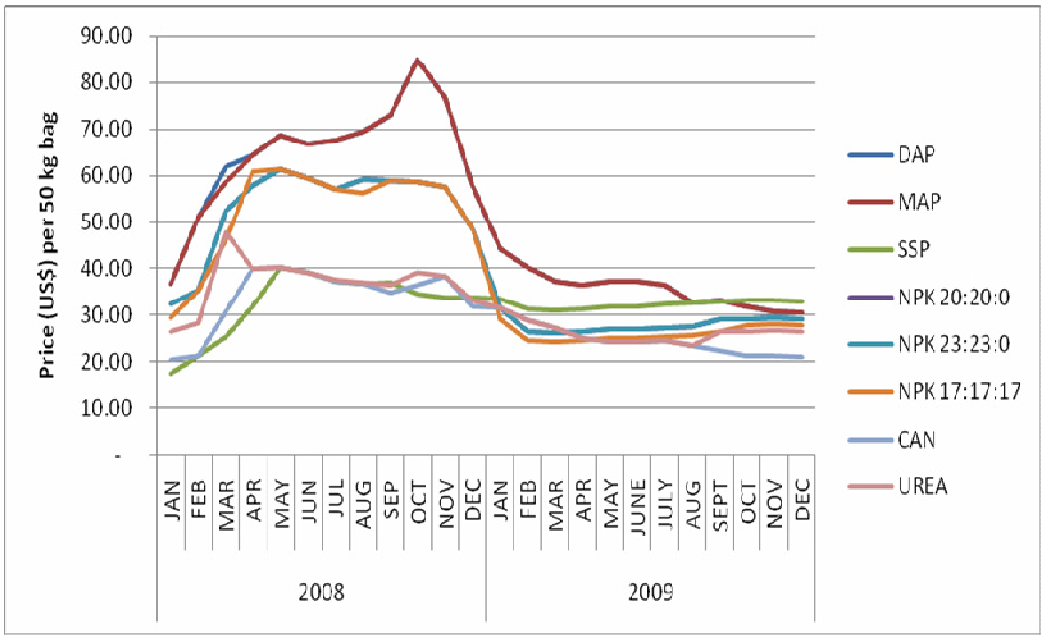


Fig. 3.4: Average Monthly Prices (US$/Kg) of Commonly Used Fertilisers (2008 – 2009)

Fertiliser imports

Almost all fertilisers used in Kenya (90%) are imported due to lack of raw materials for local factories and the high costs of importation of the raw materials. Only 10% of the fertiliser used in Kenya is locally made.

Fertiliser Manufacturing/Blending

Only one type of fertiliser single super phosphate (SSP) is manufactured in the country by KEL Chemicals in Thika. Growth in this sub-sector has been inhibited by lack of primary raw materials in Kenya for the production of fertilisers. Fertiliser blending is viewed as the feasible way of providing a balanced nutrition to soils and crops. There are only two fertiliser blending companies in Kenya, namely, Athi River Mining LTD and MEA LTD. The total fertiliser blends produced in the country in the last 12 months was 50,000MT (Athi River LTD=20,000MT and MEA LTD=30,000MT). Among, the fertiliser blends currently in the market in Kenya are Mavuno basal, Mavuno top dress, NPK blends (see appendix). The available blends are all sector-specific (tailored for certain crop sectors like Tea, Coffee, Pyrethrum, Rice) and are mostly used by the large scale farmers. Very few farmers are aware of these fertiliser blends. About 10% - 20% of farmers use fertiliser blends in Kenya (MoA, ARM). This is attributed to

disseminating the information which has been limited to farmers living where certain crops such as tea and coffee are grown. Owing to this, most small scale farmers in the country are still using the conventional fertilisers like DAP and CAN.

Biological Fertiliser

Among the soil testing laboratories visited, only two were -producing biological fertiliser using rhizobium inoculums. These are the University of Nairobi (UON), department of Soil Science laboratory and the Kenya Forestry Research Foundation laboratory which produce biological fertiliser for commercial purposes.

Between December 2008 and November 2009, the UON laboratory produced a total of 920 kg of biological fertiliser (8,500 packets of biological fertiliser each weighing 100 grams, and another 1,400 packets each weighing 50 grams) which was sold at a price of US$ 1.29 for the 100 grams packet i.e. US$ 12.9 per kg. The facility mainly produces biological fertiliser for one company that had contracted it. A few individual farmers also purchased the biological fertilitliser directly from the facility.

The Kenya Forestry Research Foundation laboratory on the other hand produced 200 Kg of biological fertiliser (2,000 packets of 100 grams each) within the same period. All the biological fertiliser produced was sold at a price of US$ 2.6 per packet (US$ 26 per Kg). The main buyers were NGO'S, ICRAF and individual farmers. Since January, 2010, the MEA fertiliser has embarked on production of biological fertiliser.

3.5 Quality of Fertiliser in Local Markets

Fertiliser standards in Kenya are set and reviewed from time to time by the stakeholders in the fertiliser industry under the guidance of Kenya Bureau of Standards (KEBS). The high standards ensure that the fertiliser in the country is of high quality.

Fertiliser quality analysis

KEBS is mandated to carryout inspection and quality control but its mission ends at the port. Kenya bureau of standards (KEBS) is a national body that promotes standardization in industry and commerce. Mostly they deal with issues of quality and safety of the different goods that

come into or out of the country. KEBS also sits in the fertiliser technical committee that helps in the policy formulation.

The role of KEBS in the fertiliser is mainly at the importation and manufacturing levels. The KEBS sets fertiliser standards used for both imported and manufactured fertilisers and enforces the same. The KEBS tests random samples of imported fertiliser to determine its conformity to the already set Kenyan standards. The inspection report by KEBS overrides the certificate of conformity issued by the international inspectors at the countries of origin and the fertilisers that fail to meet the standards are rejected and returned to the country of origin at the importer's cost. In the lower part of the supply chain, KEBS plays a minor role by conducting market surveys to determine the quality of products at the ground but they do not enforce the fertiliser standards beyond the warehouse. Kenya does not have fertiliser inspectors beyond the warehouses although KEPHIS tests samples at the stockiest level in order to verify the fertiliser quality. The government Department of Weights and Measures was pointed out as lax.

The players in the industry indicate that quality of fertiliser supplied to the country is generally rated as good. According to KEBS, there is usually over 90% compliance to the standards of the mainstream and officially traded fertilisers.

Due to the large quantities of fertiliser at the port of Mombasa, the challenge of checking for fertiliser quality may provide a loophole for poor quality fertiliser to sneak into the country. Owing to the pressure at the port some bags are under weight and the nutrient content is not usually true. This is said to be minimal and some players claim that 20% of fertiliser entering the country is of good quality.

The greatest challenge lies in adulteration and sale of underweight fertiliser which mainly occurs during bagging and re-bagging. Most of the imported fertiliser (70%) arrives as bulk cargo (not bagged) while the rest is bagged at the site where the fertiliser is procured. The concern on the fertiliser that is bagged in Kenya is that: opening and re-bagging of the fertiliser bags exposes the fertiliser to the atmosphere changing the composition; weighing equipment result to weight of a 50kg bag of fertiliser ranging between 49kg and 51kg. The composition of the fertiliser does not always conform to the labels.

KEBS assures fertiliser quality up to the warehouse. Beyond this point, adulteration may take place which includes, mixing fertilisers with other materials in order to make a profit.

Opening[16] and repackaging fertilisers is prohibited in Kenya yet about 20 – 25% of fertiliser that leaves the port is re-bagged. This is a common practice especially at the retailer level due to the high demand of fertiliser in smaller units.

There is no body charged with verifying the weight of fertilisers at the stockist level and enforcement of measures by the weights and measures department was rated by players in the chain as non strict. The result is that up to 40% of the fertiliser sold in Kenya is underweight (AGMARK) which means farmers make significant losses due to fertiliser weight mismanagement. The amount of weight loss that may be attributed to spillage during transportation is small.

The materials in the fertiliser bags are not always what the labels indicate and this is due to adulteration that happens along the distribution channel. Random fertiliser tests in 1996 by KARI revealed that in the Central region (Othaya, Siakago and Mumano) two out of ten bags of fertiliser were of poor quality.

As a response to demand for small packets of fertiliser and in order to curb the problems associated with opening and re-bagging, some manufacturers like ARM pack and sell fertilisers in 1kg, 5kg, 10kg, 25kg and 50Kg bags. Trials by various companies to package fertiliser in 1kg to 5kg were abandoned due to high costs of packaging.

3.6 Fertiliser Marketing and Distribution Channels

The fertiliser marketing and distribution channels in Kenya are as shown in Figure 3.5.

[16] Opening and re-bagging of the fertiliser bags exposes the fertiliser to the atmosphere changing the composition.

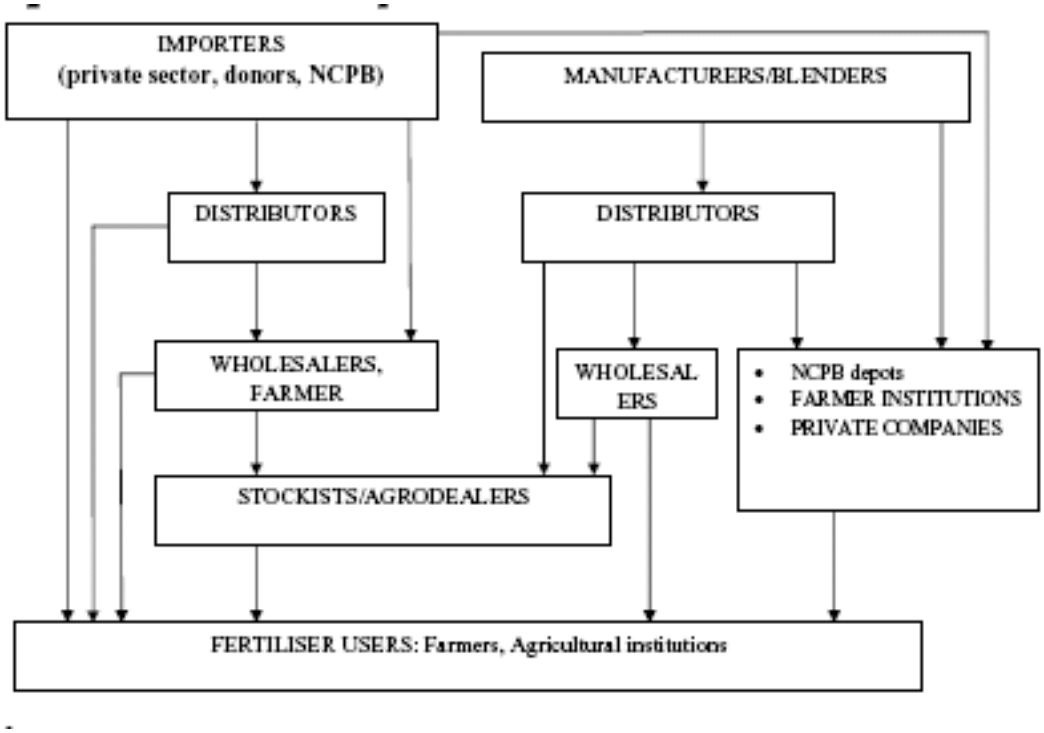


Fig. 3.5: The Fertiliser Marketing Chain

Importers

There are 64 firms which import fertilisers to Kenya with six of these importers importing up to 80% of the total fertilisers. Key fertiliser importers are YARA, MEA LTD, Pisu and Company LTD, Mijingu, Export Trading and Athi-River LTD. The Government of Kenya (Ministry of Agriculture) also imports fertilisers.

The importers: finance fertiliser imports; procure and provide logistics for shipment; and provide storage. Most of the fertiliser is imported in bulk and is then bagged at the port of Mombasa. Imported fertiliser is then stored in the warehouse ready for dispatch to the rest of the country.

Some of the importers like KTDA (imported 65 MT in 2009) and NCPB import and take their fertilisers directly to the farmers. Examples of the largest importers in Kenya are YARA LTD and MEA LTD.

Donor countries give some of their aid in kind[17]. The donating country procures fertiliser and transports it to the Kenyan port where the fertiliser is auctioned.

Most of the importers are members of the newly formed Fertiliser Association of Kenya. The association seeks to unite and organise the importers and the distributors into a unit. Currently the association has 20 members most of whom are importers.

Manufacturers[18]

The role of manufacturers is to blend or manufacture fertilisers according to various market needs. They also create the necessary systems through which they market their products to the various end users. From figure 3.5, it can be seen that the manufacturers also supply the fertilisers to the various institutions such as BAT, Mastermind and Universities among others. Some of the manufacturers provide transportation of the fertiliser from the factory to up country towns. The National Cereals and Produce Board is the sole distributor of SSP, the fertiliser that is manufactured in Kenya.

Credit: A few importers/blenders have credit arrangements with distributors, and retailers. However, they consider these credit arrangements very risky since they are based only on trust. Many importers shy away from these and sell on a cash basis alone. In this regard, women players are highly respected due their honesty and hard work.

Distributors

These are large businesses whose primary function is to transfer fertilisers in bulk from warehouses at the port or from the factory to the major towns in the country. They are mostly based in the major towns like; Nairobi, Nakuru, Kisumu, Eldoret, and Kitale. There are about 500 known distributors in Kenya with about 70 large distributors handling an average of 100MT of fertiliser each. The rest are smaller distributors.

Distributors are very important in this chain since they link the manufacturers with the farmers and retailers. They also assist in marketing of the product through product information

[17] For example the 2KR (Second Kennedy Round) which is a Japanese programme instituted in mid 1970s to donate fertilisers to the developing countries.
[18] There are a few fertiliser manufacturers in Kenya. KEL CHEMICALS who manufactures SSP and Athi River Mining who blend fertilisers

dissemination. They distribute large fertiliser volumes and hence have credit arrangements between them and the importers/manufacturers. Examples of known distributers include Jumbo agrovet, Farmers world, Agri-center etc.

Because they are only involved in the fertiliser business only during specific periods (seasons), distributors also engage in other products during the rest of the year when fertilisers are off season. They are not organized into any association of their own although some of them are members of FAK while others are in the newly formed Kenya National Association of Distributers and Agro-dealers (KENADA). Some players in the industry particularly the importers/blenders have their own distribution channels and fertiliser outlets in the major towns like Nairobi, Nakuru, Eldoret, Kitale, and Mombasa.

Wholesalers

Kenya has a distribution network of about 500 wholesalers operating in the country (Ariga *et al*., 2006). These are mostly medium businesses located in major towns. They buy fertiliser from the distributors and store it selling it in small batches to the agro-dealers/stockists. Some of these wholesalers also double up as agro-dealers.

Retailers: Stockists/Agro-dealers[19]

Agro-dealers are the direct suppliers of fertiliser to the farmers. 40-50% of all fertiliser used in the country is sold through the agro-dealers (AGMARK). These are comparatively small businesses located in small towns and shopping centres and transact not more than tens of tons of fertiliser. Most of them transact their business on a cash basis. A total of 3,826 agro-dealers are licensed by KEPHIS (KEPHIS, 2008) while 5,800 agro-dealers are registered under the CNFA/AGMARK agro-dealer project. Because of this expansion of retail outlets for fertiliser, the distance that small holder households travel to access fertiliser has been declining over the last decade. It declined from eight km in 1997 to 3.4 km in 2007 (Table 3.5). This decline has been observed in all the agricultural zones.

[19] Agro-dealers are stockists of agricultural inputs that include but are not limited to seeds, fertiliser, crop protection chemicals, equipments, machines, veterinary products and animal feeds.

Table 3.5: Mean distance (km) to fertiliser stockists

Agro-ecological zone	Distance to fertiliser stockist			
	1997	2000	2004	2007
Coastal Lowlands	30.6	24.3	18.4	11.3
Eastern Lowlands	9.8	5.4	4.2	2.7
Western Lowlands	16.0	11.6	7.5	3.8
Western Transitional	6.3	4.6	2.8	3.6
High Potential Maize Zone	5.0	4.0	3.0	3.6
Western Highlands	3.3	2.2	1.4	2.4
Central Highlands	2.7	1.5	1.4	1.3
Marginal Rain Shadow	26.2	5.8	5.4	2.3
Overall Sample	8.1	5.7	4.1	3.4

Source: Tegemeo household panel data base

Certification of agro-dealers by region

Overall, majority of the agro-dealers interviewed were certified[20] with the least proportion of certification being in the Central region (Table 3.6). These agro-dealers were serving farmers who are found at an average radius of 5.5 kilometres, with farmers in Nyanza travelling for longer distances.

Table: 3.6: Certified Agro-dealers by region

	Central	Nyanza	Western	Overall
Number and percent of certified agro-dealers	16 (69.6%)	16 (94.1%)	28 (90.3%)	60 (84.5%)
Radius (km) from where buyers of fertiliser come from (mean)	5.5	6.1	5.1	5.5

Fertiliser agro-dealers diversified the items they sold in their shops (Table 3.7). As it is the common practice, many agro-dealers selling fertiliser would also be selling seeds. Other commonly sold items include animal feeds and farm implements. Agro-dealers also sell but to a lesser extent foodstuff, non-farm hardware and other households goods.

[20]Agro-dealers who have CNFA- AGMARK certification besides being certified by the respective government certification body (KEPHIS).

Table 3.7: Other items sold by fertiliser Agro-dealers

Item sold	Number and percent of agro-dealers							
	Central		Nyanza		Western		Overall	
	Number	%	Number	%	Number	%	Number	%
Seeds	22	84.6	19	100.0	32	100.0	73	94.8
Farm implements	14	53.9	12	63.2	17	53.1	43	55.8
Animal feeds	23	88.5	11	57.9	21	65.6	55	71.4
Food stuff	3	11.5	1	5.3	9	28.1	13	16.9
Non-farm hardware	5	19.2			7	21.9	12	15.6
Other household goods					3	9.4	3	3.9
Other items	24	92.3	18	94.7	25	78.1	67	87.0

Fertiliser purchases and marketing arrangements with suppliers

The volume, suppliers, mode of delivery and prices of fertiliser purchased by the agro-dealers is provided in Table 3.8. DAP fertiliser is the most commonly purchased fertiliser, accounting for 29.1% of kgs of fertilisers bought while the least were SSP and foliar feed (0.5% and 0.2%, respectively). The main suppliers of the fertiliser were wholesalers who were between 10 and 60 kilometres away and the common mode of delivery was by vehicle. The largest volume by the agro-dealers was purchased in March which is generally the start of long rains and hence the planting season.

Table 3.8: Volume of Fertiliser Purchased by Agro-Dealer and Main Fertiliser Suppliers

Region	Central	Nyanza	Western	Overall
DAP				
Average amount of fertiliser purchased (kg)	30,184	4,704	42,934	29,327
Main fertiliser supplier (% reporting)				
Fertiliser company	20.00	11.11	6.45	12.16
Wholesale agro-dealers	80.00	83.33	90.32	85.14
Retail agro-dealers			3.23	1.35
KFA		5.56		1.35
Distance (km) to main supplier	40.58	76.97	29.18	45.29
Mode of delivery to Agro-dealer				
Vehicle	100.00	92.11	85.71	91.49
Motorcycle		7.89	4.76	4.26
Handcart			9.52	4.26
Cost of delivery (US$/kg)	0.01	0.02	0.01	0.01
Average purchase price for smallest volume	0.68	0.77	0.81	0.76
Average purchase price for largest volume	0.68	0.81	0.83	0.78
Month of purchase for largest volume	April	March	March	March
(% Reporting)	(37.5)	(55.26)	(66.67)	(54.6)
SSP				
Average amount of fertiliser purchased (kg)			500.00	500.00
Main fertiliser supplier				
Wholesale agro-dealer			100	100
Distance (km) to main supplier			15.00	15.00
Mode of delivery				
Vehicle			100	100
Cost of delivery (US$/kg)			0.01	0.01
Average purchase price for smallest volume			0.47	0.47
Average purchase price for largest volume			0.47	0.47
Month of purchase for largest volume			March	March
(% Reporting)			(100)	(100)
NPK 20:20:0				
Average amount of fertiliser purchased (kg)	9,247		250	8,684
Main fertiliser supplier (% reporting)				
Fertiliser company	40.00			37.50
Wholesale agro-dealer	60.00		100.00	62.50
Distance (km) to main supplier	73.06		50.00	71.84
Mode of delivery				
Vehicle	100.00		100.00	100.00
Cost of delivery (US$/ kg)	0.01			0.01
Average purchase price for smallest volume	0.59	-	0.65	0.59
Average purchase price for largest volume	0.59	-	0.59	0.59
Month of purchase of largest volume	March		March	March
% Reporting month	33.33		100.00	36.86
NPK 17:17:0				
Qty purchased in kg	4190			4190
Main fertiliser supplier				
Fertiliser company	20.00			20.00
Wholesale agro-dealer	80.00			80.00
Distance	39.67			39.67
Mode of delivery				
Vehicle	100			100
Cost of delivery (US$/kg)	0.01			0.01
Average purchase price for smallest volume	0.63	-	-	0.63
Average purchase price for largest volume	0.65	-	-	0.65
Month of purchase of largest volume	March/April			March/April
(% Reporting)	(41.7)			(41.7)

Table 3.8: Volume of Fertiliser Purchased by Agro-Dealer and Main Fertiliser Suppliers

Region	Central	Nyanza	Western	Overall
NPK 25:5:+5s				
Average amount of fertiliser purchased (kg)	8125			8125
Main fertiliser supplier (% reporting)				
Wholesale agro-dealer	100			100
Distance to supplier	11.00			11.00
Mode of delivery				
Vehicle	100			100
Cost of delivery per (US$/ kg)	0.01			0.01
Average purchase price for smallest volume	0.60	-	-	0.60
Average purchase price for largest volume	0.60	-	-	0.60
Month of purchase of largest volume	April/August			April/August
(% reporting)	(50)			(50)
CAN 26:0:0				
Average amount of fertiliser purchased (kg)	18,790	1,383	8,510	10,131
Main fertiliser supplier (% reporting)				
Fertiliser company	24.00	10.53	3.23	12.00
Wholesale agro-dealer	76.00	84.21	96.77	86.67
KFA		5.26		1.33
Distance (km) to main supplier	51.44	70.21	30.33	46.99
Mode of delivery				
Vehicle	100.00	89.47	93.55	94.67
Bicycle		5.26		1.33
Motorcycle		5.26	3.23	2.67
Handcart			3.23	1.33
Cost of delivery (US$/kg)	0.01	0.02	0.01	0.01
Average purchase price for smallest volume	0.44	0.59	0.58	0.54
Average purchase price for largest volume	0.44	0.59	0.59	0.55
Month of purchase of largest volume	March	March	March	March
(% reporting)	(30.56)	(38.23)	(26.31)	(30.7)
UREA 46:0:0				
Average amount of fertiliser purchased (kg)	1,287	2,696	8,228	4,265
Main fertiliser Supplier (% reporting)				
Fertiliser company	13.33	11.76	11.11	12.00
Wholesale agro-dealer	86.67	82.35	83.33	84.00
KFA		5.88		2.00
Distance (km) to main supplier	31.33	50.36	43.75	43.43
Mode of delivery				
Vehicle	100.00	88.24	94.44	94.00
Bicycle		5.88		2.00
Motorcycle		5.88	5.56	4.00
Cost of delivery (US$/ kg)	0.01	0.01	0.01	0.01
Average purchase price for smallest volume	0.49	0.61	0.59	0.58
Average purchase price for largest volume	0.51	0.62	0.60	0.59
Month of purchase of largest volume	March	April	May	June
(% reporting)	(46.67)	(40.00)	(30.77)	(37.88)
SA 21:0:0				
Average amount of fertiliser purchased (kg)	907	4,875		2,350
Main fertiliser supplier (% reporting)				
Wholesale agro-dealer	100	100		100
Distance (km) to main supplier	20.29	23.75		21.55
Mode of delivery				
Vehicle	100	100		100
Cost of delivery (US$kg)	0.01	0.01	-	0.01
Average purchase price for smallest volume	0.45	0.47	-	0.46
Average purchase price for largest volume	0.43	0.49	-	0.45
Month of purchase of largest volume	March	May to Nov		March
(% reporting)	(42.86)	(25.00)		(27.27)

Table 3.8: Volume of Fertiliser Purchased by Agro-Dealer and Main Fertiliser Suppliers

Region	Central	Nyanza	Western	Overall
FOLIAR FEEDS				
Average amount of fertiliser purchased (kg)	218	57	182	173
Main fertiliser supplier (% reporting)				
Wholesale agro-dealer	100	100	100	100
Distance (km) to main supplier	18.00	21.60	43.38	29.05
Mode of delivery				
Vehicle	100	100	100	100
Cost of delivery (US$/kg)	0.01	-	0.02	0.01
Average purchase price for smallest volume	1.94	3.41	1.64	2.19
Average purchase price for largest volume	3.09	3.41	1.62	2.59
Month of purchase of largest volume	March/April	August	March	March
(% reporting)	(28.57)	(40.00)	(37.50)	(30.00)
NPK 23:23:0				
Average amount of fertiliser purchased (kg)	15,602	325	7,150	13,002
Main fertiliser Supplier (% reporting)				
Fertiliser company	20.83	50.00	50.00	26.67
Wholesale agro-dealer	79.17	50.00	50.00	73.33
Distance (km) to main supplier	47.06	137.75	33.50	55.67
Mode of delivery				
Vehicle	100	100	100	100
Cost of delivery per (US$/kg)	0.01	0.02	0.01	0.01
Average purchase price for smallest volume	0.63	0.73	0.62	0.64
Average purchase price for largest volume	0.63	0.72	0.65	0.64
Month of purchase of largest volume	April	April	March	March
(% reporting)	(42.42)	(50.00)	(100.00)	(41.03)
NPK 17:17:17				
Average amount of fertiliser purchased (kg)	3,442		6,000	3,638
Main fertiliser Supplier				
Fertiliser company	16.67			15.38
Wholesale agro-dealer	83.33		100.00	84.62
Distance (km) to main supplier	42.47		28.00	41.56
Mode of delivery				
Vehicle	100		100	100
Cost of delivery (US$/ kg)	0.01	-	0.004	0.01
Average purchase price for smallest volume	0.68	-	0.36	0.66
Average purchase price for largest volume	0.67	-	0.36	0.65
Month of purchase of largest volume	April	January		April
(% Reporting)	(60.00)	(100)		(56.25)
MAVUNO BASAL				
Average amount of fertiliser purchased (kg)	19400	100	1192.14	9632.06
Main fertiliser supplier(% reporting)				
Fertiliser company	25.00			11.76
Wholesale agro-dealer	75.00	100.00	100.00	88.24
Distance (km) to main supplier	64.70	80.00	41.33	56.14
Mode of delivery				
Vehicle	100	100	100	100
Cost of delivery (US$/kg)	0.01	0.03	0.01	0.01
Average purchase price for smallest volume	0.63	0.65	0.69	0.66
Average purchase price for largest volume	0.60	0.74	0.71	0.66
Month of purchase of largest volume	April/August	April/January	March	March
(% Reporting)	(30.00)	(50.00)	(66.67)	(33.33)
MAVUNO TOPDRESS				
Average amount of fertiliser purchased (kg)	8,991	75	1,392	6,877
Main fertiliser Supplier(% reporting)				

Table 3.8: Volume of Fertiliser Purchased by Agro-Dealer and Main Fertiliser Suppliers

Region	Central	Nyanza	Western	Overall
Fertiliser company	27.27			20.00
Wholesale agro-dealer	72.73	100.00	100.00	80.00
Distance (km) to main supplier	68.46	100.00	23.83	56.65
Mode of delivery				
Vehicle	100.00	100.00	66.67	93.33
Handcart			33.33	6.67
Cost of delivery (US$/ kg)	0.01	0.03	0.01	0.01
Average purchase price for smallest volume	0.55	0.52	0.72	0.60
Average purchase price for largest volume	0.54	0.52	0.72	0.59
Month of purchase of largest volume	October	May	March	March
(% reporting)	(38.46)	(100)	(66.67)	(40.00)

The marketing arrangement between the interviewed agro-dealers and the suppliers shows that in the overall, the higher percentage of the agro-dealers mainly had arrangements for fertiliser delivery (transport) and credit facilities, but also had commission on sales to a lesser extent. These arrangements were mainly with the wholesalers (Table 3.9). This may be explained by the high percentage of agro-dealers purchasing from the wholesalers as discussed earlier. The fertiliser companies also did provide the same arrangements though this was on a limited scale. Also, the arrangements between fertiliser companies and agro-dealers varied across the regions.

Table 3.9: Marketing Arrangements that Agro-dealers have with Fertiliser Suppliers

Fertiliser supplier	Percent of agro-dealers reporting marketing arrangement by region											
	Central			Nyanza			Western			Overall		
	Transport	Commission	Credit	Transport	Commission	Credit	Transport	Commission	Credit	Transport	Commission	Credit
Fertiliser company												
Mea Ltd	-	3.85	3.85	5.26	-	-	3.13	-	3.13	2.60	1.30	2.60
DMBL Ruiru	-	3.85	-		-	-		-			1.30	
Chapa Meli	7.69	-	3.85	-		-	-		-	2.60		1.30
Athi River mining			3.85			-			-			1.30
Wholesale agro-dealer	50.00	7.69	30.77	10.53	5.26	15.79	21.88	-	15.63	28.57	3.90	20.78
Total	57.69	15.38	42.31	15.79	5.26	15.79	25.00	-	3.75	33.77	6.49	25.97

Fertiliser sales by agro-dealers

As discussed earlier, DAP fertiliser was the most commonly purchased fertiliser. DAP also dominated in the sales of fertiliser as it accounted for 19.7% of the total quantity sold while the least sold was foliar feed and NPK 17:17:17 (Table 3.10). The majority of the buyers were small-scale farmers (above 90%) who were located on average between 3 to 7 kilometres away. The months that the agro-dealer recorded largest sales were in March and April. DAP was the most common fertiliser sold by the agro-dealers where their margin was US$ 0.08/kg for sales of smallest volume and US$ 0.06/kg for the largest volumes. On the other hand, NPK 17:17:17 was sold at a margin of US$ 0.06 per kg and US$ 0.04/kg for largest and the smallest volumes sold, respectively. The highest profit per kg was derived from the sale of foliar feed, although the quantity sold was not much. The margin was US$ 0.73 and 0.69 per kg for smallest and largest volume sold respectively.

Table 3.10: Volume of fertiliser sold by agro-dealers to various fertiliser buyers by region

Region	Central	Nyanza	Western	Overall
DAP				
Average amount of fertiliser sold (kg)	19,329	9,222	17,402	16,107
Main fertiliser buyer (%)				
Small-scale farmers	92.31	100.00	96.77	96.00
Large-scale farmers	7.69		3.23	4.00
Average distance to main fertiliser buyer (km)	5.75	6.65	6.19	6.21
Average fertiliser selling price for smallest volume sold (US$/kg)	0.76	0.88	0.86	0.84
Average fertiliser selling price for largest volume sold (US$/kg)	0.73	0.92	0.88	0.85
Month of sales for smallest volume	January	October	December	December
% reporting	50	29.27	37.09	25.53
Month of sales for largest volume	April	March	March	March
% reporting	36.84	60.98	51.61	48.94
NPK 20:20:0				
Average amount of fertiliser sold (kg)	12,991		250	12,241
Main fertiliser buyer (%)				
Small-scale farmers	93.75		100.00	94.12
Large-scale farmers	6.25			5.88
Average distance to main fertiliser buyer (km)	6.55		2.00	6.34
Average fertiliser selling price for smallest volume sold (US$/kg)	0.63	-	0.70	0.63
Average fertiliser selling price for largest volume sold (US$/kg)	0.64	-	0.65	0.64
Month of sales for smallest volume	January		July	January
% reporting	42.86		100.00	40.91
Month of sales for largest volume	April		March	April
% reporting	33.33		100.00	31.82
NPK 17:17:0				
Average amount of fertiliser sold (kg)	4055			4055
Main fertiliser buyer (%)				

Table 3.10: Volume of fertiliser sold by agro-dealers to various fertiliser buyers by region

Region	Central	Nyanza	Western	Overall
Small-scale farmers	90.00			90.00
Large-scale farmers	10.00			10.00
Average distance to main fertiliser buyer (km)	3.33			3.33
Average fertiliser selling price for smallest volume sold (US$/kg)	0.67	-	-	0.67
Average fertiliser selling price for largest volume sold (US$/kg)	0.71	-	-	0.71
Month of sales for smallest volume	January			January
% reporting	91.67			91.67
Month of sales for largest volume	March			April
% reporting	50.00			50.00
CAN 46:0:0				
Average amount of fertiliser sold (kg)	18,425	1,366	8,628	9,959
Main fertiliser buyer (%)				
Small-scale farmers	91.67	100.00	96.67	95.89
Large-scale farmers	8.33		3.33	4.11
Average distance to main fertiliser buyer (km)	5.23	6.85	6.75	6.38
Average fertiliser selling price for smallest volume sold (US$/kg)	0.50	0.70	0.66	0.63
Average fertiliser selling price for largest volume sold (US$/kg)	0.50	0.71	0.67	0.64
Month of sales for smallest volume	January	October	December	December
% reporting	53.13	30.56	23.64	18.70
Month of sales for largest volume	March	March	May	March
% reporting	31.25	30.56	36.36	27.64
UREA 46:0:0				
Average amount of fertiliser sold (kg)	1,223	2,067	8,292	3,968
Main fertiliser buyer (%)				
Small-scale farmers	86.67	100.00	100.00	95.92
Large-scale farmers	13.33			4.08
Average distance to main fertiliser buyer (km)	4.17	5.29	6.25	5.38
Average fertiliser selling price for smallest volume sold (US$/kg)	0.58	0.71	0.64	0.65
Average fertiliser selling price for largest volume sold (US$/kg)	0.61	0.72	0.65	0.66
Month of sales for smallest volume	January	October	December	December
% reporting	60.00	30.77	50.00	26.15
Month of sales for largest volume	March	March	March/ April	March
% reporting	46.67	26.92	29.17	32.31
SA 21:0:0				
Average amount of fertiliser sold (kg)	907	4,875		2,350
Main fertiliser buyer (%)				
Small-scale farmers	85.71	100.00		90.91
Large-scale farmers	14.29			9.09
Average distance to main fertiliser buyer (km)	5.71	2.00		4.36
Average fertiliser selling price for smallest volume sold (US$/kg)	0.49	0.50	-	0.49
Average fertiliser selling price for largest volume sold (US$/kg)	0.52	0.52	-	0.52
Month of sales for smallest volume	January	January		January
% reporting	42.86	50.00		45.45
Month of sales for largest volume	March	May, Sept to Nov		March
% reporting	57.14	25.00		36.36
FOLIAR FEEDS				
Average amount of fertiliser sold (kg)	9,820	35	150	3,150

Table 3.10: Volume of fertiliser sold by agro-dealers to various fertiliser buyers by region

Region	Central	Nyanza	Western	Overall
Main fertiliser buyer (%)				
Small-scale farmers	100.00	100.00	87.50	93.75
Large-scale farmers			12.50	6.25
Average distance to main fertiliser buyer (km)	3.67	9.80	5.75	6.16
Average fertiliser selling price for smallest volume sold (US$/kg)	2.63	4.42	2.18	2.91
Average fertiliser selling price for largest volume sold (US$/kg)	3.84	4.42	2.15	3.28
Month of sales for smallest volume	January	April/ October	December	July
% reporting	50.00	40.00	37.50	26.32
Month of sales for largest volume	March	March	March	March
% reporting	50.00	60.00	50.00	52.63
NPK 23:23:0				
Average amount of fertiliser sold (kg)	11,790	265	7,150	9,944
Main fertiliser buyer (%)				
Small-scale farmers	91.67	100.00	100.00	93.33
Large-scale farmers	8.33			6.67
Average distance to main fertiliser buyer (km)	4.82	17.50	6.00	6.26
Average fertiliser selling price for smallest volume sold (US$/kg)	0.68	0.79	0.66	0.69
Average fertiliser selling price for largest volume sold (US$/kg)	0.68	0.79	0.69	0.70
Month of sales for smallest volume	January	December	December /July	January
% reporting	58.06	50.00	50.00	48.65
Month of sales for largest volume	April	April	March	April
% reporting	45.16	50.00	100.00	43.24
NPK 17:17:17				
Average amount of fertiliser sold (kg)	2,823		6,000	3,088
Main fertiliser buyer (%)				
Small-scale farmers	90.91		100.00	91.67
Large-scale farmers	9.09			8.33
Average distance to main fertiliser buyer (km)	6.23		15.00	6.96
Average fertiliser selling price for smallest volume sold (US$/kg)	0.74	-	0.39	0.71
Average fertiliser selling price for largest volume sold (US$/kg)	0.72	-	0.39	0.70
Month of sales for smallest volume	January		December	January
% reporting	54.55		100.00	50.00
Month of sales for largest volume	April		February	April
% reporting	54.55		100.00	50.00
MAVUNO BASAL				
Average amount of fertiliser sold (kg)	19338	100	1370	10195
Main fertiliser buyer (%)				
Small-scale farmers	100	100	100	100
Average distance to main fertiliser buyer (km)	8.30	6.00	4.63	6.60
Average fertiliser selling price for smallest volume sold (US$/kg)	0.70	0.70	0.80	0.74
Average fertiliser selling price for largest volume sold (US$/kg)	0.68	0.83	0.81	0.75
Month of sales for smallest volume	January/April	May/ December	December	January

Table 3.10: Volume of fertiliser sold by agro-dealers to various fertiliser buyers by region

Region	Central	Nyanza	Western	Overall
% reporting	40.00	50.00	37.50	25.00
Month of sales for largest volume	April/ August	March/April	March	March
% reporting	30.00	50.00	75.00	45.00
MAVUNO TOPDRESS				
Average amount of fertiliser sold (kg)	8,955	75	1,392	6,850
Main fertiliser buyer (%)				
Small-scale farmers	100	100	100	100
Average distance to main fertiliser buyer (km)	4.88	8.00	3.83	4.71
Average fertiliser selling price for smallest volume sold (US$/kg)	0.60	0.65	0.76	0.65
Average fertiliser selling price for largest volume sold (US$/kg)	0.58	0.65	0.75	0.64
Month of sales for smallest volume	January	April	July	January
% reporting	58.33	100.00	50.00	36.84
Month of sales for largest volume	March/ October	June	March	March
% reporting	33.33	100.00	66.67	42.11

The marketing arrangements between the agro-dealers and buyers are summarized in Table 3.11. Overall, the most common marketing arrangement was availing credit facilities to the buyers followed by discount and transport, while the least arrangement was on advice. The higher proportions of this arrangement were with small scale farmers given they comprised majority of the buyers.

Table 3.11: Marketing Arrangements with Fertiliser Buyers by Region

Buyers	Percent of agro-dealers reporting marketing arrangement by region															
	Central				Nyanza				Western				Overall			
	Transport	Discount	Credit	Advice	Transport	Discount	Credit	Advice	Transport	Discount	Credit	Advice	Transport	Discount	Credit	Advice
Small scale farmers	**15.38**	**30.77**	**53.85**	**-**	**15.79**	**10.53**	**63.16**		**9.38**	**25.00**	**56.25**		**12.99**	**23.38**	**57.14**	
Large scale farmers		-	-			5.26	10.53			-	-			1.30	2.60	
Other agro-dealer	3.85		3.85		-		-		3.13		3.13		2.60		2.60	
Farmer groups		7.69		3.85		-		-		-		-		2.60		1.30
Institutions			3.85				-				-				1.30	
Overall	19.23	38.46	61.54	3.85	15.79	15.79	73.68	-	12.50	25.00	59.38	-	15.58	27.27	63.64	1.30

Farmers

This is the largest segment in the fertiliser chain. Farmers are the consumers of fertilisers and are mostly based in the rural areas. While large scale farmers are organized into associations, small scale farmers who number about 4.5 million are, for all intents and purposes not organized. Credit arrangement between farmers and stockists are few and they are mainly based on trust.

Institutions

These include farmer institutions like KTDA and private companies like British American Tobacco (BAT), Mastermind LTD, Del Monte, Moi University etc. While private companies under this category are the end users of the fertilisers, others like KTDA and coffee cooperatives purchase fertilisers and distribute to their farmers. The institutions dealing with farmers provide information on type, quality, use and safe handling of the various fertilisers they supply.

Most of these players in the fertiliser supply chain are not organized and operate independently.

Regulators

Kenya Bureau of Standards (KEBS)

The Bureau of Standards sits in the fertiliser technical committee that helps in the policy formulation. The main function of the Kenya Bureau of Standards is to set fertiliser standards for both the imported and manufactured fertilisers. Imported fertilisers should be accompanied by a certificate of conformity issued by the international inspectors at the country of origin. KEBS then takes random samples on the landed fertiliser to determine its conformity to the Kenyan standards. Fertilisers failing to meet the Kenyan standards are rejected and returned to the country of origin at the importer's cost. According to KEBS compliance of the mainstream and officially traded fertilisers, to the standards is over 90%.

KEBS plays a minor role in lower part of the chain. While it does conduct market surveys to determine the quality of products at the ground, it does not enforce the fertiliser standards beyond the warehouse.

Kenya Plant Health Inspectorate Service (KEPHIS)

The role of KEPHIS is to inspect and enforce all products pertaining to plant health, fertilisers included. KEPHIS's role is relatively more pronounced at the wholesale and retailing levels.

3.7 Operating Environment in Fertiliser Sub-sector

This section addresses various aspects that can be used to describe the operating environment for agro-dealers in the fertiliser industry. These include market information, staff training, access to credit, insurance, investments, taxes and constraints faced by the various players.

Market information

Table 3.12: Sources of Market Information

Source of information	Percentage of agro-dealers reporting various sources for the different types of information needed to run a business						
	Type of marketing information sought						
	Suppliers of fertiliser	Demand for fertiliser	How to price fertiliser	Correct type of fertiliser to sell in area	New type of fertiliser in the market	Quality of fertiliser	Overall
Marketing information point	1.28						0.22
Neighbour /family /friend	2.56	1.30		1.30			0.87
Demonstration plot				1.30		7.79	1.52
Radio	3.85		1.32		18.18		3.90
Newspapers					1.30		0.22
Extension worker		3.90		41.56	1.30	3.90	8.44
Other fertiliser stockists	58.97	5.19	73.68	5.19	22.08	6.49	28.57
Fertiliser companies	24.36	1.30	18.42	5.19	42.86	48.05	23.38
Field day	1.28	1.30		5.19	6.49	2.60	2.81
Brochures /pamphlets	1.28		1.32			1.30	0.65
Farmer feedback		64.94	1.32	19.48	3.90	28.57	19.70
MOA	1.28			1.30			0.43
Seminars	2.56			1.30	2.60		1.08
Demand situation	1.28	22.08	2.63	15.58			6.93
Supplier/distributor	1.28		1.32	1.30	1.30	1.30	1.08
Research/soil samples				1.30			0.22

The common source of market information for running agro-dealers business is other fertiliser stockists, closely followed by fertiliser companies and then farmer feedback, while the least

important sources of information are the MoA newspapers, market information points, brochures /pamphlets and research/soil samples (Table 3.12).

Training

The most common forms of training which agro-dealers have undergone are business management and fertiliser use. Others are in fertiliser handling, application and soil testing. There were various institutions that were involved in the training of the agro-dealers as shown on Table 3.13. The sponsorship was either by self or form an NGO with the government and private companies playing a marginal role. The main benefits from such training were enhanced capcity for agro dealers to give better advice to fertiliser buyers, increased sales due to better management of their business.

Table 3.13: Training undertaken by the Agro-dealers

	Business management	**Fertiliser usage**	**Fertiliser handling**	**Fertiliser application**	**Soil testing**
Agro-dealers who have undertaken training	12	11	6	1	2
Provider of training					
• Government	2	1	1	-	-
• NGO	10	7	3	-	2
• Research institute /university	-	-	1	-	-
• Fertiliser company	-	3	1	-	-
• Agro chemical company	-	-	-	1	-
Sponsor					
• Self	6	4	4	-	-
• NGO	6	5	2	-	2
• Fertiliser/agrochemical company	-	1	-	1	-
• Govt/MOA	-	1	-	-	-
Benefits					
• Better management	12	4	4	-	-
• Increased sales	2	4	1	-	-
• Better advice to buyers	8	11	5	1	2

Credit

Out of the total sample of agro-dealers, 38% sought credit and most of those applying (90%) got the credit which on average was about US$ 12,952. The majority of the credit was from fertiliser

suppliers, microfinance institutions and commercial banks. The average repayment period was 11.3 months and all the Agro-dealers were paying back as expected (Table 3.14).

Table 3.14: Access to loan facilities in the last 12 Months

	Central	Nyanza	Western	Overall
% that sought credit over last 12 months	30.77	31.58	46.88	37.66
% that obtained credit:				
of those who sought	87.50	83.33	93.33	89.66
of all agro-dealers	26.92	26.32	43.75	33.77
Average amount received (US$)	3,960	1,071	24,031	12,952
Source of credit				
Commercial bank	37.50	14.29	21.43	24.14
Microfinance		42.86	50.00	34.48
Friends /family		14.29		3.45
Fertiliser supplier	62.50	28.57	28.57	37.93
Average annual interest rate				
Commercial bank	18.00	18.00	16.83	17.50
Microfinance	.	20.00	18.23	18.76
Friends /family	.	-	.	-
Fertiliser supplier	-	-	-	-
Overall	18.00	19.50	17.81	18.24
Average repayment period (months)	11.41	12.29	10.75	11.30
Number of instalments in a year	21	15.71	13.93	16.31
% making payments as expected	100	100	100	100

Perception of agro-dealers on credit facilities is summarized in Figure 3.6. Generally, majority felt that they have easy access to short term credit, credit received has assisted the growth of their business and the terms were friendly.

Investment

Overall, on average the initial capital to start the business was US$ 942 and the major source of this capital was from own savings. The other source of initial capital mentioned, although to a smaller extent was profits from other businesses. Out of the sampled agro-dealers, 35% had undertaken investment in the past 12 months of which majority expanded their business. On average, the agro-dealers invested an average of US$ 0.04 million and the main source of the investment was own savings followed by loans (Table 3.15).

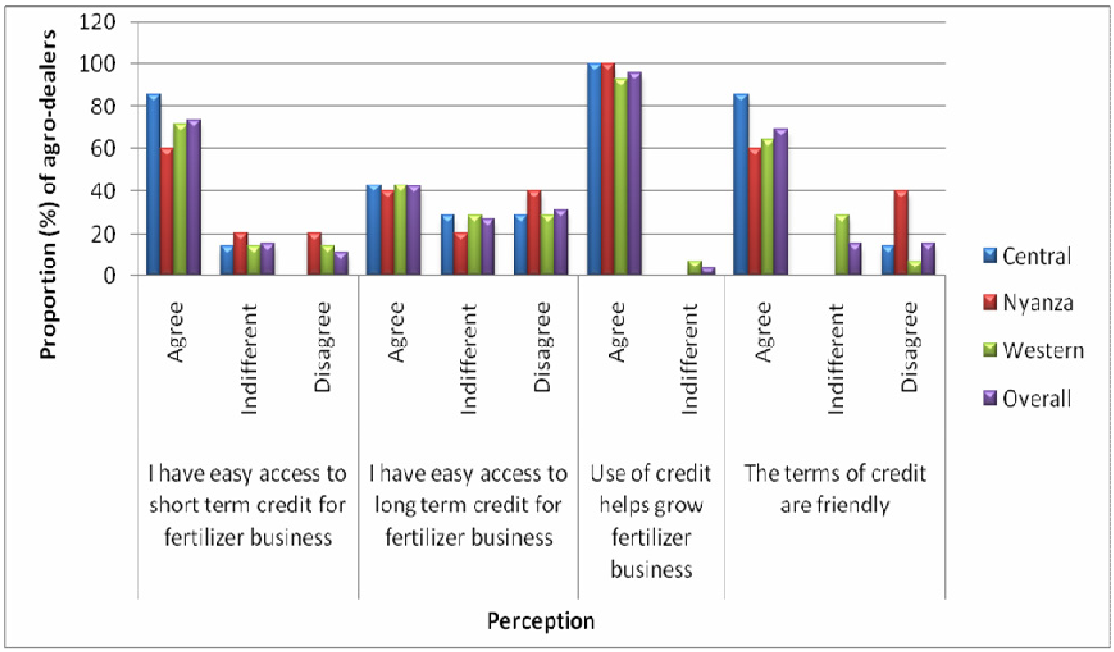


Fig. 3.6: Perceptions of Agro-dealers about credit facilities

Table 3.15: Types of investments and sources of capital for the fertiliser business in the last 12 months

	Western	Nyanza	Central	Overall
Average amount of initial capital for business (US$)	459	388	1,980	942
Source of initial capital (%)				
Savings	50.0	47.4	68.0	55.3
Business profits	28.1	10.5	8.0	17.1
% of agro-dealers that had business investments	28.1	47.4	34.6	35.1
Business investments				
Expansion of business	88.9	100.0	100.0	96.3
Opening another branch	11.1			11.1
Average value of investment (US$)	1,911	8,301	149,350	45,196
Source of funds				
Savings only	37.5	50.0	50.0	46.2
Loans	37.5	10.0	12.5	19.2

Constraints

The main constraints facing fertiliser agro-dealers are ranked and summarized in Table 3.16. The first major constraint is inadequate supply during peak season, followed by fluctuating prices and demand fluctuations in that order.

Table 3.16: Main constraints faced in running fertiliser business

Constraints faced (ranked in order of importance)	Proportion (%) of agro-dealers reporting			
	Western	Nyanza	Central	Overall
1. Inadequate supply in peak season	50.00	42.11	43.75	45.45
2. Fluctuation of fertiliser prices	50.00	36.84	37.50	41.56
3. Demand fluctuations due to seasonality	19.23	21.05	37.50	27.27

Training

Retailers can potentially play an important role in farmer education and product promotion, as well as teaching farmers on the fertiliser use and safe handling. Some manufacturers conduct workshops and seminars for the retailers and the distributors so as to empower agro-dealers with accurate information about the fertiliser and its application.

The interviewed agro-dealers indicated that the main types of information that buyers seek from them are use instructions/application rates (41.6%) and storage instructions (40.3%). Others include information on prices and nutrient composition.

3.8 Power and Governance

Although currently Kenya does not have a fertiliser policy in place, a draft fertiliser bill is currently being discussed. The *National soil fertility draft policy, and National fertiliser development strategy and action plan* seeks to facilitate the restoration and maintenance of soil fertility in order to increase productivity, improve food security and contribute to poverty reduction while conserving the soil and water resources and protecting the environment. It sets guidelines for institutionalizing soil fertility management to arrest the declining trend in soil fertility and ensure increased land productivity.

Over the years, the rules and regulations in the fertiliser industry and their enforcement are defined in *The Fertiliser Act, CAP 345* of the Laws of Kenya. The Act is currently under review and the section on technical aspect is said to be complete. Limitations of this Act have long been identified as an impediment to its enforcement. They are:

- The inability to enforce administration of the Fertiliser and Animal Food Stuffs Act (Cap 345) of the Laws of Kenya in its current form because it is not clear on the right authorities that enforce it.

- The Director of Veterinary Services is the enforcer of the Act and not the Director of Agriculture.

- The roles of the Kenya Bureau of Standards, Kenya Agricultural Research Institute and Kenya Plant Health Inspectorate Service in the analysis, inspection and regulation of fertilisers are not clear in the Act.

- The institutional placement of the agency responsible for administration of the Fertilisers and Foodstuffs Act (Cap 345) of the Laws of Kenya is an anomaly in the implementation of the Act. The fertiliser Act lumps together Fertilisers and Animal Foodstuffs, which are housed in separate Ministries of Agriculture and Livestock and Fisheries Development respectively.

- The Act defines makes reference to inorganic fertilisers but excludes organic fertilisers such as bio-fertilisers, manures and types of composts, which are on sale in the market**.**

- The Act does not provide for testing or analysis of fertilisers that are locally manufactured and blended. Thus providing a loophole for sale of underweight, low-grade and adulterated fertilisers.

- The Act does not list accredited laboratories for fertiliser analysis nor does it provide a framework through which stakeholders get linked to registered inspectors and analysts.

- Inadequate enforcement of soil conservation rules in the Agriculture Act (Cap 318) of the Laws of Kenya;

- The task of promoting fertiliser use against low producer prices and corresponding high input prices;

- Provision of soil testing services at reasonable charges while the reagents are imported at, relatively, higher costs;

- Input suppliers are not required by law to provide extension services for efficient use of the inputs they supply. Likewise, merchants are not obligated to advise farmers on the quality and quantity of the produce they desire to purchase.

- Many fertiliser traders and stockists have limited knowledge of the fertilisers and their suitability for different soils and crops. This has contributed to inappropriate use of fertilisers. There is no policy to ensure that fertiliser dealers attain some basic training in agriculture and specifically on fertiliser use.

Consultations within the fertiliser sector with regard to policy formulation is said to be increasing. Members of the Fertiliser Association of Kenya (FAK[21]) have been invited to participate in policy review currently underway. The private sector is normally consulted and also sits in the Technical committee on fertiliser where they air the views of both the importers, traders. Other key organisations represented in the review panel for fertiliser Act include; KEPHIS, KEBS, Ministry of Agriculture, Ministry of Trade, Consumer Information Network, KENFAP among others.

Price determination: The domestic price for fertiliser depends on the world fertiliser prices. The importers add the taxes, charges and their margins to these world prices. Each player along the chain also adds their logistic costs plus a small margin to determine the price at which to sell. The government who is also an importer determines and regulates fertiliser prices through its subsidy schemes.

Agro-dealers were asked about their views on power governance in the industry. A large number of them indicated that it is the fertiliser companies who set up the price. A number of them also mentioned the government and the wholesalers among other price setters (Figure 3.7).

[21] Importers (not less than 10) and some distributors formed Fertiliser Association of Kenya in 2007 to unite the players in the fertiliser industry and to act as a body through which members could air their views and grievances. This association is well still in its infancy

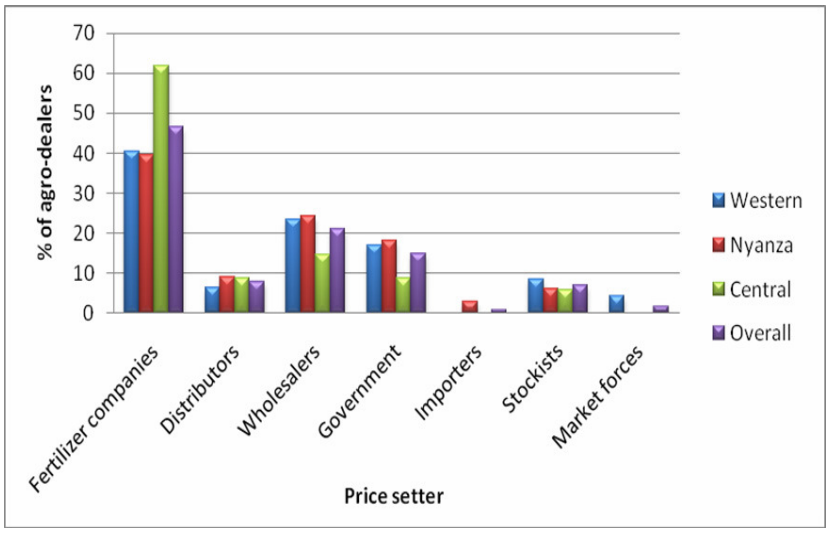


Fig. 3.7: Price setting in the fertiliser industry (Agro-dealers' Viewpoint)

The selling price by most agro-dealers is based on the fertiliser buying price with adjustments mainly for margins and transport costs (Figure 3.8).

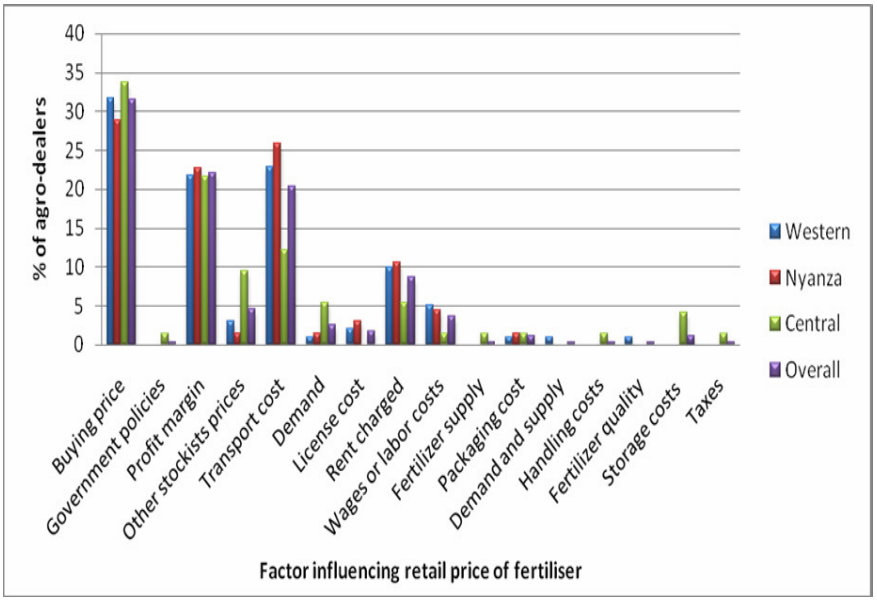


Fig.3.8: Factors Determining fertiliser retail price (Price setting by Agro-dealers)

Membership in fertiliser associations

In the past, agro-dealers were not organized into any formal groups although some wholesalers/distributors are associate members of FAK. In 2009, the first agro-dealer association Kenya National Agro-dealer Association (KENADA) was formed. It is expected to serve as a legal and technical link between the farmer and the manufacturers of farm inputs and represent

its members' interests in national discussions of agricultural development and allowing its members to achieve commodities of scale in bulk purchases and sales.

From the sampled agro-dealers, only a few were members of an association (13%). Out of the agro-dealers that were in any association, most of them were members of KENADA (Table 3.17).

Table 3.17: Membership of Fertiliser Stockists in Agro-dealer Associations

	Western	Nyanza	Central	Total
Membership to agro-dealer association	15.6	15.8	7.7	13.0
Name of agro-dealer association				
ADSP Seed Dealers		33.3		10.0
Kakamega Agricultural Suppliers	20.0			10.0
KENADA	20.0	33.3		20.0
KENADA-Kakamega	20.0			10.0
KENADA-Murang'a			50.0	10.0
Busia Agro-dealer Association	20.0			10.0
Malakisi Agro-dealer Association	20.0			10.0
MAVUNO			50.0	10.0
SILIDA/KALT		33.3		10.0

Note: SILIDA (Siaya Livestock Development Association)
KALT (Kenya Animal Health Technicians)

Women participation in fertiliser marketing chain

Women play a very important role in fertiliser distribution and use and are greatly respected due their honesty[22] and hard work. There are however no women participating in the importation or manufacturing segment of the fertiliser chain. Moreover, very few are distributors. Women are said to be mainly operating at the stockist level and at the farm level (most farmers are women). An analysis of the gender for the 80 agro-dealer respondents reveals that 61% were male while 39% were female. Out of the 80 respondents, 42 of them were owners of the agro-dealer business whilst the rest were employees and in rare cases, members of the immediate family. Gender dis-aggregation of the owners indicates that 70% were male while 30% were females. This shows that there are twice as many male owners of agro-dealer businesses as there are women owners.

Women's concentration to the lower levels of the fertiliser chain (agro-dealer and farm level) is attributed to the following:

- The fertiliser industry is very political and there exists a cartel that shuts out new entrants particularly women.

[22] Some importers claim never to have lost any money from supplying fertilisers to women chain players.

- Women lack of exposure and lack of economical empowerment, credit and knowledge.
- The participation of women is very low in the manufacturing segment because players at this level tend to deal more with issues of sale storage and transportation, duties that are commonly left to the men.
- Fertiliser business at higher levels is capital intensive venture and women are usually not comfortable with such dealings. For example, shipment of a single vessel is estimated at about 1 million dollars and most women cannot afford this.
- Culture where women cannot own anything and cannot make significant decisions on their own is a real stumbling block in the way of women's participation at higher levels.

Options for increasing women's participation: Women can be empowered to realize their full potential in this business through forming a cooperative movement that is gender friendly i.e. women empowerment its main agenda among other options.

3.9 Subsidies in the Fertiliser Sub-sector

Taxes and Levies

Fertiliser is zero rated since 2008 and hence there are no taxes imposed except the 2.25% import declaration fee (IDF) which is paid at the port of entry. However, there are certain costs to imported fertilisers as illustrated in Table 3.18.

Table 3.18: Taxes and Levies

Order of Taxes on Imported Fertiliser	
Type of Tax	**Tariff**
Pre-inspection Verification of conformity (PVoC)	0.475% FOB value
Port tariffs	5 US$ per ton.
Import Declaration Fee (IDF)	2.25% of CIF.
VAT*	16% on packaging material and services rendered like off-loading, bagging & transport
Incentives for labour**	10 US$ per ton
Order of Taxes on Locally Manufactured Fertiliser	
Type of Tax	Tariff
VAT*	16% For raw materials (Rock Phosphate and Sulfur)
Excise duty	125% on Poly-ethylene materials
IDF	2.25% CIF value

*paid then claimed later for a refund which takes as long as six months
** paid to reduce the inefficiencies at the port

Locally manufactured fertiliser is also zero rated, this tax waiver is said not to benefit the local manufacturers due to the duty imposed on polythene bags and poly-ethylene material (120%) which makes packaging costs too high. The refund against claims made by the industry normally takes too long to be released by the government.

Fertiliser Subsidy Scheme

Currently there are two government subsidy schemes designed to assist the resource poor households' in accessing fertiliser and to protect them from exploitation by traders. The two schemes are:

- National Accelerated Agricultural Input Access Programme (NAAIAP): The aim of the programme is to promote input use by improving access, affordability and incentives for poor small scale farmers who own land but cannot access inputs. The scheme is implemented by the Ministry of Agriculture in partnership with CNFA/AGMARK. The scheme which begun in 2007 will run for three years. In 2007/2008 cropping year, the scheme benefitted 14,000 farmers.. In the 2008/2009 cropping year, the number of targeted farmers were 92,000.

  Under this programme poor farm households who are currently not using purchased agricultural inputs like inorganic fertiliser were offered a free package (100% subsidy) comprising of one 50 kg bag of DAP and another of CAN. The inputs[23] were said to be enough inputs to plant on one acre of land. The farmers redeemed their voucher from agro-dealers registered with CNFA/AGMARK. The process of obtaining the government fertiliser is explained in the Figure 3.9.

[23] *The inputs supplied are:*
- *1 bag (50kg) of Basal fertiliser.*
- *1 bag (50 kg) of Top dressing fertiliser.*
- *10 kg of Seeds.*

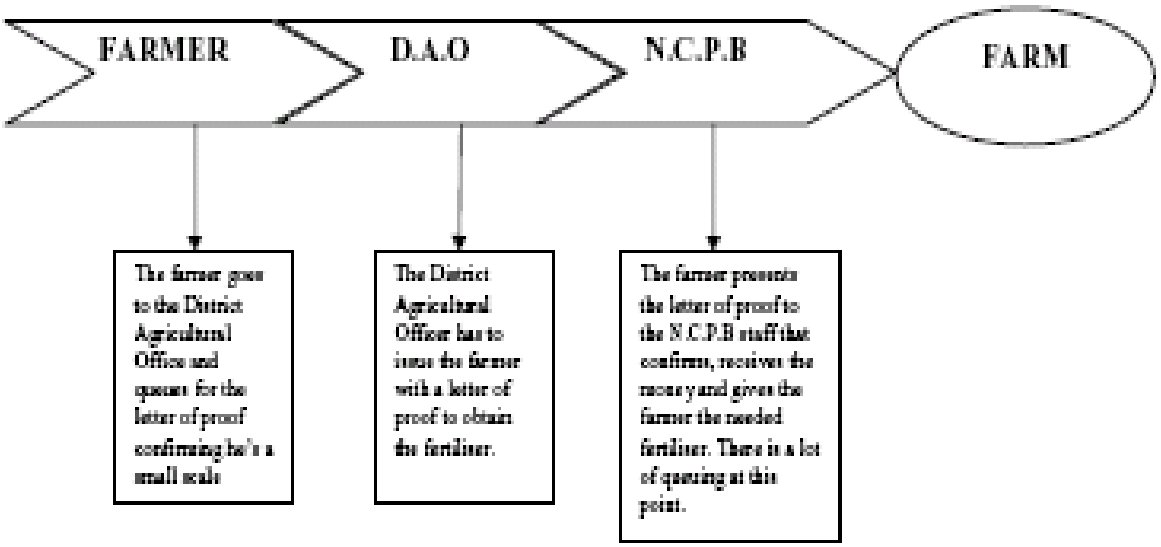


Fig. 3.9: Process of obtaining fertiliser under NAAIAP

- In 2008, the government introduced subsidized fertilisers to cushion farmers from the sharp increase in prices. The government imported 146,000 Metric Tonnes of fertiliser and sold it through NCPB depots at subsidized prices. The cost to the government of a 50kg bag of DAP was US$ 39 while the subsidized price was US$ 26, reflecting a subsidy level of 34%. For CAN, the cost to the government of a 50kg bag was US$ 31 and the subsidized price was US$ 18, reflecting a subsidy level of 42%.

Participation of agro-dealers in the fertiliser subsidy programme

Some agro-dealers participated in the fertiliser subsidy scheme, and the volume and types of fertiliser that they sold through these schemes are as shown in Table 3.19.

Overall, subsidy vouchers for fertiliser were mainly from the government, and were reported by agro-dealers in Central and Western regions only. In Nyanza region, vouchers were provided by an NGO (PLAN International).

Average volume of fertiliser sold under the subsidy scheme was highest in the Central region followed by the Western region. Apparently, NPK 20:20:0, NPK 23:23:0, Mavuno basal and Mavuno top-dress were sold only in the Central region.

Table 3.19 Volume and price of fertiliser sold through fertiliser subsidy scheme over the last 12 months by fertiliser type

Average volume and price of fertiliser	Region			
	Western	Nyanza	Central	Overall
DAP				
Volume of fertiliser sold (kg)	29000	200	267150	98783.33
Price of fertiliser per unit (US$) 50kg bag	48	44	26	41
NPK 20:20:0				
Volume of fertiliser sold			56850	56850
Price of fertiliser (US$)50kg bag			25.86	25.86
CAN 26:0:0				
Volume of fertiliser sold	29000	200	95725	55162.5
Price of fertiliser (US$)Tonne			413.76	413.76
Price of fertiliser (US$)50kg bag	23.92	33.62	23.70	25.43
NPK 23:23:0				
Volume of fertiliser sold				56250
Price of fertiliser (US$) Tonnes				517.20
Price of fertiliser (US$) 50kg bag				41.38
Mavuno-basal				
Volume of fertiliser sold				4775
Price of fertiliser (US$)50kg bag				34.91
Mavuno-top dress				
Volume of fertiliser sold				4425
Price of fertiliser (US$) 50kg bag				23.27

Generally, the perception of the agro-dealers on the fertiliser subsidy scheme was mixed. There was agreement that the fertiliser was delivered on time and resulted in higher sales. On the negative side, it brought conflict with customers, was tedious, took long to process vouchers and the whole process was too complex (Table 3.20).

Table 3.20: Perceptions of Agro-Dealers on Fertiliser Subsidy Schemes

Aspect of subsidy scheme	Percent of agro-dealers reporting:		
	Agree	Indifferent	Disagree
I sold more fertiliser under this system	87.5	-	12.5
Delivery of fertiliser was timely	75.0	-	25.0
It brought conflicts between my customers and I	62.5	-	37.5
It was too involving/tedious/time-consuming	62.5	-	37.5
There was a lot of uncertainty over whether payments will be made	50.0	-	50.0
The time taken to process the vouchers into cash was too long	62.5	-	37.5
The process was too complex	62.5	-	37.5

Limitations of fertiliser subsidy programme

The government subsidy focused on relieving the burden of high input costs from poor farmers. The fertiliser may not have benefitted the targeted households because: the subsidized fertilisers was inaccessible since it was only found in certain locations; the bureaucracies (lengthy protocol and procedures followed) in obtaining the fertiliser from the designated NCPB depots.In addition, farmers had to contend with long queues in NCPB stores and this made most farmers opt for the expensive but easily available fertilisers from stockists in view of the effects of late planting to the performance of the crops.

The NAAIAP programme, the free seeds and inputs focused on maize only and hence does not consider the other crop enterprises which small scale farmers grow.

The general view of all the key chain players apart from farmers is that the direct subsidy to the farmers is the most non-supportive government policy that has been enacted in the fertiliser industry. The subsidy scheme is said to have been initiated without consultation with the players in the industry and thus only took care of the government's interests. The scheme is not well structured and deemed to be injurious to the importers and indeed the other players in the fertiliser supply chain. The intervention is said to have distorted prices (e.g. the government does not pay IDF). Private sector would like the fertiliser sector left to operate in a free market system where demand and supply are the price determinants which is otherwise healthy for business development. If any subsidization is necessary, the government should subsidize the fertiliser at all levels of the chain. Due to the intervention, sales targets of most of the chain players were not met because they were out competed in the market. In addition the flow of stock reduced thereby increasing the storage costs. The subsidized fertilisers accounted for 31% of the total fertiliser.

4.0 SEEDS PROGRAMME

4.1 Overview of the Seed Sub-sector

Kenya's seed industry consists of formal and informal sub-sectors, which are mainly distinguished by seed handling circumstances. The informal sub-sector provides nearly 80% of the country's seed. This refers mainly to cases where farmers use seed from unregulated sources, such as seed bought from the local market or obtained from neighbours, or largely own seed saved from their own production. On the other hand, the formal seed sector operates through an established regulatory process (Seeds and Plant Varieties Act, Cap 326) and according to international seed testing and certification schemes (International Seed Testing Association, ISTA and OECD, respectively). The latter is applicable mainly to seeds of major and/or high value crops grown in high potential or under intensive production systems. Development of seed is done mainly by registered seed companies or their authorized agents. Kenya Plant Health Inspectorate Service (KEPHIS) is the national seed certification authority. Seed certification by KEPHIS is governed by the Seeds and Plant Varieties Act (Cap 326) and other related legislations. Certification of seed is a legal requirement in Kenya.

As at June 2008, there were 67 registered seed enterprises in Kenya but the number has increased to 79 currently, some of which are members of the Seed Trade Association of Kenya (STAK). STAK is an organisation of seed companies which are registered by the Kenya Plant Health Inspectorate Services (KEPHIS) to produce, process and/or distribute seed in Kenya, and includes service providers. The Seed Trade Association of Kenya accounts for about 90% of Kenya's formal seed business, but provides only 20% of total planting materials (depending on crop).

Kenya's annual seed requirement varies from 24,000 to 35,000 metric tons, with annual seed sales averaging 30,000 to 37,000 metric tons, between 2004 and 2006. Seed imports have been rising, from 4% in 1999 to 22% in 2005/06. In 2007, seed production was exceptional at 44,000 metric tons, due to good weather and early harvest.

In terms of seed availability, maize seed dominates the formal seed sector, with 97% market share. However, vegetable seed is rapidly growing. Kenya Seed Company is the largest local

seed company, and accounts for almost 90% of the formal seed sector that was available for the 2008 planting season. The proportion of maize seed available by agro-ecological zones is as follows: High altitude (78.5%), mid-altitude (14.7%), coastal areas (0.7%). Others include Open pollinated varieties (OPV) (1.2%) and early maturing (5%), (Nyachae, 2008).[24]

The KEPHIS annual report of 2008 indicates that about 27,078 mt of certified maize seed was produced in 2008, while Nyachae (2008) indicated that the total maize seed available in 2008 was 43, 681 mt. The difference perhaps indicates a proportion of maize seed that was available through informal seed production systems.

4.1.1 Organisational map of the seed supply and marketing chain

Figure 4.1 shows the organisational map of the seed supply and marketing chain in Kenya.

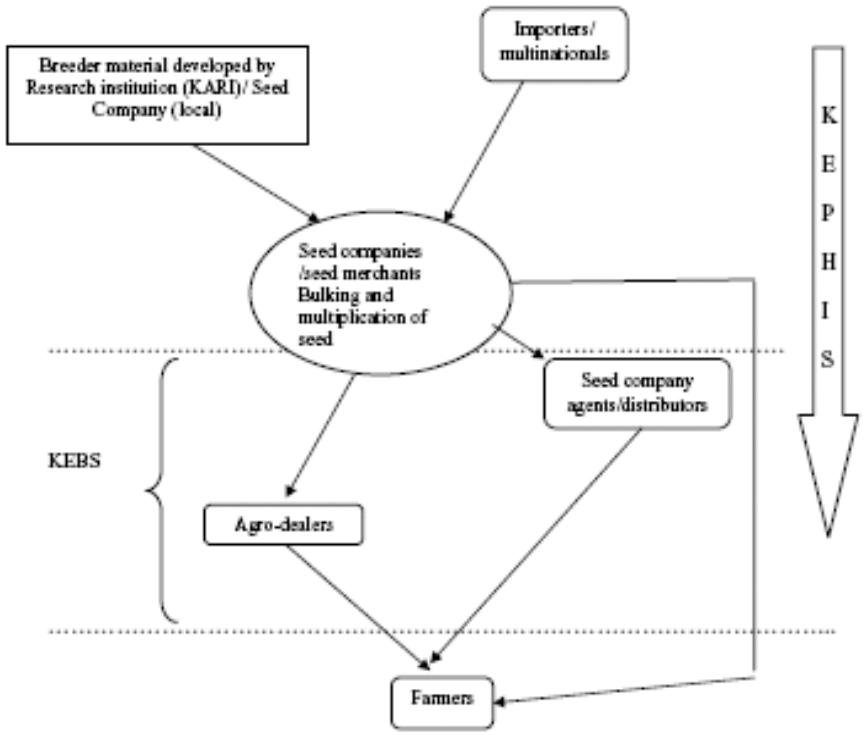


Fig. 4.1: organisational map of the seed supply and marketing chain in Kenya

[24] This section draws heavily from "Seed Availability Status", a presentation made by Obongo Nyachae to Agriculture & Rural Development Donor group Meeting, 4th March 2008.

It consists of eight key players namely the breeders, importers, seed merchants/companies, seed company agents/distributors, agro-dealers, farmers, KEPHIS and KEBS.

Breeders

The breeder seed or material may be developed by either public institutions such as KARI or by the private seed companies. Seed/material developed by KARI is available to the private seed sector on payment of royalty and in accordance with Plant Breeders Rights. Once this material has satisfactorily passed the Distinctive Uniformity and Stability (DUS) and National Performance Trials (NPT) carried out by KEPHIS, and is released into the market, it becomes commercialized and is available in the market for purchase.

Importers

These are mainly multinational companies such as Monsanto, Regina Seed and PANNAR among others that have opened affiliate companies locally through which they import seed into the country from their parent companies. Although breeding and testing is done in the parent companies but once imported into the country, the imported seed has to pass KEPHIS tests in order to be released locally.

Seed companies

Currently, there are 79 registered seed companies/merchants operating in the country. Once the companies receive breeder material, they undertake bulking/multiplication in order to produce seed to be sold to the farmers either directly or through registered agents or agro-dealers.

Agro-dealers

According to the Ministry of Agriculture and CNFA/AGMARK there are about 5,600 registered agro-dealers operating in the country. For the agro-dealers to sell certified seed they must be registered with KEPHIS.

Kenya Plant Health Inspectorate Service (KEPHIS)

This is the body that is mandated with the regulation of the seed sector in the country.

Kenya Bureau of Standards (KEBS)

The Kenya Bureau of Standards is mandated with checking to ensure that the weights and content indicated in the packaging for seed is what is actually contained in the bags.

Additional information about the players in the seed production and distribution chain is as shown in Table 4.1.

Table 4.1: Functions, Associations, Numbers and Sizes of Players in the Seed Sub-Sector

Player/segment of seed supply and marketing chain	Functions of player	Associations or groups to which players belong	Number of players in this segment	Size of business (small, medium, large)
Breeders	Coming up with breeders seeds to address challenges faced by farmers (high yielding, drought resistance seeds)	Plant Breeders Association of Kenya (PBAK)		NA
Seed company/merchants Importers	Bulking of seed and breeder material and commercialization Multinationals also import seeds	Seed Trade Association of Kenya (STAK)	79 registered companies by 2008/2009	Range from small to large scale enterprises
KEPHIS	Regulatory	NA	One	NA
Agro-dealers	Distribution of seeds to the farmers	Kenya National Agro-Dealer Association (KENADA)	5,600	Small to large scale

The status of the sector can be further explored by considering the participation of women in the subsector and quality of seed supplied in the sub-sector.

Perception of women's participation in seed chain

Generally there is high participation of women at the agro-dealers/stockist and farm levels. The reason for high women participation at the farm level is due to the fact that they undertake most of the activities in the farms. At the stockist level, women are considered to be strong competitors especially in running of their agro-dealers shops, given their good marketing and organisation skills and patience in handling customers. However, their participation is low at the seed company/importers/merchant level due to lack of economic empowerment.

Quality of seed distributed/supplied

According to the Ministry of Agriculture, there have been instances where unscrupulous individuals have sold poor quality seed ("fake") to unsuspecting farmers. The reason is mainly due to some merchants using inappropriate packaging material that does not maintain quality of

seed in storage and which is also very easy to counterfeit. Therefore, there is need to monitor the distribution, storage and marketing in order to eliminate seed adulteration and loss of viability.

One key mission of STAK is to ensure food security in Kenya through provision of quality seed from only registered seed dealers. STAK has been working closely with the regulatory authority KEPHIS to ensure that only certified seed is sold to farmers and that farmers do not end up buying "fake" seeds, which frequently resurface and are a major cause of poor crop yields. The association advises farmers to source seeds from genuine seed companies or their registered agents and retain their receipts and monitor the crops until germination stage. In case of disputes, the receipts will act as proof and ease compensation process.

4.2 Improved Seed Production and Distribution

The progress made in seed production can be seen by considering the amount of certified seed produced in the last 5 years and the new seed varieties produced during the same period of time.

Production of certified seed over the last 5 years

Production of certified seed for staples in the past 5 years is presented in the Table 4.2. The production for maize has exhibited a mixed trend with the largest proportion being produced locally (over 90%). During the five years, the share of the imported maize seed has increased although the proportion has remained at less than 10%. There was a sharp increase in the amount of bean seed between 2004 and 2005 (80%), which declined sharply declined in 2006 and then registered another huge jump between 2006 and 2007. The year 2007 recorded the highest proportion of imported bean seeds, accounting for 77% of total bean seed. Between 2004 and 2008, the total amount of sorghum seed available increased by 106%. For millet, there was modest increase of 4%. For finger millet, there was no seed production from 2004 to 2006. Although there was no production of finger millet in 2007, the amount of seed increased sharply in 2008 (1968%). As for groundnuts, pigeon peas and soya beans there was no demand throughout the last five years especially in 2006 and 2007.

Table 4.2: Volume of local and imported seed by staple over the period 2004-2008

	Local and imported quantity of seed				
Staples	**2004**	**2005**	**2006**	**2007**	**2008**
Maize					
Local production (kg)	24,881,203	24,215,835	28,978,043	28,827,950	22,974,031
Imported (kg)	1,351,032	2,345,544	3,022,287	2,937,700	2,504,207
Total (kg)	26,232,235	26,561,379	32,000,330	31,765,650	25,478,238
Beans					
Local production (kg)	392,647	607,958	172,960	375,247	440,123
Imported (kg)	261,378	567,851	0	1,288,149	0
Total (kg)	654,025	1,175,809	172,960	1,663,396	440,123
Sorghum					
Local production (kg)	297,693	230,662	492,410	551,170	606,239
Imported (kg)	0	18,000	10,000	3,000	8,000
Total (kg)	297,693	248,662	502,410	554,170	614,239
Millet					
Local production (kg)	54,139	45,147	32,576	58,817	0
Imported (kg)	3,050	0	0	500	0
Total (kg)	57,189	45,147	32,576	59,317	0
Finger millet					
Local production (kg)	0	0	3,242	0	67,075
Imported (kg)	0	0	0	0	0
Total (kg)	0	0	3,242	0	67,075
Bananas					
Local production (kg)					
Imported (kg)					
Total (kg)					
Cowpeas					
Local production (kg)	0	0	102,180	0	145,336
Imported (kg)	0	0	0	0	0
Total (kg)	0	0	102,180	0	145,336
Irish potatoes					
Local production (kg)					
Imported (kg)					
Total (kg)					
Cassava					
Local production (kg)					
Imported (kg)					
Total (kg)					
Groundnuts					
Local production (kg)	0	0	369	1,279	0
Imported (kg)	0	0	0	0	0
Total (kg)	0	0	369	1,279	0
Sweet potatoes					
Local production (kg)					
Imported (kg)					
Total (kg)					
Pigeon peas					
Local production (kg)	0	19,240	7,300	0	3,573
Imported (kg)	0	0	0	0	0
Total (kg)	0	19,240	7,300	0	3,573

Table 4.2: Volume of local and imported seed by staple over the period 2004-2008

	Local and imported quantity of seed				
Staples	**2004**	**2005**	**2006**	**2007**	**2008**
Dolichos (njahi)					
Local production (kg)					
Imported (kg)					
Total (kg)					
Soya bean					
Local production (kg)	0	0	488	1,850	0
Imported (kg)	0	0	0	0	139
Total (kg)	0	0	488	1,850	139

Source: KEPHIS as quoted in the Economic Review of Agriculture (2009)

Additional information on seed is available from KEPHIS as shown in Table 4.3.

Table 4.3: Seed Production in 2008

		Acease under seed crop (ha) in 2008		Weight of seed (jkg) in 2008			
Staple crop	**Number of varieties in DUS trials**	**Acreage of seed crop application for inspection**	**Acreage of seed crop approved**	**Weight of total seed**	**Weight of imported seed**	**Weight of locally produced seed**	**Weight of exported seed**
Maize	111	8,312	7,274	27,078,262	1,930,286	25,147,976	1,094,510
Beans	12	584	459	319,904	109,466	210,438	500
Cowpea	-	1,016	842	203,578	-	203,578	-
Pigeon peas	-	116	108	-	-	-	-
Grondnuts	6	10	10	3,678	-	3,678	-
Soyabean	6	-	-	-	-	-	-
Green grams	-	258	226	47,249	-	47,249	-
Millets	4	147	125	80,180	-	80,180	-
Sorghum	5	648	506	1,649,207	-	1,649,207	-
Rice	-	-	-		-		-
Cassava	-	-	-		-		-
Sweet potato	-	-	-		-		-
Total	144	11,090	9,550	29,382,058	2,039,752	27,342,306	1,095,010

Source: KEPHIS Annual Report for 2008

Maize dominates other crops in terms of weight of total seed, number of varieties in DUS trials, and acreage under seed crop production.

During the survey, we contacted 12 seed merchants in order to get more information on seed production. However, we got responses from only three who altogether produced about 1,000 tonnes of maize seed for the high and medium altitude zones, and about 55 tonnes of sorghum seed for the medium altitude zone. This volume of seed is very low compared to the amount of nearly 27,000 and 1,600 tonnes of maize and sorghum seeds produced in 2008, respectively as

indicated by KEPHIS (Table 4.3). Therefore, the information captured from the three seed merchants is unrepresentative of the seed production situation in Kenya. In addition, the information obtained does not allow us to identify the proportion of seed produced by different groups of seed merchants such as multinational private seed companies, local private seed companies, public seed companies, NGOs, community or farmer groups, and other organisations in the last 12 months. However, the information provided by KEPHIS provides a good indication of seed production in the formal sector.

New seed varieties produced over the last 5 years

Over the past 5 years, a total of 128 new varieties of staples have been released, which represents an increase of 412% (Table 4.4). Maize is the predominant staple for which seed has been produced, accounting for 86% of the total released varieties in 2008.

Table 4.4: New seed varieties released in the last 5 years (2004-2008) by Staple

Staples	2004	2005	2006	2007	2008	Total
Maize	25	21	15	7	42	110
Sorghum					4	4
Millet						
Bush beans					11	11
Climbing beans					3	3
Soya bean						
Dolichos (Njahi)						
Cowpeas						
Groundnuts						
Sweet potatoes						
Irish potatoes						
Cassava					6	
Bananas						
Total	25	21	15	7	66	128

Source: KEPHIS (Annual Report and Financial Statement July 2007-June 2008)

Process of development and release of varieties

Changes proposed in the process of development and release of new varieties/cultivars by the seed merchants include timing (to facilitate quick technology transfer) and the need to access the regional market for seed production and sales (in order to serve a bigger and more viable market).

The seed merchants obtain their seeds for sale from KARI, WARDA, CIMMYT AND KARI under different types of arrangements such as exclusive, verbal, and royalty. They proposed that

their seed business would improve if they were to be licensed to expand their market and sell in Rwanda and Burundi.

Seed sales by seed merchants

Distribution of seed is done by agro-dealers and so they are the main seed buyers from the seed merchants, with very little seed being purchased directly by farmers and NGOs. The agro-dealers have various arrangements with the seed companies which include transport, credit and discounts. However, the seed companies indicate that credit to small stockists and non-payment for deliveries (can be expensive to collect dues and enforce payments) limit their operations. In this regard, they propose the establishment of a credit rating system and cash on delivery. The information from the three seed companies does not allow us to report reasonable variation in distances to main seed buyers, and the variation in price at which merchants sell their largest and smallest volumes of seed to various buyers. However, they indicate that the months of sale for the largest volume of seed are March, April, and October, which coincide with the main planting periods in different areas.

Certification of Agro-Dealers

Agro-dealers are a key part of the seed distribution system in Kenya. Overall, 82% of the 80 agro-dealers interviewed were certified, with a relatively lower level of certification being recorded in the Central region (Table 4.5).

Table 4.5 Certification of Agro-dealers by region

	Region			
	Central	**Nyanza**	**Western**	**Overall**
Number of certified agro-dealers	17	16	28	31
Percent (%) of certified agro-dealers	68	94.1	87.5	82.4
Agency/Institutions providing certification (% of cases reporting within regions)				
KEPHIS	94.1	87.5	100	95.1
CNFA/AGMARK	17.6	25	21.4	21.3
PCPB (Pest Control and Poisons Board)	5.9	0	3.6	3.3
Average radius in km from buyers of seed	4.9	5.44	4.97	5.05

The certification is mainly the responsibility of KEPHIS but other agencies such as CNFA/AGMARK and Pest Control and Poisons Board (PCPB) also certify agro-dealers.

The agro-dealers sell griculture-related items such as fertiliser, animal feeds, and farm implements alongside seed as shown in Table 4.6. However, there was no mention of veterinary drugs, herbicides or pesticides. This suggests that ordinary agro-dealers avoided situations where they might be required to take another license for such items from the PCPB. They therefore sell products that would not attract penalties.

Table 4.6: Other items sold by the seed agro-dealers

Item	Percent of responses			
	Central	Nyanza	Western	Overall
Fertiliser	34.8	41.5	34.5	36.1
Farm implements	18.2	29.3	21.8	22.2
Animal feeds	37.9	29.3	19.5	27.8
Foodstuff	3.0	0	9.2	5.2
Non-farm hardware	6.1	0	10.3	6.7
Other household goods	0	0	4.6	2.1

Seed purchases by agro-dealers and marketing arrangements with seed suppliers

Details on seed purchases by agro-dealers in the last 12 months are as shown in Table 4.7.

Table 4.7: Seed purchases by agro-dealers in the last 12 months by region

Details on seed purchases by crop	Region			
	Central	Nyanza	Western	Overall
Maize				
Average amount of seed purchased (kg)	7232	3999	7202	6476
Main seed supplier of the largest volume (% reporting)				
Seed company	13.3	13.5	11.3	12.5
Wholesalers	86.7	84.0	88.7	86.9
KFA	0.0	2.6	0.0	0.6
Average distance to main seed supplier (km)				
Seed company	87.5	157.2	87.6	106.5
Wholesalers	25.9	59.4	45.0	42.5
KFA		40.0		40.0
Mode of delivery to agro-dealer shop (%)				
vehicle	86.2	96.2	92.8	91.6
bicycle	0.0	3.8	4.5	2.9
motorcycle	5.6	0.0	0.0	1.8
walking	6.1	0.0	0.0	1.9

Table 4.7: Seed purchases by agro-dealers in the last 12 months by region

Details on seed purchases by crop	Region			
	Central	Nyanza	Western	Overall
handcart	0.0	0.0	2.6	1.1
trolley	2.0	0.0	0.0	0.6
Average Cost of seed delivery per kg (US$)	0.05	0.07	0.07	0.07
Average purchase price for seed for the smallest volume purchased (US$)	1.71	1.61	1.54	1.61
Average purchase price for seed for the largest volume purchased	1.73	1.59	1.54	1.61
Month of purchase for lar est volume (% reporting)	March (44%)	March (59%)	March (47%)	March (49%)
Sorghum	Central	Nyanza	Western	Overall
Amount of seed purchased (kg)	.	368.8	203.2	313.6
Main seed supplier				
Seed company		8.3	28.5	15.7
Wholesalers		83.3	71.4	78.9
KFA		8.3	0.00	5.2
Average distance to main seed supplier (km)				
Seed company		150	28	68.6
Wholesalers		43.7	53.8	47.07
KFA		40	.	40
Mode of delivery to agro-dealer				
vehicle		100	100	100
Average cost of delivery per Kg (US$)	.	0.01	0.01	0.01
Average purchase price for seed for the smallest volume purchased		1.31	1.19	1.27
Average purchase price for seed for the largest volume purchased		1.38	1.19	1.32
Month of purchase for largest volume (%)		March (60%)	March (60%)	March (60%)

The results indicate that sorghum and maize are the major crops for which agro-dealers purchased seeds. Beans, millet and green grams seeds were stocked by very few agro-dealers. For instance, of the 80 agro-dealers visited, only 5 purchased bean seeds, 3 purchased green gram seeds and only one purchased millet seeds.

While the average amount of maize seed purchased by agro-dealers was nearly equal in Central and Western regions, purchases in Nyanza region were about half of those in the other regions. Overall, nearly 87% of the maize seed purchases by agro-dealers were from wholesalers, who are on average about 43 km away from the agro-dealers. Wholesalers in Central region are much

closer to the agro-dealers compared to the other two regions. Seed is mainly transported using vehicles with the average cost of delivery per kg being US$ 0.06. The average buying price of seed is about US$ 1.60 per kg.

Sorghum seeds were purchased by agro-dealers in Nyanza and Western region but not in the Central region and with the volumes being much lower compared to those of maize seed purchases. Most of the seed is purchased from wholesalers, who are on average 47km away from the agro-dealers.

The interviewed agro-dealers bought seed from either the seed companies or wholesale agro-dealers, with whom they had marketing arrangements in terms of transport, commission and credit. Transport arrangements are the most common in the three regions and the only type of arrangement reported by agro-dealers in Nyanza. The next important arrangement is credit.

Seed sales by agro-dealers and marketing arrangements with seed buyers

Table 4.8 shows the volume of seed sold by agro-dealers to various seed buyers by region in the last 12 months.

In the case of maize seed, the Central region had the highest amount of volume of seed sold followed closely by the Western region. Nyanza reported relatively very low volume of maize seed sold, being about a third of sales in the other regions. In all the regions, small-scale farmers bought the largest share of the volume sold. Farmer groups were a significant buyer in the Central region, buying more seed than the large-scale farmers. The average distance to the nearest maize seed buyer was 6 km. in addition, the average selling price of a kg of maize seed was nearly the same for the smallest and largest volume sold, with the prices being slightly higher in the Central region. The months of the largest sale were March and April in all the regions but in Central, there were significant sales in October. This is in tandem with other findings showing that maize is an important crop in the short season in Central province.

Table 4.8: Seed Sales by Agro-dealers in the last 12 months

Details on seed sale by crop	Central	Nyanza	Western	Overall
Maize				
Average amount of seed sold (kg)	1,806	495	1,330	1,271
Average amount of seed sold (kg) to:				
Small scale farmers	1,931.3	494.6	1,365.8	1,310.2
Large scale farmers	309.4	.	198.0	268.9
Other agro-dealers	.	.	.	.
Farmer groups	620.0	.	.	620.0
Average distance to main seed buyer (km)	6.7	6.2	5.5	6.0
Average seed selling price for smallest volume (US$/Kg)	2.02	1.90	1.74	1.87
Average seed selling price for largest volume (US$/Kg)	2.02	1.90	1.73	1.86
Month of Largest sale price per kg of seed (%)				
March	50.0	55.9	64.8	57.9
April	28.6	31.6	16.5	24.1
Sorghum				
Average amount of seed sold (kg)	.	347.2	74.9	204.6
Average amount of seed sold (kg) to:	.	347.2	74.9	204.6
small scale farmers	.	347.2	80.9	221.1
large scale farmers	.	.	48.0	48.0
Other agro-dealers	.	.	.	.
Farmer groups	.	.	.	.
Average distance to main seed buyer (km)	.	4.0	4.0	4.0
Average seed selling price for smallest volume (US$/Kg)	.	1.41	1.55	1.48
Average seed selling price for largest volume (US$/Kg)	.	1.48	1.52	1.50
Month of Largest sale price per kg of seed (%)				
March		60.0	63.6	61.9

***Only one case for Millet in Western province.

On average, about 205 kg of sorghum seed were sold. Nyanza region had the highest average amount of seed sold, while Central region recorded no sales. This is a clear indication that the common farming practices of a locality influence the seeds that agro-dealers bring into the market. Most of seed was sold to small-scale farmers. Although no sorghum seed was sold in the Central region, the average distance to the seed buyers for sorghum is recorded as 4 km in all the regions.

The price per kilogram for sorghum seed varied very slightly for the smallest and largest volumes sold. March was the month of the largest sale but unlike the case of maize, February was the second month in terms of the percent of sale in Nyanza region while it was August in the Western region.

Agro-dealers also had marketing arrangements with seed buyers, who comprised of the small- and large-scale farmers, farmers groups and other agro-dealers. Amongst the marketing arrangements with the small-scale farmers, credit had the highest occurrence followed by a

discounted price while with farmer groups the highest was discount followed by arrangements for transportation of seed. In Nyanza, the marketing arrangements with small-scale farmers were mainly on transport. In contrast, marketing arrangements in the Western region were mostly sales on discounted price. There were no marketing arrangements made with large-scale farmers and other agro-dealers in the Central region.

Majority of the agro-dealers in the three regions indicated that farmers preferred the most frequently purchased seeds because they are high yielding (Table 4.9). The second most important reason was suitability of the seeds for the area as reported in Central and Western regions, while in Nyanza, there was a tie between drought resistance and early maturity.

Table 4.9: Reasons for farmers' preference for the most purchased seed varieties

Reason	% of responses			
	Central	Nyanza	Western	Overall
Availability on time	0	2.4	0	6
Big cobs	1.9	2.4	1.3	1.7
Long shelf life	0	4.9	5.1	3.5
Drought resistance	13.5	17.1	8.9	12.2
Early maturing	15.4	17.1	8.9	12.8
Suitable for the area	25	9.8	17.7	18.0
High yielding	26.9	26.8	32.9	29.7
Lack of other varieties	0	2.4	1.3	1.2
Pest resistance	1.9	0	11.4	5.8
Tasty	0	0	5.1	2.3
Media advertisements	1.9	0	0	0.6
Cheaper	0	7.3	0	1.7
Disease resistance	1.9	2.4	2.5	2.3
Extension advise on variety	3.8	0	1.3	1.7
Popularity among other farmers	1.9	4.9	0	1.7
Strong stalks	0	0	2.5	1.2
Heavy in weight	5.8	2.4	0	2.3
Low fertiliser requirements	0	0	1.3	0.6

The reasons given in Nyanza were also important in the other two regions. Early maturity and drought resistance were ranked third and fourth, respectively, in Central region, while the two reasons tied at the fourth position in Western province, after pest resistance. Therefore, the choice of seed variety by farmers is mainly influenced by yield level, suitability of seed to the agro-ecological zone, resistance to drought and ability to mature early.

Seed losses incurred by agro-dealers are overwhelmingly due to spillage (83.3%) during transportation as well as due to pest damage (66.7%) during storage (Table 4.10).

Table 4.10: Loss of seed during transportation and while in storage

	% of responses			
	Central	**Nyanza**	**Western**	**Overall**
Causes of loss during transportation				
Poor handling	11.1	0	0	4.2
Wetness from rain	0	0	18.2	8.3
Spillage	77.8	100	81.8	83.3
Theft	11.1	0	0	4.2
Causes of loss while in storage				
Pest attack	60	66.7	71.4	66.7
Spillage	40	33.3	28.6	33.3
Maize seeds most susceptible to loss while on the shelves				
WS 505	0		16.7	5.6
DH 4	8.3		0	5.6
DK 8031	8.3		16.7	11.1
SCDUMA 41	41.7		0	27.8
KS 513	0		16.7	5.6
KS 6210	0		16.7	5.6
PHB 3253	8.3		0	5.6
SCDUMA 43	16.7		16.7	16.7
DUMA	16.7		0	11.1
SIMBA 61	0		16.7	5.6
Sorghum seeds most susceptible to loss while on the shelves				
SERENA		33.3		33.3
SEREDO		66.7		66.7

The maize seeds that are most susceptible to loss while on storage are SCDUMA 41 in the Central region, while in western region, there is a tie among WS 505, DK 8031, KS 513, KS 6210, SCDUMA 43, and SIMBA 61. Although agro-dealers in Nyanza reported seed loss during storage, they did not respond to the question about the maize seeds most susceptible to loss while on the shelves. For sorghum, Seredo was reported as the variety whose seeds are most susceptible to loss while on the shelves in Nyanza.

4.3 Training and Capacity Building in Crop Breeding

Training and capacity building are critical aspects of the seed subsector in order to ensure adequate capacity to meet the crop improvement needs in Kenya. Therefore, there is need to provide training for more or a new generation of crop breeders and agricultural scientists upon which the seed system depends for growth and productivity. Information on the number of scientists trained and who are actively involved in breeding was sought from KARI and the

universities, and is provided in Table 4.11. Though the list is incomplete, there is an indication that many of the universities have active programmes providing training in crop breeding.

Table 4.11: Scientists in plant breeding

Name of the Institution		Number of trained crop breeders				How many of them are actively involved in breeding three years after/ since graduating?			
		MSc level		PhD level		MSc level		PhD level	
Maseno University		Female	Male	Female	Male	Female	Male	Female	Male
	Staff		3		2		3		2
	Students		1				1		
University of Nairobi	Staff								
	Students		2						
Moi University	Staff								
	Students								
KU	Staff								
	Students								
Masinde Muliro	Staff								
	Students								
JKUAT	Staff								
	Students								
Egerton University	Staff		1		2		1		2
	Students								
KARI Kitale	Staff	1			2				2
KARI Embu	Staff		1		1		1		1
KARI Kakamega									

4.4 Operating Environment in the Seed Sub-sector

This section addresses various aspects that can be used to describe the operating environment for players in the seed industry. These include market information, staff training, access to credit, insurance, investments, taxes and constraints faced by the various players.

Market information

The seed merchants reported that they obtain information on how to run their businesses from various sources as shown in Table 4.12.

Table 4.12: Sources of market information for seed merchants

Information Type	Sources of information
The suppliers of breeders seed	General Market KARI, AGRA, Rockefeller Foundation
Demand for new improved seed or crop variety	General Market Own Survey KARI
How to price seed	Kenya Seed
Correct varieties of seed to sell in area of operation	General Market Field Days/ Experience KARI
Newly released varieties in the market	General Market KEPHIS Reports KARI
Quality of seed	General Market KEPHIS Reports KARI

This information indicates that seed merchants obtain market information from various sources. Information related to source, quality, demand and suitability of seed in specific growing areas is mainly obtained from KARI and KEPHIS. In addition, seed merchants carry out market surveys to determine the demand for new improved seed or crop variety.

Sources of market information necessary for running the seed agro-dealer business are as shown in Table 4.13. Most agro-dealers in Central and Nyanza regions depend on the seed companies to get information about seed suppliers while their counterparts in the Western region depend on other seed stockists. Additionally, other seed stockists are still an important source of information on seed suppliers in Central and Nyanza regions.

Table 4.13: Sources of information for seed agro-dealers by region

Source of information	Suppliers of seed			Demand for seed			How to price seed			Correct varieties to sell seed in area			New varieties in the market			Quality of seed			Overall		
	Central	Nyanza	Western	Central	Nyanza	Western	Central	Nyanza	Western	Central	Nyanza	Western	Central	Nyanza	Western	Central	Nyanza	Western	Central	Nyanza	Western
Seed companies	56.0	52.9	28.1	4.2		3.1	44.0	31.3	21.9	8.3	17.6	12.9	60.0	64.7	56.3	56.0	52.9	53.1	38.5	36.6	29.3
Other seed stockists	36.0	47.1	62.5	8.3		6.3	44.0	62.5	78.1	16.7	11.8	3.2	4.0	23.5	18.8				18.2	23.8	28.3
Farmer feedback				50.0	82.4	75.0					23.5	25.8			6.3	28.0	29.4	34.4	12.8	22.8	23.6
Demand (situation in market)				25.0	17.6	15.6		6.3		16.7	5.9	9.7	4.0			12.0	5.9		9.5	5.9	4.2
Extension worker				4.2			4.0			41.7	29.4	45.2				4.0			8.8	5.0	7.3
Field day	4.0		3.1	8.3						8.3	5.9	3.2	12.0		6.3				5.4	1.0	2.1
Radio			3.1							4.2			20.0	5.9	9.4				4.1	1.0	2.1
Supplier/distributor	4.0						4.0												1.4		
Demonstration plot										4.2	5.9						11.8	12.5	0.7	3.0	2.1
Brochures/pamphlets							4.0												0.7		
Newspapers														5.9						1.0	
MoA			3.1																		0.5
Seminars															3.1						0.5

Agro-dealers obtain information on demand for the seeds mainly from farmer feedback in the three regions. The two important sources of information on pricing are other seed stockists and seed companies. In the Central region, both sources are equally important but in Nyanza and Western, other seed stockists are more important as sources of market information on pricing.

Information on the correct seed to sell is mainly got from the extension workers. This implies the existence of extension service and underscores its importance as a source of information. Farmer feedback is also an important source in Western and Nyanza regions.

Seed agro-dealers get information on new seed varieties in the market largely from the seed companies. Other seed stockists are the second most important source of the same information in the Western and Nyanza regions. Interestingly, the second important source of information on new varieties in Central region is radio, which is increasingly becoming an important channel of delivering market information given its accessibility to many farmers. On the other hand, seed companies and farmer feedback are the two most important sources of information on seed quality. Overall, the most important sources of market information are seed companies, other seed stockists and farmer feedback in that order.

Training

Training provided for staff of the seed merchants in the last 12 months has been in the areas of marketing and business management, which has been offered by Markets Matter Inc and CIMMYT. The trainings were sponsored by an NGO and CIMMYT, and they resulted in better management of the operations of the seed companies.

Agro-dealers also provided training for their staff, with 35% of them indicating that their staff had been trained. However, there is wide variation in this percentage, ranging from as low as 16% in the Central region and 46.9% in the Western region. Details on staff training over the last 12 months are provided as shown in Table 4.14. Training in business management and soil testing is mainly provided by NGOs, while that on seed usage and handling is provided by the seed companies, while research institutes/universities provide training on seed varieties suitable for different regions. The training is paid for by the staff themselves, seed companies, NGOs, and the Government/MoA/KARI.

Table 4.14: Training provided for agro-dealers' staff

	Type of training					
	Business management	**Seed usage**	**Seed handling**	**Suitability of seed varieties**	**Soil testing**	**Total**
Provider of training (%)						
Government	16.67	20.00	35.29	0.00	0.00	24.39
NGO	66.67	20.00	17.65	0.00	100.00	34.15
Research institute /University	0.00	10.00	0.00	100.00	0.00	4.88
Seed company	16.67	50.00	47.06	0.00	0.00	36.59
Training sponsor (%)						
Self	50.00	30	29.41	0	0	34.15
Seed company	0.00	10	29.41	0	0	14.63
NGO	41.67	30	11.76	0	100	26.83
Government/MoA/KARI	8.33	30	29.41	100	0	24.39
Benefits from the training (%)						
Better management	43.5	7.1	12.5	0	0	22.2
Increased sales	21.7	28.6	20.8	0	0	22.2
Better advice to buyers	34.8	64.3	66.7	100	100	55.6

The benefits from training in business management are indicated as better management of the business, better advice to buyers and increased sales in order of importance. On the other hand, training in seed usage and handling results in better advice to buyers and increased sales. Additionally, the staff trained in soil testing and suitability of seed varieties, were able to provide better advice to seed buyers.

Credit

Information on credit sought and received by agro-dealers is as shown in Table 4.15 Results indicate that on average, 31% of the agro-dealers sought credit, while 74% of these obtained credit of an average amount of US$ 1,988. The major sources of credit are commercial banks in the Central region and Microfinance institutions in Nyanza and Western regions. Also, in Central region, seed suppliers are an important source of credit for agro-dealers. The average rate of interest is 15.5% and all the agro-dealers that obtained credit are able to make payments as expected.

Table 4.15: Credit facilities for agro-dealers by region

	Central	Nyanza	Western	Overall
% that sought credit	24	23.53	40.63	31.08
% that obtained credit	55.56	80	84.62	74.074
Average amount received (US$)	3,207	1,422	1,640	1,988
Source of credit (%)				
Commercial bank	60	25	9.09	25
Microfinance Institution	0	75	72.73	55
Farmer group	0	0	9.09	5
Seed supplier	40	0	9.09	15
Cooperative	0	0	0	0
Friends/family	0	0	0	0
Average rate of interest rate (%)	10.8	19.5	16.1	15.5
Average repayment period	6.4	3.25	3.45	4.15
Average number of instalments per year	17.8	14.25	10.45	13.05
% of agro-dealers making payments as expected	100	100	100	100

The agro-dealers were asked to indicate their perceptions regarding some aspects of the credit facilities and opportunities. Most of the agro-dealers and particularly in Central and Western regions pointed out that they had easy access to short term credit for their business. However, a relatively smaller percentage of them indicated that they had easy access to long term credit. All the agro-dealers agreed that credit helps their seed businesses grow. While all agro-dealers in the Central region indicated that the loan terms were friendly, only 33% and 50% in Nyanza and Western regions, respectively, reported friendly loan terms.

Investment

The types of investment made by agro-dealers and the sources of capital for their seed business in the last 12 months are as shown in Table 4.16. The average amount of initial capital was much higher in the Central region compared to the other regions. The sources for this initial capital were varied but the most important ones are family savings, as well as savings/profits from other businesses. Overall, about 35% of the agro-dealers made investments in terms of stock expansion in the last 12 months. The most prominent sources of funds for these investments were savings and loans.

Table 4.16: Types of Investments and Sources of Capital for the Seed Business

	Central	Nyanza	Western	Overall
Average amount of initial capital for business (US$)	1,083	481	512	693
Source of initial capital for seed business (%)				
Loans	4.2	25.0	15.6	13.9
Family savings	79.2	43.8	46.9	56.9
Savings or profits from other businesses	12.5	12.5	37.5	23.6
KENFAP kitty	0	6.3	0	1.4
Salary	0	12.5	0	2.8
Grants	4.2	0	0	1.4
Total	100	100	100	100
Agro-dealers who made investments in seed business in the last 12 months (%)	43.5	35.3	28.1	34.7
Type of investment: Expansion of stock (%)	100	100	100	100
Average value of investment (US$)	1,024	894	449	786
Source of investment funds (%)				
Business profits only	10	16.7	11	12
Profits and savings	10	0	11.1	8
Savings only	50	50	55.6	52
Salary only	10	0	0	4
Loans	10	33.3	11.1	16
Profits from another business	10	0	11.1	8
Total	100	100	100	100

Taxes

Information on taxes and levies in the seed industry was obtained from interviews with officers in the Ministry of Agriculture. Seed is currently zero rated in terms of import duty though importers of seed pay 2.25% IDF and 16% VAT on transport as well as a levy charged by KEPHIS.

Constraints

The main constraints faced by seed merchants in running the seed business include a highly regulated sector, bad debts, difficult logistics, as well as lack of capital input, marketing experience and promotion of seeds. The constraints facing seed agro-dealers are reported in Table 4.17, with the main ones being inadequate supply, low demand due to seasonality of production and lack of capital. Inadequate supply was reported as the main constraint across all the regions. However, the second most frequently mentioned constraint varied by region and was

reported as low demand due to seasonality of production in Central region, high cost of transport in Nyanza, and lack of capital in the Western region.

Table 4.17: Main Constraints Facing Agro-dealers in Running Seed Businesses

Constraint	Percent of responses			
	Central	Nyanza	Western	Overall
Inadequate supply	26.2	20.9	28.2	25.8
Lack of capital	4.9	9.3	11.5	8.8
Competition	4.9	9.3	3.8	5.5
Low demand due to seasonality in production	16.4	9.3	5.1	9.9
Fluctuation in seed prices	13.1	2.3	5.1	7.1
Government subsidy interference	8.2	0	3.8	4.4
High prices	6.6	2.3	6.4	5.5
High cost of transport	1.6	16.3	6.4	7.1
Low profits	3.3	11.6	6.4	6.6
Poor road infrastructure	0	7.0	3.8	3.3
Crop failure	1.6	0	0	0.5
Credit constraints	0	0	1.3	0.5
Poor seed quality	4.9	4.7	3.8	4.4
Bulkiness/storage constraints	0	2.3	2.6	1.6
Distribution channel constraints	3.3	0	0	1.1
Long distance to suppliers	1.6	0	0	0.5
Licensing costs	1.6	0	0	0.5
Farmers complaints on some varieties	0	0	2.6	1.1
Seed expiry date is not marked on some packets	0	0	1.3	0.5
Susceptibility to pests	0	0	1.3	0.5
Counterfeit seeds	0	2.3	2.6	1.6
Bad debts/buyers want seed on credit	0	0	3.8	1.6
Lack of modern seed production technologies	0	2.3	0	0.5
Bad weather	1.6	0	0	0.5

Consultations regarding policy overview of situation in the sector

Interviews with key informants revealed that currently, the sector is more opened up and there have been consultations among the stakeholders in the industry which have culminated into the National Seed Policy which has already been discussed by the Cabinet committee. There are also other legislative changes that have been undertaken through consultation amongst the stakeholder. Currently the sector is zero rated, and Regulations 2007 (Seeds and Plant Breeder's

Rights) has been put in place. The latter entails accrediting of private seed enterprises/individuals to undertake certain aspects of seed certification/seed testing services which were previously predominantly performed by KEPHIS. This has made it easier to operate in the industry.

4.5 Power and Governance in the Seed Sub-sector

Key informants in the seed sub-sector provided information on power and governance structure in the sub-sector with regard to setting of price, policy formulation and setting of rules and regulations (Table 4.18).

Table 4.18: Power and Governance; Roles of Players in the Seed Sub-sector

Role	Player/s responsible for the role along the seed chain
Setting price	This is usually by the seed companies that are producing and packaging seeds. Currently there are a total of 79 registered companies. The seed companies have come together to form the Seed Trade Association of Kenya (STAK) which accounts for 90% of all the formal seed produced in the country. STAK has developed a code of practice and ethics to which all members subscribe and it guides members in seed trade. The Code became operational in October 2007. Generally members of STAK set prices for locally produced seeds.
	Importers also set prices of the imported seed that they are selling locally. This is determined by the cost incurred in production and importation.
Policy formulation	Prior to 1996, the seed sector was closed and very restrictive with KEPHIS policing the seed industry. This changed after liberalization of the sector. There has been consultation among the stakeholders in the industry such as seed companies through STAK, Plant Breeders Association of Kenya (PBAK), KEPHIS, Ministry of Agriculture, KARI, and research institutions. Consultation among the stakeholders has culminated into:
	Seed and Plant Varieties (Amendment) Bill 2007Act (Cap 326) to fully liberalize the sector
	The Seeds and Plant Varieties (Seeds and Plant Breeder's Rights) Regulations 2007 accrediting private seed enterprises/individuals to undertake certain aspects of seed certification/seed testing services
	Setting up of the Seed and Plant Tribunal (Kenya Gazette Notice No. 7308, Vol. CVlll – No 66) with effect from 30th August 2006
	National Seed Industry Policy and a Bill on Seed and Plant varieties that have already been approved by the Cabinet committee on productive sector
	Efforts on harmonization of the seed industry in the region
	Granting of plant breeders rights; the Minister responded and finally published in the Kenya Gazette Notice No 5368, Vol. CVlll – No. 51 of 14th July, 2006, a list of varieties in the following four Schemes for grant of plant breeder's rights: Ornamentals and herbaceous plants; Maize; Pulses; and Fruits, Nuts and Tree Crops.
Setting rules and regulations	KEPHIS is the body that is mandated to regulate the sector
	There are various acts governing the industry
	Plant Protection Act
	Seed and Plant Variety Act
	Seed and Plant Variety (NPT) regulation
	The Kenya Bureau of Standard (KEBS) is also mandated with checking to ensure that the weights and content indicated in the packaging is what is contained inside the bags

Seed merchants indicated that when setting the selling price of seed, they consider the following price components: cost of production, margins, value to farmer, profitability and competitors' prices. Agro-dealers were asked about price setting in the industry. A majority of them (61.2%) indicated that seed companies set the price, while 28.2% pointed out that it is the wholesalers who set the price of seed. A few of the agro-dealers also mentioned stockists, forces supply and demand, and the government as price setters. With regard to what the agro-dealers base their selling price on, they enumerated a number of factors as follows: buying price (30.3% of agro-dealers), profit margin (20.2%), transport cost (18.3%), and rent charged (8.3%). Other minor factors considered include demand for seed, wages and labour costs, other stockists' prices, and storage costs.

Agro-dealers Associations

Overall, only 13.5% of the agro-dealers (8%, 17.6% and 15.6% in Central, Nyanza and Western regions, respectively) indicated that they belong to an association (Table 4.19). Half (50%) of the agro-dealers in associations belong to the Kenya Association of Agro-dealers (KENADA). In addition, 20% of agro-dealers in the Western region belong to Malakisi Agro-dealers, the Larger Busia Agro-dealers, and Kakamega Agro-dealers associations. Also, 50% of agro-dealers in Central belong to the Mavuno Club, while 33% of agro-dealers in Nyanza are in the Siaya Livestock Development Association (SILIDA).

Table 4.19: Membership of seed stockists in Agro-dealer Associations

	Central	Nyanza	Western	Overall
Membership in agro-dealer associations (% of seed agro-dealers)	8.0	17.6	15.6	13.5
Name of agro-dealer association				
KENADA	50.0	66.7	40.0	50.0
Malakisi agro-dealers ass.			20.0	10.0
Larger Busia agro-dealer ass.			20.0	10.0
Mavuo club	50.0			10.0
KASA			20.0	10.0
SILIDA		33.3		10.0

4.6 Seed Subsidy Schemes

The Ministry of Agriculture is involved in two seed subsidy schemes, the National Accelerated Agriculture Inputs Access Programme (NAAIAP), and the Orphaned Crops Programme.

The NAAIAP programme was started in 2007 with the objective of improving access and affordability of key inputs to smallholder farmers, particularly those living below the absolute poverty line, so that they can get out of the vicious cycle of poverty and participate in agriculture as a business enterprise. It has two components: (i) Kilimo Plus Starter Kits (KPSK) which provides in kind grant of US$ 65 for inputs to enhance food (previously US$ 91) security/availability at household level and generate income from surplus; and (ii) Kilimo Biashara Packages (KBP) which is a graduation from KPSK for farmers with economically viable enterprises but constrained by lack of basic inputs. Inputs are provided at cost while credit is subsidized from financial institutions. Under NAAIAP, the government gave out free maize seeds in 2009/2010 amounting to 750 tonnes (10 kg of seed to 75,000 farmers).

The Orphaned Crops Programme aims at diversifying sources of food through promotion of indigenous crops that are drought tolerant, and includes multiplication of seeds: cow peas, pigeon peas, green grams, cassava, sweet potatoes, millets, and sorghums. Under this programme, the government through the Ministry of Agriculture and KARI has been spending US$ 3.88 million every year in distributing seeds for green grams, beans, sorghum, millet, cassava, and sweet potatoes. Annually, 323 tonnes of assorted grain seed, 1,335,485 cassava cuttings, 2,104,000 sweet potato cuttings and 40 tones of Irish potato seeds have been distributed.

None of the three seed merchants interviewed was involved in any seed subsidy scheme. However, agro-dealers did participate in the NAAIAP programme and details are provided in Table 4.20. Subsidy vouchers for maize were mainly obtained from the government (85.7%) in Central and Western regions and from an NGO for the Nyanza region. On average, the highest volume of subsidized seed was sold in the Central region followed by the Western region. The reported price of subsided seed ranged from US$ 1.49 in Nyanza to US$ 1.68 per kg in Central. The maize seed variety frequently bought under the subsidy scheme was KS 513 followed by DH4, H516 and Pioneer.

According to a key informant from the MoA, small traders/agro-dealers indicated that they were not happy with the NAAIAP subsidy programme as it had eaten into their market, while large companies embrace it since they have the opportunity to sell seeds to the government.

Table 4.20: Participation in seed subsidy schemes by the agro-dealers

	Central	Nyanza	Western	Overall
Institutions providing vouchers				
Government	57.1	0.0	28.6	85.7
NGO	0.0	14.3	0.0	14.3
Volume and Price of Seed				
Average Volume of Seed Sold (Kg)	3,096.2	2.7	965.3	2,271.3
Average Price of Seed (US$/(Kg)	1.68	1.49	1.53	1.63
Maize variety				
KS 513	23.1	33.3	33.3	26.3
DH4	15.4	33.3		15.8
H516	7.7	33.3	33.3	15.8
Pioneer	15.4			10.5
DH 02	7.7			5.3
DH1	7.7			5.3
DK 8031	7.7			5.3
Duma 41	7.7			5.3
KS 614			33.3	5.3
PAN 7M-97	7.7			5.3
Price of seed per unit US$/kg				
Kg	1.57	-	-	1.57
2kg packet	4.20	2.97	3.06	3.32
10 kg bag	16.81	-	-	16.81
Tonne	1,486.95	-	-	1,486.95
Level of subsidy per unit US$/Unit				
Kg	1.57	-	-	1.57
2kg packet	2.94	2.97	3.06	2.97

The agro-dealers were asked about their perception on the seed subsidy schemes. The results are presented in Table 4.21. Majority of the agro-dealers indicated that the process of accessing subsidized seed was too tedious and time consuming, too complex that it brought conflict between agro-dealers and their customers. Moreover, there was uncertainty over whether payments would be made. This notwithstanding, delivery of seeds was timely and the agro-dealers benefitted since they were able to sell a higher volume of seeds.

Table 4.21: Perception of seed subsidy schemes by the agro-dealers

		Central	Nyanza	Western	Overall
Sold more seed under subsidy scheme	Agree	75.0	100.0	100.0	85.7
	Disagree	25.0			14.3
Delivery was timely	Agree	50.0	100.0	100.0	71.4
	Disagree	50.0			28.6
It brought conflict between customers and I It	Agree	75.0		50.0	57.1
	Disagree	25.0	100.0	50.0	42.9
was too involving/tedious/time consuming	Agree	100.0		50.0	71.4
	Disagree		100.0	50.0	28.6
Uncertainty over whether payments will be made	Agree	50.0		100.0	57.1
	Disagree	50.0	100.0		42.9
Took too long to process vouchers	Agree	100.0		50.0	71.4
	Disagree		100.0	50.0	28.6
Process too complex	Agree	100.0		50.0	71.4
	Disagree		100.0	50.0	28.6

5.0 MARKET ACCESS PROGRAMME

5.1 Overview of Output Market

Smallholder participation in staple markets

Access to profitable markets is one of the most important factor constraining agricultural productivity and overall growth of the agricultural sector. Agricultural commercialization[25], benefits the poor by increasing agricultural labour productivity which in turn generates employment in low-capital smallholder agricultural production. Market participation among the smallholder farmers is by a minority of households with the majority of the households selling very little quantities (Tegemeo, 2010). This low participation in agricultural markets for staples is attributed to amongst others, the low volumes produced; consumption at home; constraints in accessing markets for these commodities and low incentives to participate in markets.

Data from Tegemeo panel shows that between 2000 and 2007, smallholder farmer participation in food staples markets increased marginally. The proportion of households selling maize increased from: 30 to 47%; from 30 to 33% for beans; from 30 to 35% for other cereals and pulses; and from 39 to 43% for roots and tubers. The proportion of staples sold also increased marginally moving: from 17 to 20% for maize; from 13 to 15% for beans; from 11 to 13.6% for other cereals and pulses and from 17 – 23% for roots and tubers. The volumes marketed declined from: 900 to 882 kg of maize; 61 to 38 kg of beans; 41 to 38kg of cereals and pulses and from 435 to 326 kg of roots and tubers.

Markets for Staple Crops

Grain marketing in Kenya is fully liberalized[26] and producers dispose their produce to willing buyers at market prices. Among the smallholder farmers, the main market outlet for staple crops is the local markets. Other market outlets include: institutions like schools, hotels and hospitals; agro-processors like grain flour millers and animal feed processors and the NCPB.

[25] a shift from subsistence production to an increasingly complex production and consumption system based on the market (Goletti, 2005)

[26] Kenya's Grains Sector reform programme commenced in 1988 and was fully liberalized in 1993.

Smallholder farmers sell staples either at the farm gate, in retail or wholesale markets located nearest to their homes. Such sales are transacted in spot mark arrangements and on a cash basis. Sales to local institutions like schools, a popular market outlet for smallholder farmers are settled in-kind i.e. converted to school fees. Only farmers with substantive quantities may sell their produce directly to the NCPB and to millers. On average, smallholder farmers travel 5 – 8 km to the nearest major market for food crops. Although the distance appears short, transportation is made difficult by the poor roads. This makes transportation of goods a daunting task and costly activity particularly during the rainy season when most rural roads become impassable.

The buyers for staple crops are traders and consumers who frequent the local markets during scheduled market days. Otherwise, farmers sell their staples to consumers or brokers at the farm gate.

Local Markets in Kenya

Smallholder farmers are known to dispose their produce immediately after harvest in the local markets. The local markets maybe classified into open-air/farmer's markets and permanent markets. A farmer's market is a public marketplace where farmers gather on a regular basis to sell staples, fruits, vegetables and other farm products. Traders also gather to sell foodstuffs and different kinds of merchandise to the farmers and other consumers. These open-air markets are held in public spaces.

Farmers' Markets vary in terms of their size and infrastructural facilities. The simplest type of Farmers' Market is the *open-air market*. These markets are undeveloped and only provide farmers with the space without any other infrastructure. Open-air markets are the most common form of farmers markets in Kenya and they are found in almost every shopping centre across the country. Another type of Farmers' Market is one which provides the farmers minimum protection and at the same time offers easy access from all sides. These markets have perimeter wall and simple sheds for the farmers and traders to use temporarily, some of them have storage facilities for wares that have long shelf life like cereals.

Permanent Enclosed Markets have the basic infrastructural facilities and are operational year-round. The users are mainly traders. Facilities in such markets: Shelter, clean and adequate number of bathrooms, running water, security arrangement, stores, and a drainage system. Some

of the markets with improved infrastructural facilities are: Kibuye and Ahero markets in Nyanza region; Karatina, Gakoromone and Embu markets in the Central region; Kakamega market in Western region.

National Cereals and Produce Board (NCPB)

Under the commercial role, the NCPB buys and sells grain products such as maize, wheat, beans, rice, millet and sorghums. It also offers services related to grain marketing such as: Leasing out surplus facilities, grain drying, weighing, fumigation, grain cleaning, grading, warehousing, bagging at silos, clearing and forwarding, and hiring of tarpaulins and dunnages.

Food Aid

The World Food Programme's (WFP) Purchase for Progress (P4P)[27] programme is offering a relatively new market outlet for staple crops in form of sales to the relief food/food aid kitty. This programme seeks to promote smallholder marketing of staple food crops and build the capacity of small producers and suppliers to meet market demand. Under this project, a range of procurement approaches will be piloted including: buying directly from farmers' organisations; commercial villages; small-scale traders and agro-dealers. The project also expects to test approaches like the warehouse receipt system and work with processing firms to promote market linkages for smallholder farmers. The project expects to purchase 60,000 metric tonnes of mixed commodities (Maize, sorghum, mixed pulses and corn-soya blend) and hopes to impact on 56,000 smallholder and low-income farmers and 50 farmers' organisations.

Collective Action in marketing

The proportion of households with group membership and hence the potential to form marketing groups/federation is high ranging between 78% in 2000 and 75% in 2007 (Tegemeo, 2010). In-spite of this, the proportion of smallholder farmers marketing their produce as a group is however very low and uncommon in marketing of staple foods. Smallholder farmers mainly market their staple crops as individuals. The few who are organized in groups have been able to sell their staples to the WFP and to large processors like the East African Breweries.

The positive attributes of collective marketing include: giving farmers a stronger bargaining position in the market for inputs and outputs, providing a platform for sharing information that may be helpful in productive and marketing activities by the farmers, reducing marketing costs through economies of scale.

5.2 Wholesale Prices of Staples in Various Markets

Among the staple crops, pulses (led by beans) fetch the highest price followed by the cereals led by finger millet, sorghum and then maize. Roots and tubers (cassava) fetch the lowest price. The prices for all staples were steady or declining in the later part of 2009 (Figure 5.1). By the end of that year, the staple prices started rising dramatically and until mid 2009 when there was a drop and/or stabilizing of prices depending on the crop. The world prices for staple foods too recorded dramatic increases in price between 2007 and 2008. According to the Food and Agriculture organisation of the United Nations (FAO), food price index rose by 9% in 2006 and 23% in 2007.

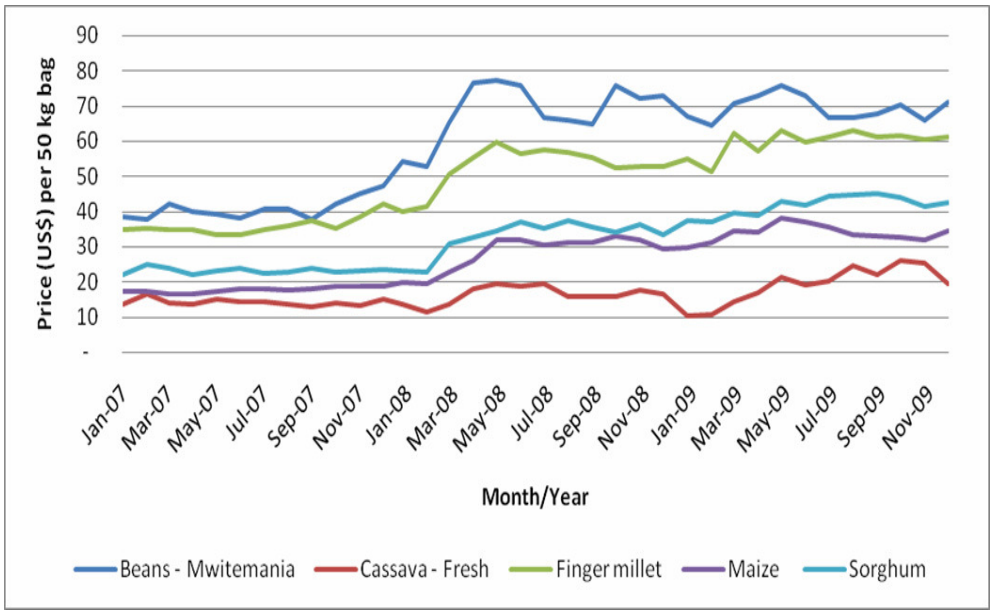


Fig. 5.1: Monthly average wholesale price (US$) of staples (2007 – 2009)

In Figure 5.2, monthly prices were compared to the price in January 2007. In 2007, the price change was small flatuating between + or – 7% that of January 2007. The price change by the end of 2007, was dramatic and continued rising steadily up to April-May 2009. In the first

quarter of 2009, the price of maize was 100 to 140% higher than that in January 2007 while beans were sold at a price 90 – 100% price higher than the price in January 2007. Although the surging prices appear to have softened, during the second half of 2009, the prevailing prices for cereals and pulses remained well above their 2007 levels i.e at least 80% to 100% higher than the prices in January 2007.

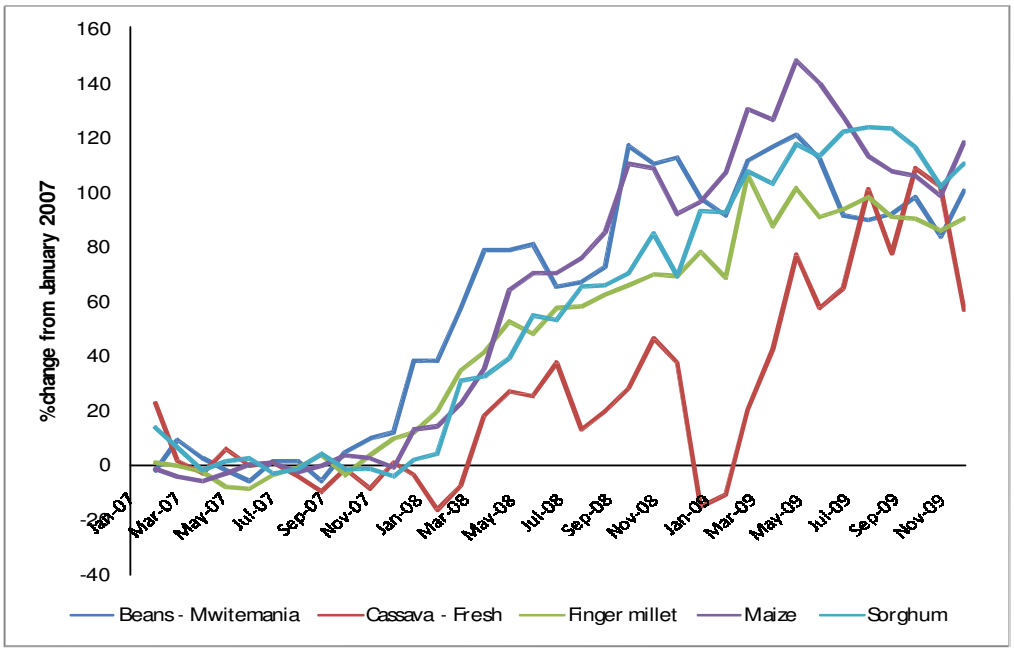


Fig. 5.2: Percentage change in price; average monthly prices (2007 – 2009) compared with price in January 2007

Market Information System

The Ministry of Agriculture has established a market information service where wholesale price for a wide range of commodities, such as cereals, pulses/legume, tubers/roots, and horticulture is collected from a network of markets and provided to users. The information is gathered and relayed to a central office by way of: telephone calls, internet/email, physical visits or walk-ins and short message services (SMS). The information assembled is disseminated by way of: Print media, Radio, emails and TV. All media houses receive and disseminate this information. Figure 5.3 shows that enquiries about the market were made using four modes of communication. The intensity of use of the marketing information services which is a facility provided by the MoA is as follows: The internet and email is the most frequently used (a rate of 10[28] enquiries in a day).

[28] The total days in the year are computed as - 21 working days in a month for 12 months

This is followed by physical visits to the MoA offices (a rate of 8 inquiries in a day), short text messages - SMS (a rate of 6 enquiries in a day).

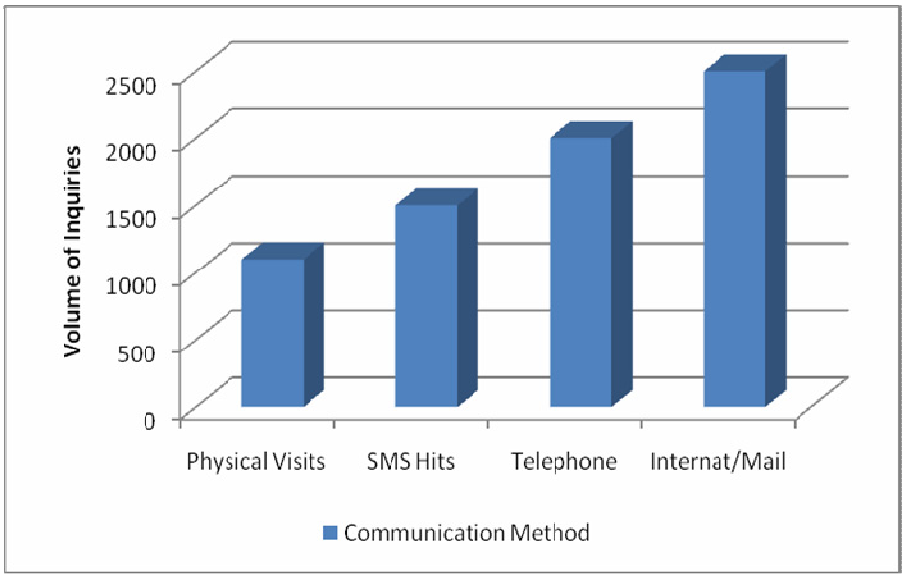


Fig. 5.3: Volume of inquiries made in 2009 at MoA's MIS

5.3 Warehousing and Grain Banks

The idea behind Warehouse Receipts Scheme (WRS) is to have producers store their grain in secure warehouses and use the warehouse receipts as collateral for obtaining credit for immediate financial needs. A certified warehouse management firm keeps the maize in a secure warehouse so that farmers can sell their maize later in the year and benefit from increased maize prices which usually occur several months after the harvest.

Currently there is only one such facility located in Nakuru (Lesiolo Grain Handlers), a privately owned company, launched in April, 2008 at the Nakuru Wheat Silos in Nakuru by the Eastern African Grain Council (EAGC), in conjunction with Kenya Maize Development Programme (KMDP) and Regional Agricultural Trade Expansion Support (RATES).

Equity Bank has developed a special financial product to serve this scheme. To date, over 10,000 (90 kg) bags of maize have already been delivered to the warehouse and Equity Bank has provided loans worth $130,000 to producers who have delivered maize to the warehouse and obtained a warehouse receipt.

National Cereals and Produce Board

NCPB proposes to start a Warehouse Receipting System to address cereals' marketing and food security issues. This initiative aims at strengthening the commodity supply chain through a certified linkage of warehouses systems. The certified warehouses shall issue tradable receipts/warrants for commodities delivered. A Legislation to formalise warehousing activities is in the pipeline and a bill is being drafted (pers com. with East African Grain Council (EAGC).

NCPB has over 110 Warehouses spread out throughout the country in major staple food producing regions with a storage capacity of over 1.8 million metric tonnes. The facilities and activities in NCPB depots and silos are discussed below.

Nairobi/Eastern Regional Office: There are 17 depots but the main ones covered by this regional office include Nairobi Grain Silos, GCP, Thika, Loitokitok, LungaLunga and Kibwezi. The Nairobi Grain Silos can store bulk grains up-to 880,000 bags x 90kg, part of which is available for leasing at minimal charges. There are facilities for drying grains and two weighbridges. There are conventional stores available for warehousing. These have a capacity of 100,000 bags x 90kgs.

South Rift Regional Office: Based at Nakuru and covers 18 depots. The main depots include Nakuru, Kilgoris, Narok Silos, Kericho and Nyahururu. Products dealt with are mainly maize, wheat and beans. Facilities available are: Silos for bulk storage of maize and wheat, Cyprus bins and conventional stores for bagged products. Services offered include drying, cleaning services, storage (leasing and warehousing).Weighing facilities are also available.

North Rift Regional Office: Located in Eldoret town and covers 14 depots including 2 Silo Complexes. The main depots are Eldoret, Kitale, Moi's Bridge, Turbo and Kapenguria. Facilities available include weighing, silo storage for wheat and maize, conventional stores and a dryer. Services offered are drying, cleaning, weighing, bagging and grading. They have available for leasing and warehousing the following-; Bulk grain – 440,000 bags x 90kgs bagged products in silos and 1310,000 bags x 90kgs for bagged (packed) products in the conventional stores.

Lake/Western Regional Office: Located in Kisumu town at the Kisumu Silo Complex and has 23 depots including 2 silos. The main depots include Kisumu, Bungoma, Kisii, Nyansiongo and Webuye. The main crops include maize, beans rice and millet.

Northern Regional Office: Located in Embu town and covers 19 depots. The main depots include Meru, Sagana, Kitui and Garissa and the main crops are rice, beans, millet, sorghum and green grams. Services offered are grading, warehousing and space available for leasing. The facilities have a storage space of 100,000 bags. The main activities in this area are Rice milling and distribution, famine relief distribution and procurement of staples such as green grams and sorghum.

Coast Regional Office: It covers 7 depots, the main ones being Mombasa, Changamwe and Voi. Main activities include clearing and forwarding, warehousing and leasing of excess capacity, import and export and weighing of customer vehicles. The storage facilities have a storage capacity of 190,000 bags and weighbridge facilities.

Cereal Banks[29]

In Cereal Banking, farmers form their own marketing associations to inspect, bulk, store and trade maize. This approach allows them to sell maize for top prices to larger-scale buyers, such as millers, but also to take greater control over their local food supply and sell small quantities for reasonable prices during grain shortages'. The Cereal Banking System was first introduced in Western province in 2003 by SACRED, a local NGO.

The National Acceleration Agricultural Input Access Programme (NAAIAP) adopted the same principle of farmers getting together to manage their harvest. The principle behind this idea was a sustainable NAAIAP activity where farmers farm on one acre of land under maize were able to purchase farm inputs, on a sustainable basis. Farmers were brought together to conduct collective marketing by pooling their harvest and storing for sale later when market prices improve. The farmers are expected to set aside 30% of their produce (ranges between 3 – 4 bags), for storage

[29] Cereal banks were first introduced in Kenya in 2002 by NGOs. A review found poor progress and showed weaknesses, and could not be considered a sustainable form of business enterprise. The main weaknesses were: difficulty competing in spatial arbitrage; slow collective decision-making; corruption and decapitalization (Coulter, 2006).

in a communal store (Cereal Bank). Farmers have a choice on whether to withdraw the produce for their use and pay for storage and handling or sell as a group and use the funds either as collateral for borrowing from banks or to buy inputs.

Table 5.1: NAAIAP Cereal Banks

Year	Number of Districts	Number of Beneficiaries	Number of Cereal Banks Started	Number of 90 Kg Bags (Maize) Handled
2007	30	36,000	0	
2008	*62	92,000	34	1,039
2009	103	175,000	**25	1,800
Total	195	303,000	59	2,839

*Some districts were visited for 2 years
**Cereal Banks formed 2009/2010

The districts with cereals banks under the NAAIAP programme are listed in Table 5.2.

Table 5.2: Districts with NAAIAP Cereal Banks

1	Bungoma South	12	Nzawi
2	Mt Elgon	13	Mukaa
3	Msambeni	14	Kangundo
4	Kwale	15	Mwala
5	Nandi North	16	Kilungu
6	Kisii Central	17	Kathyani
7	Kitale East	18	Embu East
8	Lugari	19	Embu West
9	Butere	20	Meru south
10	Rachuonyo	21	Kandara
11	Transmara west	22	Kigumo
		23	Maara

5.4 Commodity Exchange

The Kenya Agricultural Commodity Exchange (KACE) is a private firm that was launched in 1997 to link farmers and buyers of agricultural commodities. The initial component was a trading floor at the Jamhuri showground in Nairobi. KACE has developed alternative systems which it believes will improve access by poor smallholder farmers and other small and medium scale agro-enterprises (SMEs) to market information, market linkage and other relevant services. The system uses modern information and communication technologies for transmitting information and has the following components:

- Rural Based Market Information Centre's
- Franchised Market Resource Centres
- Mobile Phone Messaging Service
- Interactive Voice Response Service
- Internet. KACE's Website, www.kacekenya.co.ke

- Radio. KACE's Soko Hewani

KACE has franchised MIPs and MICs to market resource centers (MRCs) owned by local entrepreneurs. These will be operated on a commercial basis. So far, KACE has four pilot MRCs[30] all in Western Province of Kenya: Chwele and Kimilili in Bungoma District, Cheptais in Mt. Elgon District and Mumias in Mumias/Butere District. Each MRC is a registered limited liability company under the Companies Act, Cap 486 of the Laws of Kenya.

KACE is also piloting a virtual trading floor through the use of a local FM radio station (West FM Radio Station) thereby integrating the MIS components of MRCs, SMS, IVR and radio to concurrently provide timely market information and facilitate market linkages for farmers through an interactive radio programme. One of the products, Soko Hewani (supermarket on air) is an interactive radio programme that is broadcasted weekly (Tuesdays from 0900 – 1000 hrs) and matches sale offers and bids for commodities by smallholder farmers and other SMEs in the community. The catchment zone covers Western, parts of Nyanza and parts of Rift Valley Provinces of Kenya and eastern Uganda.

Inquiries from KACE about the market were made using four modes of communication (Figure 5.4). The intensity of use of KACE's marketing information services is as follows: The short text messages - SMS is the most frequently used (a rate of 1,984[31] enquiries in a day). Others are the internet and email (a rate of 10 enquiries in a day). Physical visits to the KACE and KACE affiliated facilities offices was the least used mode.

[30] Established in August 2006 and were officially launched on October 27, 200
[31] The total days in the year are computed as - 21 working days in a month for 12 months

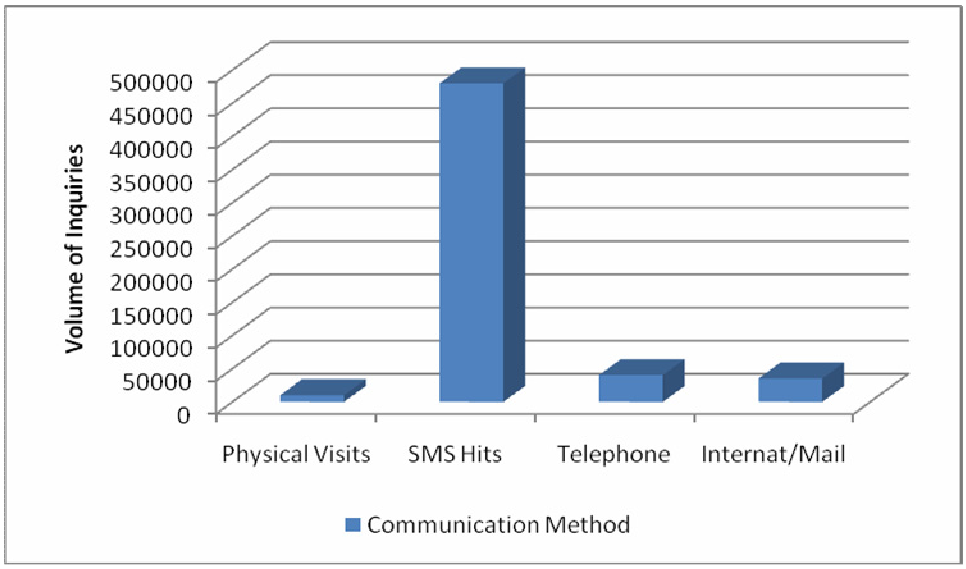


Fig. 5.4: Volume of inquiries made in 2009 at KACE's MIS

5.5 Agro-Processing of Staples

5.5.1 Overview of the Agro-Processing Sub-sector

The share of manufacturing value-added to the overall GDP ranges between 10-12% and has been growing at the rate of only 2.3% over the last two decades. Agro-processing is one of the two main activities in the manufacturing sector[32]. It has the largest number of firms (18% of total number of manufacturing firms – in the formal sector). In 2006, the value-added by food agro-processing contributed 21% of GDP (KIPPRA, 2009). In addition, Kenyan manufactured exports are mainly agro-processed products. At the micro level, agro-processing is important because it contributes to food security, value-addition of farm output, creation of employment and to reduction in poverty. Agro-industry is pro-poor since it is mainly carried out by MSE's[33], creates employment in rural areas, and has high absorption capacity for labour which is particularly critical in the rural areas.

Kenya met over 99% of the domestic demand for grain flour and only 25% of the demand in animal feeds. 76% of domestic demand for animal feeds is imported. Demand for agro-processed goods is expected to rise as the population in Kenya increases and as livestock production

[32] The other is oil refining
[33] MSE's account for 12% of the value added in manufacturing (GOK, 2006), create 87% of all new employment and absorb 77% of total employees (GOK, 2007). However they are characterized by low value-addition.

systems intensify. Urbanization and subsequent food diversification is also an opportunity for processed staples. Market opportunities for agro-processed food are expected to grow further with the creation of free trade areas at regional level and with preferential trade agreements with certain countries-regions. In Kenya, like other countries in sub-Saharan Africa, little attention has been paid to the value chain through which staple crops and their products reach the final consumers. And hence an enormous potential of value added and employment opportunities still remains unexploited.

5.5.2 Description of Value-Addition Activities

Maize is the main staple that is being processed in Kenya, followed by other staples such as sorghum and millets. In Kenya, food staples are mainly used in processing of flour (maize milling) and for animal feeds. Maize milling is carried out by: (1) posho millers who are located in residential areas and villages and (2) medium and large-scale millers who are located in major towns. Medium and large-scale millers in addition to milling package and distribute their products. Grain flour millers source maize grain mainly from farmers, traders and the NCPB.

Maize flour is a staple food with high demand and therefore once milled and packaged, the flour is not stored (fast moving foodstuff) but leaves the mill for distribution through various outlets (wholesalers, retailers, institutions). Approximately 20% of the milled grain are by-products (maize germ and bran), that are mainly used in the livestock feeds manufacturing (Figure 5.5).

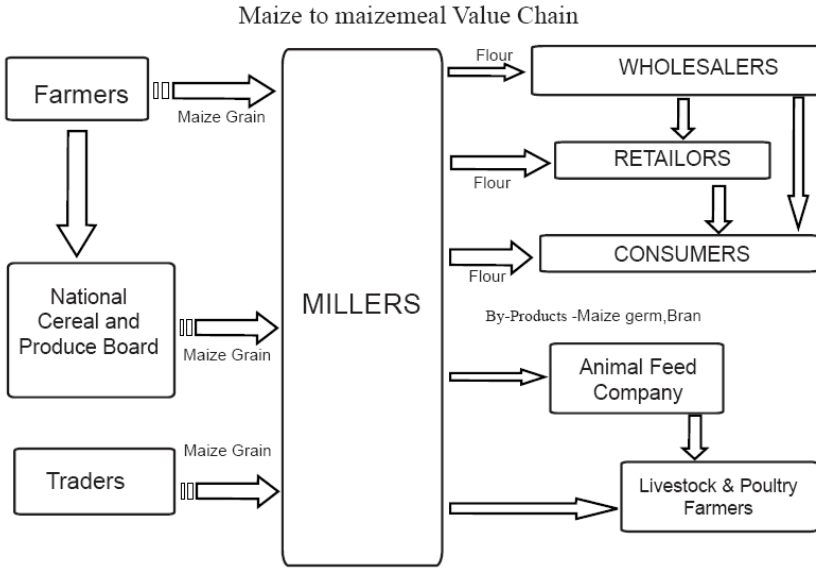


Fig. 5.5: Marketing Channels of Maize Grain and Maize Meal

Source: MoA/KARI report on maize grain value chain analysis

According to recent a survey carried out by Kenya's Ministry of Agriculture (2009), the level of agro-processing of staples other than maize and rice is in most of the cases non existent or very basic; besides, and as consequence of this low level of agro-processing capacity, the country faces huge post-harvest losses which were estimated at 40% (MoA, 2009). An estimated 2.5 million tonnes of roots and tuber crops produced in 2007 however, only a small fraction (0.041%) was processed (Economic Survey, 2007). There is no data on bulk processing of roots and tubers in Kenya. The level of processing is low despite the high potential and benefits from processing these crops. Processing has the potential to reduce post harvest losses of roots and tubers currently estimated at 7.5% in (MoA, 2007).

Processing of roots and tubers in the western region is mainly carried out by informal small and micro-enterprises owned by individuals or small groups of between 7 – 24 members (MoA, 2009). The product range includes: cassava chips used in making flour for porridge and *Ugali*; composite flours that include sweet potatoes flour (sweet potatoes, soya, *wimbi* or sweet potato, soya, amaranth). A few groups are making soap using sweet potatoes as filler material. Products from soya bean include: soya flour and beverage, soya yoghurt while groundnuts are ground into flour or roasted.

A similar picture is observed in Nyanza, where groups are processing the whole range of staples i.e. cassava, rice, maize, groundnuts, soya bean, amaranth, bananas, sweet potatoes sorghum, millets. The rice millers are comparatively bigger. Dominion rice is a large scale rice milling company in Siaya, Nyanza. In the Central region, cereals are milled and combined to make composite flours. Composite flours comprising millets, sorghum and grain amaranth are common. Others may incorporate flour made from pulses. One such composite flour is currently in major supermarkets under the brand name AZURI/BASCOT. Alternatively, the pure flours are mixed in various proportions according to the taste and preference of individual consumers.

Results from Tegemeo Survey Amongst formal MSE's in Agro-processing

Tegemeo also carried out a survey of agro-processors who process staple crops. As indicated earlier, these processors were purposively selected from a larger list of registered millers and animal feed processors. Out of the agro-processors who provided Tegemeo Institute with

information, all except one were MSE's employing 3 to 15 persons while one of them had 51 employees (Table 5.3).

Table 5.3: Size of Firms by Number of Employees

Task	Mode of employment			Total
	Permanent	Casual	Contract	
Selling	7		1	8
Cashier	6			6
Loading n offloading	5	9	1	15
Procurement	2			2
Cleaning	1	3	2	6
Transport	2			2
Machine operator	8	2	2	12
Supervision	10	1		11
Managers	12		1	13

Most of the processing companies have employed managers, supervisors, sales and accounts persons with such skills were permanently hired while the unskilled labourers like cleaners and off loaders were employed on casual basis. The most popular kind of training that staff had undergone was in business management and such training was mainly self-sponsored. Only 20% of the staff had undertaken training on technical aspects like product handling/health and safety. Such trainings were sponsored solely by the public sector.

The animal feed processors interviewed have an installed capacity ranging from 1,200 MT to 52,560 MT per annum. The utilized capacity ranges from 1% to 60%. The interviewed grain flour millers have an installed capacity ranging from 394 MT to 39,420 MT per annum. The utilized capacity ranges from 5% to 72%. The most commonly processed staple by the grain flour millers is maize grain followed by sorghum whilst maize germ and wheat bran were the most commonly used amongst animal feed processors (Table 5.4 and 5.5).

Table 5.4: Raw Materials and Capacity in Animal Feed Processing in the Various Regions

Town Province	Githunguri Central	Githunguri Centra	Thika Centra	Meru Eastern	Thika Centra	Nakuru Rift Valley	Eldoret Rift Valley	Kisumu Nyanza
Raw materials processed								
	Maize germ	Cotton seed cake	Maize	Maize	-	Maize germ	Maize bran	Maize
	Maize bran	Sunflower cake	Maize germ	Maize germ	Maize bran	Maize	Wheat bran	Soyabeans
	Wheat bran	Copra	Maize bran	Maize bran	Wheat bran	Wheat bran	Molases	Cotton seed cake
	Wheat pollard	Fishmeal	Wheat bran	Wheat bran	Wheat pollard	Wheat pollard	Rice bran	Wheat bran
	Cotton seedcake		Wheat pollard	Rice bran	Rice bran	Rice bran	Salt	Maize germ
	Sunflower cake			Wheat	Proteins	Molases		Sorghum
	Cane molasses			Sorghum		Cotton cake		
	Fishmeal			Cotton seed cake		Sunflower cake		
	Bakery waste							
	Additives					Bonemeal		
	Common salt							
Installed capacity (ton per year)	7,665	1,560	6,570	29,200	52,560	1,278	20,904	1872
Utilized capacity (ton per year)	2,185	936	3,120	8,400	9,984	78	1,612	16.27
Prop. of utilized capacity	28	60	47	29	19	6	8	1

Table 5.5: Raw Materials & Capacity in Grain Flour Milling in the Various Regions

Town	Embu	Sagana	Embu	Meru	Nakuru	Nakuru	Moi's Bridge	Mumias (Isongo/ Makunga)
Province	Eastern	Central	Eastern	Eastern	Rift Valley	Rift Valley	Rift Valley	Western
Staples processed								
1	Maize	Maize	Maize	Maize	Maize	Maize	Maize	Cassava
2	Sorghum	-	Sorghum	-	Millet	-	-	Maize
3	Millet	-	Millet	-	-	-	-	Millet
4	Amaranthus	-	Amarald	-	-	-	-	-
5	-	-	Cassava	-	-	-	-	-
6	-	-	Dagga	-	-	-	-	-
Installed capacity (ton per year	39,420	34,490	986	-	8,213	2,365	3,650	394
Utilized capacity (ton per year)	11,232	24,960	562	324	4,106	889	168	99
% of installed capacity utilised	28	72	57	-	50	38	5	25

In terms of volume, maize grain and maize by products were found to be the most processed staples. The mean volumes of each staple are indicated in Table 5.6.

Table 5.6: The volume of each staple processed over the last 12 months (2009)

	Grain flour miller		Animal feed processor		Total	
Staple	**Mean**	**N**	**Mean (kgs)**	**N**	**Mean (kgs)**	**N**
Cassava	4,942	3			4,942	3
Maize	3,939,630	8	356,946	5	2,561,675	13
Millet	51,550	4			51,550	4
Sorghum	61,800	3	234,225	2	130,770	5
Soya beans			3,000	1	3,000	1
Amaranth	8,808	2			8,808	2
Maize germ			2,810,057	7	2,810,057	7
Maize bran			702,600	5	702,600	5
Wheat bran			302,524	7	302,524	7
Wheat pollard			359,000	4	359,000	4
Bakery waste			260,000	1	260,000	1
Rice bran			156,750	4	156,750	4
Wheat grain			208,000	1	208,000	1

The buying prices reported for various staples are shown in the Table 5.7. Millet was the most expensive staple at US$ 0.8 followed by sorghum, soya bean and cassava. Maize grain was the cheapest amongst staples at US$ 0.33 to US$ 0.34. per kg. When compared with the average price received by farmers, the margin or price spread for maize was small, (US$ 0.12), while that for cassava and millet waslarge, (US$ 0.35 and 0.3 respectively). The price spread between farmer's price and purchase price for sorghum by a grain miller is US$ 0.43 and US$ 0.25 if

purchased by an animal feeds processor. The price paid for soya bean by the animal feed processor is US$ 0.23 below the average price that the farmer received.

Table 5.7: Purchase Price (US$/Kg) for various staples and other raw materials used

	Food miller		Animal feed		Total		Price received
Staple	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**by farmers***
Cassava	0.51	2	-		39.5	2	0.18
Maize	0.33	8	0.34	5	25.7	13	0.32
Millet	0.80	4	-		61.5	4	0.50
Sorghum	0.75	3	0.29	2	44.0	5	0.32
Soya bean			0.61	1	47.0	1	0.85
Amaranthus grain	0.68	2	-		52.5	2	
Maize germ			0.19	7	14.6	7	
Maize bran			0.21	5	16.1	5	
Wheat bran			0.12	7	9.6	7	
Wheat pollard			0.17	4	13.0	4	
Cotton seed cake			0.23	6	17.8	6	
Sunflower cake			0.16	4	12.6	4	
Cane molasses			0.12	3	9.2	3	
Fishmeal			0.36	1	28.0	1	
Rice bran			0.08	4	6.1	4	
Bone meal			0.43	2	33.0	2	
Copra			0.26	1	20.0	1	
Wheat grain			0.35	1	27.0	1	
Barley			0.23	1	18.0	1	

*This is the reported price from household survey

5.5.3 Acquisition of Raw Materials

Staples are produced in widely dispersed geographical areas in small parcels of land and by numerous small farmers who have limited use of purchased inputs and improved technologies. Staples are produced in systems that are solely rain-fed. Agro-processors mainly purchase their raw materials from traders who in turn rely on the spot market sales from farmers and small traders in local and regional wholesale markets. Traders and agro-processors normally need elaborate systems (assemblers) and lengthy periods to aggregate the small volumes of staples purchased from individual farmers and small traders into to large volumes for processing. Agro-processors also purchase staples particularly maize from large farmers.

Among the firms that we visited, traders followed by brokers and then farmers in descending order are the important suppliers of staples to the millers. The farmers supply mainly to the grain flour processors while traders and brokers mainly supply the animal feed processors. Animal feed processors also purchase raw materials directly from the grain flour millers.

Most processors have some additional arrangements (not formal) with the suppliers of raw materials (staples) and the buyers of the products. Processors may provide their suppliers with credit to purchase raw materials and/or transport to ferry the raw materials from source to factory gate. It is more common to provide credit while very few were paid commission for supplying the animal feed processors. Processors have similar marketing arrangements with buyers of products i.e. credit for products purchased and distribute products to wholesale or retail outlet.

The roads in rural areas where raw materials are produced are poor. This has implications on timeliness in procuring; it limits the scale of operation; overcapitalization due to low utilization of processing facilities. Storage capacity for raw materials is limited only to some of the large millers store at grains. The rest process the raw materials as they are purchased. This coupled with the fact that production of staples under rain-fed conditions is highly seasonal which means that staples are available during specific time periods and this has negative implications on utilized capacity. In processing of composite flours, sand contamination leads to 20% losses.

5.5.4 Sale of Processed Products

Products from staples are destined for human consumption, animal consumption and industrial use. Outlets for products derived from staples therefore vary with the end-use, the scale of production and whether processing was by manufacturing plants in the formal or informal sectors. Products from formal sector include those that are certified by or bear the mark of Kenya Bureau of Standards which indicates that they have undergone through the rigour of certification and that they are from taxpaying entities. Such products may be sold through formal retail markets especially supermarkets. Others products are sold through informal channels which include kiosks, shops in local shopping centres and do not get to the main market where consumers of processed products frequent.

In terms of market reach, Kenya has two dominant formal retail networks for processed food products: i.e. Uchumi and Nakumatt Supermarkets that works as a bridge between local manufactures and local consumers. Uchumi Supermarket which has 14 retail outlets in Kenya commits itself to procuring most of its supplies from local manufacturers. Nakumatt Supermarket is a privately owned supermarket and has many outlets spread across capital cities in Kenya, Uganda and Rwanda. It also has outlets in major regional markets in Kenya and targets

high-end markets with a wide variety of choices among local and international brands. It is estimated that 70% of the formal retail on food is transacted through the two supermarkets. In addition, there are other supermarkets that serve both ends of the market operating in Kenya and the region. Suppliers' to supermarkets like Uchumi must meet supplier and product requirements (see Annex 6). The other formal retail outlets for processed food products include hotels and institutions.

Outlets for animal feed products are: farmers, farmer cooperatives for use in their productive activities, private companies like Kenchic and Farmers Choice, agro-vet shops as well as other shops in local shopping centres. Wholesale outlets include the Kenya Farmers Association, Farmer cooperatives for onward distribution to their members and agro-dealers/agro-vet shops.

Staple by-products which are destined for further processing were sold to traders/middlemen while a few firms had direct linkages with the intermediate user firms (animal feed processors).

When prices of raw staples that were reported by the farmer are compared with the prices of products listed in Table 5.8, it is evident that the value of staple crops greatly increases after they are processed. The price spread (difference between price of product and farmer's price) for staples is a good indicator for the value-added to these commodities. From the basic processing of the staples, the value-added is: US$ 0.71 to 0.78 for sorghum, US$ 0.54 to 0.61 for millet, US$ 0.34 to 0.48 for maize, and US$ 0.41 to 0.61 for cassava.

Table 5.8: The reported whole sale price (US$/kg) for various products

End Use	Raw Material	Product	Lowest Ex factory wholesale price/kg	Highest Ex factory wholesale price/kg
Grain flours	Cassava	Cassava flour	0.48	0.78
	Cassava	Cassava chips	0.58	0.65
	Maize	Maize flour	0.45	0.55
	Millet	Millet flour	1.03	1.10
	Sorghum	Sorghum flour	1.03	1.10
	Composite	Uji mix	0.10	0.10
Animal feeds	Amaranth	Amaranthus flour	2.33	2.33
	Composite	Maize germ	0.20	0.23
		Maize bran	0.13	0.18
		Dairy meal	0.22	0.24
		Chick mash	0.32	0.33
		Dairy meal standard	0.21	0.22
		Kienyeji mash	0.25	0.27
		Dairy meal premium	0.23	0.24
		Dairy meal super	0.27	0.27
		Broiler starter	0.36	0.38
		Broiler finisher	0.34	0.36
		Pig finisher	0.22	0.23
		Sow and weaner	0.22	0.23
		Growers mash	0.24	0.28
		Layers mash	0.29	0.30

5.5.5 Alternative Uses of Processed Products

In addition to food and feeds, there are other potential users of products from staples that are yet to be exploited. The main alternative is in industrial use of starch in manufacture of adhesives, glue, starch for textile use and starch for food industries and for making paper, composite flours, feeds. The other alternative use for staples is in brewing. Sorghum and maize are already being used in beer making (as a substitute for barley) and there are prospects of using cassava as well. Sweet sorghum may be crushed to extract syrup while the crushed stalks may be explored as alternative material for making boards for ceilings and partitioning walls (pers com.).

5.5.6 Business Operating Environment

The growth of MSE's in agro-processing may be hindered by the business environment in which they operate. The business environment maybe defined in terms of: availability of, access to and the terms of financial services, degree of organisation, the legislation and regulation. Other

factors that define the operating environment are the level of technical and managerial skills. Next we discuss the information received from agro-processors in context of the business environment.

Financial services

Approximately 61% of processors sought for credit, mainly from the bank and all of them received it which indicates the willingness of credit institutions especially banks to offer credit probably because agro-processors interviewed have assets that act as collateral. The amounts received ranged from US$ 1,940 to 51,720 for the animal feed processors and US$ 3,879 to 10,990 for grain flour millers. One had an overdraft facility of US$ 12,930 per month. The term of the credit two to three years at an interest rate 13 – 21% for animal feeds and 15 – 24 for grain flour millers. Figure 5.6 indicates that most of those interviewed had a positive perception about accessibility to credit, the terms of credit and its effect on their agro-processing business.

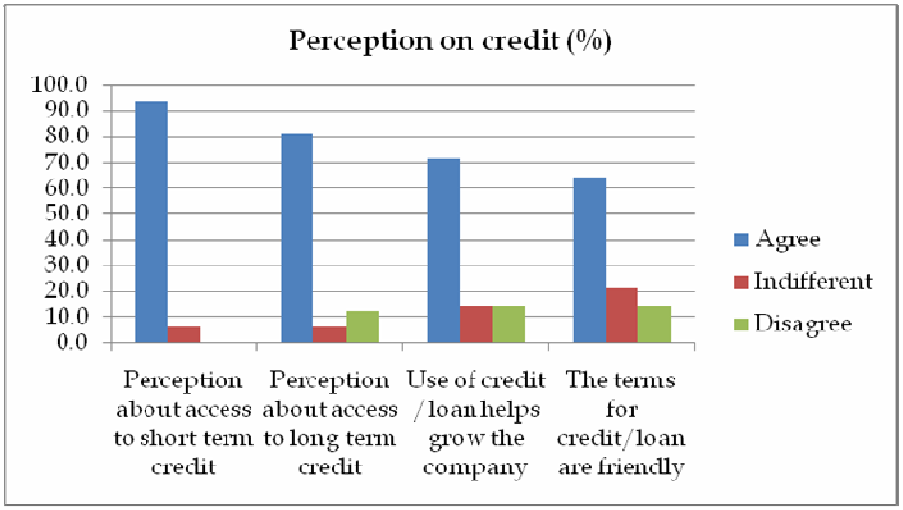


Fig. 5.6: Agro-processors perception of credit services

From Table 5.9 we note that the initial start-up capital for agro-processors dealing with staples was greater amongst animal feed processors (US$ 1,293 to US$ 387,900) compared with the capital for start-up by grain flour millers (US$ 452.5 to US$ 15,516). With as low as US$ 452.5 a grain flour milling facility was set-up while an animal feed processing plant needed at least US$ 1,293 to set-up. The source of start-up capital is mainly savings from the owners of the business while a few relied on credit/loan.

Table 5.9: Value of Investments by Agro- processors (US$)

Initial investment by agro- processors					
Type of miller	**N**	**Mean**	**Std. Deviation**	**Min**	**Max**
Grain flour miller	7	51,785	5,518,771	453	155,160
Animal feed processor	8	92,449	10,552,014	1,293	387,900
Average	15	73,473	8,447,664	453	387,900
Investment made in the last 12 months					
Type of miller	N	Mean	Std. Deviation	Minimum	Maximum
Grain flour miller	5	6,374	659,200	582	20,688
Animal feed processor	7	68,400	3,834,105	6,853	122,835
Average	12	42,556	37,78,604	582	122,835

All the agro-processors indicated that they have invested further in their agro-processing businesses within the last one year. The source of such funds was retained earnings and loan/credit and the investments made were worth between US$ 582 to US$ 122,835 (Table 5.10). Most of them invested in new equipment and vehicles for the business while others invested in land and furniture.

Table 5.10: Source of Capital for Investment

Source of Initial Capital						
	Food miller		**Animal feed processor**		**Average**	
	Count	%	Count	%	Count	%
Savings	4	57.1	6	85.7	10	71.4
Credit	1	14.3	1	14.3	2	14.3
Savings & Credit	2	28.6	0	0.0	2	14.3
Source of capital in the last 12 months						
	Food miller		Animal feed processor		Average	
	Count	%	Count	%	Count	%
Retained earnings	1	25.0	2	33.3	3	30.0
Loan/credit	1	25.0	4	66.7	5	50.0
Savings	2	50	0	0	2	20

All the agro-processors interviewed have an insurance cover with majority of them having a general cover as opposed to more specific insurance cover like fire, employee and burglary.

It is interesting to note that agro-processors (both grain flour millers and animal feed processors) source technical information (quality of staples to purchase and quality control of products) from the relevant regulatory bodies and technical experts. In contrast, market information on supply,

demand and pricing is commonly obtained from other players in the market place (Table 5.11a and b).

Table 5.11: Information Sources for Agro-Processors

(a) Grain flour millers					
Information sought	**The suppliers of staples**	**Demand for your products**	**How to price your products**	**Quality of staples to purchase**	**Quality control of your products**
	Newspapers/TV/ Internet	Sales person	Buyers	Documentation	Documentation
	Brokers	Sales person	Sales persons	Moisture meter	Moisture meter
	Brokers	Customers	Other processors and dealers	Internal controls	Customers
Information Provider	Newspapers	Customers	Other processors	Internal controls	Customers
	Field	Own performance	Costing	Internal controls	KEBS
	Information gatherer	Customers	Market	Internal controls	KEBS
	Exporation	Customers	Market fluctuations	Internal controls	KEBS
	Market	Customers demand	Demand	Physical inspection	Own knowledge
(b) Animal feed processors					
Information sought	**The suppliers of staples**	**Demand for your products**	**How to price your products**	**Quality of staples to purchase**	**Quality control of your products**
	Personal exploration	Marketing research	Competitors	KARI/KIRDI	Technical consultants
	Suppliers sales people	Buyers	Business calculations	KEBS	Internal control
	Asking millers	From farmers	Quality and Competitors	Send samples to KARI/KIRDI	Analysing samples
Information Provider	Asking millers	Sales people	Competitors	Send samples to KARI/KIRDI	Samples in laboratories
	The suppliers themselves	Sales people	Competitors/ Sales people	From millers	Internal control
	Other processors	Farmers	Cost of production plus mark-up	KEBS	KEBS
	Samples by individuals	Retailers	Distributors and retailers	KEBS	Kenya Association of Manufacturers
	From field	Advertisement and exhibitions	Other processors	KEBS	Experts and Institutions like Universities

The factors that inhibit growth in agro-processing are outlined below.

- The highly dispersed and small agricultural production units highly increase the costs of acquiring raw materials.
- Seasonality and reliance on rain-fed agriculture means that most firms operate way below the installed capacity.
- Poor rural road network and poor communication constraints the search and collection of raw materials for processing, marketing and distribution of products

- Unreliable supply of water, energy and other inputs constraint the manufacturing operations and increase costs. Costs of repair and maintenance, energy, skilled labour, transportation and raw materials are high and still rising further.
- On the demand side, agro-processing is constrained by low sales price due to the limited purchasing power in Kenyan (46% of Kenyans fall below the poverty line) and regional markets as well as volatile output markets.
- Legislation to enforce standards in the food industry (Food Sanitation Act) is necessary for sustaining a vibrant food and feed manufacturing industry.
- Standards for use in manufacturing products from the relatively newer staples in agro-processing (cassava, sorghum, millets, pulses etc) are needed so as to boost development in their processing
- Enforcement of adherence to standards and sanitary requirements
- Lack of a policy on agro-business and agro-processing to provide a strategy for development of this sub-sector.

PART IV SUMMARY OF KEY FINDINGS

Summary of Key Findings

Tegemeo Institute was consulted by the Alliance for a Green Revolution in Africa (AGRA) to conduct a study whose objective was to establish a baseline against which AGRA's interventions in the three programmatic areas – soil health, market access and seed - will be monitored and evaluated. To this end, Tegemeo conducted baseline surveys at various levels in the agricultural value chain in Kenya; farmer level (households), input markets, output markets and institutions. In this section findings from the surveys are summarized.

Farm Household Level

The farm households are headed by persons with a mean age of 52 years with 24% of the household being headed by females. For majority of the household heads, the highest education attained was primary level of education. The average land holding was three acres but much lower in the Central region. The value of physical assets owned was US$ 2,376 but varied across the regions with households in the central region having the highest asset value and the western having the lowest. Majority (96%) of the households keep at least one type of livestock and the mean value of livestock owned was US$425.

The mean annual income for the households was US$ 1,892. Households in the highest income quintile have 18 times higher income than their counterparts in the lowest quintile suggesting high inequality in incomes among the households. Farm enterprises (crops and livestock) constituted 65% of the household income while activities off the farm accounted for the remaining 35%. The share of income from crop enterprises was 48% while that from livestock enterprises was 17%. Income from business was the most important source of off-farm income. These results indicate the importance of agricultural enterprises, especially crops, to the livelihoods of the farm households. On average, the households cultivated 3.4 acres of land. For majority of the households, the cultivated land parcels were own land without a title (42%) while 32% was own land with a title. 19% of the households cultivated leased parcels of land. Majority (85%) of the households do not practise irrigation.

Distance to nearest agricultural service providers was 4 km for fertiliser and improved seed sellers while extension and veterinary service providers were located 5km and 3.5km respectively away from the households.

While majority of the households were aware of most of the soil fertility management practices, only a small proportion practised them. Use of farm yard manure and inorganic fertilisers was most common (70% of the households), while terracing, crop rotation and use of grass strips were practised by just over half of the households. In over half of the cases, the farmers perceived themselves to be proficient in the application of the SFM technologies.

Maize and common beans were the most commonly grown staples among the households with over 95% of the households producing them. Other staples produced by households were bananas, sweet potatoes, cassava and cow peas. The area under individual staple crops was generally less than one acre of land, indicating that most of the households are small holders in production of staples. Inter-cropping of staples, especially of maize and common beans, was the norm rather than exception among most of the households. The average annual production was 9 tonnes, 1.4 tonnes, 0.3 tonnes, 3 tonnes and 0.08 tonnes for industrial crops, fodder crops, cereals, vegetables and pulses respectively. The yield of maize averaged 923 kg/acre while that of beans averaged 175kg/acre. Across the regions, maize yields were 1,053 kg/acre in Nyanza, 786 kg/acre in Central and 946 kg/acre in Western regions.

Majority of the sample households had at least one livestock of whatever kind, with chicken and cattle being the most widely kept of all livestock. Over half of the sample households produced cow milk, with the proportion highest in Central region and lowest in Western region. The annual milk production by a household averaged 1,165 litres, with households in the Central region producing the highest volume due to the dominance of improved cattle breeds in the region.

Over 69% of the households used inorganic fertilisers while 77% used organic fertilisers. Approximately 43% of the households used a combination of inorganic and organic fertiliser. The use of fertiliser was lowest in Nyanza. The proportion of cultivated area with fertiliser was 61%, 52%, and 48% for inorganic, organic and combination of both fertilisers respectively. Application rate of inorganic fertiliser averaged 37 kg/acre while the dose rate averaged 81

kg/acre. The most popular inorganic fertilisers used by the households were DAP, CAN, Urea, and the NPKs (23:23:0 and 17:17:0) in that order.

Adoption of improved varieties among the households was highest for maize (65% of households) while the remaining staples registered adoption rates of between 0% and 6%. In Nyanza region less than 30% of the households reported having planted improved maize varieties. The proportion of cultivated area planted with improved maize varieties was 57% and lowest in Nyanza region (22%) suggesting a low intensity of adoption of improved varieties. Maize had the highest biggest range of improved varieties planted with the most common improved maize varieties being H513, WS505, H614, Pioneer and DH4.

On average, over 98% of the households were aware of at least one fertiliser type. The most widely known fertiliser types were manure, DAP, CAN and Urea. On improved seed varieties, 88% of the households were conversant with at least one variety of maize, while only 27% were familiar with at least one variety of common beans. Awareness of the households about improved varieties for the other staples was low.

Families/friends, fellow farmers and extension workers were the main sources of information on SFM technologies. The main sources of information on improved varieties were fellow farmers, agro-dealers and extension workers in that order, while the main providers of information on input prices to the sample of households were agro-dealers, fellow farmers and family members and friends in that order. Personal communication was the most common mode for acquiring information about fertilisers, improved seed varieties and input prices.

Households purchased fertilisers and improved seed varieties from outlets located further than those nearest to them, indicating that the nearest markets for these inputs may not be offering the inputs to the satisfaction or expectation of the households.

On financial services, only 11% of the households sought agricultural credit although the success rate was high (86%) for those seeking credit. The main providers of the agricultural credit were neighbours (25%), NGOs/MFIs (18%), relatives/friends (14%) and commercial banks (13%).

On average, 27% of the households had membership in agricultural producer groups which mainly engaged in crop and livestock production. The services offered to group members included mainly training, marketing, inputs acquisition and financial services. Women constituted 46% of the groups' membership and 25% of the groups' management committees.

Concerning marketing and storage of staples, between 2% and 16% of the staples produced by the households was marketed. Market orientation was higher for groundnuts, bananas, soybeans, sweet potatoes and millet where over 10% but less than 16% of the total production reached the market. It was lowest for cowpeas, Irish potatoes, sorghum and cassava. Buyers of the staples were mainly small traders and consumers, indicating lack of organized marketing arrangements for the commodities. Highest prices were received from pulses (Dolichos (*njahi)*, soybeans, cowpeas and groundnuts in that order) while the least prices were received for the tubers (cassava, sweet and Irish potatoes) and bananas.

Maize, sorghum millet, beans and groundnuts were stored for less than three months before sale while the rest of the staples, except cowpeas, were stored for less than one month before being sold. Approximately 37% the households had grain stores, majority of which were rooms in the main house or traditional stores. The average storage capacity was 2.6 tonnes but the largest volume stored by households was 0.7 tonnes of maize (highest among the stored grains). Storage losses were quite minimal for most of the grains and the main cause of storage losses were storage pests.

Although 14% of the households were aware of cereal banks, less than 2% used these facilities. Only 5% of the households were aware of the Warehouse Receipt System and none had used the system.

Commodity buyers, family members and friends, fellow farmers, local markets and market information points in that order were the main sources of market information on commodity prices, commodity availability in the market and potential market/buyers for commodities. Personal communication was the dominant mode of acquiring market information.

On aspects of gender, the results have revealed that households headed by women had fewer assets and earned lower incomes compared with households headed by males. In addition, the

level of adoption of productivity enhancing technologies like inorganic fertilisers and improved varieties in staple production was lower. Majority of the women were widows.

Soil Health Programme

Kenyan soils, like others in sub-Saharan countries, have continued to suffer from depletion of soil nutrients even in formerly fertile areas. Use of fertiliser is recommended as a source of essential plant nutrients added to the soil to replace or replenish the soil reserve for better and proper crop performance. Application of manure or compost whose use increases resource use efficiency is also advocated for.

The Tegemeo panel shows that the proportion of farm households using inorganic fertiliser has been increasing over the last decade. The data also shows that a considerable proportion (17%) of farmers did not apply inorganic fertiliser at all over the last decade. The fertiliser rate (kg/acre) among fertiliser users increased in most zones. The national average rate in maize plots was 59 kg per acre which is still below the recommended rate even in high potential areas where returns to fertiliser are comparatively high. Over the last decade manure and compost use has marginally increased in most areas except in western highlands. Use of manure or compost appears to be inversely related to use of inorganic fertilisers in most of the areas except the central highlands.

Soil quality analysis is a pre-requisite to good soil fertility management. Kenya has a number of soil testing laboratories in the universities, national research organisations, international research organisations and fertiliser manufacturers. Although the Kenya Agricultural Research Institute (KARI) being the main provider of soil analysis services to the public, the institute has closed some of the regional laboratories due to lack of equipment, equipment breakdown among other reasons. In addition, some of the regional laboratories that are open were found to be operating below capacity and lacking equipment for some types of analysis. The National Agricultural Research Laboratories (NARL) in KARI Kabete handles most of the soil samples collected through KARI's regional offices.

The fertiliser market which was liberalized in early 1990s has attracted over 10 importers, 500 wholesalers and 7,000 retailers. Fertiliser use has increased dramatically following the liberalization of fertiliser market with the total annual consumption rising from a mean of

250,000 MT in the 1990s to over 400,000 MT in the 2007/8 period. All key informants indicated that demand for fertiliser as a whole and for different fertiliser types has grown tremendously over the last two years. Demand for new fertiliser types e.g. the blends and the foliar feed has also increased over the same period of time. The off-take for fertiliser blends in 2008/9 was 60,000 MT (MoA). DAP is by far the most popular planting fertiliser. Its use has grown from 100,000 MT in the 2001/02 season to over 160,000MT in the 2008/9 season. The volume of other planting fertilisers (NPK's and SSP) has not been more than 20,000 MT. Use of topdressing fertilisers has also increased from around 85,000 MT in 2001/02 season to over 120,000 MT in 2008/09 season. CAN is the most commonly used topdressing fertiliser and its use has grown from around 45,000 MT in 2001/02 season to over 90,000 MT in 2008/09 season. The use of UREA has not changed and remains at slightly over 30,000 MT. Up to 2005/06 season, the use of specialized fertiliser fluctuated highly. One of the main reasons for the low use of fertilisers among smallholder farmers is the high cost against low output prices.

Almost all fertilisers used in Kenya (90%) are imported due to lack of raw materials for local factories and the high costs of importation of the raw materials. Only 10% of the fertiliser used in Kenya is locally made and only one type of fertiliser, single super phosphate (SSP) is manufactured in the country. Growth in manufacturing has been inhibited by lack of primary raw materials within the country. There are two fertiliser blending companies in Kenya, namely, Athi River Mining LTD and MEA LTD. The total volume of fertiliser blends produced in the country in the last 12 months was 50,000MT. The fertiliser blends currently available in the market are Mavuno basal, Mavuno top dress, NPK blends. Most are tailored for certain crops like Tea, Coffee, Pyrethrum, Rice and are mostly used by the large-scale farmers. About 10% - 20% of farmers use fertiliser blends in Kenya and most small scale farmers use the conventional fertilisers like DAP and CAN.

The two laboratories producing biological fertiliser using Rhizobium inoculums are the University of Nairobi, department of Soil Science laboratory and the Kenya Forestry Research Foundation laboratory. Since January, 2010, one of the fertiliser companies has embarked on production of biological fertiliser.

The Kenya Bureau of Standards (KEBS) is mandated to set fertiliser standards and carry out inspection and quality control mainly at the port of entry. According to KEBS, there is usually

over 90% compliance to the standards of the mainstream and officially traded fertilisers. Most of the imported fertiliser (70%) arrives as bulk cargo (not bagged), the greatest challenge is therefore in adulteration and sale of underweight fertiliser which mainly occurs during bagging and re-bagging.

Opening and repackaging fertilisers is prohibited in Kenya yet about 20 – 25% of fertiliser that leaves the port is re-bagged mainly at the retailer level due to the high demand of fertiliser in smaller units. Enforcement of measures by the weights and measures department was rated by players in the chain as non strict. The result is that up to 40% of the fertiliser sold in Kenya is underweight (AGMARK).

Agro-dealers are the direct suppliers of fertiliser to the farmers. A total of 3826 agro-dealers have been licensed by KEPHIS (KEPHIS, 2008) while 5800 agro-dealers have been registered under the CNFA/AGMARK agro-dealer project. Because of this expansion of retail outlets for fertiliser, the distance that small holder households travel to access fertiliser has been declining over the last decade. It declined from eight km in 1997 to 3.4 km in 2007.

These agro-dealers serving farmers who are located at an average radius of 5.5 kilometres. Many agro-dealers selling fertiliser also sold seeds. Other items sold were animal feeds and farm implements. A small number sell foodstuff, non-farm hardware and other household goods. The main suppliers of the fertiliser to agro-dealers were wholesalers located between 10 and 60 kilometres away. The largest volume by the agro-dealers was purchased in March which is generally the onset of long rains. Most wholesalers provided for fertiliser delivery (transport) and credit facilities, but also had commission on sales to a lesser extent. Fertiliser companies did the same but to a limited extent. Agro-dealers sold fertilisers to farmers who were located on average between 3 to 7 kilometres away and the months of largest sales were March and April.

The common source of market information for running agro-dealers business was other fertiliser stockists, closely followed by fertiliser companies and farmer feedback. The common training offered to agro-dealers was on fertiliser handling and usage and the sponsorship was either by self, NGO or the government through the MOA.

Farmers 38% sought credit and most of them received credit averaging at about US$ 12,930. The majority of the credit was from fertiliser suppliers, microfinance institutions and commercial

banks. The average repayment period was 11 months. The main constraints facing the fertiliser agro-dealers are inadequate supply during peak season, fluctuating prices and fluctuation in fertiliser demand.

The initial capital for starting the agro-dealer business was US$ 942 and the major source of capital was own savings followed by profits from other businesses. Some 35% of agro-dealers had undertaken investment in the past 12 months to expand their business. On average, the agro-dealers invested an average of US$ 43,962 and the main source of the investment was own savings followed by loans.

The first agro-dealer association Kenya National Agro-dealer Association (KENADA) was registered in 2009. From the sampled agro-dealers, only a few were members of an association (13%), mainly in KENADA.

Women mainly operate at the stockist level. There are none at the importer and manufacturers and very few are distributors. Among the 80 agro-dealer respondents, 39% were females. Gender disaggregation of the owners indicates that 70% were male and 30% were females. Women's concentration to the lower levels of the fertiliser chain mainly at agro-dealers and farmers was attributed to the following: cartels that shut out new entrants particularly women; lack exposure and economical empowerment, credit and knowledge, and; fertiliser business at being capital intensive.

Fertiliser is zero rated since 2008 and hence there are no taxes imposed except the 2.25% import declaration fee (IDF) which is paid at the port of entry. Other costs to imported fertilisers include pre-inspection, verification of conformity and port tariffs. Locally manufactured fertiliser is also zero rated but suffers from a duty imposed on polythene bags and poly-ethylene material (120%) which makes packaging costs high.

There are two government fertiliser subsidy schemes designed to increase resource poor household's fertiliser use and to protect them from high fertiliser prices. The National Accelerated Agricultural Input Access Programme aims to promote input use by improving access, affordability and incentives for poor small scale farmers who own land but cannot access inputs. In the cropping year 2008/2009 the number of targeted farmers was 92,000. Under this programme poor farm households were offered a free package (100% subsidy) comprising of one 50 kg bag of DAP and another of CAN. Another subsidy scheme was

instituted by the government in 2008 to cushion farmers from the sharp increase in fertilizer prices. It involved a subsidy level of 34% for DAP and 42% for CAN fertilizers.

The general view of all the key chain players apart from farmers is that the direct subsidy to the farmers is the most non- supportive government policy that has been enacted in the fertiliser industry. The subsidy scheme is said to have been initiated without consultation with the players in the industry and hence not well structured and deemed to be injurious to the importers and the other players in the fertiliser supply chain.

Seeds Programme

Kenya's seed industry comprises of formal and informal sub-sectors with the informal sub-sector providing nearly 80% of the country's seed. The formal seed sector operates through an established regulatory process (Seeds and Plant Varieties Act, Cap 326) and according to international seed testing and certification schemes (International Seed Testing Association, ISTA and OECD, respectively). Development of seed is mainly by registered seed companies or their authorized agents whilst the Kenya Plant Health Inspectorate Service (KEPHIS) is the seed certification authority. Certification of seed is a legal requirement in Kenya and is governed by the Seeds and Plant Varieties Act (Cap 326).

Maize seed dominates the formal seed sector, with 97% market share and the share of vegetable seed is rapidly growing. Over the past 5 years, a total of 128 new varieties of staples were release. About 27,078 tonnes of certified maize seed was produced in 2008. Kenya Seed Company is the largest local seed company accounting for almost 90% of the formal seed sector that was available for the 2008 planting season. The key players in seed supply and marketing chain are the breeders, importers, seed merchants/companies, seed company agents/distributors, agro-dealers, farmers, KEPHIS and KEBS.

Distribution of seed is mainly by agro-dealers and so they are the main seed buyers from the seed merchants, with very little seed being purchased directly by farmers and NGOs. The agro-dealers have various arrangements with the seed companies which include transport, credit and discounts. However, the seed companies indicate that credit to small stockists and non-payment for deliveries (can be expensive to collect dues and enforce payments) limit their operations. In this regard, they proposed the establishment of a credit rating system and cash on delivery.

Sorghum and maize are the major crops for which agro-dealers purchased seeds but beans, millet and green grams seeds were stocked by very few agro-dealers. Nearly 87% of the maize seed purchases by agro-dealers are from wholesalers, who are on average located 43 km away. The suppliers were seed companies or wholesalers with which they had transport, commission and credit arrangements.

The volume of maize seed sold was the highest. The average distance to the nearest maize seed buyer was six km while the months of the largest sale were March and April in all the regions. October sales were significant in the Central region.

Seed loss incurred by agro-dealers was overwhelmingly due to spillage (83.3%) during transportation while pest damage during storage was also important (66.7%). The maize seeds that are most susceptible to loss while on storage are SCDUMA 41, WS 505, DK 8031, KS 513, KS 6210, SCDUMA 43, and SIMBA 61. Seredo was reported in Nyanza as the sorghum variety that is most susceptible to loss while on the shelf.

Seed merchants obtain market information from various sources. Information related to source, quality, demand and suitability of seed in specific growing areas was mainly obtained from KARI and KEPHIS. Seed merchants also carry out market surveys in order to determine the demand for new improved seed or crop variety. Most agro-dealers in Central and Nyanza regions depend on the seed companies to get information about seed suppliers while their counterparts in the Western region depend on other seed stockists. Additionally, other seed stockists are an important source of information on seed suppliers in Nyanza province. Information on demand for the seeds was mostly got from farmer feedback. The two important sources of information on pricing are other seed stockists and seed companies. Information on the correct seed to sell is mainly got from the extension workers while farmer feedback is also an important source in Western and Nyanza regions. Agro-dealers get information on new seed varieties in the market largely from the seed companies but other seed stockists and radio are also important sources. Seed companies and farmer feedback are the two most important sources of information on seed quality.

Seed merchants provided training for their staff in marketing and business management while agro dealers provided training in business management and soil testing, seed usage and handling and on seed varieties suitable for different regions. The training was provided by various institutions including, seed companies, NGOs, and the Government/MoA/KARI.

Agro-dealers (31%) sought credit with 74% of them obtained credit of an average amount of US$ 1,988. The major sources of credit are commercial banks in the Central region and Microfinance institutions in Nyanza and Western regions. In the Central region, seed suppliers

are an important source of credit for agro-dealers. Most of the agro-dealers and particularly in Central and Western regions pointed out that they had easy access to short term credit for their business. But fewer indicated that they had easy access to long term credit. All the agro-dealers agreed that credit helps their seed businesses grow. Agro-dealers obtained initial capital for business from family savings and profits from other businesses. Overall, about 35% of the agro-dealers made investments over the last 12 months, with most funds coming from savings and loans.

The main constraints faced by seed merchants in running the seed business include a highly regulated sector, bad debts, difficult logistics, lack of capital for marketing and promotion of seeds. Constraints facing seed agro-dealers are inadequate seed supply, low demand due to seasonality of production and lack of capital.

Interviews with key informants revealed that currently, the sector is more opened up and there have been consultations among the stakeholders in the industry which have culminated into the National Seed Policy which has already been discussed by the Cabinet committee. There are also other legislative changes that have been undertaken through consultation amongst the stakeholder. Currently the sector is zero rated, and Regulations 2007 (Seeds and Plant Breeder's Rights) has been put in place. The latter entails accrediting of private seed enterprises/individuals to undertake certain aspects of seed certification/seed testing services which were previously predominantly performed by KEPHIS. This has made it easier to operate the industry.

Seed merchants indicated that when setting the selling price of seed, they consider the following price components: cost of production, margins, value to farmer, profitability and competitors' prices. In addition, agro-dealers indicated that it is the seed companies and wholesalers who mainly set the price of seed. They (agro-dealers) base their selling price on the buying price, profit margin, transport cost and rent charged.

Overall, only 13.5% of the agro-dealers indicated that they belong to an association. 50% of the agro-dealers belong to the Kenya Association of Agro-dealers (KENADA) while the rest belong to region specific associations.

There are two seed subsidy schemes both under the MoA namely, the National Accelerated Agriculture Inputs Access Programme (NAAIAP), and the Orphaned Crops Programme. The NAAIAP programme which was started in 2007 has two components: (i) Kilimo Plus Starter Kits (KPSK) which provides in kind grant of US$ 65 for inputs to enhance food (previously 91) security/availability at household level and generate income from surplus; and (ii) Kilimo Biashara Packages (KBP) which is for farmers with economically viable enterprises but constrained by lack of basic inputs. Under NAAIAP, the government gave free maize seeds in 2009/2010 amounting to 750 tons (10 kgs of seed to 75,000 farmers).

The Orphaned Crops Programme is aimed at diversifying sources of food through promotion of indigenous crops that are drought tolerant namely, cow peas, pigeon peas, green grams, cassava, sweet potatoes, millets, and sorghums. Under this programme, the government through the Ministry of Agriculture and KARI has been spending US$ 3.88 million every year in production and distribution of seeds. Annually, 323 tonnes of assorted grain seed, 1,335,485 cassava cuttings, 2,104,000 sweet potato cuttings and 40 tons of Irish potato seeds has been distributed.

None of the three interviewed merchants were involved in any seed subsidy schemes. However, agro-dealers participated, and indicated that subsidy vouchers for maize were mainly from the government (85.7%), with the rest being provided by an NGO. Agro-dealers thought the process was too tedious and time consuming, too complex, that it took so long to process vouchers, it brought conflicts between them and their customers and there was uncertainty over whether payments would be made. This notwithstanding, delivery of seeds was timely and the agro-dealers benefitted since they were able to sell a higher volume of seeds.

Market Access Programme

Access to profitable markets is one of the most important factors constraining agricultural productivity and overall growth of the agricultural sector. Low volumes of production; consumption at home; constraints in accessing markets and lack of incentives are some of the reasons for low participation in agricultural markets for staples.

This study has established lack of organized marketing arrangements for staples among smallholder farmers, as majority of the staple sales is in spot markets and on a cash basis. In

addition, smallholders also face difficulty in transporting commodities to the market, especially during rainy periods, due to poor roads.

The most common markets for staples are the local markets. These maybe: open-air markets, which are found in almost every shopping centre across the country; or markets with perimeter wall and simple sheds and limited storage facilities; or permanent enclosed markets which have basic infrastructural facilities and are operational year-round. In addition to these market places, the NCPB buys and sells grains such as maize, wheat, beans, rice, millet and sorghums and also offers drying and other services related to grain marketing. The World Food Programme's Purchase for Progress programme is also a relatively new market outlet which farmers can use for staple crops.

Smallholder farmers mainly market their staple crops as individuals, the positive attributes of collective marketing notwithstanding. However, the few who are organized into groups are able to sell their staples to the WFP and to large processors such as the East African Breweries.

Among the staple crops, pulses (beans) fetch the highest price followed by the cereals led by finger millet, sorghum and maize. Roots and tubers (cassava) fetch the lowest price. The price received by farmers for the various staple crops were compared to wholesale prices in the respective regional markets. In western, the price spread is lowest for maize followed by ground nuts and bananas. It is highest for sorghum followed by sweet potatoes, cassava and then beans. In Nyanza, the price spread is lowest for sorghum followed by cassava and then maize. It is highest for beans, millet and sweet potatoes. In central, the price spread is lowest for cassava, followed by cowpeas, bananas and then maize. It is highest for millet, followed by dolichos, irish potatoes and sweet potatoes.

Market information services are provided by the Ministry of Agriculture and KACE. The volume of inquiries made at KACE was much higher than the inquiries made at the MoA market information service points. The internet is the most frequently used to access information from MoA while short text messages is the most frequently used mode of acquisition information from KACE. Others used are the internet, email and visits to the respective offices.

On storage, there is currently one privately owned facility operating the Warehouse Receipt System which is located in Nakuru. The NCPB proposes to initiate a Warehouse Receipting

System using. It has over 110 warehouses with a storage capacity of over 1.8 million metric tonnes spread out throughout the country in the major staple food producing regions. The NAAIAP programme has initiated cereal banks in 23 districts across Kenya.

In commodity trading, KACE has franchised MIPs and MICs to four pilot market resource centres (MRCs) which are located in Western Province of Kenya. The MRCs are owned by local entrepreneurs. In addition, KACE is also piloting a virtual trading floor through the use of a local FM radio station (West FM Radio Station) which integrates the MIS components of MRCs, SMS, and radio to concurrently provide timely market information and facilitate trade.

Products made from processing of staples are mainly flour and animal feeds. Maize is the main staple that is being processed followed by other staples like sorghum and millets. Maize milling is carried out in posho mills located in residential areas and villages and by medium and large-scale millers who are located in major towns. Grain flour millers source maize grain mainly from farmers, traders and the NCPB.

The level of agro-processing of other staples (other than maize and rice) is minimal or non-existent in many areas. Processing of roots and tubers is mainly carried out by informal small and micro-enterprises owned by individuals or small groups of between 7 – 24 members. The product range includes: cassava chips used in making flour for porridge and Ugali and composite flours. A similarly picture is observed in Nyanza, where groups are processing cassava, rice, maize, groundnuts, soya bean, amaranth, bananas, sweet potatoes sorghum, millets. In the central region: cereals are milled and combined to make composite flours comprising millets, sorghum and grain amaranth.

Among the respondents, animal feed processors had an installed capacity ranging from 1,200 MT to 52,560 MT per annum while the utilized capacity ranged from 1% to 60%. Grain flour millers had an installed capacity ranging from 394 MT to 39,420 MT per annum and its utilization ranged between 5 to 72%. The most commonly processed staple by the grain flour millers is maize grain followed by sorghum whilst maize germ and wheat bran were the most commonly used amongst animal feed processors. In terms of volume, maize grain and maize by products were found to be the most processed staples.

Among the staples that are used as raw materials, millet is the most highly priced staple at US$ 0.8 followed by sorghum, soya bean and cassava. Maize grain was the cheapest amongst staples at US$ 0.33 to US$ 0.34 per kg. The margin or price spread for maize is small (US$ 0.01) while that for cassava and millet is large (US$0.35 & 0.3 respectively). The price spread for sorghum by a grain miller is US$ 0.43 and US$ 0.25 if purchased by an animal feeds processor.

Agro-processors mainly purchase their raw materials from traders who in turn rely on the spot market sales from farmers and small traders in local and regional wholesale markets. Traders and agro-processors normally have elaborate systems (assemblers) and spend lengthy periods in aggregating the small volumes of staples purchased from individual farmers and small traders into to large volumes for processing. Farmers also supply staples to the millers. Most processors provide their suppliers with credit to purchase raw materials and/or transport to ferry the raw materials from source to factory gate. They also have similar marketing arrangements with buyers of products i.e. credit for products purchased and distribute products to wholesale or retail outlet. These were all informal arrangements. Most of the processors have limited storage capacity for raw materials and hence process the raw materials as they are purchased. This means that most staples are available only during specific time periods with negative implications on utilized capacity.

The value-added (as indicated by price spread) processing of staples is: US$ 0.71 to 0.78 for sorghum, US$ 0.54 to 0.61 for millet, US$ 0.34 to 0.48 for maize, and US$ 0.41 to 0.61 for cassava.

Most processors (61%) interviewed sought for credit mainly from the bank and all of them received it. The amounts received ranged from US$ 1,940 to 51,720 for the animal feed processors and US$ 3,879 to 10,991 for grain flour millers. The term of the credit was for two to three years at an interest rate ranging between 13 to 24%. Most of the agro-processors had a positive perception about accessibility to credit, the terms of credit and its effect on their agro-processing business.

The initial start-up capital for agro-processors was US$ 1,293 to US$ 387,900 for animal feed processors and US$ 453 to US$ 15,516 for grain flour millers. The source of start-up capital was savings from the owners. All interviewed had invested further in their agro-processing businesses within the last one year. The source of such funds was retained earnings and loan/credit and the investments made were worth between US$ 582 to US$ 122,835. Most of them invested in new equipment and vehicles for the business while others invested in land and furniture. All agro-processors had an insurance cover with majority of them have a general cover as opposed to more specific insurance like fire, employee and burglary.

Agro-processors source technical information on type of staples to process and quality control of products from technical experts and the regulatory bodies. Market information on supply, demand and pricing was obtained from other players in the market place.

On the operating environment for agro-processing constraints on the supply side are: lack of a government policy on agro-business and agro-processing to guide the development of this sub-sector; the highly dispersed and small agricultural production units which increase the costs of acquiring raw materials; seasonality and reliance on rain-fed agriculture such that most firms operate at low capacity; poor rural road network and poor communication which constraints the search and collection of raw materials for processing, marketing and distribution of products; unreliable supply of water, energy and other inputs which constraints the manufacturing operations and increases costs; high and rising costs of repair and maintenance, energy, skilled labour, transportation and raw materials. On the demand side, agro-processing was constrained by low sales price due to the limited purchasing power; lack of legislation to enforce standards in the food industry (Food Sanitation Act); and lack of standards for use in manufacturing products from the relatively newer staples in agro-processing (cassava, sorghum, millets, pulses etc).

6.0 Monitorable Indicators

Household Level Indicators

	Baseline (2008/9)			
	Western	**Nyanza**	**Central**	**Overall**
Household annual income (US $)				
Total income	1,912	1,880	1,879	1,892
Crops income	909	902	610	803
Livestock income	272	260	331	290
Income from business	319	356	292	319
Income from informal labour	50	20	107	62
Income from formal labour	306	285	443	348
Remittance	56	58	95	70
Household annual production of staple crops				
Area under staple crops (acre)				
Maize	0.8	0.8	0.9	0.9
Sorghum	0.4	0.5	1.0	0.5
Millet	0.4	0.5	1.0	0.5
Beans	0.8	0.8	0.9	0.9
Pigeon peas	0.5	0.1	1.0	1.0
Soya bean	0.4	0.4	1.1	0.5
Dolichos (Njahi)	0.0	0.0	0.9	0.9
Cowpeas	0.3	0.5	1.0	0.5
Groundnuts	0.5	0.7	0.6	0.6
Sweet potatoes	0.3	0.2	0.9	0.4
Irish potatoes	0.3	0.5	0.6	0.6
Cassava	0.5	0.4	0.8	0.5
Bananas	0.6	0.6	0.8	0.7
Rice	0.2	1.1	1.1	1.1
Yield for staple crops (kg/acre)				
Maize	946	1,053	786	923
Sorghum	312	406	53	346
Millet	327	1,144	52	422
Beans	205	132	172	175
Pigeon peas	20	900	91	107
Soya bean	173	81	285	154
Dolichos (Njahi)			52	52
Cowpeas	98	63	55	74

	Baseline (2008/9)			
	Western	**Nyanza**	**Central**	**Overall**
Groundnuts	368	249	8	311
Sweet potatoes	1,849	2,177	568	1,744
Irish potatoes	624	2,123	1,816	1,777
Cassava	872	952	315	794
Bananas	1,327	1,310	1,033	1,194
Rice	263	1,409	885	1,308
Production volume for staple crops (kg)				
Maize	1,021	1,242	773	990
Sorghum	103	164	42	130
Millet	114	726	14	190
Beans	217	125	170	177
Pigeon peas	10	90	110	107
Soya bean	43	23	57	39
Dolichos (Njahi)	0	0	31	31
Cowpeas	16	20	27	20
Groundnuts	113	138	5	123
Sweet potatoes	440	413	214	400
Irish potatoes	182	412	211	215
Cassava	323	178	218	269
Bananas	403	339	513	438
Rice	75	1,588	898	1,461
Household annual marketing of staple crops				
Marketed volume for staple crops (kg)				
Maize	212	159	148	176
Sorghum	10	14	18	12
Millet	10	40	2	14
Beans	44	23	28	33
Soya bean	6	3	18	6
Dolichos (*njahi*)			8	8
Cowpeas	2	3	3	2
Groundnuts	7	41	0	22
Sweet potatoes	104	89	41	91
Irish potatoes	33	108	19	21
Cassava	20	23	7	18
Bananas	157	108	180	157

	Baseline (2008/9)			
	Western	**Nyanza**	**Central**	**Overall**
% of hh production marketed for staple crops				
Maize	11.4	8.6	7.9	9.5
Sorghum	4.6	5.7	5.0	5.2
Millet	9.4	15.9	4.6	10.2
Beans	10.9	11.5	6.2	9.3
Soya bean	9.9	10.4	29.6	10.8
Dolichos (*njahi*)	0.0	0.0	8.4	8.4
Cowpeas	2.2	2.5	2.5	2.4
Groundnuts	7.5	26.6	0.0	15.7
Sweet potatoes	10.0	13.2	8.6	10.6
Irish potatoes	12.5	27.8	2.3	3.3
Cassava	4.7	9.7	2.8	5.3
Bananas	10.3	9.5	12.6	11.1
Household storage of staples				
% of hh using improved on-farm storage technologies	2.2	2.8	9	4.7
Capacity of improved stores (tonnes)	2.7	3.7	3.4	3.4
Household use of fertilizer				
Use of Inorganic fertiliser				
% of hh using inorganic fertiliser	70.9	46.8	83.2	69.1
% of cultivated area under inorganic fertilizer	52.6	47.3	74.6	60.9
Application rate (kg/acre)	31	26	48	37
Dose rate (kg/acre)	61	56	112	81
Use of organic fertiliser				
% of hh using organic fertiliser	75.1	58.3	92.2	76.8
% of cultivated area under organic fertilizer	37.3	38.4	72.8	52.3
Use of both organic & inorganic				
% of hh using both types of fertilisers	35.1	18.3	71.1	43.3
% of cultivated area under both types of fertilizers	31	30.7	60.1	47.5
Household use of improved crop varieties				
% of hh using improved staple crop varieties				
Maize	77.0	29.6	77.2	65.1
Beans	1.7	1.3	2.9	2.0
Sorghum	2.7	4.2	14.3	4.4
Millet	1.8	0.0	0.0	1.4
Bananas	1.8	0.8	10.4	5.5

	Baseline (2008/9)			
	Western	**Nyanza**	**Central**	**Overall**
Cowpeas	1.0	0.0	2.5	1.1
Irish potatoes	0.0	0.0	1.9	1.8
Cassava	1.3	3.1	0.0	1.5
Groundnuts	0.0	1.0	0.0	0.4
Sweet potatoes	1.2	1.9	3.3	1.7
Pigeon peas	0.0	0.0	0.0	0.0
Dolichos (njahi)	0.0	0.0	4.2	4.2
Soya beans	5.7	0.0	0.0	4.1
Household awareness of technologies				
% of hh aware of at least one type of fertilizer	99.00	97.20	99.70	98.90
% of hh aware of improved variety of staples				
Maize	91.5	67.9	99.4	88.3
Sorghum	1.2	8.7	2.3	3.5
Millet	0.5	0.0	0.0	0.2
Rice	1.0	19.4	5.7	7.3
Beans	20.2	19.8	40.2	27.1
Cowpeas	0.2	0.0	0.6	0.3
Soya bean	0.5	0.0	0.0	0.2
Cassava	6.2	1.2	0.9	3.1
Sweet potato	1.2	2.0	4.3	2.5
Irish potato	0.0	0.0	5.2	1.8
Banana	3.2	1.2	30.5	12.2
Household use of MIS				
% of hh using MIS to acquire agricultural information				
Market information	0.4	0.1	0.2	0.3
Seed information	0.5	0.4	0.3	0.4
fertilizer information	0.2	0.0	1.2	0.5
Household membership in farmer groups				
% of hh with membership in groups	16.0	15.5	48.3	27.1
% of female members in groups	19.3	50.0	46.2	46.0
% of female members in management committees	48.8	57.9	16.5	25.0
Household access to financial services				

	Baseline (2008/9)			
	Western	**Nyanza**	**Central**	**Overall**
% of hh seeking agricultural credit	10.2	11.5	11.8	11.1
% of seekers receiving agricultural credit	80.5	86.2	90.2	85.6
Mean amount of credit sought (US $)	264	260	153	222
Mean amount of credit received (US $)	220	118	126	157
Formal sources of credit of credit (%)				
NGO/MFI	33.3	10.3	7.0	17.5
Commercial bank	14.3	6.9	16.3	13.2
SACCO	0.0	3.4	18.6	7.9

Program Level Indicators

Market Access program

	Baseline 2009			
	Western	**Nyanza**	**Central**	**Overall**
Spread between producer price and market price (MoA - 2009) in US$ per Kg				
Maize	0.04	0.06	0.07	0.05
Sorghum	0.22	0.01	0.09	0.12
Millet	0.15	0.18	0.23	0.16
Beans	0.17	0.2	0.15	0.15
Soyabeans				
Dolichos (Njahi)			0.22	0.17
Cowpeas	-0.1	-0.07	0.03	0.02
Groundnuts	0.06	-0.04	0.16	0.16
Sweet potatoes	0.22	0.15	0.17	0.19
Irish potatoes	0.09	0.14	0.22	0.17
Cassava	0.18	0.04	0.01	0.03
Bananas	0.07	0.11	0.05	0.12

Soil Health Program

	Baseline 2008			
	Nyanza	**Western**	**Central**	**National**
Value of sales of fertiliser by Agro-dealers at location level & below (US $)	9,632	2,336	13,476	9,040
Value of sales of fertiliser by Agro-dealers at division level (US $)	28,693	19,941	78,983	44,070
Number of functional soil science laboratories				21
Number of soil laboratories commercially producing rhizobium inoculum for smallholder farmers				2
Volume of rhizobium inoculums produced commercial purposes (100gm packs)				11,200
Level of subsidy in fertilizer price				
NAAIP				100%
Other				
DAP				34%
CAN				42%
Inorganic fertilizer off take (MT) 2008/2009				
Planting				
DAP				158,973
MAP				5,013
TSP				9,299
SSP				18,307
NPK20:20:0				14,283
NPK23:23:0				20,118
Sub Total				**225,993**
Top-dressing				
CAN				84,939
ASN				2,100
UREA				30,128
SA				2,943

	Baseline 2008			
	Nyanza	Western	Central	National
Sub Total				**120,110**
TEA				
NPK25:5:5:5s				58,948
NPK25:5:5:3.95s+2.6MgO				-
NPK22:21:17				-
NPK22:6:12+5S				-
Sub Total				**73,948**
COFFEE				
NPK18:4:12				1,685
NPK20:10:10				3,827
NPK17:17:17:				18,769
NPK16:16:16				-
Sub Total				**24,281**
Specialised				
MgNo3				1,012
MgSo4				3,715
CN				744
MOP/SOP				8,609
AN				1,460
Iron chelate				2,937
Potassium Nitrate				2,646
NPK28:28:0				605
NPK19:19:19				666
NPK19:19:19+M.E+1%MgO				30
Ferrous sulphate				2,541
Organic fertilizer				1,513
Others				1,816
Sub Total				**26,176**
Total fertilizer Off take				**470,508**

Fertilizer prices	**CIF, Mombasa (US$/MT)**		**National average retail price (US$/MT)**	
	2008	**2009**	**2007/2008**	**2008/2009**
DAP	1,280	403	1,013	599
MAP	1,300	430	1,013	980
UREA	680	295	827	680
CAN	640	280	533	967
NPK20:20:0	850	390	800	1,200
NPK23:23:0	850	390	813	967
NPK17:17:17	850	390	840	980
MOP	560	300		
AS	480	285		
TSP	1,150	385	907	1195

Seed program

	Baseline 2008/9			
	Western	**Nyanza**	**Central**	**National**
Number of new crop varieties adapted to local farmer conditions (2005 - 2009)				
maize				66
Bean				14
Cassava				6
sorghum				5
wheat				4
Rice				5
Pigeonpeas				2
Cowpeas				1
Soybeans				5
Average time (yrs) from entry in national performance trials (NPT) to variety release (by crop)				3 or more
Time (yrs) from NPT release to commercial availability of improved seeds.				1 upto 3
Number of private seed companies producing seed of staple crops				25
Number of certified agro-dealers (licenses issued to stockists, agents and sub-agents)	559	136	643	3,896
Number of certified agro-dealers per 1000 farms	1.33	0.54	1.32	0.61
Average value of sales of improved seed by Agro-dealers - location level & below (KES)	48.2	27.7	89.6	57.4
Average value of sales of improved seed by Agro-dealers - division level (KES)	367.6	226.2	187.8	413.7
Volume (kg) of improved seed offered for sale				
Maize				27,078,262
Beans				319,904
Cow pea				203,578
Ground Nuts				3,678
Green grams				47,249
Millets				80,180
Sorghum				1,649,207

Country Level Indicators

	Baseline 2008/9	
	Expenditure in Billion US$	Proportion of Public Expenditure (%)
Gross Value of Agricultural Output - GDP	6.36	24
Share of public expenditure on agricultural sector	25.8	5
Share of public expenditure on agriculture ministry	15.4	3
Share of R & D in public expenditure on agriculture	0.74	0.15

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Annexes

Annex 1: Conversion Factors for Adult Equivalents

Age	Males	Females
Under 1 year	0.33	0.33
1 - 1.99	0.46	0.46
2 - 2.99	0.54	0.54
3 - 4.99	0.62	0.62
5 - 6.99	0.74	0.70
7 - 9.99	0.84	0.72
10 - 11.99	0.88	0.78
12 - 13.99	0.96	0.84
14 - 15.99	1.06	0.86
16 - 17.99	1.14	0.86
18 - 29.99	1.04	0.80
30 - 59.99	1.00	0.82
60 and over	0.84	0.74

As per the World Health organisation (Jayne and Argwings-Kodhek 1997)

Annex 2: Frequency Distribution of Specific Improved Varieties for Staples Planted by Household

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Maize								
KS 513	65	12.7	34	27.9	254	41.0	353	28.2
WS 505	159	31.2	15	12.3	1	0.2	175	14.0
KS 614	106	20.8	0	0.0	52	8.4	158	12.6
Pioneer	1	0.2	10	8.2	66	10.6	77	6.2
DH4	15	2.9	9	7.4	31	5.0	55	4.4
DK 8031	12	2.4	5	4.1	30	4.8	47	3.8
Duma 41	3	0.6	7	5.7	33	5.3	43	3.4
SCDUMA43	0	0.0	6	4.9	33	5.3	39	3.1
KS 613	14	2.7	1	0.8	10	1.6	25	2.0
DAKARB	0	0.0	0	0.0	22	3.5	22	1.8
KS 511	8	1.6	1	0.8	9	1.5	18	1.4
KS 515	10	2.0	1	0.8	6	1.0	17	1.4
KS 625	16	3.1	0	0.0	1	0.2	17	1.4
PANNAR	0	0.0	5	4.1	11	1.8	16	1.3
KS 514	12	2.4	0	0.0	3	0.5	15	1.2
WS 502	10	2.0	3	2.5	0	0.0	13	1.0
WS 504	12	2.4	1	0.8	0	0.0	13	1.0
H516	3	0.6	1	0.8	8	1.3	12	1.0
Katumani	3	0.6	4	3.3	4	0.6	11	0.9
KS 512	2	0.4	2	1.6	5	0.8	9	0.7
KS 616	1	0.2	0	0.0	8	1.3	9	0.7
DK 3081	3	0.6	2	1.6	2	0.3	7	0.6
WS 309	3	0.6	2	1.6	2	0.3	7	0.6
DH2	2	0.4	0	0.0	4	0.6	6	0.5
PAN 4M-19	0	0.0	0	0.0	6	1.0	6	0.5
WS 205	4	0.8	0	0.0	1	0.2	5	0.4
ZM 523	4	0.8	0	0.0	1	0.2	5	0.4
WS 403	4	0.8	0	0.0	1	0.2	5	0.4
KS6 210	4	0.8	0	0.0	0	0.0	4	0.3
PH1	0	0.0	4	3.3	0	0.0	4	0.3
PH2	0	0.0	4	3.3	0	0.0	4	0.3
KS 6213	3	0.6	0	0.0	0	0.0	3	0.2
H515	0	0.0	2	1.6	0	0.0	2	0.2
Kinyanya	0	0.0	0	0.0	2	0.3	2	0.2
KS 612	2	0.4	0	0.0	0	0.0	2	0.2
KS 621	2	0.4	0	0.0	0	0.0	2	0.2
KS 629	2	0.4	0	0.0	0	0.0	2	0.2
MRI 624	2	0.4	0	0.0	0	0.0	2	0.2
PAN 33	2	0.4	0	0.0	0	0.0	2	0.2

Annex 2: Frequency Distribution of Specific Improved Varieties for Staples Planted by Household

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
PAN 4M-19	0	0.0	0	0.0	2	0.3	2	0.2
Pan 5243	0	0.0	1	0.8	1	0.2	2	0.2
PHB 3253	0	0.0	0	0.0	2	0.3	2	0.2
Simba	0	0.0	0	0.0	2	0.3	2	0.2
WS 501	2	0.4	0	0.0	0	0.0	2	0.2
KS 635	2	0.4	0	0.0	0	0.0	2	0.2
KS 520	2	0.4	0	0.0	0	0.0	2	0.2
KS 624	0	0.0	0	0.0	2	0.3	2	0.2
DUMA	0	0.0	0	0.0	2	0.3	2	0.2
WS 905	1	0.2	0	0.0	0	0.0	1	0.1
DH3	1	0.2	0	0.0	0	0.0	1	0.1
DK 8051	1	0.2	0	0.0	0	0.0	1	0.1
GV 704	1	0.2	0	0.0	0	0.0	1	0.1
KS 615	1	0.2	0	0.0	0	0.0	1	0.1
KS 622	1	0.2	0	0.0	0	0.0	1	0.1
KS 9401	0	0.0	1	0.8	0	0.0	1	0.1
Makueni	1	0.2	0	0.0	0	0.0	1	0.1
Monsanto	0	0.0	0	0.0	1	0.2	1	0.1
PAN 52	0	0.0	0	0.0	1	0.2	1	0.1
PAN 67	1	0.2	0	0.0	0	0.0	1	0.1
SC 506	1	0.2	0	0.0	0	0.0	1	0.1
SC 513	1	0.2	0	0.0	0	0.0	1	0.1
WS 105	1	0.2	0	0.0	0	0.0	1	0.1
WS 404	1	0.2	0	0.0	0	0.0	1	0.1
WS 503	1	0.2	0	0.0	0	0.0	1	0.1
WS 904	1	0.2	0	0.0	0	0.0	1	0.1
WS 202	0	0.0	1	0.8	0	0.0	1	0.1
LILONGWE	1	0.2	0	0.0	0	0.0	1	0.1
KAMANA	0	0.0	0	0.0	1	0.2	1	0.1
Total	510	100.0	122	100.0	620	100.0	1252	100.0
Sorghum								
Sekedo	0	0.0	2	40.0	1	33.3	3	27.3
Serena	1	33.3	1	20.0	1	33.3	3	27.3
Seredo	2	66.7	2	40.0	1	33.3	5	45.5
Total	3	100.0	5	100.0	3	100.0	11	100.0
Millet								
Serere 22	1.0	100.0	0	0.0	0	0.0	1.0	100.0
Total	1.0	100.0	0	0.0	0	0.0	1.0	100.0
Rice								

Annex 2: Frequency Distribution of Specific Improved Varieties for Staples Planted by Household

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
IR 36	0	0.0	9	52.9	0	0.0	9	45.0
Pishori	0	0.0	0	0.0	1	33.3	1	5.0
Nerica	0	0.0	0	0.0	1	33.3	1	5.0
BWO	0	0.0	4	23.5	0	0.0	4	20.0
Basmati	0	0.0	4	23.5	0	0.0	4	20.0
B 816	0	0.0	0	0.0	1	33.3	1	5.0
Total	0	0.0	17	100.0	3	100.0	20	100.0
Beans								
Mwitemania GLP 92	2.0	40.0	0	0.0	4	26.7	6	27.3
Nyayo	0.0	0.0	0	0.0	1	6.7	1	4.5
PAN 128	0	0.0	0	0.0	4	26.7	4	18.2
Red haricot (wairimu)	2	40.0	0	0.0	5	33.3	7	31.8
Rosecoco	1	20.0	2	100.0	1	6.7	4	18.2
Total	5	100.0	2	100.0	15	100.0	22	100.0
Soya bean								
Maksoy	2	40.0	0	0.0	0	0.0	2	40.0
SB72	1	20.0	0	0.0	0	0.0	1	20.0
SB3	2	40.0	0	0.0	0	0.0	2	40.0
Total	5	100.0	0	0.0	0	0.0	5	100.0
Cassava								
SS4	1	33.3	2	100.0	0	0.0	3	60.0
MM	1	33.3	0	0.0	0	0.0	1	20.0
Migyera	1	33.3	0	0.0	0	0.0	1	20.0
Total	3	100.0	2	100.0	0	0.0	5	100.0
Sweet potato								
SPK 004	1	100.0	1	100.0	0	0.0	2	50.0
Kalulu	0	0.0	0	0.0	2	100.0	2	50.0
Total	1	100.0	1	100.0	2	100.0	4	100.0
Sweet potato								
Tissue culture	1	100.0	1	100.0	4	13.8	6	19.4
Israel	0	0.0	0	0.0	11	37.9	11	35.5
Mkia wa chui	0	0.0	0	0.0	1	3.4	1	3.2
Kampala	0	0.0	0	0.0	11	37.9	11	35.5
William hybrid	0	0.0	0	0.0	1	3.4	1	3.2
Golden Cavendish	0	0.0	0	0.0	1	3.4	1	3.2
Total	1	100.0	1	100.0	29	100.0	31	100.0

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Maize								
KS 513	156	10.2	46	10.1	233	13.7	435	11.8
Pioneer	46	3.0	42	9.2	241	14.1	329	8.9
KS 614	203	13.3	7	1.5	108	6.3	318	8.6
WS 505	205	13.4	34	7.5	5	0.3	244	6.6
SCDuma 41	13	0.8	16	3.5	184	10.8	213	5.8
Katumani	31	2.0	58	12.7	88	5.2	177	4.8
KS 625	116	7.6	5	1.1	47	2.8	168	4.5
KS 511	45	2.9	23	5.1	75	4.4	143	3.9
DK 8031	20	1.3	6	1.3	87	5.1	113	3.1
KS 512	32	2.1	18	4.0	49	2.9	99	2.7
KS 613	48	3.1	4	0.9	32	1.9	84	2.3
DH4	30	2.0	15	3.3	37	2.2	82	2.2
KS 515	28	1.8	10	2.2	33	1.9	71	1.9
KS 514	27	1.8	7	1.5	33	1.9	67	1.8
WS 502	51	3.3	14	3.1	2	0.1	67	1.8
PANNAR	0	0.0	10	2.2	52	3.0	62	1.7
SCDUMA43	0	0.0	5	1.1	51	3.0	56	1.5
WS 504	49	3.2	6	1.3	1	0.1	56	1.5
H516	19	1.2	3	0.7	21	1.2	43	1.2
KS 616	23	1.5	0	0.0	20	1.2	43	1.2
KS 622	33	2.2	4	0.9	0	0.0	37	1.0
DAKARB	1	0.1	1	0.2	34	2.0	36	1.0
KS 626	14	0.9	3	0.7	16	0.9	33	0.9
WS 403	22	1.4	3	0.7	8	0.5	33	0.9
KS 627	26	1.7	0	0.0	4	0.2	30	0.8
PH1	0	0.0	28	6.2	2	0.1	30	0.8
KS 628	20	1.3	0	0.0	8	0.5	28	0.8
WS 503	26	1.7	0	0.0	2	0.1	28	0.8
DK 3081	13	0.8	5	1.1	9	0.5	27	0.7
DH2	4	0.3	2	0.4	19	1.1	25	0.7
KS 621	21	1.4	2	0.4	2	0.1	25	0.7
WS 205	12	0.8	8	1.8	3	0.2	23	0.6
DUMA	0	0.0	2	0.4	18	1.1	20	0.5
KS 629	16	1.0	0	0.0	2	0.1	18	0.5
KS 615	10	0.7	3	0.7	3	0.2	16	0.4
Simba	1	0.1	1	0.2	14	0.8	16	0.4
DH 02	3	0.2	0	0.0	12	0.7	15	0.4
DH1	0	0.0	4	0.9	11	0.6	15	0.4

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Makueni	0	0.0	0	0.0	15	0.9	15	0.4
WS 402	9	0.6	1	0.2	3	0.2	13	0.4
KS 612	6	0.4	2	0.4	5	0.3	13	0.4
KS6 210	12	0.8	0	0.0	1	0.1	13	0.4
WS 905	10	0.7	2	0.4	0	0.0	12	0.3
DLC	4	0.3	2	0.4	6	0.4	12	0.3
Maseno DC	0	0.0	12	2.6	0	0.0	12	0.3
DK 8071	1	0.1	3	0.7	7	0.4	11	0.3
CG 5252,	0	0.0	0	0.0	9	0.5	9	0.2
DKC8073	4	0.3	0	0.0	5	0.3	9	0.2
KS 611	5	0.3	1	0.2	3	0.2	9	0.2
KS 6213	8	0.5	0	0.0	1	0.1	9	0.2
PH4	0	0.0	8	1.8	1	0.1	9	0.2
WS 904	9	0.6	0	0.0	0	0.0	9	0.2
KS 520	5	0.3	0	0.0	3	0.2	8	0.2
H515	1	0.1	3	0.7	3	0.2	7	0.2
KS 623	6	0.4	0	0.0	1	0.1	7	0.2
PAN 14	4	0.3	2	0.4	1	0.1	7	0.2
DH3	1	0.1	1	0.2	4	0.2	6	0.2
DK 8051	3	0.2	0	0.0	3	0.2	6	0.2
PAN 4M-19	0	0.0	0	0.0	6	0.4	6	0.2
Pan 5243	4	0.3	1	0.2	1	0.1	6	0.2
Striga Resistant Maize (IR)	5	0.3	1	0.2	0	0.0	6	0.2
WS 404	6	0.4	0	0.0	0	0.0	6	0.2
WS 501	5	0.3	1	0.2	0	0.0	6	0.2
KS 624	4	0.3	0	0.0	1	0.1	5	0.1
KH500-33A	0	0.0	0	0.0	5	0.3	5	0.1
DKC 8033	1	0.1	1	0.2	2	0.1	4	0.1
DKC 8053	0	0.0	0	0.0	4	0.2	4	0.1
PAN 4M-19	0	0.0	0	0.0	4	0.2	4	0.1
PAN 52	1	0.1	0	0.0	3	0.2	4	0.1
PH2	0	0.0	4	0.9	0	0.0	4	0.1
WS 105	4	0.3	0	0.0	0	0.0	4	0.1
DH	0	0.0	1	0.2	3	0.2	4	0.1
CG 5051	1	0.1	0	0.0	2	0.1	3	0.1
KS 9401	1	0.1	1	0.2	1	0.1	3	0.1
MM 504	2	0.1	0	0.0	1	0.1	3	0.1
MRI 624	2	0.1	1	0.2	0	0.0	3	0.1
PAN 15	1	0.1	0	0.0	2	0.1	3	0.1
PAN 33	2	0.1	0	0.0	1	0.1	3	0.1

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
PAN 67	1	0.1	2	0.4	0	0.0	3	0.1
SC 513	3	0.2	0	0.0	0	0.0	3	0.1
SC 515	3	0.2	0	0.0	0	0.0	3	0.1
WS 500	1	0.1	1	0.2	0	0.0	2	0.1
AFG 4611	0	0.0	0	0.0	2	0.1	2	0.1
CG 4141	0	0.0	0	0.0	2	0.1	2	0.1
DKC8053	1	0.1	0	0.0	1	0.1	2	0.1
MM 502	2	0.1	0	0.0	0	0.0	2	0.1
PAN 4M-17	0	0.0	0	0.0	2	0.1	2	0.1
PAN 6227	1	0.1	0	0.0	1	0.1	2	0.1
PAN 6243	2	0.1	0	0.0	0	0.0	2	0.1
PAN 6549	0	0.0	1	0.2	1	0.1	2	0.1
PAN 67	0	0.0	2	0.4	0	0.0	2	0.1
PAN 69	0	0.0	0	0.0	2	0.1	2	0.1
PAN 77	0	0.0	1	0.2	1	0.1	2	0.1
PAN 7M-97	1	0.1	0	0.0	1	0.1	2	0.1
SC 525	2	0.1	0	0.0	0	0.0	2	0.1
WS 909	2	0.1	0	0.0	0	0.0	2	0.1
Punda milia	0	0.0	0	0.0	2	0.1	2	0.1
C 5121	0	0.0	0	0.0	1	0.1	1	0.0
C 6222	1	0.1	0	0.0	0	0.0	1	0.0
Chitedze 5	0	0.0	1	0.2	0	0.0	1	0.0
Coast Composite	0	0.0	0	0.0	1	0.1	1	0.0
CRN 3501	0	0.0	0	0.0	1	0.1	1	0.0
CRN 3631	0	0.0	0	0.0	1	0.1	1	0.0
DKC 8073	0	0.0	0	0.0	1	0.1	1	0.0
GV 67	0	0.0	0	0.0	1	0.1	1	0.0
KH500-21A	0	0.0	0	0.0	1	0.1	1	0.0
Kinyanya	1	0.1	0	0.0	0	0.0	1	0.0
KS 636	1	0.1	0	0.0	0	0.0	1	0.0
Monsanto	0	0.0	0	0.0	1	0.1	1	0.0
MRI 404	0	0.0	0	0.0	1	0.1	1	0.0
MRI 634	1	0.1	0	0.0	0	0.0	1	0.0
PAN 37	1	0.1	0	0.0	0	0.0	1	0.0
Pan 5195	1	0.1	0	0.0	0	0.0	1	0.0
Pan 5355	0	0.0	1	0.2	0	0.0	1	0.0
PAN 61	1	0.1	0	0.0	0	0.0	1	0.0
PAN 6363	0	0.0	0	0.0	1	0.1	1	0.0
PAN 6804	0	0.0	0	0.0	1	0.1	1	0.0
PAN 683	1	0.1	0	0.0	0	0.0	1	0.0

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
PAN 7M-81	0	0.0	0	0.0	1	0.1	1	0.0
PHB 30G19-6	0	0.0	0	0.0	1	0.1	1	0.0
PHB 30V53-7	0	0.0	0	0.0	1	0.1	1	0.0
PHB 3253	0	0.0	1	0.2	0	0.0	1	0.0
SC 401	1	0.1	0	0.0	0	0.0	1	0.0
SC 403	1	0.1	0	0.0	0	0.0	1	0.0
SC 405	0	0.0	1	0.2	0	0.0	1	0.0
SC 501	1	0.1	0	0.0	0	0.0	1	0.0
SC 506	1	0.1	0	0.0	0	0.0	1	0.0
SC 527	1	0.1	0	0.0	0	0.0	1	0.0
SC 633	1	0.1	0	0.0	0	0.0	1	0.0
SC 713	0	0.0	1	0.2	0	0.0	1	0.0
SC 717	0	0.0	0	0.0	1	0.1	1	0.0
SR 52	0	0.0	0	0.0	1	0.1	1	0.0
UH6303	1	0.1	0	0.0	0	0.0	1	0.0
ZM 421	1	0.1	0	0.0	0	0.0	1	0.0
ZMS 510	1	0.1	0	0.0	0	0.0	1	0.0
WS 202	1	0.1	0	0.0	0	0.0	1	0.0
LILONGWE	1	0.1	0	0.0	0	0.0	1	0.0
WS 309	1	0.1	0	0.0	0	0.0	1	0.0
DH 05	1	0.1	0	0.0	0	0.0	1	0.0
DH 5311	1	0.1	0	0.0	0	0.0	1	0.0
KQ 500H	0	0.0	0	0.0	1	0.1	1	0.0
KS 620	0	0.0	0	0.0	1	0.1	1	0.0
Total	1532	100.0	455	100.0	1706	100.0	3693	100.0
Sorghum								
Seredo	3.0	30.0	16.0	69.6	4	50.0	23	56.1
Sekedo	2.0	20.0	4.0	17.4	2	25.0	8	19.5
Serena	5.0	50.0	3.0	13.0	0	0.0	8	19.5
Red Swazi	0.0	0.0	0.0	0.0	1	12.5	1	2.4
GADAM	0.0	0.0	0.0	0.0	1	12.5	1	2.4
Total	10	100.0	23	100	8	100.0	41	100.0
Millet								
Nyankhombo	1	25.0					1	25.0
SaWAepo	1	25.0					1	25.0
Serere 22	1	25.0					1	25.0
GULU - E	1	25.0					1	25.0

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Total	4	100.0					4	100.0
Rice								
Basmati	0	0.0	31	24.8	6	13.0	37	20.9
Pishori	3	50.0	10	8.0	17	37.0	30	16.9
IR 36	0	0.0	23	18.4	0	0.0	23	13.0
ITA 230	0	0.0	21	16.8	0	0.0	21	11.9
Sindano	3	50.0	6	4.8	8	17.4	17	9.6
IR 27	0	0.0	17	13.6	0	0.0	17	9.6
B11	0	0.0	0	0.0	9	19.6	9	5.1
BR	0	0.0	7	5.6	0	0.0	7	4.0
BWO	0	0.0	5	4.0	0	0.0	5	2.8
Kilombero	0	0.0	0	0.0	2	4.3	2	1.1
NERICA1	0	0.0	0	0.0	2	4.3	2	1.1
Burma	0	0.0	1	0.8	0	0.0	1	0.6
IR 56	0	0.0	1	0.8	0	0.0	1	0.6
IR 54	0	0.0	1	0.8	0	0.0	1	0.6
IR 24	0	0.0	1	0.8	0	0.0	1	0.6
TOPRADO	0	0.0	1	0.8	0	0.0	1	0.6
PAKISTAN	0	0.0	0	0.0	1	2.2	1	0.6
JAPAN	0	0.0	0	0.0	1	2.2	1	0.6
Total	6	100.0	125	100.0	46	100.0	177	100.0
Beans								
Rosecoco	62	38.8	43	47.3	86	25.6	191	32.5
Red haircot (wairimu)	52	32.5	29	31.9	67	19.9	148	25.2
Mwitemania GLP 92	4	2.5	0	0.0	102	30.4	106	18.1
Nyayo	21	13.1	16	17.6	33	9.8	70	11.9
Canadian wonder	6	3.8	0	0.0	2	0.6	8	1.4
Wanja	1	0.6	0	0.0	4	1.2	5	0.9
Miezi mbili	5	3.1	0	0.0	0	0.0	5	0.9
Selina 05	0	0.0	0	0.0	3	0.9	3	0.5
Mzuri	0	0.0	0	0.0	3	0.9	3	0.5
Mama safi	0	0.0	0	0.0	3	0.9	3	0.5
Njata	0	0.0	0	0.0	3	0.9	3	0.5
Bat 331	0	0.0	0	0.0	2	0.6	2	0.3
PAN 128	0	0.0	0	0.0	2	0.6	2	0.3
NYLON	2	1.3	0	0.0	0	0.0	2	0.3
Mwezi moja GLP 24	2	1.3	0	0.0	0	0.0	2	0.3
Gachumba	0	0.0	0	0.0	2	0.6	2	0.3
Michigan	0	0.0	0	0.0	2	0.6	2	0.3
Tanzania	2	1.3	0	0.0	0	0.0	2	0.3

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Saitoti	0	0.0	0	0.0	2	0.6	2	0.3
Nyakairo	0	0.0	0	0.0	2	0.6	2	0.3
Mshindi	0	0.0	1	1.1	0	0.0	1	0.2
NABE4	0	0.0	0	0.0	1	0.3	1	0.2
PAN 185	0	0.0	0	0.0	1	0.3	1	0.2
Pesa	0	0.0	0	0.0	1	0.3	1	0.2
Urafiki	0	0.0	0	0.0	1	0.3	1	0.2
KK 2	1	0.6	0	0.0	0	0.0	1	0.2
Msembe	1	0.6	0	0.0	0	0.0	1	0.2
D6	0	0.0	1	1.1	0	0.0	1	0.2
Miezi tatu	1	0.6	0	0.0	0	0.0	1	0.2
Ithuru	0	0.0	0	0.0	1	0.3	1	0.2
CAPI B9	0	0.0	0	0.0	1	0.3	1	0.2
Samantha	0	0.0	0	0.0	1	0.3	1	0.2
Panandon	0	0.0	0	0.0	1	0.3	1	0.2
Ogadi	0	0.0	0	0.0	1	0.3	1	0.2
Mihawa	0	0.0	0	0.0	1	0.3	1	0.2
Katumani 9	0	0.0	0	0.0	1	0.3	1	0.2
Katumani 1	0	0.0	0	0.0	1	0.3	1	0.2
Geturo	0	0.0	0	0.0	1	0.3	1	0.2
Loyal	0	0.0	1	1.1	0	0.0	1	0.2
Mutuku	0	0.0	0	0.0	1	0.3	1	0.2
Naomi	0	0.0	0	0.0	1	0.3	1	0.2
Monica	0	0.0	0	0.0	1	0.3	1	0.2
Kaiyaba	0	0.0	0	0.0	1	0.3	1	0.2
Kigen	0	0.0	0	0.0	1	0.3	1	0.2
Total	160	100.0	91	100.0	336	100.0	587	100.0
Cowpeas								
Kunde 1					1	100.0	1	100.0
Total					1	100.0	1	100.0
Soya bean								
Maksoy	1	100.0					1	100.0
Total	1.0	100					1.0	100.0
Cassava								
Migyera	17	53.1	1	25.0	0	0.0	18	46.2
SS4	4	12.5	3	75.0	0	0.0	7	17.9

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
MM	2	6.3	0	0.0	0	0.0	2	5.1
Mucericeri	0	0.0	0	0.0	2	66.7	2	5.1
MAP	1	3.1	0	0.0	0	0.0	1	2.6
MM99	1	3.1	0	0.0	0	0.0	1	2.6
Canada	1	3.1	0	0.0	0	0.0	1	2.6
MM87	1	3.1	0	0.0	0	0.0	1	2.6
Tigonia	1	3.1	0	0.0	0	0.0	1	2.6
Mkhasi mwimbi	1	3.1	0	0.0	0	0.0	1	2.6
Junior	1	3.1	0	0.0	0	0.0	1	2.6
Bumba	1	3.1	0	0.0	0	0.0	1	2.6
Magana	1	3.1	0	0.0	0	0.0	1	2.6
Pondo	0	0.0	0	0.0	1	33.3	1	2.6
Total	32	100.0	4	100.0	3	100.0	39	100.0
Sweet potatoes								
Bungoma	1	20.0	0	0.0	9	47	10	33.3
SPK 004	3	60.0	4	66.7	2	10.5	9	30.0
Kapoko	0	0.0	0	0.0	5	26.3	5	16.7
Kalulu	0	0.0	0	0.0	3	15.8	3	10.0
Simama	0	0.0	2	33.3	0	0.0	2	6.7
Juhudi	1	20.0	0	0.0	0	0.0	1	3.3
Total	5	100.0	6	100.0	19	100.0	30	100.0
Irish potato								
Tigoni					9	37.5	9	37.5
Nyayo					5	20.8	5	20.8
Omba suti					3	12.5	3	12.5
Asante					3	12.5	3	12.5
Meru					1	4.2	1	4.2
Roslin Tana					1	4.2	1	4.2
Magic					1	4.2	1	4.2
Liseata					1	4.2	1	4.2
Total					24	100.0	24	100
Bananas								
Israel	1	5.9	0	0.0	62	33.9	63	31.0
Kampala	0	0.0	0	0.0	56	30.6	56	27.6
Tissue culture	3	17.6	3	100.0	20	10.9	26	12.8
Giant cavendish	0	0.0	0	0.0	10	5.5	10	4.9

Annex 3: Frequency distribution of specific improved varieties for staples of which households are aware

Staple/Variety	Western		Nyanza		Central		Overall	
	Count	%	Count	%	Count	%	Count	%
Golden cavendish	0	0.0	0	0.0	7	3.8	7	3.4
Mbogoya	5	29.4	0	0.0	0	0.0	5	2.5
Chinese dwarf	1	5.9	0	0.0	4	2.2	5	2.5
William hybrid	0	0.0	0	0.0	5	2.7	5	2.5
Kasuku	3	17.6	0	0.0	0	0.0	3	1.5
Varlerie	1	5.9	0	0.0	2	1.1	3	1.5
Mkia wa chui	0	0.0	0	0.0	3	1.6	3	1.5
Grand 9	0	0.0	0	0.0	3	1.6	3	1.5
Uganda green	0	0.0	0	0.0	3	1.6	3	1.5
Grosse Michel	0	0.0	0	0.0	2	1.1	2	1.0
Estebe	1	5.9	0	0.0	0	0.0	1	0.5
Muruli	1	5.9	0	0.0	0	0.0	1	0.5
Dhasia	1	5.9	0	0.0	0	0.0	1	0.5
Lazatan	0	0.0	0	0.0	1	0.5	1	0.5
Red banana	0	0.0	0	0.0	1	0.5	1	0.5
Mugithi	0	0.0	0	0.0	1	0.5	1	0.5
Play star	0	0.0	0	0.0	1	0.5	1	0.5
Kisii Matoke	0	0.0	0	0.0	1	0.5	1	0.5
FHIA	0	0.0	0	0.0	1	0.5	1	0.5
Total	17	100.0	3	100.0	183	100.0	203	100.0

Annex 4: Soil Labouratories Functionality and Capacity							
Institution		**Number of months a laboratory was active in the different types soil analysis between December 2008 and November 2009**				**Samples analyzed**	**Comments**
	Contacts	**Soil Ph**	**Organic carbon**	**Nutrient analysis**	**Micro organisms analysis**		
1.KEFRI	P.O. Box 20412 - 00200 Nairobi Mobile: +254-0724-259781/2, +254-722-157414 director@kefri.org	12	12	12	O	566	Most of the samples analyzed in the laboratory are from the forests under the Kenya Forestry Services care. Researchers, government institutions, NGO's and individual farmers are the other major clients. The services offered in the laboratory are demand driven
2. University of Nairobi	P.O. Box 29053-00625	8	10	9	1	DN	The laboratory is mainly used for teaching purposes, as well as soil analysis for individual farmers and researchers.
3. KARI-Muguga South	PO Box 30148, Nairobi 32880/6/2 00220(Wireless) 066 karimug@kari.org	12	12	12	0	611	Microbial analysis was not performed due to lack of a specialist in the facility. The main clients to the laboratory are individual farmers, researchers, government institutes, NGO'S and CBO's. The major constraint to the laboratory is human resources.
4. KEPHIS (6 Regional laboratories in Nairobi, Kitale, Nakuru, Kisumu, Embu and Mombasa)	P.O. Box 49592-00100 Nairobi. Tel: 254-020-3597201/2/3 Email kephisinfo@kephis.org	12	12	12	12		Soil sample analysis in the laboratory is demand driven. Between July 2008 and June 2009, the laboratories analysed a total of 188 soil samples, with 125 of the samples analysed in Kitale laboratory. There was a 40% decline in the number of soil samples analysed when compared to July 2007 to June 2008 where a total of 310 soil samples were analysed.
5. JKUAT	P.O. Box 62,000 - 00200 NAIROBI Tel: +254-06752711 Email: pro@jkuat.ac.ke	12	12	12	0	10	The facility is mainly used for teaching purposes. The major limitation in the facility is the lack of a full time soil labouratory technician to analyses soil samples commercially.
6. MIAD		12	12	12	0	657	Most of the facilities' clients are the farmers with the NIB irrigation schemes. Farmers in the surrounding Mwea areas outside the irrigation scheme also use the facility. Farmers within the NIB irrigation schemes are not charged to analyze their soil samples. The cost of this analysis is covered by the NIB's research fund.
7. KARI	P.O. Box 1433, Nairobi	12	12	12	12	5000	Most of the soil analysis done in the facility is demand

Annex 4: Soil Labouratories Functionality and Capacity							
Institution		**Number of months a laboratory was active in the different types soil analysis between December 2008 and November 2009**				**Samples analyzed**	**Comments**
	Contacts	**Soil Ph**	**Organic carbon**	**Nutrient analysis**	**Micro organisms analysis**		
(NARL)-KABETE	4444144-444413 -031 020 karikabete@kari.org						driven. The installed capacity of the laboratory is over 20000 samples per annum. The major constraints in the laboratory are lack of finances and obsolete equipment. The cost of analyzing a sample is subsidized (US$ 12.93/ soil sample).
8. CRF	P.O Box 4-00232 Ruiru TEL +254-6725081/2 crf@kenyaweb.com	12	1	12	0	11000	The laboratory has the capacity of analyzing 35000 samples per annum; however the utilized capacity is about a third. This is mainly due to financial constraints. The facility mostly serves coffee farmers as well as non coffee farmers. Coffee farmers are served at a subsidized price. For example, the cost of nitrogen analysis id US$ 1.94 for coffee farmers and US$ 7.76 for non coffee farmers. Apart from finances, other constraints include poor instrumentation, limited training of personnel, high running costs.
9. TSBF	P.O. Box 30677 Nairobi ciat-lab.analitico@cgiar.org	12	12	12	2		Bulk density tests are done only when adjusting field water holding capacity, especially when determining Carbon dioxide respiration on dry soils
10. KARI Embu	P.O. Box 2, Embu 31116-318 3 4183301/20 068 kariembu@kari.org	9	0	1	0	20	Despite a high demand for the laboratory services in the Mt Kenya region, the equipment in the laboratory has broken down. The laboratory is mainly doing soil Ph analysis and moisture content tests. The samples received in the laboratory are sent to NARL for further analysis. Majority of their customers are smallholder farmers.
11. MEA Ltd	P.O. Box 1018 Nakuru, Kenya Tel: +254-051-2212220 mea-factory@mea.co.ke	12	12	12	0	142	The laboratory is fully commercial and also serving the MEA fertiliser factory to check for fertiliser quality. Most of the clients are small farmers. Large scale farmers especially those in floriculture use the facility too.

Annex 4: Soil Labouratories Functionality and Capacity							
Institution		**Number of months a laboratory was active in the different types soil analysis between December 2008 and November 2009**				**Samples analyzed**	**Comments**
	Contacts	**Soil Ph**	**Organic carbon**	**Nutrient analysis**	**Micro organisms analysis**		
12. Egerton University	P.O. Box 536 Egerton 20115 Kenya 254-051-2217891/2 254-051-2217781 info@egerton.ac.ke	12	12	12	12	DN	The laboratory is for teaching purposes. Students and researchers from the university use the facility. The laboratory is constrained by lack of some equipments and delay in repairing/replacing equipments due to lack finances
13. KESREF	P.O. Box 44 – 40100, Kisumu, Kenya. Tel.: +254-020-204 7307 kesref@kesref.org	11	9	7	8	1540	Procurement of chemicals, apparatus and repair services of broken equipment is a major problem to the laboratory. The other constrain is the water purification system. The laboratory is supplied with borehole water which is very hard.
14. TRF	P.O Box 820 Kericho 20200,Kenya. Tel:254-052-20598/9. lib-trfk@kenyaweb.com.	12	2	12	0	3100	The laboratory is meant to serve tea farmers from all tea growing areas. Major laboratory constraints are power blackouts and power rationing leading sometimes to machine breakdown.
15. National Museums of Kenya	publicrelations@museums.or.ke +254 (0)20 3741424	5	0	5	0	537	The laboratory is a new establishment that became functional in July, 2009
16. ICRAF	P.O. Box 30677 Nairobi, Kenya phone: (254-2) 521450	12	12	12	12		Regional
17. Maseno University	P.O. Box Private Bag, Maseno Telephone: 057-351620/2 vc@maseno.ac.ke						No soil science laboratory
18. Masinde Muliro University	P.O. Box 190 -50100 Kakamega +254 - 056 - 30771						No soil science laboratory

Annex 4: Soil Labouratories Functionality and Capacity							
Institution		**Number of months a laboratory was active in the different types soil analysis between December 2008 and November 2009**				**Samples analyzed**	**Comments**
	Contacts	**Soil Ph**	**Organic carbon**	**Nutrient analysis**	**Micro organisms analysis**		
19. KARI Mtwapa	P.O. Box 16, Mtwapa 548620 -5485839 041 karimtw@kari.org						The laboratory is not functional
20. CROP NUTRITION	P.O. Box 66437 Nairobi Telephone(+254) 20 - 356 1192						
21. Kenya Marine and Fisheries	P.O. Box 81651 80100 Mombasa, Kenya Phone: 254 - 41-475157 pro@kmfri.co.ke						
22. Moi University	P.O. Box 1125 - 30100 Eldoret, Kenya Tel: +254-(0)53-2063160 deanagriculture@mu.ac.ke						
23. KARI Kakamega	P.O. Box 169, Kakamega 30031/9 056 karikak@kari.org						
24. KARI Kitale	P.O. Box 450, Kitale 303 8-30408 054 karikit@kari.org	0	0	0	0	0	The laboratory has not been functional since 2006 due lack of necessary equipment

Annex 5: Sources of Soil Samples

Institution	Sources of Soil Samples
KEFRI	Naivasha, Maseno, Machakos, North Eastern (Galana), Kiambu, Lodwar, Nyeri
UON	Kajiado, Kabete, Kitengela, Maseno, Machakos
KARI-MUGUGA SOUTH	Kiambu, Muranga, Kirinyaga, Muhoroni, Maseno, Makueni,Athi River,Kakamega,Caost, Turkana, Marsabit
KEPHIS	Data not available
JKUAT	Thika, Meru
MIAD	Kirinyaga, Ahero, West Kano, Bunyala, Bura, Mwingi, Mbeere, Perkerra, Kibwezi
KARI (NARL)	Narok, Kirinyaga – data on request
CRF	Muranga, Kiambu, Kirinyaga, Nyeri, Thika, Embu, Machakos, Trans Nzoia, Nandi, Meru, Keiyo, West Pokot, Kericho, Nakuru, Rachuonyo, Kabondo, Kisii, Bungoma, Mt Elgon, Kakamega
TSBF	East and Central Africa
KARI EMBU	Embu, Nyeri, Kirinyaga, Meru, Mbeere
KARI KAKAMEGA	
EGERTON UNIVESRSITY	No records of where samples came from as they were students samples
MOI UNIVERSITY	
TRF	All tea growing regions- Kericho, Kirinyaga, Kisii, Nyeri among others
MEA	Southern Sudan, Nakuru, Narok, Thika, Nyeri, Gatundu, Nyahururu, Machakos, Nairobi, Kiambu, Siaya, Busia, Kitale, Trans Nzoia, Uasin Gishu
NMK	Tharaka- Chogoria (Mt Kenya Forest) Laikipia- Sirimon (Mt Kenya Forest) Kilifi (Arabuko Sokoke forest) Taita (Taita hills Forest) Kajiado, Makueni (Chyulu hills National Park) Narok (Masai Mau Forest)
KESREF	Bungoma, Mumias, Nyando, Kisumu, Kakamega, Kilifi, Ainamoi, Lamu and Rachuonyo

Annex 6: Requirements for Suppliers to Uchumi Supermarket

Suppliers' requirements

Supplier must be registered with the registrar of companies under the provisions of the company Act; Supplier must possess PIN certificate issued by Kenya revenue authority; Supplier must be registered for Value Added Tax and issued with a VAT certificate or Exemption letter; Supplier should have a good reputation with no record of fraudulent dealings and must maintain high integrity in all business transactions with Uchumi; Supplier should have the capacity to fully supply orders issued by the head office and/or Uchumi branches; Supplier will be required to fill a Supplier Profile Form and Terms of Trade agreement with Uchumi to formalize the trading contract between the two parties.

Products' requirement

Products must meet health, safety and standardization requirements as set out by Kenya bureau of Standards and other government regulatory bodies; Product must be properly packaged and/or labeled to appeal to customers and express its attributes; Products must bear valid Bar Codes issued by a recognized Bar coding body; The product labeling must include the following as minimum requirement:- Brand, Product Name, Manufactures name and country of origin, Expiration date (for perishable products), Storage instructions (for perishables or products that deteriorate with time), Ingredients (for processed products), Bar code, Size (weight, volume, length).

Annex 7: Percent of Households Aware of Various Types of Fertilizer

Fertilizer type	Western	Nyanza	Central	Overall
Manure	85.0	86.1	86.2	85.7
DAP	87.0	56.3	85.3	78.7
CAN(26:0:0)	72.6	27.4	85.9	65.8
UREA	45.9	45.2	17.5	35.9
Compost	42.1	19.4	9.8	25.2
NPK (23:23:0)	1.0	0.0	67.2	23.8
NPK (17:17:0)	3.7	0.0	63.8	23.7
NPK (20:20:0)	3.5	0.4	54.3	20.4
UREA (46:0:0)	20.2	3.6	21.8	16.6
Mavuno	11.2	7.5	27.3	15.9
Liquid fertilizer(foliar feeds)	12.0	4.8	16.7	11.8
NPK	19.5	1.2	0.0	8.1
NPK (20:10:10)	0.0	0.0	11.5	4.0
SA (21:0:0)	0.5	10.3	0.6	3.0
ASN(26:0:0)	0.7	1.2	5.2	2.4
NPK (23:23:23)	0.0	0.0	4.9	1.7
SSP	3.2	0.0	0.9	1.6
MAP	2.0	0.0	1.4	1.3
TSP	2.0	0.4	0.6	1.1
GREEN MANURE	2.7	0.0	0.0	1.1
Lime	1.5	0.0	0.6	0.8
DSP	0.5	0.4	1.1	0.7
MOP	0.0	0.4	1.4	0.6
NPK (25:5:+5S)	0.0	0.0	1.7	0.6
NPK (18:14:12)	0.2	0.0	0.9	0.4
NPK 17:17:17	0.5	0.0	0.3	0.3
NPK (15:15:15)	0.0	0.4	0.3	0.2
NPK 22:6:12	0.0	0.0	0.6	0.2
Compund C	0.0	0.4	0.0	0.1
Compund D	0.2	0.0	0.0	0.1
Kero green	0.0	0.4	0.0	0.1
NPK 18:18:18	0.0	0.0	0.3	0.1
NPK 14:14:20	0.2	0.0	0.0	0.1

Annex 8: Percent of Households Aware of and Practising Various Soil Fertility Management Techniques

Soil fertility managemet practice	Western		Nyanza		Central		Overall	
	% aware	% practising	% aware	% practising	% aware	% practising	% aware	% practising
Use of farm yard manure	93.5	69.3	91.3	61.1	99.7	92.5	95.1	75.3
Use of inorganic fertilizers	98.0	71.8	96.0	46.8	98.3	87.1	97.6	70.8
Terracing	89.8	58.6	75.8	42.1	91.7	57.2	86.9	53.9
Crop rotation	87.5	75.8	84.5	52.8	64.7	24.7	78.8	52.2
Grass trips	77.1	47.6	57.1	20.6	95.1	79.9	78.3	52.0
Wind breaks	62.8	38.9	63.1	26.2	65.5	42.0	63.8	36.8
Contour farming	56.4	38.9	70.2	38.9	51.4	27.3	58.1	34.9
Cut-off drains/soil bounding	67.1	42.6	65.9	48.0	45.4	12.1	59.2	33.4
Composting	84.0	46.4	56.7	25.4	53.4	13.5	66.5	29.7
Mulcing/cover crop	68.1	38.7	71.4	21.4	66.4	19.0	68.3	27.5
Fallow	70.8	31.7	92.5	50.0	47.4	5.5	68.1	27.2
Afforestation	58.6	27.9	64.7	21.0	61.5	21.0	61.1	23.8
Agro forestry (other trees)	33.7	12.2	25.8	4.8	65.5	50.3	42.8	23.6
Growing legume crops	24.9	17.5	39.3	29.8	20.1	10.3	26.9	18.1
Slash and burn	67.3	20.7	77.8	26.6	39.7	4.3	60.3	16.5
Water pans/planting basins	11.5	7.0	35.3	17.9	16.1	6.3	19.1	9.5
Use of green manure fertilizers	33.7	12.2	20.2	6.0	25.9	6.6	27.6	8.7
Minimum tillage	17.7	6.0	43.7	11.5	23.6	4.3	26.3	6.8
Agro forestry (legume trees	27.2	11.5	29.8	3.6	10.1	2.0	21.9	6.2
Gabions/storm bands	33.9	3.2	39.7	5.2	45.1	3.2	39.3	3.7
Use of lime	9.2	1.2	6.7	0.0	8.6	0.9	8.4	0.8
Use of innoculum	1.7	0.2	1.2	0.0	0.6	0.0	1.2	0.1

Annex 9: Percent of Households Aware of Various Seed Varieties for Staples

Variety	Western		Nyanza			Overall	
	Count	% of hh	Count	% of hh	% of hh	Count	% of hh
Maize							
KS 513	156	38.9	46	18.3	67.0	435	43.5
Pioneer	46	11.5	42	16.7	69.3	329	32.9
KS 614	203	50.6	7	2.8	31.0	318	31.8
WS 505	205	51.1	34	13.5	1.4	244	24.4
SCDuma 41	13	3.2	16	6.3	52.9	213	21.3
Katumani	31	7.7	58	23.0	25.3	177	17.7
KS 625	116	28.9	5	2.0	13.5	168	16.8
KS 511	45	11.2	23	9.1	21.6	143	14.3
DK 8031	20	5.0	6	2.4	25.0	113	11.3
KS 512	32	8.0	18	7.1	14.1	99	9.9
Sorghum							
Seredo	3	0.7	16	6.3	1.1	23	2.3
Sekedo	2	0.5	4	1.6	0.6	8	0.8
Serena	5	1.2	3	1.2	0.0	8	0.8
Red Swazi	0	0.0	0	0.0	0.3	1	0.1
GADAM	0	0.0	0	0.0	0.3	1	0.1
Millet							
Nyankhombo	1	0.2	0	0.0	0.0	1	0.1
SaWAepo	1	0.2	0	0.0	0.0	1	0.1
Serere 22	1	0.2	0	0.0	0.0	1	0.1
GULU - E	1	0.2	0	0.0	0.0	1	0.1
Rice							
Basmati	0	0.0	31	12.3	1.7	37	3.7
Pishori	3	0.7	10	4.0	4.9	30	3.0
IR 36	0	0.0	23	9.1	0.0	23	2.3
ITA 230	0	0.0	21	8.3	0.0	21	2.1
Sindano	3	0.7	6	2.4	2.3	17	1.7
IR 27	0	0.0	17	6.7	0.0	17	1.7
B11	0	0.0	0	0.0	2.6	9	0.9
BR	0	0.0	7	2.8	0.0	7	0.7
Beans							
Rosecoco	62	15.5	43	17.1	24.7	191	19.1
Red haircot (wairimu)	52	13.0	29	11.5	19.3	148	14.8
Mwitemania GLP 92	4	1.0	0	0.0	29.3	106	10.6
Nyayo	21	5.2	16	6.3	9.5	70	7.0
Cowpeas							
Kunde 1	0	0.0	0	0.0	0.3	1	0.1
Soybeans							

Variety	Western		Nyanza			Overall	
	Count	% of hh	Count	% of hh	% of hh	Count	% of hh
Maksoy	1	0.2	0	0.0	0.0	1.0	0.1
Cassava							
Migyera	17	4.2	1	0.4	0.0	18	1.8
SS4	4	1.0	3	1.2	0.0	7	0.7
MM	2	0.5	0	0.0	0.0	2	0.2
Mucericeri	0	0.0	0	0.0	0.6	2	0.2
Sweet potato							
Bungoma	1	0.2	0	0.0	2.6	10	1.0
SPK 004	3	0.7	4	1.6	0.6	9	0.9
Kapoko	0	0.0	0	0.0	1.4	5	0.5
Kalulu	0	0.0	0	0.0	0.9	3	0.3
Simama	0	0.0	2	0.8	0.0	2	0.2
Irish potato							
Tigoni	0	0.0	0	0.0	2.6	9	0.9
Nyayo	0	0.0	0	0.0	1.4	5	0.5
Omba suti	0	0.0	0	0.0	0.9	3	0.3
Asante	0	0.0	0	0.0	0.9	3	0.3
Banana							
Israel	1	0.2	0	0.0	17.8	63	6.3
Kampala	0	0.0	0	0.0	16.1	56	5.6
Tissue culture	3	0.7	3	1.2	5.7	26	2.6
Giant cavendish	0	0.0	0	0.0	2.9	10	1.0
Golden cavendish	0	0.0	0	0.0	2.0	7	0.7