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REVIEW OF FERTILIZER USE BY CROP AND BY PRODUCT IN KENYA



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ACRONYMS AND ABBREVIATIONS

AFO	African Fertilizer Organization
ASAL	Arid and Semi-arid Land
ARM	Athi River Mining Company
BAT	British American Tobacco
CRF	Coffee Research Foundation
DAP	Di-ammonium Phosphate
EAC	East Africa Community
EAGC	Eastern Africa Grain Council
IFDC	International Fertilizer Development Centre
IDF	Import Declaration Fees
CAN	Calcium Ammonium Nitrate
CIF	Cost, Insurance and Freight
FTWG	Fertilizer Technical Working Group
FUBC	Fertilizer Use by Crop
GDP	Gross Domestic Product
KALRO	Kenya Agricultural and Livestock Research Organization
KEBS	Kenya Bureau of Standards
KEPHIS	Kenya Plant Health Inspectorate Services
KIPPRA	Kenya Institute of Public Policy and Research Analysis
KTDA	Kenya Tea Development Agency
MALF	Ministry of Agriculture, Livestock and Fisheries
MDG	Millennium Development Goal
M&E	Monitoring and Evaluation
MIS	Market Information Systems
MT	Metric Ton
NAAIAP	National Accelerated Agricultural Input Access Programme
NCPB	National Cereals and Produce Board
NPK	Nitrogen Phosphate Potassium
SSP	Single Super Phosphate
TSP	Triple Super Phosphate
VAT	Value Added Tax
ToR	Terms of Reference

2 INTRODUCTION

2.1 Background of the study

The Kenyan economy is largely agriculture based with the sector accounting for 31.5% of the Gross Domestic Product (GDP) and 65% of the export earnings. The sector indirectly contributes 27% of the country's GDP through agro-processing, marketing and other related services. Agriculture provides approximately 70% of informal and 18% formal employment. The agricultural sector is not only important for economic development in the country but is also expected to deliver other regional and global commitments. One such commitment is the achievement of the first Millennium Development Goal (MDG1) on poverty and hunger. Indeed, Kenya Vision 2030 has identified the agricultural sector as one of the key sectors to deliver the 10% annual growth rate envisaged under the economic pillar (GoK, 2008, Kenya Vision 2030). To achieve this growth, transforming smallholder agriculture from subsistence to an innovative commercially oriented and modern agriculture is critical.

2.2 Purpose of the study

This study was commissioned by the AfricaFertilizer.org initiative led by IFDC, which has been working with Kenya CountrySTAT project to improve the quality and availability of official fertilizer statistics (mainly production, import, export, consumption). Since 2011, the two agencies use stakeholders-based approach to assist the CountrySTAT national Secretariats and Technical Working Groups by engaging public and private partners in national Fertilizer Technical Working sub Groups (FTWG), able to review and provide expertise and advice specifically on fertilizer statistics.

The overall objective of this study is to document and publish the data on estimates of fertilizer use by type and by nutrients for major crops in Kenya covering 2014 to 2016.

The specific objectives are:

- To provide best estimates of the real fertilizer consumption and Fertilizer Use By Crop (FUBC) statistics for Kenya from 2014 to 2016.
- To assist in designing a cost-effective framework for estimating consumption and FUBC.

3 METHODOLOGICAL FRAMEWORK

3.1 Methodological approach

The methodological approach adopted was guided by the Terms of Reference (TORS) for the study that required estimation of actual fertilizer nutrients used by type and by crop type. Table 1 summarizes the broad items that were used in developing the study concept, the reason for choice of the items as well as the key variables considered under each item. Figure shows the conceptual framework used in the study.

Table 1: Items considered for development of Conceptual Framework

Concept development item	Reasons	Key variables
Fertilizer Supply	Knowledge of quantities of available fertilizer	Import, local manufacturing and blending
Apparent consumption fertilizer	Knowledge of broad trends of fertilizer utilization	Local distribution, exports
Main food and industrial crops that use fertilizers and counties where crop is grown	To determine spread of fertilizer demand and actual use in the field	County estimated annual achieved crop area in Ha;
Fertilizer use by type	To establish the main types of fertilizers used by each crop	Main types of fertilizers used for planting; Main fertilizer used for top dressing for each crop
Fertilizer utilization by crops	To establish actual fertilizer quantities by type used by specific crops	Percentage of planted applied with fertilizer; average planting fertilizer application rates by crop; average top-dressing fertilizer application rate by each crop
Fertilizer nutrients utilization	To establish fertilizer nutrients annual uptake by each crop	NPK equivalent of each fertilizer types used by each crop

Figure 1: Conceptual Framework for developing the Fertilizer Consumption study for Kenya

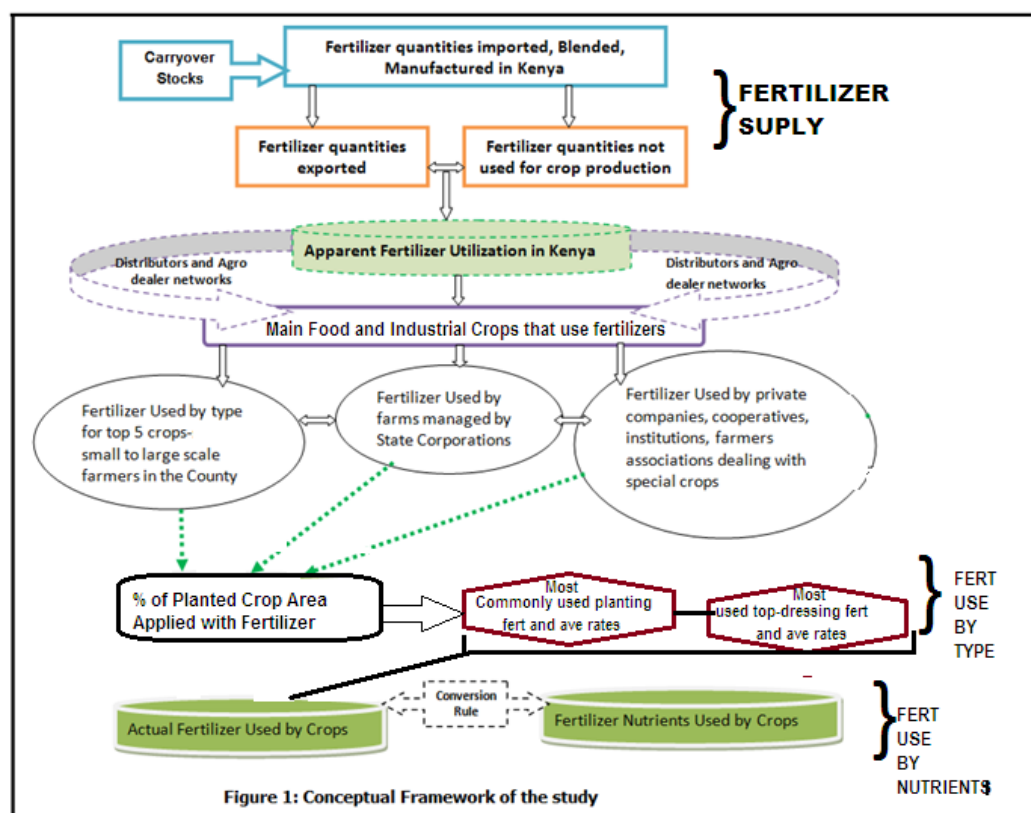


Table 2: SWOT analysis of the sources of data

Data type	Main data source	SWOT elements	
1. Data on Imported and exported fertilizers	Kenya Revenue Authority (KRA), Kenya Bureau of Statistics, Kenya Bureau of Standards	Strength	i) Have legal authority to access data; ii) Have good records of inputs inflows and outflows. iii) Easy means of getting data
		Weaknesses	i) KRA: mix up of various fertilizers with non-fertilizers ii) Importers evading taxes change inputs codes and names iii) Data not given frequently; delays lead to difficulties of sorting out mixed fertilizer codes
		Opportunities	i) Training of officials on identification of none fertilizer inputs; ii) Timely data access to ease sorting of mixed fertilizers. iii) Attaching a trained agricultural statistician to work with institutions such as KRA to handle agricultural inputs statistics; iv) Use of relevant computer software to help in automating data analysis and validation
		Threats	i) Few staff availability to undertake extra duties of data management; ii) Lack of fertilizer quality control and imports/exports regulatory framework
		Strength	i) Data fairly accurate;

2. Data on blended fertilizers	Private companies undertaking fertilizer blending and sales	Weaknesses	<ul style="list-style-type: none"> i) Difficulties of getting data from some companies due to fear of competition ii) Some blends have complex nutrient mixtures hence difficult to classify;
		Opportunities	<ul style="list-style-type: none"> i) Almost all companies are in Nairobi, hence easy to access; ii) Liaison with association members to enhance data collection;
		Threats	<ul style="list-style-type: none"> i) Lack of legal framework controlling data provision to government; ii) Low awareness by managers of some companies on the value of data provision to the government.
3. Data on fertilizer distribution and uptake by farmers	State Corporations given mandate to promote development of a specific crop e.g. Tea, coffee; government of Kenya, private traders, wholesalers and retailers	Strength	<ul style="list-style-type: none"> i) Accessible and reliable data where the government or state corporation is directly involved in provision of fertilizers to farmers; ii) Easy way of getting data through published reports; iii) Ease of estimating fertilizer consumption by crops due to good farmer records, et tea and coffee
		Weaknesses	<ul style="list-style-type: none"> i) Many state corporations have poorly trained agricultural statistics officials; ii) Difficulties of accessing historical data due to poor data archiving practices
		Opportunities	<ul style="list-style-type: none"> i) Introduction of modern technology to enhance data collection and dissemination; ii) Mass training of officers on simple techniques of fertilizer data use estimation iii) Support by officials from Kenya Bureau of Statistics with relevant experiences;
		Threats	<ul style="list-style-type: none"> i) Recent merger of some state corporations leading to lack of clarity of data sources; ii) Government changes of fertilizer subsidy system to avoid direct purchase and supply may lead to limited access to data.
4. Data on actual fertilizer used by crop and by regions	County Extension offices, national government offices	Strength	<ul style="list-style-type: none"> i) Large number of extension officers responsible for data collection at grassroots; ii) Ease of getting some accurate data from farmers' or cooperatives' records; iii) Cheap way of data collection and management
		Weaknesses	<ul style="list-style-type: none"> i) Field officers heavy work load ii) Inadequate funds to support elaborate field mobility; iii) Lack of skills on fertilizer use data collection methods iv) Lack of proper sampling and survey methods v) Officers at HQ office handling revenant statistics are few and very busy

		Opportunities	<ul style="list-style-type: none"> i) Experienced crops and agribusiness officers deployed at County and Sub-county level assisting with data validation ii) Introduction of modern technology to enhance data collection and dissemination; iii) Mass training of field officers on simple techniques of fertilizer data use estimation iv) Support by officials from Kenya Bureau of Statistics with relevant experiences;
		Threats	<ul style="list-style-type: none"> i) Poor cooperation by field officers in the devolved Counties; ii) Aging field extension staff iii) Inadequate staff deployed to handle statistics at HQ office
5. Data on fertilizer consumption rates, fertilizer use by soil types and other secondary data	Research institutions such as KALRO, Agricultural Universities such as Tegemeo Institute	Strength	<ul style="list-style-type: none"> i) Data tends to be accurate ii) Data sources fairly accessible
		Weaknesses	<ul style="list-style-type: none"> i) Lack of consistency in data supply ii) Difficulties of accessing soft data
		Opportunities	<ul style="list-style-type: none"> i) Enhanced stakeholders' collaboration
		Threats	<ul style="list-style-type: none"> i) Inadequate stakeholders' collaboration ii) Few institutions dedicated to data collection and dissemination

3.1.1 *The data sources and targeted structures*

a) Farm level crop production data: For most data generated from smallholder farmers, data was obtained from County crops officers. The County data are based on data generated by field extension officers who are deployed within extension units or Wards. In each Ward, the agricultural extension officers work with about 36 Contact Farmers who should be randomly selected. Among other things, the Contact Farmers are taught to keep farm records on most of the farm operations. On monthly basis, key agricultural production variables such as planted area, harvested crops, farm gate prices, inputs use, among others, are generated by the Ward Extension officers, who compile monthly reports to the Sub-county, and subsequently, county offices. At end of each season, the seasonal crop production report (with data) prepared. At end of calendar year, annual production report is prepared.

To capture data on fertilize use by crops within the assignment period, the County Crops officers were asked to covered at least top 5 crops grown in each County that use fertilizers, planted crop area in Ha during 2014, 2015 and 2016; average estimated percentage of planted Ha for which fertilizer are applied; types of fertilizers used as basal as well top dressing material; average fertilizer application rates in Kg per Ha for each type of fertilizer, and average quantities of fertilizer type applied per Ha per crop based on long-term application rates provided by local field extension officers. Appendix 1 shows County Fertilizer Use by Crop Data capture template.

For large scale, private commercial, institutional, cooperatives and state corporation farms, questionnaire was designed and posted to them to generate required data (see Samples Annex 2).

b) Agro-dealer survey: a structured questionnaire was developed administered to key agro-dealers such as importers and manufacturers of fertilizer. Hired enumerators as well as mailing methods were used to get the data (See Questionnaire sample-Annex 3).

c) Key informant interviews in the fertilizer industry: semi-structured questionnaire was used to obtain data either through email or telephone interviews. The questionnaires were also posted to some of the key informants.

3.2 Techniques and data collection instruments

3.2.1 Collaboration with Ministry of Agriculture / Public services

Review of documentary evidence- This considered research publications on agro-ecological zones; crops grown in various zones; soil and weather patterns of the zones; and recommended fertilizers and application rates for each zone and by crop variety based on national field extension guide book¹.

Collection of secondary data- These data were obtained from existing crop production as well as fertilizer supplies and distribution reports available at the headquarter office of the State Department of Agriculture, County Agricultural Offices, private farms, farmers associations, among others. Other secondary data were obtained from fertilizer study reports from multilateral organizations (FAO statistics), and research institutes like Tegemeo (2009, 2006ⁱⁱ)ⁱⁱⁱ and KALRO (2006)^{iv} as well as data from regulatory bodies such as KRA and KEPHIS^v. Substantial data was obtained from reports of State Corporations (details in appendix 1) as well as private companies that deal with crops production in Kenya.

Collection of primary data- This involved receiving data from different fertilizer stakeholders.

3.2.2 The interviews and questionnaires

For this report, data was gathered from ministry of agriculture departments and parastatals who, in a different capacity, conducted interviews and sent out questionnaires, and the feedback received, in turn used in the development of this assessments. See Annex 2 for the sample questionnaires used for the Irrigation board and fertilizer importers/companies.

3.3 Treatment method

3.3.1 Constraints and limitations of the method used

Despite the great success in implementing this, a few limitations/obstacles were observed and should be reported 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 fertilizer and output markets. Due to lack of actual field surveys (data captured past years), it was not easy to establish actual sampling sizes, thus the study had to rely on proxy sample sizes reported by those who collected data. Due to time and financial constraints, the study team could not interview sufficient numbers of key informants. Following devolution process, challenges in getting corporation and support was not amongst some County officials leading to many cases of incomplete or missing information.

4 OVERVIEW OF AGRICULTURE IN KENYA

4.1 Cropping systems and agro-ecological zones

Kenya grows two broad categories of crops, namely food and industrial crops. Food crops include cereals, pulses, nuts, roots and tubers, fruits and vegetables. The industrial crops include tea, coffee, pyrethrum, tobacco, sugar cane and flowers. The crops in Kenya can also be categorized as annual and perennial crops. The annual crops are those that grow within one to two seasons, while the perennial crops grow beyond two seasons.

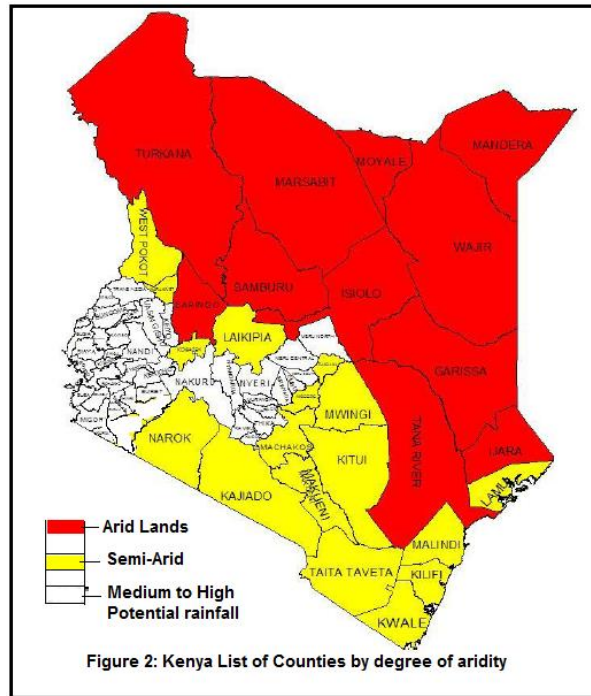
The two seasons for annual crops are long rains (between March to September) and Short Rains (between October to February) seasons.

Kenyan farmers fall under small scale farmers (about 75%) and medium to large scale farmers (about 25%). Most of the medium and large scale farmers apply fertilizer as per required prescription. However, most of the small scale farmers use below average or no fertilizer. In Kenya, the use of fertilizer on crops is proportional to value of crop in terms of earnings as well as awareness levels of the farmers.

Crop production in Kenya depends on the agro-ecological zones in Kenya. In Kenya, the zones are broadly categorized into Arid and Semi-Arid Lands (ASAL) as well as the high and medium rainfall areas (see figure 2). In Kenya, there are 7 Counties that are 100% arid; namely Turkana, Moyale, Marsabit, Isiolo, Wajir, Mandera, and Garissa. No substantial fertilizer-dependent crop production takes place in these Counties. In terms of area size, the 100% arid Counties occupies 56% of the total land mass. The next category is the Counties with 85-100% aridity. These Counties, which constitute 21% of total land mass, include Kitui, Makueni, Tana River, Taita Taveta, Kajiado, and Samburu. In these Counties, fertilizer-dependent crop production is mainly carried out in the irrigation schemes, which are mostly managed by the National Irrigation Board as well as government State Corporations. In this category of Counties, data on fertilizer use by crop is mainly obtained from the major irrigation schemes. Within ASAL, the last category is those that are 50-85% arid, representing 8% of the total land mass. In these Counties, some portions or Sub-counties (Districts) may be arid while other portions are not arid. The Counties in this category include Machakos, Mwingi, Tharaka Nithi, Laikipia, West Pokot, Baringo, Kwale and Kilifi. In these Counties, the survey process involved delineating and separating the arid portions at administrative level. These arid portions or Sub-counties were left out of the study due to lack of substantial fertilizer-dependent crops. Data for the study in these counties were therefore collected only in the Sub-counties with medium to high rainfall. For the remaining Counties that are classified as medium to high rainfall areas, data was collected through survey reports. The Counties include Kisumu, Siaya, Homa Bay, Kisii, Nyamira, Migori, Busia, Kakamega, Bungoma, Uasin Gishu, Trans-Nzoia, Bomet, Nandi, Narok, Kericho, Nakuru, Elgeyo Marakwet, Nyandarua, Kiambu, Murang'a, Kirinyaga, Nyeri, Meru, Embu, Mombasa and Lamu.

4.2 Crop Calendar of Major Crops

Food crops have two major planting seasons namely; the short rains starting from September-December (main season for East of the Rift) and the long rains which starts from March-May (main season for West of the Rift). Coffee is normally top dressed in April and September during the flowering stage.



SEASON	CROPS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Major Season (Long Rains)	Beans			■	■	■	■	■	■	■	■		
	Fertilizer peak demand				■	■							
	Maize			■	■	■	■	■	■	■	■	■	
	Fertilizer peak demand			■	■	■							
	Millet			■	■	■	■	■	■	■	■		
	Fertilizer peak demand				■								
	Sorghum		■	■	■	■	■	■	■	■			
	Fertilizer peak demand		■	■	■								
	Wheat							■	■	■	■	■	■
	Fertilizer peak demand							■	■				
Rice													
Peak demand													
Minor Season (Short Rains)	Maize, Millet, Sorghum, B	■	■								■	■	■
	Fertilizer peak demand	■											■

Key: fertilizer Peak demand ■ sowing ■ growing ■ harvesting ■
Source: FAO/GIEWS

4.3 Agricultural statistics (areas, production, yield)

Kenya produces a wide range of crops that use various types of fertilizers. The main food crops are categorized into cereals and pulse crops (maize, wheat, rice, sorghum, millet; beans, chick pea, beans, cow pea and green gram), roots and tuber crops (potatoes, cassava, yams, sweet potato) and oil crops (ground nuts, sunflower, sesame). The main cash crops include tea, coffee, sugarcane, tobacco, pyrethrum, and sisal. Kenya also produces several horticultural crops as well as flowers, both for consumption and also for export. Besides commodity crops, Kenya also produces a wide variety of seeds. The national area, production and average yields of specific crops in the country from 2014 to 2017 is summarized in **Error! Reference source not found..**

Table 3: National Area, Crop Production and Yield for 2014- 2017

Crop	Growing system/region	Year 2014			Year 2015			Year 2016			Year 2017		
		Planted Area (x1000 ha)	Production (x1000 tons)	Yield (Tons/ha)	Planted Area (x1000 ha)	Production (x1000 tons)	Yield (Tons/ha)	Planted Area (x1000 ha)	Production (x1000 tons)	Yield (tons/ha)	Planted Area (x1000 ha)	Production (x1000 tons)	Yield (tons/ha)
Maize	rain fed	2116	3513	1.7	2321	3973	1.7	2321	3339	1.4	2337.6	3.3	0.0
Tea	rain fed		0	-	208	399	1.9	219	473	2.2	187.9	377.9	2.0
Sugarcane	rain fed	211	6478	30.7	78	7165	92.1	85	7142	84.1	84.4	5822.6	69.0
Wheat	rain fed	147	329	2.2	145	441	3.0	153	395	2.6	146.6	32.9	0.2
Flowers	irrigated			-	5	194	37.5	8	261	31.6	12	102	8.6
Barley	rain fed	22	110	5.1			-			-	14.2	65.2	4.6
Sorghum	rain fed	214	178	0.8	196	239	1.2	185	125	0.7	203.7	12.9	0.1
Rice	irrigated	28	112	4.0	29	110	3.7	30	90	3.0	29.9	102.4	3.4
Finger Millet	rain fed	0	0	-	27	27	1.0	27	21	0.8			-
Pearl Millet	rain fed	139	130	0.9	63	65	1.0	61	31	0.5	109.0	6.5	0.1
Other Cereals S/Total		402	530	1.3	315	441	1.4	303	267	0.9	357	187	0.5
Beans	rain fed	1052	616	0.6	1244	942	0.8	1172	728	0.6			-
Soya Bean	rain fed	9	1566	172.7	3	3	0.9	2	2	0.9			-
Cowpeas	rain fed	282	139	0.5	239	173	0.7	228	147	0.6	254.6	13.2	0.1
Dolic Beans	rain fed	1312	403473	307.6	11	15	1.3	17	15	0.9			-
Pigeon Peas	rain fed	276	275	1.0	67	68	1.0	66	54	0.8	114.3	7.2	0.1
Garden Peas	rain fed			-			-	22	75	3.5	19.6	9.5	0.5
Chickpea	rain fed			-	1	0	0.7	0	0	0.5			-
French beans	rain fed			-			-	6	42	7.0	3.8	30.6	8.2
Snow peas	rain fed			-			-			-	1.8	11.3	6.1
Green Gram	rain fed	259	121	0.5	198	105	0.5			-	302.3	13.4	0.0
Grain Amarantha	rain fed	0	0	1.0			-	0	0	0.6			-
Sugar snaps	rain fed			-			-			-			-
Legumes S/Total		3190	406189	127.3	1763	1307	0.7	1513	1063	0.7	696	85	0.1
Sweet Potatoes	rain fed	61	69	1.1	72	1232	17.1	47	697	14.8	70.8	667.3	9.4
Cassava	rain fed	64	858	13.5	50	710	14.1	47	572	12.3	68.4	807.8	11.8
Coco Yam	rain fed	2	27	12.6	12	20	1.8	2	22	10.0	2.8	17.7	6.4
Yams	rain fed	1	20	16.6	1	19	12.6	1	12	9.8	1.0	7.3	7.2
Irish Potatoes	rain fed	135	1576	11.7	167	2073	12.4	766	3299	4.3	192.3	1519.9	7.9
Roots & Tubers S/Total		263	2551	9.7	302	4054	13.4	863	4602	5.3	335	3020	9.0
Carrots	rain fed	6	180	32.7			-	7	111	16.2	4.1	76.9	18.8
Cabbages	rain fed	15	443	28.9			-	27	776	28.8	18.0	490.0	27.3
Kales	rain fed	24	349	14.3			-	32	490	15.2	27.7	332.2	12.0
Tomatoes	rain fed	24	400	16.6			-	22	410	18.7			-
Spinach	rain fed			-			-	6	76	13.5	4.7	46.8	10.1
Melon	rain fed			-			-	8	174	21.8	4.7	107.3	22.8
Bulb Onion	rain fed			-			-	4	53	13.1	6.8	96.9	14.4
Spring onions	rain fed			-			-	3	26	9.5			-
Pinneapple	rain fed			-			-	4	119	29.1	5.9	121.0	20.4
Other Vegetables	rain fed			-	113	1934	17.0	345	4309	12.5			-
Vegetables& Horticulture S/Total		69	1371	19.8	113	1934	17.0	458	6543	14.3	72	1271	17.7
Macadamia	rain fed	6	42	7.0			-	3	25	7.8			-
Bambara groundnuts	rain fed		0	-			-	0	1	6.4			-
Coconut	rain fed	177	129	0.7			-	47	92	1.9			-
Cashew nuts	rain fed	22	22	1.0			-	30	25	0.8			-
Nuts	rain fed			-	80	182	2.3	19	22	1.1			-
Simsim	rain fed	8	7	0.9	3	3	1.2	4	4	0.9			-
Nuts S/Total		212	200	0.9	83	185	2.2	104	168	1.6	0	0	-
Other Fruits	rain fed			-	153	2918	19.1	4	26	7.1	1	9	7.6
Banana	rain fed	52	1430	27.5			-	63	1289	20.4	54.3	1140.2	21.0
Mangoes	rain fed	48	745	15.6			-	49	778	15.8	51.7	543.7	10.5
Avocado	rain fed			-			-	10	176	17.1			-
Oranges	rain fed			-			-	7	85	11.7	5.9	61.0	10.3
Tangerines	rain fed			-			-	1	10	9.1			-
Lemons	rain fed			-			-	1	11	8.0	1.0	10.7	10.5
Passion	rain fed			-			-	4	32	8.2	3.7	39.6	10.7
Pawpaw	rain fed			-			-	8	108	13.3			-
Pyrethrum	rain fed			-			-	1	0	0.2			-
Cotton	rain fed			-			-	29	16	0.6			-
Sisal	rain fed			-			-	40	24	0.6			-
Local Seed	rain fed			-			-			-	14	47	3.3
Coffee	rain fed			-	114	42	0.4	114	46	0.4	109.8	65.4	0.6
Tobacco	rain fed			-			-			-	14.8	22.5	1.5
Medicinal and Aromatics	rain fed			-	9	105	12.1	9	89	9.5			-
Grand Total		6,711.0	423,335.3	63.1	5,608.6	23,158.3	4.1	6,367.5	26,943.2	4.2	4,485.4	12,841.9	2.9

Source: State Department of Agriculture; Crops Directorate

4.4 The main actors in the agricultural sector

In the farming of cereals, large scale farmers and small-scale farmers dominate the scene with large scale farmers owning more than 50 acres of land and small-scale farmers owning below 50 acres of land. Cash crop farming features estates/institutions and small-scale farmers. Examples include multinationals in tea and coffee farming such as the tea farms of Kericho while sugarcane and tea farming is characterized by estates.

4.5 Agricultural policies

The government in response to recurrent food crises since independence has in the past attempted to tackle the crises through formulation of various policies. These policies have largely been targeted on three types of interventions, namely: increasing supply; stabilizing prices; and enhancing income related policy interventions. The implementation of these policies failed to produce the desired results, prompting the government to refocus the interventions. These policies are outlined below:

- **The Kenya Rural Development Strategy (KRDS) 2002-2017** was developed as a long-term framework with a broad range of strategies for the improvement of Kenya's rural areas over the preceding 15 years. The strategies emphasized food security as the initial step towards poverty alleviation/reduction and accelerate rural development.
- **The Economic Recovery Strategy (ERS)** for wealth and employment creation 2003 -2007, which majorly focused on achieving good governance, transparency and accountability and providing a lasting solution to hunger, poverty and unemployment.
- **The Agriculture Sector Development Strategy (2009- 2020)** was developed to align the sector initiatives to Vision 2030.
- **The 2011 National Food Security and Nutrition Policy (NFSNP)** aims at enhancing food and nutrition security, information management systems and coordination of the roles of various ministries and agencies to achieve food security.

These policy interventions are yet to attain food and nutritional security in Kenya. With this realization, the Government has prioritized food and nutrition security under the **"Big Four"** agenda.

The Big Four Agenda

It has pledged to ensure that all Kenyans are food secure by the year 2022 through **expansion of food production and supply, reduction of food prices to ensure affordability**, and through **support to value addition in the food processing value chain**. This is an ambitious achievable target considering that the population size will have increased to over 50 million, more than five times compared to the population at independence.

The Kenya Vision 2030

The Kenya Vision 2030 proposes a **three-tier fertilizer cost reduction strategy**. Local manufacturing and blending are identified as tiers in this strategy to be pursued to bring fertilizer prices to affordable levels. The government therefore encourages firms who would like to venture into local manufacturing or blending. MEA Ltd and ARM (now Omya) have expressed intentions of expanding their blending capacities and the government is encouraging these investment plans. The two have been informed that the fertilizers they produce locally will be promoted by the government if they are crop or soil specific. The recent identification of Toyota Tsusho Africa Ltd (a new blender) as a strategic partner in fertilizer manufacturing is another initiative that the government is undertaking to encourage local manufacture and blending.

Amendment of CAP 345

Act CAP 345 was reviewed in 2015 focusing on the creation of a fertilizer regulatory body to regulate manufacturing, importation, exportation, sales, utilization of fertilizers and fertilizer supplements, fertilizer quality management, capacity building and penalties).

5 THE FERTILIZER MARKET IN KENYA

5.1 Production, import, export, and apparent consumption

Most of the fertilizer used in Kenya is imported from various countries in Europe, United States of America, South Africa and North African countries. In 2016, fertilizer imported to the country was 659,288.19 MT by 96 companies but only 20 of these imported significant amounts.

In 2016, it was estimated that the apparent fertilizer consumption in the country was 602,908.19 MT comprising about 37 fertilizer types. Over 95 percent of these fertilizers was used for crop production, with about 5% used for fodder and pasture production.

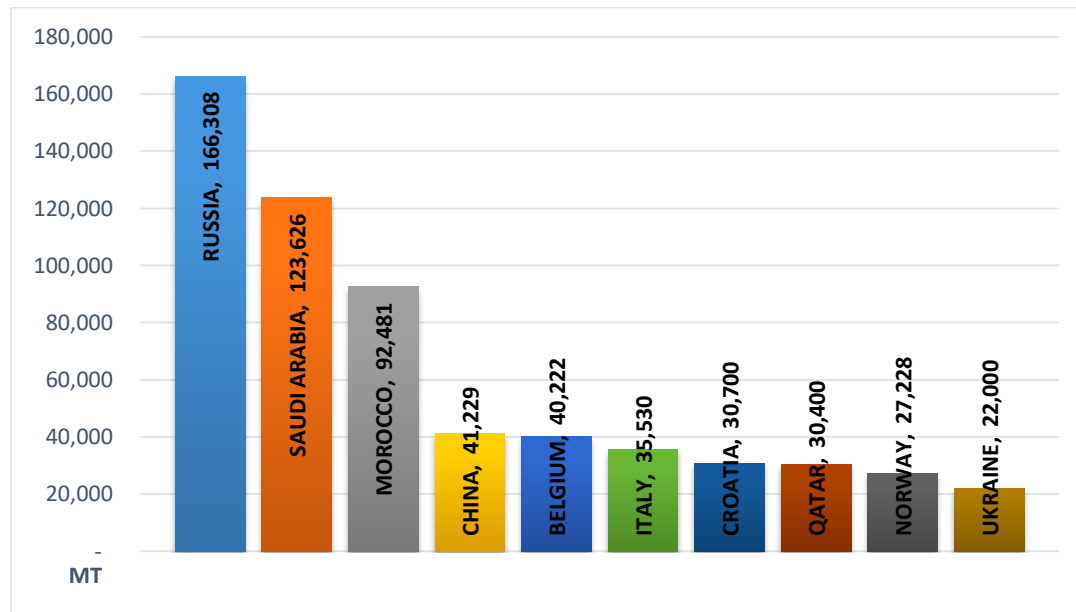


Figure 2: top 10 countries of origin

5.1.1 Fertilizer production

Only 2,500 MT of Single Super Phosphate (SSP) are manufactured in the country by KEL Chemicals Company based in Thika town. This company specializes in sulphuric acid production.

Local fertilizer blending in Kenya is done by MEA Limited, Athi River Mining (ARM) Company (NOW Omya), Toyota Tsusho Africa fertilizer limited, and Export trading Company Inputs Kenya limited. These companies have a capacity to blend up to 100,000, 30,000, 50,000 and 50,000 Metric tons of fertilizer per year respectively. The blends from these companies are either soil or crop specific. For example, blends from ARM, popularly known as Mavuno fertilizers, contain eleven (11) elements including trace elements. The feedstock for fertilizer blending is imported while other materials are found locally. The imported materials include Diammonium Phosphate (DAP), Murate of Potash (MOP), Urea as well as trace elements such as Zinc, Manganese, Copper, Boron and Molybdenum. The locally available materials used in blending include Gypsum and limestone. In order to enhance quality of blended fertilizers, the Kenya Bureau of Standards (KEBS) has developed a code of conduct for fertilizer blenders that should be followed strictly by all blenders.

5.1.2 Imports and exports

The Kenya fertilizer market is estimated to be approximately 550,000mt annually. Import volumes vary from year to year, as shown in the table below and this is attributed to the annual review of the national fertilizer subsidy program, accounting for 30% of the total market.

Figure 3: top fertilizer imports per year (2013-2016)

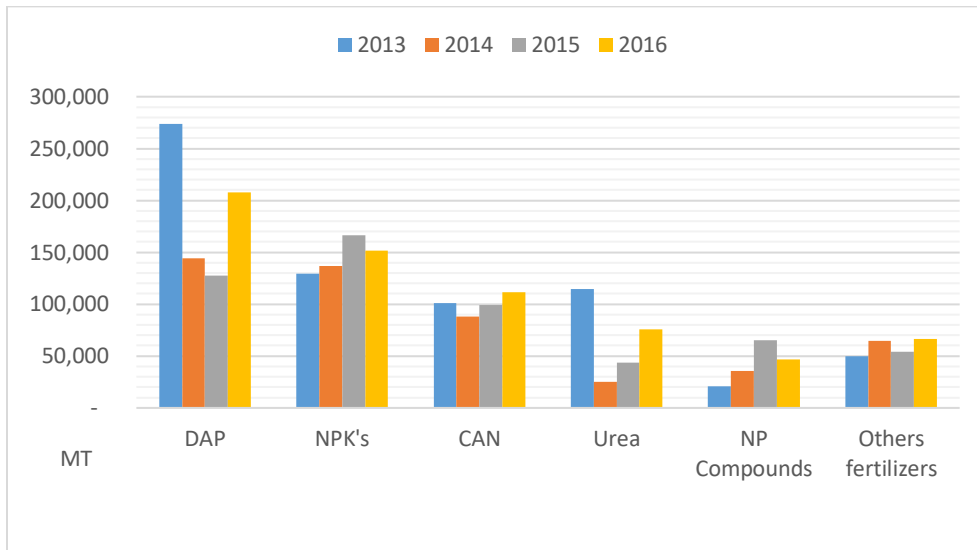
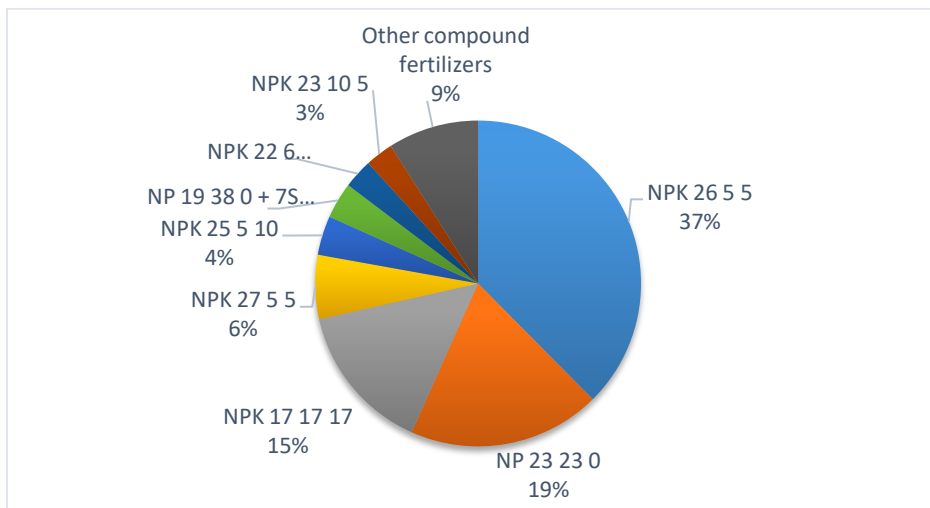
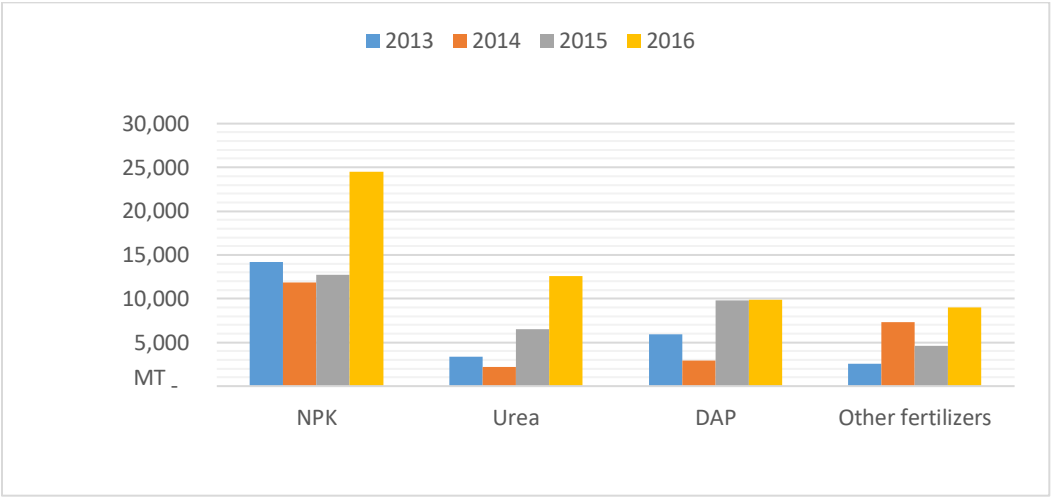


Figure 4: distribution of NPK'S per grade in 2016



The Mombasa port is a gateway for Uganda and Rwanda markets. Kenya exports approximately 45,000mt, of fertilizers annually to the neighboring countries to supplement the direct imports to these countries.

Figure 5: top fertilizer exports per year (2013-2016)



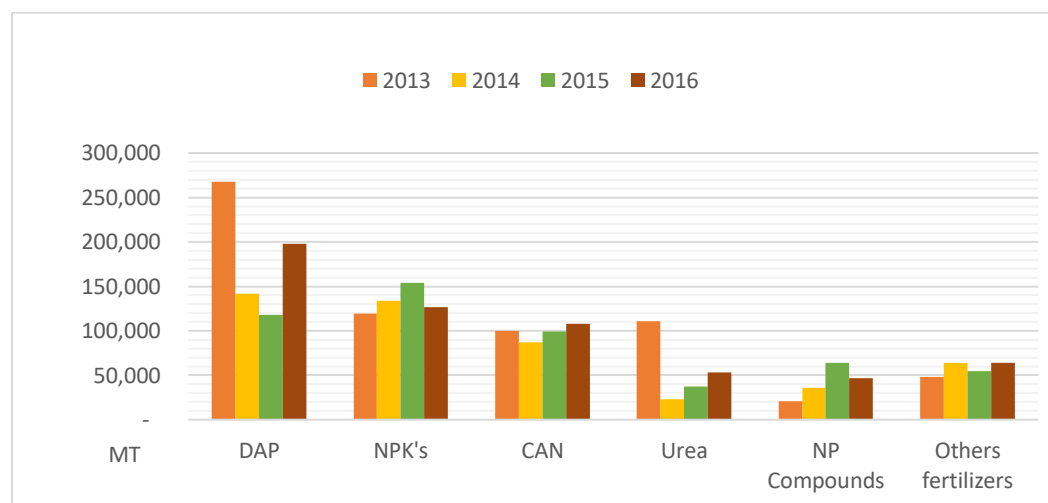
5.2 Evolution of apparent consumption

Apparent consumption is derived from available fertilizer trade data and the country fertilizer production figures. It is assumed that all the fertilizer imported to the country together with the quantity produced in the country is used for crop production in during the year in question. Apparent consumption in a year is given as follows:

Table 4: Fertilizer apparent consumption from 2013-2016

HS Code	Fertilizer Name	2013	2014	2015	2016
3105300000	DAP	267,988	141,553	117,859	198,105
3105200000	NPK's	119,283	133,878	153,640	126,821
3102400000	CAN	99,898	87,021	98,940	108,118
3102100000	Urea	110,838	22,941	37,105	53,297
3105510000	NP Compounds	20,829	35,587	64,218	46,541
	Others fertilizers	48,146	64,029	54,560	64,142
Total (mt)		666,981	485,008	526,322	597,024

Figure 6: fertilizer apparent consumption per year



5.3 Structure and size of the national market

5.3.1 The main distribution channels

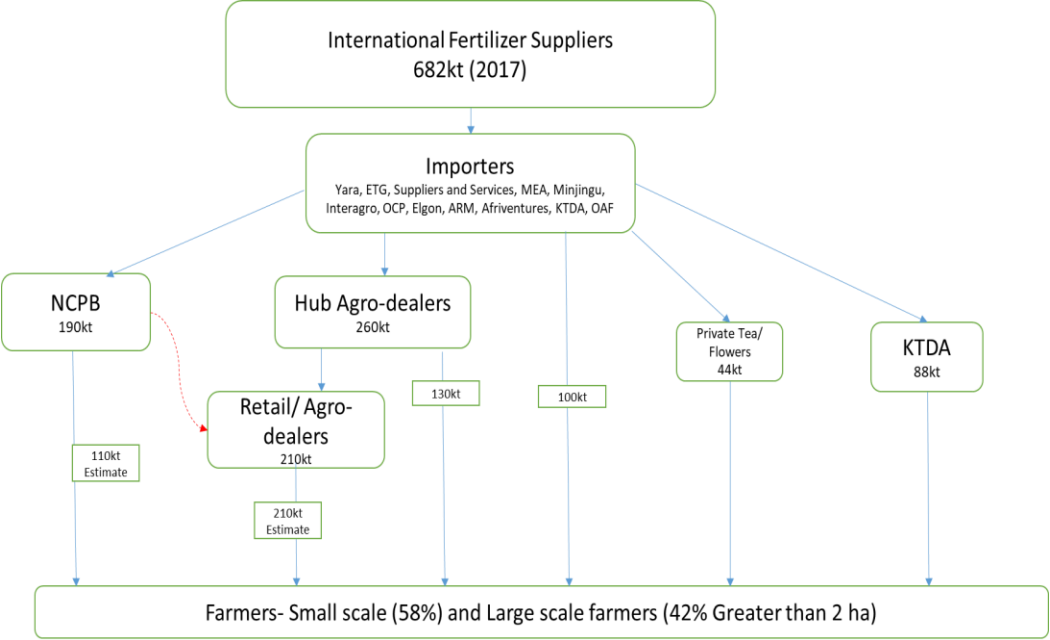
There are three main types of fertilizer distribution channels serving the farming community in Kenya. The first is the commodity-based interlinked input-credit-output marketing systems typified by the Kenya Tea Development Agency (KTDA) fertilizer distribution model. In this system, farmers, especially smallholders, are given credit in form of physical farm inputs purchased in bulk by supporting agency that also distributes the fertilizer to supported farmers. The other fertilizer distribution system involves network of private, independent importers, wholesalers, and retailers operating on a demand and supply basis. Distributors in this system are estimated to be 8,000 agro-dealers working with about 3,000 wholesalers and retailers. The third distribution category involves Government procurement of fertilizer, distribution, and sale of fertilizer to targeted needy farmers at subsidized prices under the fertilizer price stabilization plan. Under this arrangement, governments distribute fertilizers to farmers through NCPB which has 180 NCPB depots countrywide. **Error! Reference source not found.** details the quantities of fertilizer procured and supplied to farmers under the fertilizer subsidy programme while **Error! Reference source not found.** gives a summary of fertilizer imports and distribution channels in Kenya.

Table 5: Quantities of Fertilizer Procured by Government of Kenya

Period	Financial Year	Quantity of fertilizer procured in Mt	Cost Kshs. (Billions)	Number of Beneficiaries
Pre 2013	2008/2009	129,745.60	2.992	432,485
	2009/2010	16,623.70	0.758	55,412
	2010/2011	96,000.00	2.995	320,000
	2011/2012	94,154.50	3.323	313,848
	2012/2013	66,275.70	3.146	220,919
		402,799.50	13.214	1,342,664
Post 2013	2013/2014	171,750.00	3.9	572,500
	2014/2015	205,955.00	4	467,783
	2015/2016	147,926.00	3.6	507,000
	2016/17	177,600.00	4.9	770,000
	TOTAL		703,231.00	16.4
GRAND TOTAL		1,106,030.50	29.61	3,659,947

Source: State Department of Agriculture; Agribusiness Directorate

Figure 7: Fertilizer value chain for Kenya



5.3.2 The key players in the fertilizer market

Major Fertilizer importers

In 2016, there were about 98 importers of fertilizers to Kenya but the most active were 19. The 19 importers supply fertilizer to both the large scale and small-scale farmers. Most of the imported fertilizer (70%) arrives as bulk cargo (not bagged), the greatest challenge is therefore in adulteration and sale of underweight fertilizer which mainly occurs during bagging and re-bagging. Some 20 – 25% of fertilizer that leaves the port is re-bagged mainly at the retailer level due to the high demand of fertilizer in smaller units. **Error! Reference source not found.** shows list of main fertilizer importing companies in 2016.

Table 6: Main fertilizer importing companies in Kenya in year 2016

	COMPANY	TOTAL (MT)	MARKET SHARE
1.	Yara East Africa Limited	118,943.59	18.0
2.	National Cereals & Produce Board/GoK	110,280.00	16.7
3.	Export Trading Company Limited	88,439.32	13.4
4.	Kenya Tea Development Agency Holdings Limited	74,581.35	11.3
5.	Mea Limited	57,116.81	8.7
6.	Elgon Kenya Limited	44,639.55	6.8
7.	Supplies Services Ltd	32,052.73	4.9
8.	OCP Kenya	27,305.00	4.1
9.	Devji Meghji & Bros Ltd (now Interagro)	25,332.10	3.8
10.	Interagro (K) Ltd	16,884.50	2.6
11.	Arm Cement Limited	13,498.50	2.0
12.	One Acre Fund	9,132.57	1.4
13.	Afri Ventures (K) Limited	8,232.00	1.2
14.	Hydery (P) Limited	6,200.00	0.9
15.	Minjingu Mines And Fertilizer Ltd	5,398.00	0.8
16.	Amiran Kenya Limited	4,732.08	0.7
17.	Toyota Tsusho East Africa Limited	1,845.34	0.3
18.	Polyserve East Africa Limited	1,600.00	0.2
19.	British American Tobacco Kenya Ltd	1,470.00	0.2
20.	Others	11,584.75	1.9
	Grand Total	659,268.19	100

Source: KRA

Wholesale and Retailers

There are about 8000 agro-dealers (farm inputs stockists) in major cities, towns and market centers that sell fertilizer on wholesale and retail basis. The stockists keep up to 500 bags of various types of fertilizers, with large volumes stored mainly during the planting seasons. These types of traders play a very crucial role in the fertilizer value chain by ensuring that fertilizers are accessible to the farmers. Some stockists have been trained by various projects on fertilizer storage and management, as well as farmers' education on fertilizer use (Okello *et al*, 2010^{vi}).

Other important stakeholders in the fertilizer industry

To ensure fertilizer quality, fertilizer analysis is undertaken largely by government institutions and to a smaller extent, private laboratories. Those in the public category include:

- National Agricultural Research Laboratories (NARL) at Kabete, Nairobi
- Kenya Plant Health Inspectorate Services (KEPHIS) laboratory at Nairobi
- Mines and Geological Department laboratory
- Kenya Bureau of Standards Analytical Laboratory
- The Government Chemist

The private laboratories include:

- SGS LABS (K), Nairobi
- GMP/ACCL LABS, Nairobi
- INTERTEK, Nairobi
- Crop Nutrition Laboratory Services Ltd, Nairobi
- Polucon Services (K) Ltd, Laboratory Department, Mombasa
- MEA Ltd Nakuru

5.4 Fertilizer sector value chain environment

5.4.1 Research & Extension

Kenya Agricultural & Livestock Research Organization (KALRO) is the national institution bringing together research programs in food crops, horticultural and industrial crops, and livestock. KALRO was established in 2013. It merged with the Kenya Research Institute (KARI), Coffee Research Foundation, Tea Research Foundation and the Kenya Sugar Research Foundation and has oversight of 18 research institutes.

The extension services in Kenya are provided through 3 different models or a mixture of them:

- Model 1- Offers free public extension services, mostly to smallholder farmers engaged in staple foods and minor cash crops across all the agro-ecological zones;
- Model 2- Partial cost shared provision of extension services, mostly within the public sector where limited commercialization has taken place.
- Model 3- Fully commercialized and mostly involving the private (e.g., private companies and Cooperatives) and quasi-public organizations, mainly on specific commodities such as tea.

5.4.2 Regulation of fertilizers

Fertilizer policy in Kenya

In an effort to boost food security status, Kenya targets to increase fertilizer consumption to 50kg/ha from the current 31kg/ha by the year 2015. This is envisaged to increase production and crop productivity to ensure food security and income at farm level for the small scale farmers (who make over 80% of the farming community in the country). The increased use of fertilizers is a key factor and this is in line with the Abuja Declaration of 2006 which acknowledges that; *'Fertilizer is crucial for achieving an African Green Revolution in the face of a rapidly rising population and declining soil fertility'*.

Kenya has developed a draft fertilizer policy which is at advanced stage of conclusion. The draft policy sets guidelines for institutionalization of soil fertility management in agriculture and related sectors to arrest the declining trend in soil fertility and ensure increased land productivity. The specific objectives of the policy include promotion of efficient and sustainable use of natural resources (soil and water), provision of framework for developing and applying appropriate soil fertility management techniques, and facilitation of prioritization of soil fertility improvement in national programs.

The Draft policy proposes a fertilizer regulatory directorate to be based at the Ministry of Agriculture and Irrigation headquarters. Moreover, institutions such as Kenya Agricultural Research Organization (KALRO), Kenya Plants Health Inspectorate Services (KEPHIS), and Government Chemist, commissioner of Mines, Ministry of Trade and Kenya Bureau of Standards (KEBS) will be closely involved in fertilizer matters.

Kenya is also involved in the drafting of the East African Community (EAC) Fertilizer Policy which will eventually lead to the EAC Fertilizer Act and Regulations. The team working on drafting of the EAC Fertilizer Policy has come up with priority areas which need regional harmonization and approval by top leadership. The proposed areas of policy harmonization address the inefficiencies in fertilizer access, price setting, marketing and regulations. The main themes are:

- a) Taxation: Ensuring that agricultural inputs are tax free, harmonizing other taxes such as Withholding Tax (WHT) and Value Added Tax (VAT) in all the Partner States.
- b) Targeted subsidies to support to Resource Poor Farmers: EAC Partner States have agreed to put in place the following mechanisms to address the challenges associated with subsidies:
 - i. Each Partner State to design a harmonized food insecure household inputs support facility.
 - ii. Each State to develop a harmonized tool for identifying food insecure households to benefit from the scheme.
- c) To ensure accessibility to the inputs, the support system must be farmer centered
- d) Privatization / Liberalization: All Partner States to embrace full liberalization to support private sector participation.
- e) Importation and infrastructure: To minimize fertilizer prices, there is need for policies in the EAC to facilitate the importation and storage of large quantities of fertilizers. There should also be appropriate financing mechanisms available for the establishment of fertilizer storage facilities especially in member states where these are lacking. These facilities have the advantage of reducing retail prices for the smallholder farmers.
- f) Policies to improve and increase fertilizer use: In particular, smallholder farmers should have credit access to purchase agricultural inputs and crop insurance to protect their investments in the event of crop failure.
- g) Registration of fertilizers, importers, and distributors: In order to reduce trade and access related barriers, procedures for registration of fertilizers, importers and distributors need to be harmonized. This would make it possible for a fertilizer entity that has been registered in one partner State to be exempted from the same registration procedures in the rest of the Partner States.
- h) Institutional structure, mandate, and roles: Need for Partner State to establish Fertilizer Management Authority to facilitate coordination, regulations, fair play and fertilizer quality controls.
- i) Acts/Laws: Need to harmonize all legal instruments related to fertilizer marketing, distribution, storage, pricing, etc.
- j) Fertilizer standards: Fertilizer grades, mark labelling, fertilizer classification, packaging, fertilizer contents (Formulation) i.e., ratios, fertilizer quality including moisture content, heavy metal; handling and storage.
- k) Procedures: Fertilize sampling and testing, importation and exportation, manufacture, registration of new fertilizers.

6 FERTILIZATION AND FERTILIZER USE IN MAJOR CROPS

Kenya farmers use a wide variety of inorganic fertilizers for production of different crops. The fertilizers used in large volumes are those applied to food crops, horticulture and industrial crops. **Error! Reference source not found.** shows the top ten most important fertilizers used in Kenya as well as the group of crops on which the fertilizers are applied.

Table 7: Top ten most utilized fertilizers in Kenya

Fertilizer type	Estimated apparent consumption in MT	Main crops fertilizer used on
Di-Ammonium phosphate (DAP)	198,105	Cereals, horticulture
Calcium ammonium nitrate	108,118	Cereals, horticulture, coffee
NPK 26 5 5	74,581	Tea
Urea	53,297	Cereals, sugarcane
NP 23 23 0	37,945	Cereals, horticulture
NPK 17 17 17	28,978	Cereals Coffee and fruits
Calcium nitrate	23,338	Flowers and vegetables
Ammonium Sulphate	15,178	Rice
NPK 25 5 5	14,887	Tea
Potassium chloride (Muriate of potash)	4,756	Fruits and sugarcane
TOTAL	559,183	

Source: Validated 2016 fertilizer trade data

6.1 For each key crop

Study results indicate that in Kenya, fertilizer use by crops varies depending on value of crop, soil types, reliability of rainfall and farmers' agronomic practices (see details in **Error! Reference source not found.**). For most crops, fertilizer is applied in two c

ommon regimes: planting fertilizer applied during crop sowing and top-dressing fertilizer applied later during plants' vegetative growth. While this split application of fertilizer is recommended to enhance crop's nutrients uptakes, farmers do not necessarily apply same volumes of planting and top-dressing fertilizer on one crop. Results of this study show that overall; farmers tend to use more volumes of planting fertilizers compared to top-dressing fertilizers.

Table 8: Factors influencing fertilizer use by crop

Factor	Details
Crop value	Crops with good economic returns and ready market
Soil type	Whether soil is acidic or alkaline
Rainfall reliability	Farming risks associated with rainfall in a rain-fed agriculture system; farmers willing to invest more in fertilizer when rainfall is reliable
Farmers' agronomic practices	Farmers who have adopted fertilizer application tend to use more fertilizer
Availability of fertilizer	Ease of access, e.g. through subsidy, affects utilization

The main crops that utilize fertilizer in Kenya are listed in **Error! Reference source not found.**. The crops range from cereals to pulses, root crops, horticultural crops (vegetables, fruits, flowers), nuts and oil crops, and industrial crops (tea, Coffee, Sugar cane) and seeds. Not all the crops grown in Kenya are shown in the table, as it only reflects the crops that use fertilizers within measurable levels. Collectively, it is estimated that the total quantities of fertilizer used by crops increased from 512,363mt in 2014 to 533,276mt in 2015. In 2016 however, the total volumes of fertilizer used by crops is estimated at 528,425mt. The marginal decline in total volumes of used fertilizer is attributed to poor weather conditions that affected several parts of Kenya in 2016. Of the crops listed, maize uses the largest amount of fertilizers followed by tea, sugar cane, wheat, beans and flowers respectively.

Table 9: Total quantity of fertilizer used by Crop in 2014-2016

CROP	2014	2015	2016
Maize	220,699.28	242,175.82	259,361.43
Wheat	26,666.14	26,723.55	25,481.41
Barley	3,664.25	3,664.25	3,563.24
Beans	15,402.39	8,969.45	17,457.44
Rice	5,161.73	4,620.15	3,809.57
Sorghum	6,871.08	5,310.52	6,737.22
Millet	6,291.25	1,037.75	696.14
Cowpeas	3,284.15	2,146.41	2,445.94
Irish potato	5,118.64	5,808.25	24,979.47
Tomato	3,875.43	3,394.08	3,879.67
French beans	630.74	1,081.11	1,149.49
Snow peas	449.11	327.37	339.44
Sugar Snaps	473.25	473.25	473.25
Garden peas	743.19	743.19	2,665.52
spinach	1,361.88	552.26	606.27
Cabbage	1,648.98	4,006.92	4,121.39
Kales	938.81	2,059.56	2,162.19
Carrots	283.64	238.15	420.91
Bulb Onions	307.35	313.24	368.54
Banana	66.85	248.10	220.24
Mango	20.15	469.31	518.79
Purple passion	1,054.73	421.72	6,185.24
Oranges	28.54	487.03	148.55
Lemons	3.10	9.46	9.97
Grape fruit	0.72	0.72	0.72
Lime	44.36	44.36	44.36
Tree tomato	39.22	68.23	83.35
Pineapples	674.25	326.09	342.97
Melons	394.32	601.94	424.86
Flowers	20,861.28	20,861.28	20,861.28
Coffee	1,637.59	24,236.56	24,368.52
Sugarcane	22,162.51	20,124.45	42,100.01
Tobacco	2,053.40	2,053.40	2,053.40
Tea	98,983.94	109,517.84	115,086.60
TOTAL FERTILIZER USED	448,792.22	493,115.80	573,167.38

6.2 Fertilization: Recommended Rates and Farmer Practices

Study results from extension officers and other stakeholders showed that in Kenya, fertilizer application rates is highly influenced by farmers' level of education, levels of crop profitability, historical practices (such as introduction of fertilizer use in the region by colonial governments), soil types and farmers' adoption of modern farming practices. According to Tegemeo Institute (2009), fertilizer dosage rates are widely affected by Agro-regional positioning of the farmers. Shows average farm households' fertilizer dosage or fertilizer application rate established per Agro-Regional Zones through panel study of sampled farmers by Tegemeo Institute.

Table 10: Tegemeo Panel Study Fertilizer application rates (Kgs/acre)

Year	1997	2000	2004	2007
Marginal Rain Shadow	26.1	31.7	33.4	28.6
Central Highlands	105.9	121.4	103.2	96.1
Western Highlands	30.4	44.5	51.1	46.7
High Potential Maize zone	63.4	62.8	66.9	70.9
Western Transitional	37.4	69.8	51.6	54.4
Western Lowlands	59.3	42.5	9.8	18.7
Eastern Lowlands	27.5	13.8	11	16.5
Coastal Lowlands	18.1	2.3	4.5	5.6
Overall Sample	64.8	72.1	64.8	63.2

Source: Tegemeo (2009)^{vii}

The fertilizer use recommendations were last developed in the 1980's under the Fertilizer Use Recommendation Project (FURP). Since then, occasional recommendations are provided through the Kenya Agricultural and Livestock Research Organization (KALRO). A follow up verification exercise was done under the Fertilizer Extension Project (FEP) in early 1990's. More recently in 2014 through the NAAIAP project, recommendations were made for maize and other food crops such as potatoes, beans, and peas in 164 sub counties.

Within the Ministry of Agriculture, field extension officers follow Field Extension manual that indicates recommended rates of fertilizer for various crops in Kenya. The fertilizer rates **Error! Reference source not found.** shows recommended application rates of most fertilizers by crops based on the Field Extension Handbook published in 2012.

Table 11: Kenya Recommended Fertilizer Application Rates

CROP TYPES	Planting Recommended Rates Kgs/Ha	Top Dressing Recommended Rates Kgs/Ha	Others Recommended Rates Kgs/Ha
BARLEY- Normal	DAP- 90	CAN- 300	
		ASN- 90	
BARLEY- Malting	DAP- 90	CAN- 180	
	MAP: 100	ASN- 90	
MAIZE	DAP: 150-200	CAN: 250	
	TSP: 150	UREA: 150	
	Mavuno: 150		
	NPK: 23:23:0- 200		
WHEAT	New land (virgin)	NPK 11:52:0 -130	
	2 nd year crop	D.A.P 130	
	3 rd year crop	D.A.P 109	
	4 th year crop	D.A.P 87	
	Over 4 years	NPK 20:20:0 200	
RICE	DAP: 100	SA: 180	Nursery: DAP: 160
	NPK 17:17:17 -100	CAN: 100	
	NPK 23:23:0 100		
MILLET	DAP: 120	CAN: 125	
	MAP: 180		
SORGHUM	DAP: 120	CAN: 100	
	MAP: 180		
	NPK 23:23:0 100		
BEANS	DAP: 200		
	NPK 23:23:0: 200		
	NPK 17:17:17: 200		
COW PEAS	DSP: 100	CAN: 150	
	TSP: 80	UREA: 100	
	NPK 20:20:20: 150		
IRISH POTATO	DAP: 500		
BEET ROOT	DAP: 300		
BRINJALS /EGG	NPK 23:23:0: 120		
BROCCOLI	DAP: 500		
CABBAGE	DAP: 250	CAN: 250	
CARROTS	DAP: 200	CAN: 200	
	DSP: 220		
CUCUMBER	DSP: 200		
FRENCH BEANS	DAP: 200	CAN: 100	
GARDEN PEAS	TSP: 200	CAN: 150	
KALES	DSP: 500	CAN: 200	
	TSP: 250		
LEEKs	DAP: 250	CAN: 125	
LETTUCE	TSP: 200	CAN: 125	
	DSP: 400		
ONIONS	DSP: 400	CAN: 300	
	TSP: 200		
	DAP: 150		
SNOW PEAS	DAP: 250	CAN: 200	
TOMATO	DSP: 200		
	TSP: 100		
	DAP: 100		

AVOCADO	Age of tree	CAN (g/tree)	TSP(g/tree)	
	1-3yrs	120	120	
	4-5yrs	220	450	
	6-7yrs	450	650	
	Over 8yrs	650	650	
BANANA	DAP: 200	CAN: 300 NPK 23:23:0: 150		
CITRUS	Age of tree	CAN (g/tree)	TSP(g/tree)	
	1-3yrs	200	300	
	4-5yrs	400	450	
	Over 6-7yrs	600	750	
MANGO				
PASSION FRUITS	TSP: 200 DAP: 200	CAN: 300		
PINEAPPLES	DAP: 500 UREA: 200 NPK: 23: 23: 0- 250 SA: 200			
MELON	TSP: 200	CAN: 250 DAP: 200		
COFFEE (Coffee Research Foundation)				
Recommended types of nitrogen fertilizers based on soil reaction				
Soil Reaction	Acid Soil	Moderately Acid soil	Mildly Acid Soil	
PH	Under 4.4	4.4 – 5.4	Over 5.4	
Form of Nitrogen Fertilizer	For each three applications use CAN twice, ASN or Urea* once	Alternate between Calcium Ammonium Nitrate (CAN) and Ammonium Sulphate Nitrates (ASN) or Urea	Use Ammonium Sulphate (AS) or Ammonium Sulphate Nitrate (ASN)	
Note: for Urea (46% N) multiply rate by 0.55.				
Amount of crop estimated in the current season	Kg Nitrogen/ha per year	gm per tree		
		21% N	26% N	21% N
Less than 1000 kg clean coffee per hectare (5 kg of cherry per tree)	80	330	260	390
1000 - 1500kg clean coffee per hectare (5 – 7 kg of cherry/tree)	100	358	290	476
1500 – 2000 kg clean coffee per hectare (7 – 10 kg) of cherry/tree	100 – 150	358 to 538	290 to 434	476 to 715
Over 2000kg clean coffee per hectare (Over 10 kg of cherry /tree)	Up to 200	716	578	952
Recommended types of application for Phosphate fertilizers				
Soil reaction	Acid soil	Moderate acid soil	Mildly acid soil	
PH	under 4.4	4.4 – 5.4	over 5.4	
Types of Phosphate fertilizers	Single or Triple Super phosphate	SSP TSP	DAP	
Recommended rate of application for Phosphate fertilizers				
Types	Quantity (g/tree)			
SSP	350	350	-	
TSP	150	150	-	

DAP	-	-	150
Phosphoric acid *	40ml in 20l water (30 trees)	40ml in 20l water (30 trees)	40 ml in 20l water
(3 – 4 sprays per year)			
TEA (Tea Research Foundation)			
Fertilizer: Use compound fertilizers (NPK 26:5:5 or 20:10:10)			

Source: MOALF Extension Handbook (2012)^{viii}

6.3 Maize

6.3.1 Sector and Main Actors

Maize is the staple food in Kenya. Both large and small-scale farmers produce the crop and a large percentage of the population depends on maize farming as an income-generating crop. Since maize is adaptable to a whole range of climate conditions, it is the single most extensively grown crop in Kenya. It is mainly sold to the National Cereals and Produce Board (NCPB).

6.3.2 Planted Areas, production and yields

Year	Planted Area (ha)	(x1000)	Production (tons)	(x1000)	Average (Tons/ha)	Yield
2014	2,116		3,513		1.7	
2015	2,321		3,973		1.7	
2016	2,321		3,339		1.4	
2017	2,338		3		0.0	

6.3.3 Fertilization: Recommended Rates and Farmer Practices

Recommended Application Rates Kgs/Ha		
Crop	Planting	Top Dressing
Maize	DAP: 150-200	CAN: 250
	TSP: 150	UREA: 150
	Mavuno: 150	
	NPK: 23:23:0- 200	

6.3.4 Fertilizer Supply Chain

Both Small scale and large-scale farmers buy from either retailers or wholesalers on cash basis. The government also supplies subsidized fertilizer that is available at the National Cereals and Produce Board (NCPB). The peak fertilizer demand period for maize is from March to May during the main planting season.

6.3.5 Fertilizer Consumption

Fertilizer Product	Volumes of Fertilizer Applied(tons)				
	2013	2014	2015	2016	2017
DAP	145326	84910	81141	113987	163589
Mavuno- P	9083	32692	25464	10115	12924
NPK 23:23:0	16770	15099	42440	31253	19573
CAN	79576	71636	70561	73985	94422
Urea	15780	14181	20313	27355	17546
Mavuno-TD	2428	2182	2257	2667	
Yara Mila 23:10:5	1141				

6.3.6 Comments on the quality of the data

The data has been compiled by field extension officers who are located in Wards. There are between 8-20 Wards in a County. This data was aggregated and extrapolated to a sub-county level by sub-county Agricultural Officers and then to county level by the County Crop Officers and County Agribusiness Officers.

6.4 Tea

6.4.1 The Sector and its main actors

Tea is the leading foreign exchange earner in agriculture sector. The tea industry is divided between small farms and large estates. The parastatal Kenya Tea Development Authority (KTDA) controls the small-scale sector. The estates, consisting of 60–75 private

companies, operate on their own. KTDA was established in 2000 and is owned by 54 tea companies with more than 500,000 small-scale tea farmers as individual shareholders. The tea companies collectively manage 63 tea-processing factories.

6.4.2 *Planted areas, production and yields*

Year	Planted (x1000 ha)	Area	Production (x1000 tons)	Yield (Tons/ha)
2015	208		399	1.9
2016	219		473	2.2
2017	188		378	2.0

6.4.3 *Fertilizer recommended rates and Farmer Practices*

Crop	Fertilizer Recommendation
Tea	Use compound fertilizers (NPK 26:5:5 or 20:10:10)

Source: Tea Research Foundation

6.4.4 Fertilizer Supply chain

KTDA imports fertilizer directly from the international market, annually. Fertilizer is distributed to the small scale tea farmers through an out-grower credit system.

6.4.5 Fertilizer consumption

Fertilizer Product	Volumes of Fertilizer Applied(tons)				
	2013	2014	2015	2016	2017
CAN					6998
Ammonium Sulphate					179
Urea					32298
NPK 26:5:5	64516	69289	76662	80561	69289
NPK 25:5:5	23365	29695	32855	34526	29695

6.4.6 Comments on quality of the data

The data was compiled by consultants working with the Ministry of Agriculture.

6.5 Wheat

6.5.1 Sector and its main actors

In Kenya, it is the second most important cereal grain crop after maize and is grown in areas like Narok, Kitale, Nakuru, Trans-Nzoia, Uasin Gishu, some parts of Laikipia, among others. The major variety of wheat grown in Kenya is the Durum. However, there are a number of other wheat varieties. These include Robin, KS- Chui, Kenya eagle and Kenya kingbird.

6.5.2 Planted Areas, production and yields

Year	Planted (x1000 ha)	Area	Production (x1000 tons)	Average (Tons/ha)	Yield
2014	147		328	2.2	
2015	145		440	3	
2016	145		439	3.3	
2017	146		33	0.22	

6.5.3 Fertilization: Recommended Rates and Farmer Practices

Recommended Application Rates Kgs/Ha		
Crop	Planting Recommended Rates Kgs/ha	Top Dressing Recommended Rates Kgs/Ha
Wheat	New land(virgin)	NPK 11:52:0-130
	2 nd Year crop	Dap 130
	3 rd year crop	DAP 109
	4 th year crop	DAP 87
	Over 4 years	NPK 20:20:0 200

6.5.4 Fertilizer consumption

Fertilizer Product	Volumes of fertilizer applied (ton)		
	2015	2016	2017
CAN	13,080	13,804	13,328
MAP	1,316	1,391	1,337
DAP	12,739	13,430	12,419

From the table, there has been a slight increase of fertilizer consumption from 2015 which recorded the least in the period.

6.6 Sugarcane

6.6.1 Sector and its main actors

More than five million people directly or indirectly depend on sugarcane farming in Kenya. Most farming is in western Kenya. Previously some sugarcane was grown in parts of Coast Province. Sugarcane is a coarse perennial grass of the tropical world.

6.6.2 Planted Areas, production, and yields

Year	Planted Area (x1000 ha)	Production (x1000 tons)	Average Yield (Tons/ha)
2014	211	6,478	30.7
2015	78	7,165	92.1
2016	85	7,142	84.1
2017	84.4	5,822.6	69.0

6.6.3 Fertilization and recommended rates

Recommended Application Rates Bags/Ha			
Crop	Planting Rates bags/ha	Recommended Rates bags/ha	Top Dressing Recommended Rates bags /Ha
Sugarcane	DAP 2-3.5		Urea 4-5
	SSP 6-9		CAN 8-9

6.6.4 Supply chain

The individual sugar factories are in charge of marketing their produce. This is done through the various wholesale outlets throughout the country. In most cases the sugar production has failed to meet the local needs hence leaving no surplus for export.

6.6.5 Fertilizer consumption

Fertilizer Product	Volumes of fertilizer applied (ton)				
	2013	2014	2015	2016	2017
DAP	8,081	1,797	1,342	11,953	
MOP	718	359	2,683	531	
NPK 23:23:0	180	179	1,342	11,953	
NPK 17:17:17	90	90	1,342	133	
Urea	16,162	16,149	12,075	23,095	
CAN	1,751	3,499	1,073	5,179	
Ammonium Sulphate	90	90	268	133	
Specialties	1,033				

6.7 Irish potato

6.7.1 Sector and its main actors

The National Potato Council of Kenya (NPCK) is a Public Private Partnership (PPP) and a multi-stakeholder organization whose responsibility is to help plan, organize and co-ordinate potato value chain activities with the aim of developing the subsector into a robust, competitive, and self-regulating industry. The Potato Council organizational structure enables it to draw synergies from a wide membership, representing all stakeholders and actors in the potato industry. NPCK members include: Farmers, Researchers (National and international), Public institutions, Extension providers, seed producers, Traders, Processors, Regulatory agencies, Financial service providers, input providers, Ministry of Agriculture for National and County governments, Development partners and other actors and players.

6.7.2 Planted area, production and yield

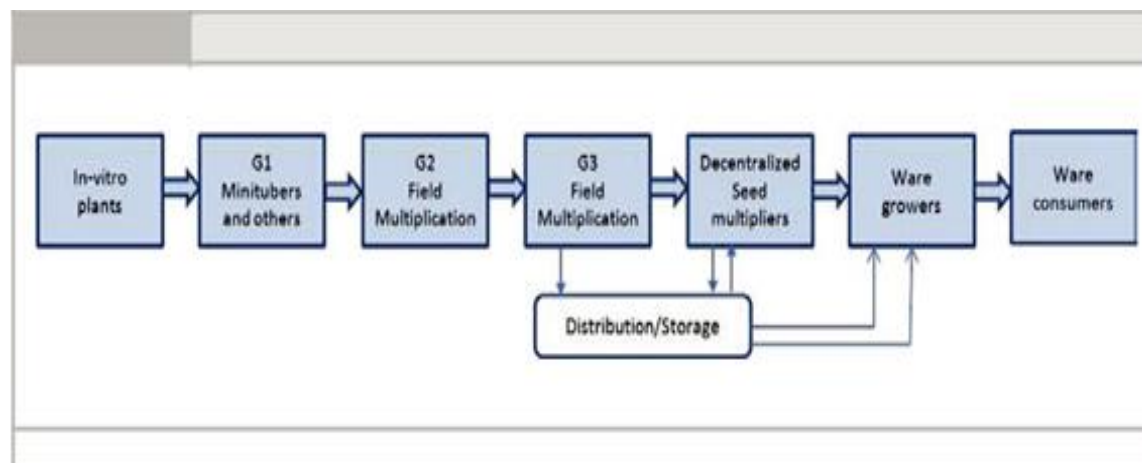
Year	Planted Area (x1000 ha)	Production (x1000 tons)	Average Yield (Tons/ha)
2014	135	1,576	11.7
2015	167	2,073	12.4
2016	766	3,299	4.3
2017	192.3	1,519.9	7.9

6.7.3 Recommended rates and farmer practices

Crop	Planting Recommended Rates Kgs/ha
Irish potato	DAP 500

6.7.4 Supply chain

The seed potato sector in Kenya is very small. In the value chain for quality seed potato different actors produce seed potatoes of different generations, starting with pathogen-free seed from laboratories or imported high quality certified seed (pre -basic) and ending with ware producers.



6.7.5 Fertilizer consumption

Fertilizer Product	Volumes of fertilizer applied (ton)				
	2013	2014	2015	2016	2017
DAP	12,995	5,119	5,808	29,979	19,694

6.8 Flowers

6.8.1 Sector and main actors

Flower Farming in Kenya – Kenya is the largest supplier of cut flowers to the European Union. In Africa, it is one of the most prominent fresh flower exporting countries. Flower farming in Kenya is the most developed sector and accounts for about 40 per cent of all horticultural exports. It is dominant around Lake Naivasha and in Kinangop, Nakuru, Limuru, Athi River, Thika, Kiambu and Eldoret.

6.8.2 Planted area, Production and Yield

Year	Planted Area (x1000 ha)	Production (x1000 tons)	Average Yield (Tons/ha)
2015	5	194	37.5
2016	8	261	31.6
2017	12	102	8.6

6.8.3 Supply chain

Kenya Flower Council (KFC) is a voluntary association of independent growers and exporters of cut-flowers and ornamentals, formed in 1996, with the aim of fostering responsible and safe production of cut flowers in Kenya with due consideration of workers welfare and protection of the environment.

Against this background the KFC has become a common platform for industry representation, promotion, and compliance to pertinent local and international standards, deemed necessary to secure markets

Kenya is the lead exporter of rose cut flowers to the European Union (EU) with a market share of 38%. Approximately 50% of exported flowers are sold through the Dutch Auctions, although direct sales are growing. In the United Kingdom, supermarkets are the main outlets. Over 25% of exported flowers are delivered directly to these multiples, providing an opportunity for value addition at source through sleeving, labelling and bouquet production. Kenya flowers are sold in more than 60 countries.

6.8.4 Fertilizer consumption

Fertilizer Product	Volumes of fertilizer applied (ton)			
	2014	2015	2016	2017
Calcium Nitrate	5,778	11,286	11,286	5,643

Potassium Sulphate	1,369	1,137	1,337	1,337
NPK 14:14:20	2,007	1,960	1,960	
NPK 27:6:6+S	1,997	1,931	1,931	1,931
Rock Phosphate	1,338	1,307	1,307	1,307
MOP	1,460	1,426	1,426	
Other Specialties	3,856	1,616	1,616	5,727

6. Consolidation of data on fertilizer consumption in major crops in Kenya

Below, is the table showing the recommended fertilizer application rate per crop in Nigeria. The application rates have been distributed based on the fertilizer classes for the different crops cultivated across the different agro-ecological zones in the country.

CROP TYPES	Planting Recommended Rates Kgs/Ha	Top Recommended Kgs/Ha	Dressing Rates	Others Recommended Rates Kgs/Ha
BARLEY- Normal	DAP- 90	CAN- 300		
		ASN- 90		
BARLEY- Malting	DAP- 90	CAN- 180		
	MAP: 100	ASN- 90		
MAIZE	DAP: 150-200	CAN: 250		
	TSP: 150	UREA: 150		
	Mavuno: 150			
	NPK: 23:23:0- 200			
WHEAT	New land (virgin)	NPK 11:52:0 -130		
	2 nd year crop	D.A.P 130		
	3 rd year crop	D.A.P 109		
	4 th year crop	D.A.P 87		
	Over 4 years	NPK 20:20:0 200		
RICE	DAP: 100	SA: 180		Nursery: DAP: 160
	NPK 17:17:17 -100	CAN: 100		
	NPK 23:23:0 100			
MILLET	DAP: 120	CAN: 125		
	MAP: 180			
SORGHUM	DAP: 120	CAN: 100		
	MAP: 180			
	NPK 23:23:0 100			
BEANS	DAP : 200			
	NPK 23:23:0: 200			
	NPK 17:17:17: 200			
COW PEAS	DSP: 100	CAN: 150		
	TSP: 80	UREA: 100		
	NPK 20:20:20: 150			
IRISH POTATO	DAP: 500			
BEET ROOT	DAP: 300			
BRINJALS /EGG	NPK 23:23:0: 120			
BROCCOLI	DAP: 500			
CABBAGE	DAP: 250	CAN: 250		
CARROTS	DAP: 200	CAN: 200		
	DSP: 220			
CUCUMBER	DSP: 200			
FRENCH BEANS	DAP: 200	CAN: 100		
GARDEN PEAS	TSP: 200	CAN: 150		
KALES	DSP: 500	CAN: 200		
	TSP: 250			
LEEKS	DAP: 250	CAN: 125		
LETTUCE	TSP: 200	CAN: 125		
	DSP: 400			

ONIONS	DSP: 400	CAN: 300		
	TSP: 200			
	DAP: 150			
SNOW PEAS	DAP: 250	CAN: 200		
TOMATO	DSP: 200			
	TSP: 100			
	DAP: 100			

AVOCADO	Age of tree	CAN (g/tree)	TSP(g/tree)		
	1-3yrs	120	120		
	4-5yrs	220	450		
	6-7yrs	450	650		
	Over 8yrs	650	650		
BANANA	DAP: 200	CAN: 300			
	NPK 23:23:0: 150				
CITRUS	Age of tree	CAN (g/tree)	TSP(g/tree)		
	1-3yrs	200	300		
	4-5yrs	400	450		
	Over 6-7yrs	600	750		
MANGO	Age of tree	CAN (g/tree)	TSP/DAP(g/tree)		
	1-3yrs	240	150		
	4-5yrs	400	500		
	Over 6-7yrs	400	1000		
PASSION FRUITS	TSP: 200	CAN: 300			
	DAP: 200				
PINEAPPLES	DAP: 500	UREA: 200			
	NPK: 23: 23: 0- 250				
	SA: 200				
MELON	TSP: 200	CAN: 250			
	DAP: 200				
COFFEE (Coffee Research Foundation)					
Recommended types of nitrogen fertilizers based on soil reaction					
Soil Reaction	Acid Soil	Moderately Acid soil	Mildly Acid Soil		
PH	Under 4.4	4.4 – 5.4	Over 5.4		
Recommended rate of application for Phosphate fertilizers					
Types	Quantity (g/tree)				
SSP	350	350	-		
TSP	150	150	-		
DAP	-	-	150		
Phosphoric acid *	40ml in 20l water (30 trees)	40ml in 20l water (30 trees)	40 ml in 20l water		
(3 – 4 sprays per year)					
TEA (Tea Research Foundation)					
Fertilizer: Use compound fertilizers (NPK 26:5:5 or 20:10:10)					
1 st year: apply 180kg/ha (6g per plant) 6 weeks after transplanting and thereafter at 8 weeks intervals up to end of the first year					
2 nd year: apply 160kg/ha (15g/bush) every 3 months					
3 rd year: Apply 720kg/ha (67g/bush) once					
1000 - 1500kg clean coffee per hectare (5 – 7 kg of cherry/tree)	100	358	290	476	385

1500 – 2000 kg clean coffee per hectare (7 – 10 kg) of cherry/tree	100 – 150	358 to 538	290 to 434	476 to 715	385 to 577
Over 2000kg clean coffee per hectare (Over 10 kg of cherry /tree	Up to 200	716	578	952	769
Note: The above fertilizer rates are based on coffee density of 1330 trees/ha or 2.74 m x 2.74 m spacing.					
Apply Nitrogen fertilizer only when the soil is wet					
Phosphate (P) fertilizers					
Recommended types of application for Phosphate fertilizers					
Soil reaction	Acid soil	Moderate acid soil	Mildly acid soil		
PH	under 4.4	4.4 – 5.4	over 5.4		
Types of	Single or Triple Super	SSP	DAP		
Phosphate fertilizers	phosphate	TSP			
Recommended rate of application for Phosphate fertilizers					

6.9 Quantities of fertilizers consumed by type and nutrients

The amount of nutrients from mineral fertilizers used by various crops in Kenya depends on the area of crop planted, portions of planted area applied with fertilizer, and the rates of fertilizer application.

Table 12: 2014 analysis of nutrient consumption

CROP	Area Cultivated Ha	Area applied fert Ha	Area applied fert. (%)	Consumption N MT	Consumption P2O5 MTs	Consumption K2O MTs
Maize	2,116,142.00	1,362,831.90	64.40	47,741.45	51,031.25	3,269.19
Wheat	147,278.00	133,531.89	90.67	5,370.51	7,563.93	664.27
Barley	18,827.00	17,885.65	95.00	762.24	972.75	-
Beans	1,052,410.00	308,047.70	29.27	2,710.87	6,931.07	77.01
Rice	28,390.20	26,630.14	93.80	1,544.01	866.87	135.20
Sorghum	207,813.00	74,149.50	35.68	1,798.39	1,813.43	-
Millet	138,822.00	58,925.95	42.45	1,579.65	1,637.01	-
Cowpeas	281,879.00	34,962.55	12.40	859.66	731.81	-
Irish potato	131,613.62	93,516.98	71.05	921.35	2,354.57	-
Tomato	20,378.73	14,662.90	71.95	569.66	772.96	59.82
French beans	1,399.20	746.23	53.33	29.64	40.75	2.84
Snow peas	1,668.80	1,431.96	85.81	64.60	80.56	6.56
Sugar snaps	1,979.00	1,633.55	82.54	92.36	101.27	32.09
Garden peas	21,506.82	8,928.17	41.51	480.95	643.23	105.87
Spinach	131,171.73	90,005.86	68.62	2,822.68	4,233.03	-
Cabbage	47,263.99	29,430.62	62.27	1,273.24	1,072.81	-
Kales	24,677.79	10,265.60	41.60	412.13	400.62	9.80
Carrots	7,650.25	3,480.52	45.50	51.66	166.05	9.56
Bulb onions	2,536.91	2,061.06	81.24	33.55	95.64	2.19
Banana	53,507.10	1,012.91	1.89	31.16	38.36	-
Mango	55,233.84	3,066.65	5.55	113.50	118.65	4.83
Purple passion	3,013.13	1,701.09	56.46	74.89	69.39	1.88
Oranges	7,506.00	1,146.40	15.27	18.45	58.58	-
Lemons	1,161.04	81.94	7.06	1.16	3.69	-
Grapefruit	71.00	19.70	27.75	0.10	0.33	-
Lime	517.00	20.55	3.97	7.50	7.84	7.37
Tree tomato	479.20	168.72	35.21	6.82	7.75	1.48
Pineapples	5,653.75	1,218.47	21.55	53.24	60.48	77.38
Melons	3,206.17	1,463.49	45.65	52.84	51.49	2.57
Flowers	11,880.00	11,880.00	100.00	3,039.56	1,403.86	2,089.55
Coffee	110,000.00	18,232.00	16.57	285.63	251.35	253.11
Sugarcane	213,920.00	89,846.40	42.00	11,104.66	1,607.35	4,129.43
Tobacco	12,128.00	8,489.60	70.00	356.28	296.00	296.00
Macademia nuts	3,077.00	1,795.85	58.36	3.61	2.58	2.58

Ground/pea nut	17,311.00	16,706.55	96.51	370.12	770.10	-
Tea	203,006.00	188,656.20	92.93	16,362.52	3,183.37	3,183.37
Seeds	14,343.10	14,343.10	100.00	596.04	743.40	-
SUBTOTAL	5,099,421.37	2,632,978.33		101,596.69	90,184.17	14,423.95

Table 13: 2015 analysis of nutrient consumption

CROP	Area Cultivated Ha	Area applied fert Ha	Area applied fert. (%)	Consumption N MT	Consumption P2O5 MTs	Consumption K2O MTs
Maize	2,267,152.0	1,423,244.2	62.8	55,189.7	53,706.7	2,546.4
Wheat	145,237.0	133,841.5	92.2	5,382.5	7,577.5	666.1
Barley	18,827.0	17,885.7	95.0	762.2	972.8	-
beans	1,243,882.2	358,778.0	28.8	1,399.3	3,587.8	269.1
rice	29,438.0	26,453.7	89.9	1,576.1	857.2	230.5
sorghum	195,506.8	68,634.1	35.1	1,486.4	1,172.1	-
millet	27,452.0	10,863.9	39.6	289.4	169.3	-
cowpeas	238,318.9	29,279.0	12.3	612.8	332.4	-
Irish potato	166,614.0	115,735.1	69.5	1,045.5	2,671.8	-
Tomato	19,026.9	13,850.1	72.8	575.9	695.4	68.8
French beans	5,670.9	5,020.4	88.5	206.6	290.4	19.2
Snowpeas	1,656.4	1,424.3	86.0	63.9	79.2	6.5
Sugar Snaps	1,979.0	1,633.6	82.5	92.4	101.3	32.1
Garden peas	20,380.0	8,476.4	41.6	459.4	614.7	101.3
spinach	5,010.1	3,203.6	63.9	114.7	148.9	-
Cabbage	25,982.0	18,974.6	73.0	836.3	839.2	-
kales	29,281.5	11,648.1	39.8	463.5	466.3	11.8
carrots	2,657.0	2,182.2	82.1	31.9	102.1	1.1
Bulb Onions	3,493.4	3,003.7	86.0	48.0	137.8	3.2
banana	60,718.0	1,727.7	2.8	53.6	66.6	-
Mango	46,363.7	2,835.6	6.1	106.6	131.0	3.4
purple passion	3,415.2	1,992.8	58.4	88.7	82.3	2.2
oranges	7,062.3	3,929.5	55.6	70.3	224.0	-
Lemons	1,247.4	93.1	7.5	1.4	4.4	-
Grape fruit	71.0	19.7	27.7	0.1	0.3	-
Lime	517.0	20.6	4.0	7.5	7.8	7.4
Tree tomato	803.0	323.6	40.3	13.5	15.3	2.8
Pineapples	3,842.2	1,038.7	27.0	45.0	55.0	58.1
Melons	7,953.1	3,486.0	43.8	129.8	121.5	6.0
flowers	11,880.0	11,880.0	100.0	3,039.6	1,403.9	2,089.5
Coffee	113,761.0	93,695.4	82.4	4,108.8	4,075.6	4,076.0
Sugarcane	213,610.0	67,081.5	31.4	8,291.0	1,200.1	3,083.1
Tobacco	13,420.0	9,394.0	70.0	356.3	296.0	296.0
Tea	207,597.1	192,650.1	92.8	17,166.2	3,339.7	3,339.7
Ground/pea nuts	17,311.0	16,706.6	96.5	370.1	770.1	-
Macademia nuts	3,077.0	1,795.9	58.4	35.6	79.8	14.3
Seeds	14,343.1	14,343.1	100.0	596.0	743.4	-
SUBTOTAL	5,174,557.0	2,677,145.7		105,116.7	87,139.5	16,934.5

Table 14: 2016 analysis of nutrient consumption

CROP	Area Cultivated (Ha)	Area applied fert Ha	Area applied fert. (%)	Consumption N MT	Consumption P2O5 MTs	Consumption K2O MTs
Maize	2,337,587.0	1,476,524.4	63	60,690.84	61,034.10	543.00
Wheat	153,119.0	145,269.0	95	5,032.39	7,866.93	547.46
Barley	18,827.0	17,885.7	95	744.06	926.29	-
beans	1,171,710.0	343,508.4	29	3,022.93	7,728.94	85.88
rice	29,574.0	18,729.3	63	1,091.96	565.58	96.59
sorghum	184,654.0	70,705.9	38	1,790.76	1,724.47	-
millet	27,061.0	9,080.7	34	176.63	128.13	-
cowpeas	228,023.0	26,836.5	12	649.51	521.39	-
Irish potato	613,846.3	404,866.2	66	4,496.31	11,490.56	-
Tomato	21,921.0	16,144.8	74	668.71	911.33	151.48
French beans	6,023.2	5,323.9	88	219.62	296.42	27.95
Snowpeas	1,668.8	1,432.0	86	65.90	78.95	9.74
Sugar Snaps	1,979.0	1,633.6	83	92.36	101.27	32.09
Garden peas	21,506.8	8,928.2	42	466.20	605.54	105.87
spinach	5,614.9	3,606.5	64	126.78	158.03	-
Cabbage	26,946.3	19,541.2	73	860.55	861.06	-
kales	30,739.4	12,191.7	40	485.54	492.75	12.24
carrots	6,865.0	4,076.2	59	54.35	179.21	1.83
Bulb Onions	4,085.0	3,532.2	86	56.40	162.03	3.75
banana	63,298.6	1,534.2	2	47.62	59.10	-
Mango	49,102.8	3,031.4	6	117.66	135.46	4.84
purple passion	46,363.7	29,425.7	63	1,298.81	1,220.03	33.25
oranges	7,267.5	1,220.6	17	21.42	68.33	-
Lemons	1,345.4	99.0	7	1.45	4.59	-
Grape fruit	71.0	19.7	28	0.10	0.33	-
Lime	517.0	20.6	4	7.50	7.84	7.37
Tree tomato	881.7	358.7	41	16.26	18.37	4.46
Pineapples	4,067.9	1,099.1	27	47.57	57.46	60.47
Melons	5,443.8	2,482.1	46	91.15	86.80	4.50
flowers	11,880.0	11,880.0	100	3,039.56	1,403.86	2,089.55
Coffee	114,401.0	94,218.1	82	4,131.22	4,097.77	4,098.23
Sugarcane	213,610.0	132,807.6	62	14,960.51	5,673.54	607.06
Tobacco	14,460.0	10,122.0	70	356.28	296.00	296.00
Tea	218,538.2	202,628.6	93	18,348.89	3,569.82	3,569.82
Macademia Nuts	3,077.0	1,795.9	58	3.61	2.58	2.58
Ground/pea nuts	17,311	16,707	97	370.12	770.10	-
Seeds	14,343.1	14,343.1	100	596.04	743.40	-
SUBTOTAL	5,677,730.7	3,113,608.8		124,247.55	114,048.32	12,396.00

6.10 Analysis of nutrient consumption by nutrients (IFA table)

Fertilizer Use by Crop Statistics														
Country : Kenya														
Crops / groups of crop	Planted Area (000 ha)	Average Yield (kg/ha)('000	Percent of the Planted Area that is Fertilized (%)			Recommended Application Rate (kg nutrient/ha)			Actual Application Rate (kg nutrient/ha)			Total Fertilizer Consumption (metric tonnes nutrients)		
			N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
not to filled out														
Maize														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	2,116	1.7	90%	90%	90%	59	60	5	40.52	42.75	4.27	85750	90465	9047
2014 + 2014/15	2,123	2.0	90%	90%	90%	59	60	5	51.22	39.64	3.96	108754	84168	8417
Bean														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	1,052	0.6	60%	60%	60%	90	13	1	0.00	0.00	0.00			
2014 + 2014/15	1,084	0.8	60%	60%	60%	90	13	1	0.00	0.00	0.00			
Wheat														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	147	2.2	100%	100%	100%	290	5	1	107.38	117.25	0.00	15807	17260	0
2014 + 2014/15	131	3.6	100%	100%	100%	290	5	1	78.93	53.69	0.00	10365	7050	0
Rice														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	28	2.2	100%	100%	100%	260	54	48	53.49	48.12	2.12	1519	1366	60
2014 + 2014/15	35	3.1	100%	100%	100%	260	54	48	50.40	44.25	1.95	1763	1548	68
Sorghum														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	214	0.8	70%	70%	70%	207	15	1	37.98	32.83	0.00	8110	7010	0
2014 + 2014/15	222	1.0	70%	70%	70%	207	15	1	29.80	25.76	0.00	6617	5719	0
Millet														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	37	0.9	70%	70%	70%	231	15	1	40.03	41.83	0.00	1497	1564	0
2014 + 2014/15	88	1.0	70%	70%	70%	215	15	1	17.00	17.76	0.00	1497	1564	0
Irish Potatoe														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	133	11.7	95%	95%	95%	115		1	42.75	109.25	0.00	5666	14479	0
2014 + 2014/15	126	14.8	95%	95%	95%	115		1	22.44	57.35	0.00	2833	7240	
Sugarcane														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	211	30.7	60%	60%	60%	130	87	1	15.00	20.70	9.00	3170	4375	1902
2014 + 2014/15	214	18.6	60%	60%	60%	130	87	1	15.30	9.18	0.00	3271	1963	
Tea														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	203	2.2	97%	97%	97%	83	56	1	143.08	27.89	27.89	29045	5661	5661
2014 + 2014/15	199	1.8	97%	97%	97%	83	56	1	149.65	28.45	28.45	29728	5651	5651
Barley														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	22	5.1	100%	100%	100%	290	5	1	107.25	119.50	0.00	2309	2573	0
2014 + 2014/15	23	5.1	100%	100%	100%	290	5	1	87.38	59.75	0.00	1981	1355	0
coffee														
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14	110	2.2	100%	100%	100%	125	25	75	101.20	125.60	43.20	11132	13816	4752
2014 + 2014/15	112	2.0	100%	100%	100%	125	25	75	101.38	125.82	43.28	11355	14092	4847
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14									0.00	0.00	0.00			
2014 + 2014/15									0.00	0.00	0.00			
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14									0.00	0.00	0.00			
2014 + 2014/15									0.00	0.00	0.00			
2012 + 2012/13									0.00	0.00	0.00			
2013 + 2013/14									0.00	0.00	0.00			
2014 + 2014/15									0.00	0.00	0.00			
TOTAL														
2012 + 2012/13	0.0								0.00	0.00	0.00	0.00	0.00	0.00
2013 + 2013/14	4,273.5								688.68	685.71	86.49	164004.90	158570.00	21422.30
2014 + 2014/15	4,356.7								603.50	461.65	77.64	178163.10	130349.00	18983.00

6.11 Limitations of the study

6.11.1 Access to Missing Data - Quantity and Quality

It is assumed that in general, it is the overall responsibility of the government of Kenya to manage and provide relevant, accurate and timely agricultural data to meet the demands of policy makers as well as other data users. Overall, access to data on fertilizer production, importation, distribution, export and utilization by crops is constrained by several factors. The major ones include:

a) Institutional and Management challenges

- General low appreciation of the importance of data and quality statistics at various levels in the public sector.
- Limited networking and collaboration amongst relevant stakeholders and agencies.
- Inadequate budgetary provision for data collection and management activities.
- Inadequate policy and regulatory framework for agricultural statistics management.
- Lack of understanding, hence poor cooperation by private sector in providing data when required by the government.

b) Staff Capacity

- Inadequate staff capacity: few number of staff deployed to handle agricultural statistics and data management at both national and county levels.
- Use of field extension officers to generate most of the field data: deployment of extension officers to combine extension work with data collection face certain challenges e.g., low quality data if the officers are not facilitated to move to the field, or when supervision is poor, among other challenges.
- Limited technical knowledge: Most of the extension officers are not trained statisticians yet there are very few trainings given to the officers in the field of data management in general and fertilizer use data collection in particular.
- Lack of validated sampling frames: Owing to lack of census of agriculture, the country lacks valid master sampling frame that can be used to undertake routine surveys for data generation. Although field extension officers are expected to randomly select contact farmers from whom they collect most data, the sampling design, sampling accuracy, sampling errors, etc, are not clear.
- Lack of basic tools and equipment for data collection and analysis.
- Low application of modern technology including ITC tools and systems.

6.11.2 Recommendations

Proposed changes to support data collection and management

In order to improve on fertilizer data management in Kenya, the following suggestions should be considered:

- Restructuring of agricultural statistics unit at the Ministry Headquarters; expanding its mandate and improve staffing.
- Review of agricultural statistics legal framework and policy to take care of emerging challenges and concerns. Among other things, the legal framework should emphasize need by private sector to provide data when required by government and also to provide sufficient confidentiality assurance by the government.
- Training of officers responsible for fertilizer data collection.
- Quarterly meeting of the FTWG to validate and up-date the fertilizer data.
- Adoption of new technologies such as ICT-based systems to reduce time and paperwork in data management.
- Sensitization of stakeholders responsible for fertilizer data provision on the need to share data with the government.
- Support national fertilizer association to have independent Secretariat responsible for management of fertilizer data.
- Use census and surveys methods to capture more data on fertilizer use at various levels to complement data collected by field extension officers.
- Establishment of an automated system that links data and information generated by third party agencies to that of the MOALF for easy access of fertilizer data available within the agencies.
- Strengthen collaboration between MOALF, KNBS, KRA and KPA for improved fertilizer data collection and sharing of available data.

Cost-effective ways if collecting real consumption and FUBC data

Results from this study show that there are several variations of the data on the amount of fertilizer manufactured, imported, exported and utilized by each crop. There is therefore need to establish cost-effective way of collecting data based on consumption and fertilizer use by crops. In order to achieve this goal, the following suggestions should be considered:

- Use of public extension staff to assist in collection of certain data (after training)
- Sending questionnaires to other data sources through email (after sensitization);
- Establishment of an automated system that will connect the Counties and MOALF for easy access of fertilizer availability and utilization at county level.
- Strengthen collaboration between MOALF, KNBS, KRA, KPA and KEPHIS for improved fertilizer data collection.
- Organize annual regional fertilizer data validation workshops to enable countries learn from each on the cheapest means of getting fertilizer data.
- Support national fertilizer association to establish independent secretariat that can deal with fertilizer data and statistics to support the fertilizer industry.

7 CONCLUSIONS

This study provided a good starting point for generation of data on fertilizer used by regions; fertilizer use by crops; and fertilizer nutrients use by crop. Several lessons were learnt, including regional comparison of the procedures and challenges faced with this type of study, which was also conducted amongst EAC Partner States. There were basic challenges such as limited funding and time frame for the study, the timing of the study around the month of December, which affected data generation since most institutions close in December; lack of trainings and detailed briefings of the field officers who participated in data collection; limited corporations amongst certain private sector agencies as well as field officers who were not paid for the work, among others. However, the challenges can be improved upon during future studies as the people and institutions involved in fertilizer data management gain more experience.

8 APPENDICES

8.1.1 Fertilizer use By Crops Data template

Counties: Fertilizer use By Crops Data template																
County	crop	Area (HA)	% of Area applied with fertilizer	Area applied with fert Ha-	Planting fert type-DAP 80%	Quantity of plating fert applied /Ha (Kg) DAP	Planting fert type-Mavuno 20%	Quantity of planting fert applied/ha Mavuno	Top dressing Fert- type 85% CAN	Quantity of top dress applied/ha CAN	Top dressing Fert- type 15% Urea	Quantity of top dress applied/ha /kgs	Total DAP	Total mavuno	Total CAN	Total urea
	Cereals Crops															
Meru	Crop 1 e.g maize	400	80%	320	0.8	100	0.2	75	0.85	100	0.15	75	25600	4800	27200	3600
	Crop 2															
	Crop 3															
	Crop 4															
	Legumes															
	Crop 1															
	Crop 2															
	Roots & Tubers															
	Crop 1															
	Crop 2															
	Hort Crops															
	Crop 1															
	Crop 2															
	Crop 3															
	Crop 4					0										
	Industrial crops															

	Crop 1															
	Crop 2															
	Crop 3															

Notes: 1. In this example, the crop grown, maize: aim is to know area applied with fertilizer; main types of fertilizer used for planting and for top dressing; amounts of fert used by this crop

- 2 For each crop, based on 2014,2015, 2016 1nd 2017 achieved crop area, estimate percentage of area applied with fertilizer; then actual planted area applied with fertilizer. Here 80% of planted area= 320 Ha
- 3 Next, indicate the main fertilizer types used for planting and for top-dressing; estimate percentages used (here, DAP (80%) and Mavuno (20%) are used for planting; CAN (85%), Urea (15%) used for top-dressing
- 4 For each fertilizer and crop, indicate the average application rates; the usual amount of fertilizer used in Kg per Ha by most farmers in the county
- 5 Total amount of fertilize used: calculated by area applied with fertilizer multiplied with average application rates and percentage of the fertilizer used (for planting or for top-dressing)
- 6 All the major food and industrial crops that use fertilizer in the county should be on this table.

Sample 1: Kenya Fertilizer Consumption survey Questionnaire- Irrigation Board

Name of irrigation project eg Wei Wei Integrated multipurpose project				
Fertilizer bought in 2014 (Kg)		2014 fertilizer used in the project/irrigation farm		
Fert type eg NPK 17: 17:0	Amount (Kg)	Main crop eg Rice production		
		Fert type eg 23:23:0	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert
		Second crop eg maize seed production		
		Fert type eg DAP	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert
		Third crop -specify		
		Fert type eg TSP	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert
Fertilizer bought 2015 (Kg)		2015 fertilizer used in the project/irrigation farm		
Fert type eg NPK 17: 17:0	Amount (Kg)	Main crop eg Rice production		
		Fert type eg 23:23:0	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert

		Second crop eg maize seed production		
		Fert type eg DAP	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert
		Third crop -specify		
		Fert type eg TSP	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert
Fertilizer bought 2016 (Kg)		2016 fertilizer used in the project/irrigation farm		
Fert type eg NPK 17: 17:0	Amount (Kg)	Main crop eg Rice production		
		Fert type eg 23:23:0	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert
		Second crop eg maize seed production		
		Fert type eg DAP	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert

	Third crop -specify		
	Fert type eg TSP	Amount used both seasons (Kg)	Total Area (Ha) applied with Fert

Proceed to another project.....

Note: Fertilizer types should be specified; eg NPK as 17:17:17 etc.

Sample 2:

Private Companies Kenya Fertilizer Consumption Survey

Name of Company							
Fertilizer Data and Statistics 2014							
Crop	Area planted (HA)	Planting Fertilizer used and amount used (Kgs)			Top-dressing Fertilizer used and amount used (Kgs)		
		Eg DAP	Eg Mavuno	Eg NPK 23:23:0			
Eg Wheat	Eg 2,000	Eg 200,000	Eg 100,000	Eg 80,000			
Fertilizer Data and Statistics 2015							
Crop	Area planted (HA)	Planting Fertilizer used and amount used (Kgs)			Top-dressing Fertilizer used and amount used (Kgs)		
		Eg DAP	Eg Mavuno	Eg NPK 23:23:0			
Eg Wheat	Eg 2,000	Eg 200,000	Eg 100,000	Eg 80,000			

Fertilizer Data and Statistics 2016							
Crop	Area planted (HA)	Planting Fertilizer used and amount used (Kgs)			Top-dressing Fertilizer used and amount used (Kgs)		
		Eg DAP	Eg Mavuno	Eg NPK 23:23:0			
Eg Wheat	Eg 2,000	Eg 200,000	Eg 100,000	Eg 80,000			

Note: Fertilizer types should be specified; eg NPK as 17:17:17 etc, not just "NPK".

Fertilizer Data and Statistics 2016				
Fert type eg NPK 17: 17:0	Amount imported (MT)	Amount manufactured/ blended (MT)	Amount sold or given to farmers locally for crop production (MT)	Amount sold or give out locally for non-crop production (MT)

Note: Fertilizer types should be specified; eg NPK as 17:17:17 etc, not just "NPK".

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