Value chain analyses of grain legumes in N2Africa

Kenya, Rwanda, eastern DRC, Ghana, Nigeria, Mozambique, Malawi and Zimbabwe

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N2Africa

Putting nitrogen fixation to work for smallholder farmers in Africa

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1 Summary

In the N2Africa target countries value chain analyses of the four target grain legumes - common bean, cowpea, groundnut and soyabean – were carried out in 2011. Within the value chain analysis, five different aspects were identified: (1) the role of the target grain legumes in smallholder farmers' strategies for cash incomes, food security, nutrition, natural resource management and gender equity, (2) trends in production, (3) the structure and dynamics underway in the value chains, (4) opportunities and constraints on improving performance of the value chain and (5) the nodes for leveraging research investments to resolve constraints and permit smallholders, traders, and agribusiness firms to exploit the end market opportunities. Generally, common bean is important in eastern and southern Africa, cowpea in western Africa and groundnut and soyabean across the three regions. In all regions, production of marketable surplus is geographically concentrated in areas characterized by soils and climatic conditions favourable for these crops, preferences for different legumes for home consumption and grain legume development projects. Overall, there is an upward trend in area, yield and production, mainly driven by increasing end market demand, increasing procurement from the farm gate by large scale agribusiness firms that integrate logistics with markets and technological change. The value chains are rapidly evolving. End-market demand opportunities with significant potential for improving performance lie in the increasing and currently unmet demands in urban centers in domestic and regional markets, substitution for imported food and international markets. Constraints include erratic production and lack of capacity to supply end-markets with products with consistent quality, quantity and timeliness and at competitive prices; lack of input supply systems for certified seed of improved appropriate varieties, inoculants, fertilizers, agro-chemicals, tractor and machinery hire services; weak public extension services; poor access to output markets and lack of farmers' capacity to participate in markets; difficulties honouring contracts; lack of financing; competition from imports; and policy inconsistencies. Priority research interventions identified include development, testing and promotion of new varieties adapted to the local agro-ecological conditions; crop and post-harvest management practices; input supply systems for seeds, inoculants, fertilizers and agro-chemicals; output marketing systems; the provision of information; the development of micro-finance markets; farmers' organizations; and the creation of an enabling environment for business.

2 Introduction

This report contains the legume value chain studies carried out in the N2Africa core countries, carried out by Joseph Rusike. The described value chains usually consist of four or five channels, which can be split in commercial or non-commercial channels. The non-commercial channel usually consists of the subsistence production and consumption chain. The commercial channels consist of chains of public and private agricultural organizations engaged in agricultural research and technology development, extension and training; supply of seed, fertilizers, agrochemicals; growers, local and central assemblers, commission agents, agricultural commodity exchanges, exporters, importers, food and feed processors and manufacturers, wholesalers, supermarkets, retailers, restaurants and institutional markets, and consumers. Different channels have different configurations of chains of actors, activities, resources, institutions, linkages and governance structures.

The methods used for these value chain studies were largely similar and have been combined into one section. The role of the N2Africa target legumes and the characteristics and dynamics of their value chains are discussed per country. Also for each country, opportunities, constraints and specific research interventions have been identified.

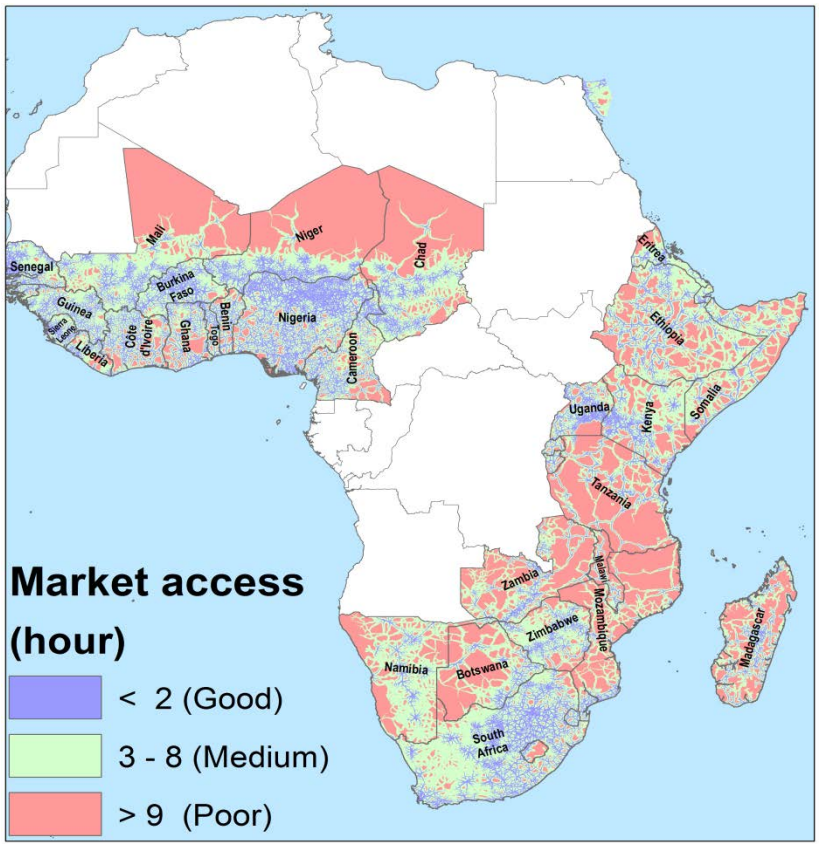


Figure 2.1: Market Access in western, southern and eastern Africa

3 Research approach

The value chain analyses were implemented using rapid analysis value chain surveys with key players along the value chains for common bean, cowpea, groundnut and soyabean in Kenya, Rwanda, eastern DRC, Ghana, Nigeria, Mozambique, Malawi and Zimbabwe. Interviews were conducted among government researchers, extension agents, traders, agricultural-processing firms, representatives of farmers groups, non-governmental organizations (NGOs), and government decision makers. The questionnaire was designed to elicit information on (1) the role of the four N2Africa target grain legumes (common beans, cowpeas, groundnuts and soyabeans) in smallholder farm household strategies for incomes, food security, nutrition, sustainable natural resource management (NRM) and gender equity, (2) production areas and trends (3) levels of commercialization, (4) value chain structures, (5) opportunities and constraints for grain legume-led growth and (6) specific research interventions to relax constraints and generate the impact at scale. The samples of respondents were drawn list of public and private organizations engaged in research, farmer training and extension, agricultural input supply, farmers' organizations, and output marketing and policy making of the target legumes.

Complementary to the interviews, information was obtained from the N2Africa baseline surveys. In addition, secondary time series data were collected from agricultural Ministries and national bureaus of statistics. The secondary data included release data of new varieties, trends in area, yield and production, market prices and data on imports and exports. An overview of the methods and data sources used in the different countries is given in Table 3.1.

Table 3.1: Summary of methods and data sources per country.

Country	Time of research	No. of interviews	Secondary data	Market prices	Consumer price indices and exchange rates
Kenya	September 2011	30	Ministry of Agriculture and National Bureau of Statistics	Weekly prices for common beans and groundnuts in open air markets in the major urban areas from May 2008 - June 2011 from the Regional Strategic Analysis and Knowledge Support System-Eastern and Central Africa (ReSAKSS-ECA)	IMF (2012)
Rwanda	June 2011	17	Ministry of Agriculture and Animal Resources, 2011	Monthly price averages for common bean, cowpea, groundnut and soyabean in rural and urban markets from Jan 2004 – Sep 2011 from National Institute of Statics of Rwanda and Ministry of Agriculture and Animal Resources (2012)	IMF (2012)
Eastern DRC	July 2011	17	Annual reports from provincial division of agriculture in South-Kivu from 2001-2005	Weekly price averages for common bean in open air urban air markets from FAO office in Bukavu	IMF (2012)
Ghana	August 2011	44	Annual estimates of agricultural production from the Statistics, Research and Information Directorate (SRID), Ministry of Food and Agriculture	Monthly wholesale and retail prices for major trading markets from Statistics, Research and Information Directorate (SRID), Ministry of Food and Agriculture	IMF (2012)
Nigeria	July 2011	44	Annual estimates of agricultural production from the Federal Ministry of agriculture and Rural Development.	Monthly wholesale and retail prices for major trading markets in Kano, Kaduna and Benue from the State Agricultural Development Programs.	IMF (2012)
Mozambique	April-June 2011	24	Ministry of Agriculture	Ministry of Agriculture	IMF (2012)
Malawi	April-June 2011	37	Ministry of Agriculture	Ministry of Agriculture	IMF (2012)
Zimbabwe	April-June 2011	26	Ministry of Agriculture	Zimbabwe Farmers Union	IMF (2012)

4 Kenya

4.1 Role of the target grain legumes in smallholder farmers' strategies for incomes, food security, nutrition, sustainable natural resource management (NRM) and gender equity

The common grain legumes beans, groundnut and cowpea, but also soyabean, are mostly grown by smallholders with limited use of inputs such as inorganic fertilizers or inoculants. Farmers operating on small land holdings mainly use the hand-hoe, those with medium land holdings use oxen and large scale farmers use tractors.

In Kenya, common beans are high in demand and grown in many areas throughout the country, except for the dry areas. Often maize and beans are grown in intercrop. Common bean plays very important roles in smallholder farmers' strategies for cash incomes, food security, nutrition, NRM and gender. Women dominate the growing, marketing and utilization of income from beans. However, these gender roles change during commercialization and men displace women. 80-90% of the farmers growing common bean use improved varieties developed under the Grain Legume Project implemented in the 1980s. From 1982 to 2010, 28 bean varieties were released. However, since seed companies in the past were not concentrating on bean seed, less than 10% of the farmers use certified seed. Although input use on legumes is limited, common bean is often likely to benefit from inorganic fertilizer application to maize, with which common bean is often intercropped.

Cowpea is important for food security both as a major vegetable (it contains more minerals and nutrients than most other vegetables) and as a grain. Also, in both forms it is sold to urban markets. Cowpea is wholly a woman's crop. Although 10 cowpeas varieties were released between 1987 and 2010, less than 10% of the farmers use improved varieties. This is mainly caused by a lack of certified seed of improved varieties.

Groundnut is consumed in smaller quantities than common bean and cowpea, often mixed with maize or as paste added to dishes and thus have a smaller role in food security. However, groundnuts have a higher market price than the other legumes. Groundnut is a woman's crop although men are becoming involved in production, marketing and spending of the groundnut incomes. Groundnuts are intercropped with sugar cane, cotton, maize and sorghum. Although more than 80% of groundnut farmers use improved varieties, few farmers use certified seed. Only in May 2011 these varieties have been officially released for multiplication as certified seed.

Because its gross margins per hectare are lower than for other grain legumes such as bean and groundnut, soyabean is more often produced during the short rains season than during the long rains season, like an off-season crop. In the Rift Valley soyabean is being introduced to large scale farmers for rotation with wheat. For smallholders, soyabean only plays a minor role for cash incomes, food security, and nutrition. Its production and marketing is constrained by the lack of knowledge of how to use the crop. However, agricultural projects are promoting soyabean for soil fertility management. Like the other legumes, soyabean is mostly a woman's crop, planted as intercrop using early maturing varieties, as a catch crop between wheat crops or as a second season crop. All the soyabean area is planted to improved varieties, mainly Nyala, Gazelle and EAI 3600. However most farmers use recycled seed. Two varieties – SB19 TGx1740-2F and SB8 – were officially released in 2010. Seed companies have started multiplying certified seed for sale to farmers.

4.2 Production by geographical area

For common bean, the main marketable surplus-producing areas are concentrated in a few agricultural zones. These include, in decreasing order of importance, the Western, Nairobi, Coast and Rift Valley provinces (Figure 4.1). The underlying reasons for the importance of the production areas include suitable soil; high rainfall; temperature; and eating habits. The major common bean-growing areas are zones that also produce maize, which forms, together with beans, the main staple food.

Cowpea is grown as a green leafy vegetable mainly in Western Kenya and for grain mainly in the dry lands in Eastern Kenya (Eastern, Coast and Nyanza Provinces). Cowpea grown as a vegetable requires rich soils and high rainfall. In contrast, cowpea grown for grain requires low rainfall and high temperature. Surplus groundnut-producing areas are clustered in the Nyanza, Western and the Rift Valley Provinces, where the growing conditions are favourable and eating habits include groundnut. Soyabean is mostly grown in the Western, Rift Valley, and Nyanza Provinces.

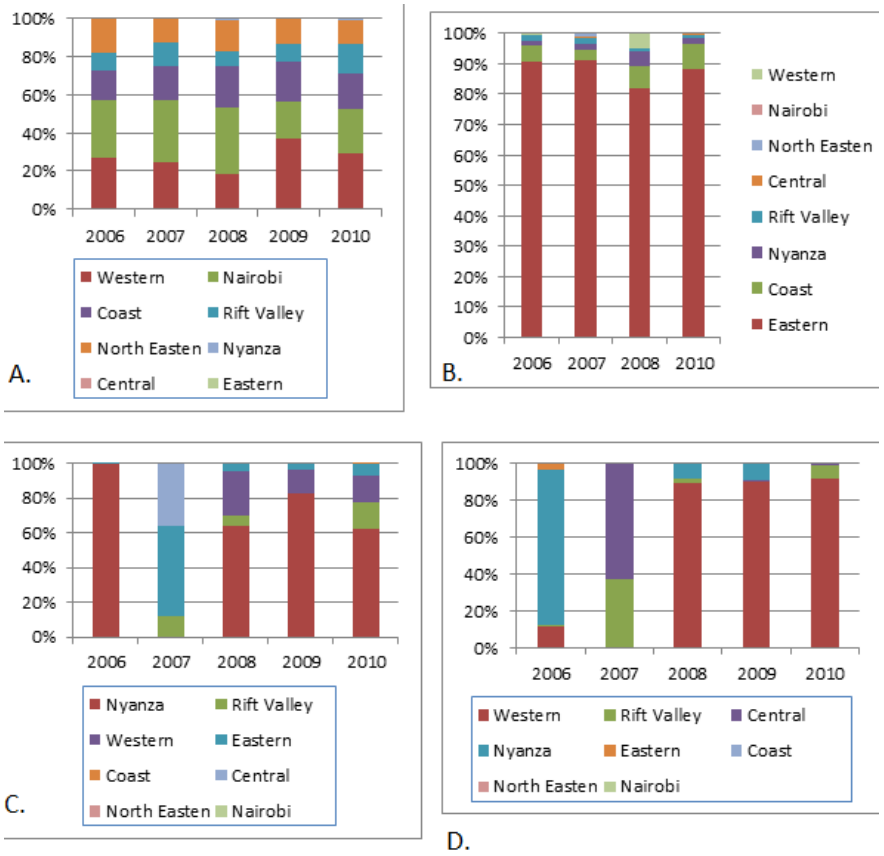


Figure 4.1: Shifts of production shares in different areas in Kenya from 2006-2010 for A) common bean, B) cowpea (grain), C) groundnut, D) soyabean.

4.3 Trends in area planted, yields and production

The areas planted to cowpea and soyabean trended upwards during the past 10 years (Figure 4.2). The upward trends are mainly attributed to increasing demand resulting from population growth, a growing food and feed manufacturing industry (mainly for soyabean), better disease resistant and tolerant higher yielding varieties and improved crop and pest management technologies. The yields have also trended upwards because of development, availability and adoption by farmers of improved varieties and agronomic technologies, including timely weeding, and the application of farmyard manure and agrochemicals. Nevertheless, yields still remain very low at around 400 kg per hectare compared to 1,000 to 1,500 kg per hectare reported by researchers. In contrast, the areas planted to common beans and groundnuts have trended downwards because of the lack of certified seeds of improved varieties.

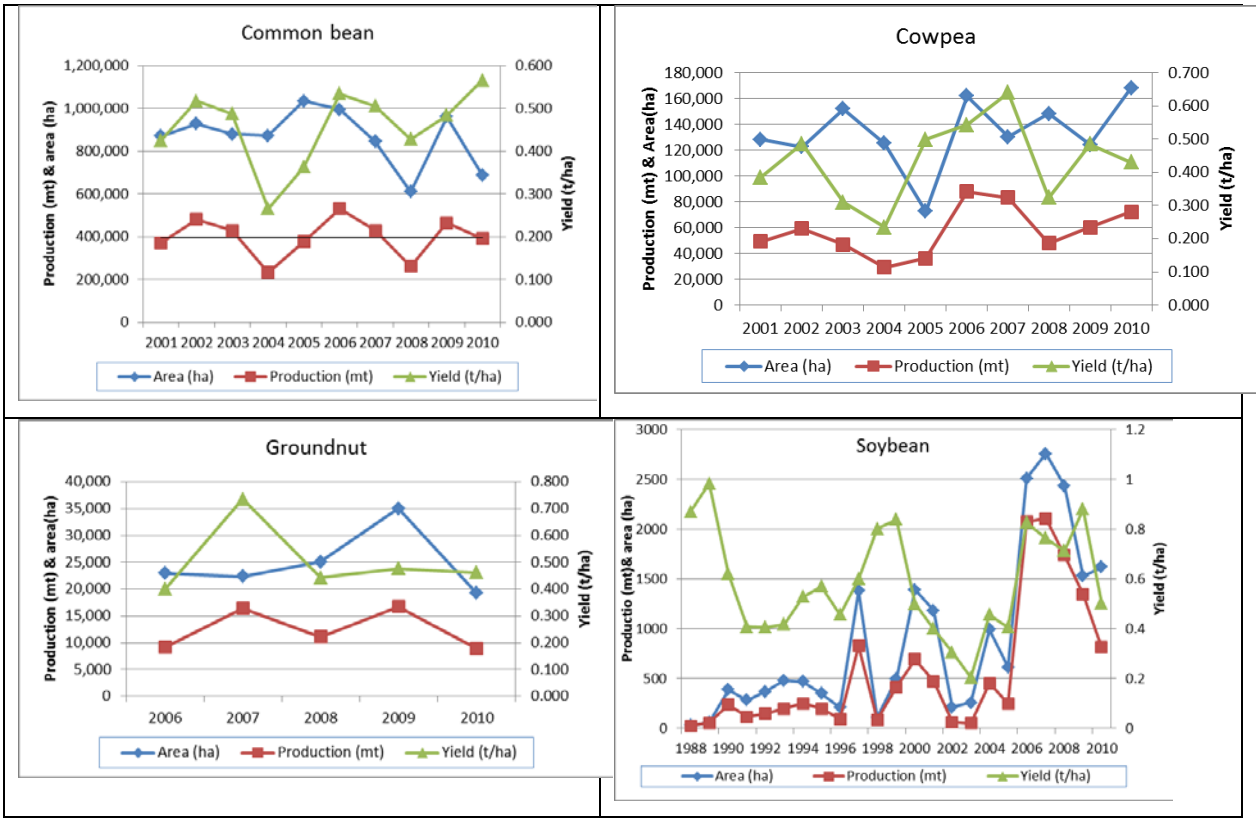


Figure 4.2: Trends in aggregate area, yields and production in Kenya between 2001-2010 for A) common bean B) cowpea C) groundnut and D) soyabean.

4.4 Structure and dynamics underway in the grain legumes value chains

In the legume value chains, there is a high degree of commercialization. Approximately 80% of the legume growing farmers sell some of their harvest to markets. Roughly 60 % of total harvest is sold within 12 months after harvesting. More than 90 % is sold in the dried form and the remaining 10% is marketed as fresh grain. The centers of consumption are mainly urban areas: Nairobi, Mombasa, Thika, Eldoret, Kisumu, and Nakuru.

The mapping of the value chains shows 5 main channels: one non-commercial subsistence production and consumption channel, and four commercial channels in which (1) fresh unprocessed grain is sold to nearby and long distance markets, (2) dried unprocessed grain is sold to nearby and long distance markets, (3) dried unprocessed and processed grain is sold to export markets and (4) dried grain is sold for industrial processing and manufacturing of edible vegetable oil, food and feed products. The share of subsistence production and consumption ranges from 20% for commercial grain legumes, such as soyabean, to 60-70 % for subsistence food crops such as beans and cowpeas.

Local and central assemblers buy products from farmers and move them to wholesale and retail markets as well as to processors, packers and human food and animal feed manufacturers in urban centers. Because aggregate domestic demand for common bean, cowpea, groundnut and soyabean exceeds domestic supply, traders in Kenya import common bean, cowpea, groundnut and soyabean from traders in Malawi, Tanzania, Rwanda, DRC and Uganda. Processed soyabean flour is imported mainly from the Netherlands, India, the United States, and Uganda. Soyabean crude oil is sourced from Argentina and Singapore. Much of the soyabean oil is exported after refining within the region to DRC, Ethiopia, Malawi, Rwanda, Sudan, Tanzania, Uganda and Zambia.

Within the commercial channels, small quantities of grain legumes are marketed as fresh unprocessed grain through informal channels dominated by local and central assemblers and retail traders. The bulk of the grain legumes are sold as dried unprocessed grains through more formal channels dominated by urban-based wholesale grain stores. The cowpea chain on the other hand is dominated

by informal traders, due to lower market demands and proneness to weevil attacks. Small quantities of cowpea are processed, branded and packed in private retailer labels and sold through supermarkets. Groundnuts are processed by informal household enterprises into peanut butter, roasted and fried nuts and sold through urban open air markets. Beans and groundnuts are marketed through grain stores and open retail markets as well as through retail private labels through supermarkets and grocery stores. Most of the soyabean is sold as processed derivative products.

Commercial marketing chains have as their starting point agricultural research and technology development and dissemination. Table 4.1 summarizes the different actors that play roles in research, input supplies or both. To date 28 common bean, 10 cowpea, 4 groundnut and 7 soyabean varieties have been officially released (Appendix I). Up until 2011 groundnut and soyabean varieties were only made available to farmers as pre-released varieties and could only be multiplied and sold to farmers as standard seed. This constrained seed companies in multiplying and marketing certified seed.

Seed companies sell seed through their distributors. The CNFA-AGMARK has implemented agrodealer development programs starting in 2004 to train rural traders in business management, product knowledge, safe use of inputs, demand creation through demonstrations and to build networks of agrodealers. To date 1,921 agro-dealers have been trained. Agro-dealers are carrying out extension as the public extension services are severely constrained and government extension alone cannot reach all the farmers. Agro-dealers are also involved in fertilizer trade. However, fertilizer is bulky, requires large capital outlays and timely stocking before the planting season. Agro-dealers are distributing Biofix inoculants produced by MEA as part of a pilot crop insurance scheme.

Table 4.1: Actors in the environmental marketing chain that play a role in research or input supply.

Actor	Role
Kenya Agricultural Research Institute (KARI)	-Carries out agricultural research for grain legumes. -Produces breeder and foundation seed
Ministry of agriculture provincial crops and livestock departments, NGOs, agro-dealers	-Participatory technology development, agricultural extension
Farmers' associations (self-help groups, cooperatives, outgrower and contract farmers)	-Extension, bargaining power, linking farmers to input supply and output markets
CIAT, ICRISAT, and IITA	-Provide germplasm for legumes
Large seed companies (Kenya Seed Company, Monsanto, Seed Co, Pioneer (Pannar) and East Africa Seed Company)	-Carry out in-house legume breeding (Kenya Seed Company) -Carry out basic and certified seed production
Local seed companies (Western Seed, Faida, Freshco, Dry Land Seed, Leldet and Olerai)	-Produce common bean, cowpea and soyabean seed as a secondary business line to support hybrid maize seed. Only Leldet is producing groundnut seed
Kenya Plant Health Inspectorate Service (KEPHIS)	-Conducts official national performance variety trials, variety release, and registration; seed certification and plant protection
CNFA-AGMARK	-Agrodealer development programs
Export Trading and Crown agents	Import the bulk of the fertilizer, sell to agro-dealers and government
Athi River Mining	-Produces fertilizer blends
MEA	-Produces fertilizer blends - Produces and markets rhizobia inoculants (Biofix) in various package size, also for smallholders and for export
National Agricultural Access Input Program (NAIP)	-Fertilizer subsidies for 4 million smallholder farmers growing 0.5 hectares or less of maize area.

There is no significant fertilizer manufacturer in Kenya supplying fertilizers directly to farmers. The bulk of fertilizers, including DAP and urea, are imported. Although there is no fertilizer production in Kenya, there is fertilizer blending by Athi River Mining and MEA. Fertilizer companies distribute the products mostly through agro-dealers in packs of 1kg, 2 kg, 5 kg, 25 kg and 50 kg. Fertilizer companies also

sell through the government fertilizer subsidy program, the National Agricultural Access Input Program (NAIP). Under the program fertilizer is sold at subsidized prices to 4 million smallholder farmers growing 0.5 hectares or less of maize area. The fertilizer is sold for Kenya Shillings 2,500 per 50 kg bag for DAP and Kenya Shillings 1,600 per 50 kg bag for CAN compared to the unsubsidized market prices of Kenya Shillings 3,900 per 50 kg bag for DAP and Kenya Shillings 2,400 per 50 kg bag for CAN.

The formal soyabean chain is characterized by actors producing both human food and animal feed products (Table 4.2). Human food manufacturing companies use around 10,000-15,000 tons per annum, and feed milling firms produce in total about 500,000 tons of animal feed (mainly poultry), from fish meal, soyabean cake and flour, sunflower and cotton seed cake. The feed millers are mainly clustered in Edoret, Kitale, Kisumu, Mombasa, Meru, Nakuru, Nairobi, Naivasha, and Thika. The major companies are Unga Feeds, MCK Feeds, Sigma Feeds, Unifeeds and Lakefeeds. Unifeeds and Lakefeeds dominate the market in Western Kenya. Because annual domestic production is less than 2,000 tons, the bulk of the soyabean is imported. As much as 30,000-40,000 tons of processed soyabean is imported, mostly from India, for livestock feed manufacturing. The dairy feed segment is the fastest growing sector in Kenya.

With a small annual volume of production of around 10,000 tons, the demand for groundnut oil is insignificant in Kenya. There are a few food companies that manufacture peanut butter.

Table 4.2: Actors in the formal soyabean processing chain.

Manufacturer	Producing	Annual capacity (tons)
BIDCO Oil Refineries	-Soyabean oil -Cake or meal for feed millers -Sunflower oil (small part)	36,000
Promasidor, SoyAfrica and Farmers' Choice	-Human food products, including corn-soyabean blend flour, soyabean mince, biscuits, and milk	
Some poultry farmers	-Poultry feed	
>100 feed milling firms	-Animal feed (mainly poultry)	Aggregate annual production: 500,000

The World Food Programme Purchase for Progress (P4P) Kenya is trying to engage farmers to build local demand for food, by buying their maize, sorghum, beans, cowpeas, and pigeon peas, which they use for humanitarian feed programs targeting primarily refugees, school feeding programs, and HIV affected people throughout the country. P4P is also trying to buy corn soyabean blend. However, this is difficult because the locally processed product is more expensive than internationally sourced products and the organization does not buy at prices above international market prices. The experience of P4P shows that farmers often default on quality and quantity when they sign contracts to supply a minimum of 56 metric tons per order cycle. Farmers find it challenging both to aggregate as a farmers' group and to aggregate for capital. P4P's contracting time is 60 days from aggregation to payment. Farmers' groups try to negotiate with banks so that they get the money. In addition, maize and common beans are prone to aflatoxin problems, especially for farmers in Eastern Kenya because they harvest and dry the crops naturally when it is still raining. P4P planned to buy about 5,000 metric tons of common beans and 5,000-10,000 metric tons of cowpea per year. However, they only managed to buy 500 tons of common beans per year. Since P4P started to buy in 2009 it has managed to procure 60 tons of cowpeas. P4P does not have specific preferences for varieties, as long as they are pure. This further compromises local farmers to sell to P4P, because they often have a mixture of varieties.

Kenya Agricultural Commodity Exchange (KACE) operates as a marketing information system. KACE collects retail and wholesale agricultural commodity prices in urban markets and disseminates the information to farmers through cell phone companies and the website. KACE introduced a call market center through which farmers can sell and buy agricultural commodities. KACE delivered fertilizers and seeds to farmers through the National Accelerated Agricultural Inputs Programme.

4.5 Opportunities and constraints in grain legume value chain

Table 4.3 summarizes the opportunities, constraints and specific research interventions needed to tackle the constraints as perceived by the interviewed key actors. Because feed manufacturing firms annually require 30,000-40,000 tons of processed soyabeans and because soyabean is used directly for human consumption and for manufacturing human food products, respondents argued that the opportunity is to start producing for the soyabean industry. Other opportunities lie in supplying currently unmet demands for direct food use of urban markets. Also for other grain legumes there are opportunities to meet demands for direct food use of urban markets.

Key on-farm production constraints on increasing yield and expanding production of soyabean include lack of utilization technologies; lack of marketing; poor performance of improved varieties available especially against soyabean rust; and lack of seed of certified improved varieties. On farm constraints for common bean include pest and diseases; lack of certified seed of improved varieties; and poor agronomic practices. On-farm constraints for groundnuts are lack of certified seed of improved varieties; pests and diseases especially rosette; high labour requirements for harvesting and shelling; and poor agronomic management in terms of fertilizers and magnesium for pops.

Table 4.3 also includes the research interventions mentioned to resolve the constraints. Because there are strong complementarities among the components, these interventions need to be targeted at leverage nodes throughout the value chain.

Table 4.3: Summary of opportunities, constraints and specific research interventions related to the legume value chains, mentioned by respondents.

Opportunities	-Sale of dried grains to domestic urban markets -Import substitution (domestic supply can be doubled or tripled without meeting domestic demand) -Soyabean: supply to oil expressers, fast growing supply food and feed manufacturers to substitute imports
Constraints	1. Low productivity 2. Limited scale to timely and consistently supply end-markets with adequate volumes of products that meet grades and standards at competitive prices 3. Competition from imports 4. Lack of organized marketing 5. High volatility of international prices of grain legumes and low farm gate prices 6. Lack of appropriate post-harvest management technologies 7. Lack of organized financing 8. Poor government policies
Specific research interventions	(a) increasing productivity and profitability of production and expand volume of production through closing yield gaps and driving drive down costs of production by relaxing on-farm constraints through better multiplication and distribution systems of certified seed of improved varieties; better mechanisms for delivering inoculants and fertilizers; and improved crop management practices such as spacing, time of planting, pests and disease control; (b) organized production such as introducing soyabeans in rotation with wheat systems and marketing especially transport logistics and costs; (c) appropriate post-harvest methods storage facilities through farmers' associations to attain economies of scale; (d) financing mechanisms; (e) improving government policies especially on seed certification and fertilizer input subsidies and grades and standards.

5 Rwanda

5.1 Role of the target grain legumes in smallholder farmers' strategies for incomes, food security, nutrition, sustainable natural resource management (NRM) and gender equity

Results from the N2Africa farm household baseline survey indicate that common bean is the first major crop prioritized on 35 % of plots. Common bean is followed, in decreasing order of importance, by sweet potato (11 %), sorghum (10 %), cassava (7 %), banana (7 %), wheat (4 %), maize (4%), Irish potato (3%), groundnuts and soyabeans (2 %). The rate of certified seed use is low despite farmers being supplied seed for free under the Crop Intensification Program because of seed multiplication and distribution constraints for legumes. Farmers do not use inoculants on beans and soyabeans. This is in part because of unavailability of inoculants and in part because of the lack of information on use and importance of inoculants. Farmers use hand power in all farming operations. There is no use of draft animal and tractor power.

Common bean is grown by most farmers throughout the country and is the most important legume, both for household own consumption and for earning cash income. Rwanda has together with Burundi, Uganda and Eastern Democratic Republic of Congo some of the highest per capita consumption of common beans in the world. Besides beans rural households have few alternative cash crops. Traditionally common beans are a woman's crop. Common bean thus plays important roles in smallholder farmers' strategies for incomes, food security, nutrition, NRM and gender. However, during commercialization, common bean becomes a marketable commodity and women get disposed. Consequently, beans need to be promoted through interventions in their value chains with other crops that can take over their traditional roles under the control of women. Much of the common beans are climbing beans. Although common bean is grown in all areas of the country, the Northern and Eastern Provinces are the most important surplus production areas for both bush and climbing beans, due to favourable production conditions. About 30% of the common bean farmers use certified varieties.

Although their full potential is still untapped, soyabean is the second most important grain legume after common bean. When soyabean is cultivated for the household's subsistence requirements, women control the management and decision making of its production, utilization and consumption. During commercialization men dominate the decision making and control of incomes. Soyabean is produced mostly in the Southern Province (Muhanga, Kamonyi, Huye, Ruhango, Gisagara, Nyaruguru, Nyamagabe and Nyanza); the Western Province (Rusizi, Nyamasheke, Karongi, Ngororero and Rutsiro); and the Eastern Province (Bugesera, Kayonza, Nyagatare). In addition to better growing conditions for soyabean compared to common bean, another factor is that there are several soyabean production projects in these areas being implemented by non-governmental organizations (NGOs). These are promoting soyabean processing to improve food nutrition especially by vulnerable households, weaning foods and products for vegetarians. Surprisingly much soyabean is consumed locally at household level. As high as 62 % of soyabean growing sample households reported that they consume their total harvest of soyabean. Virtually all households reported that they use the residues for compost manure and benefit from biological fixation of nitrogen.

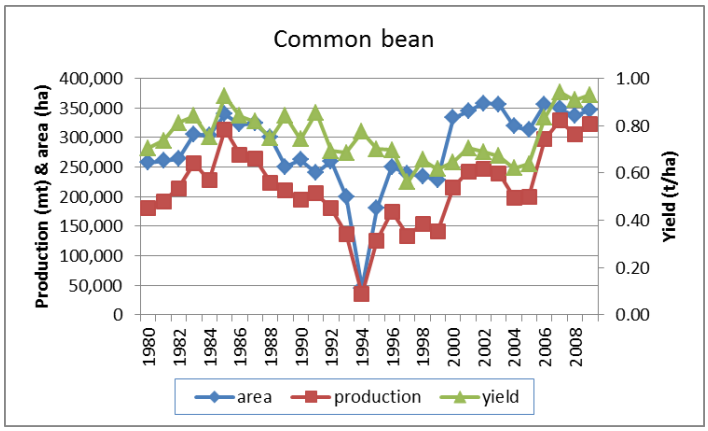
Cowpea is unimportant for incomes, food security, nutrition, NRM and gender equity. The production, marketing and consumption of cowpea is insignificant. Past agricultural development programs have not introduced, evaluated and promoted cowpeas.

Also groundnut is a minor crop and is grown only in few areas and in small quantities. Groundnuts are traded in the market mostly as green fresh pods. If marketed as dried grain groundnut is processed into flour. Groundnut is consumed mostly as a sauce with cassava and cassava leaves. Consequently, groundnut has a more critical role in food security and nutrition in areas where it can be competitively produced and supplied to markets. The most important areas of surplus production for groundnut are in the Eastern Province: Bugesera, Ngoma, Kayonza, Gatsibo, Nyagatare, Rwamagana and Kirehe, which have rainfall, temperature and sandy soils that favor the production of groundnuts.

5.2 Trends in area planted, yields and production

Common bean varieties in Rwanda include 27 climbing bean varieties, which were released and made available to farmers in three waves (before 1990, from 1995 to 2001 and from 2002-2010). Seven soyabean varieties have been officially released, also in three waves (from 1986 to 1988, in 2000 and from 2005-2009) (Appendix II). Four other soyabean varieties have been made available for cultivation by farmers although they have not been officially released. The national soyabean program is evaluating two soyabean rust tolerant varieties from SeedCo (Zimbabwe): Saga and Squire.

In 2009, the latest year for which data are available, annual aggregate production was estimated at around 322,964 tons for common beans; 15,077 tons for groundnuts; and 53,698 tons for soyabeans (Figure 5.1). Production is dominated by smallholders. There are no large scale farmers. However, the government is implementing a land consolidation program where farmers pool together their fragmented parcels of land into larger units and jointly cultivate these as cooperatives in order to generate and exploit economies of scale.



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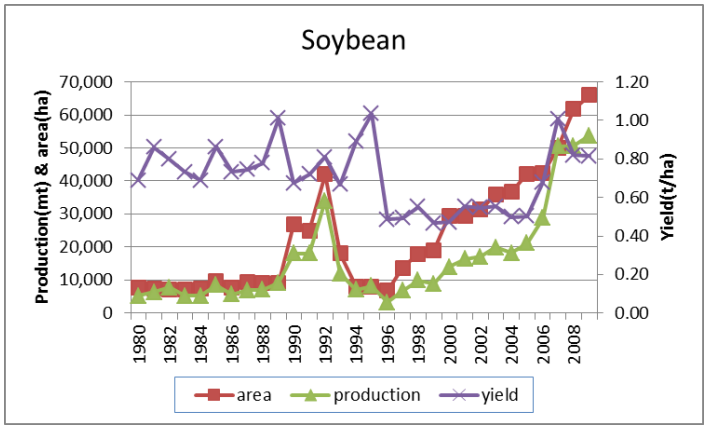


B.

Figure 5.1: Trends in area, production and yield of A) common bean and B) soyabean (Ministry of Agriculture and Animal Resources, 2011).

The area planted to common bean and soyabean has trended upwards during the past decade (Figure 5.1). This is being driven by the return to peace following civil war from 1990-1994; security of property rights; increasing domestic and regional demand for food because of population, urbanization and income growth; and the development, release, dissemination and adoption of improved varieties, crop management and post-harvest management technologies and the implementation of the land consolidation and crop intensification program interventions beginning in 2006, which involved better economies of scale in management of the fields, better access to inputs, markets and credit resulting from the organization of farmers into cooperative and increased use of certified seed of improved

varieties and fertilizers resulting from importation and distribution of agricultural inputs under the crop intensification program having an effect on common beans production. The improved technologies were developed by the Institut des Sciences Agronomiques du Rwanda (ISAR) and the Consortium of International Agricultural Research (CGIAR) Centers.

Also yields of common bean and soyabean have trended upwards during the past decade, driven by the crop intensification program. Farmers have better access to certified seed of improved varieties and fertilizers for maize, from which the legumes grown in intercrop or rotation also benefit. Soyabean is rapidly increasing in importance because of dissemination and diffusion of information and knowledge of its high nutritional value, production, utilization and marketing. Farmers are investing in improved soyabean production practices because they are aware of the importance of soyabeans. Another factor is that there are also several partners of the Ministry of Agriculture and Animal Resources (MINIAGRI) engaged in the promotion of soyabeans. These include the Clinton Hunter Development Initiative, CARITAS, CRS, TROCAIRE-funded Duhamic-ADRI, Counseil Consultatif Des Femmes (COCOF), IPFG and Association Rwandaise pour la promotion du Developpement Integre (ARDI) projects. These projects are contributing to increasing knowledge and skills for soyabean growers, especially agronomic practices and use of inorganic fertilizers and inoculants.

5.3 Structure and dynamics underway in the grain legumes value chains

There is some degree of commercialization among farm households (Table 5.1). The main consumption centers are the urban centers in Rwanda, Burundi, DRC, Uganda, Kenya, South Sudan and Somalia. Common bean is mostly consumed without processing by formal commercial firms. Soyabean is mostly consumed as maize, sorghum and cassava blended flour or consumed as roasted grain, soymilk and paste mixed with local vegetables.

Table 5.1: Baseline data showing degree of commercialization among farm households.

Legume type	% farmers selling some of the produce	% that net selling households on average market	Mostly sold as
Common bean	40	41	Dried grain
Soyabean	40	55	Dried grain
Groundnut	30	28	Fresh grain

Figure 5.2 reports the pathways from source to end-markets. This shows that the value chain is organized into 5 main channels: (1) subsistence production and consumption; (2) dried grain sold through rural markets and wholesale and retail urban markets for direct human food consumption; (3) dried grain for processing into human foods by cottage industries; (4) dried grain for manufacturing of human foods by formal processors; and (5) exports to Burundi, DRC, Uganda, Kenya, South Sudan and Somalia. The subsistence production and consumption chain accounts for the bulk of the trade flows. The rural and urban direct human food and cottage food processing value chains account for a small share of the trade flows.

Commercial marketing channels start with agricultural research, technology development and extension. The main actors in the commercial channel are summarized in Table 5.2. The Crop Intensification Program started in 2007 when the government imported seeds for maize, potatoes and wheat from Kenya and Tanzania. Currently, the government is emphasizing its own seed production. Through farmer associations and cooperatives and local and international NGOs, Rwanda Agricultural Development Authority (RADA) distributes seeds to the farmers, based on estimated areas that farmers plan to plant to different crops (estimates made by MINIAGRI). Farmers can also buy seed directly from RADA. However, most farmers receive the seed for free. To qualify for free seed, farmers are first required to buy fertilizers using coupons distributed through the fertilizer subsidy scheme.

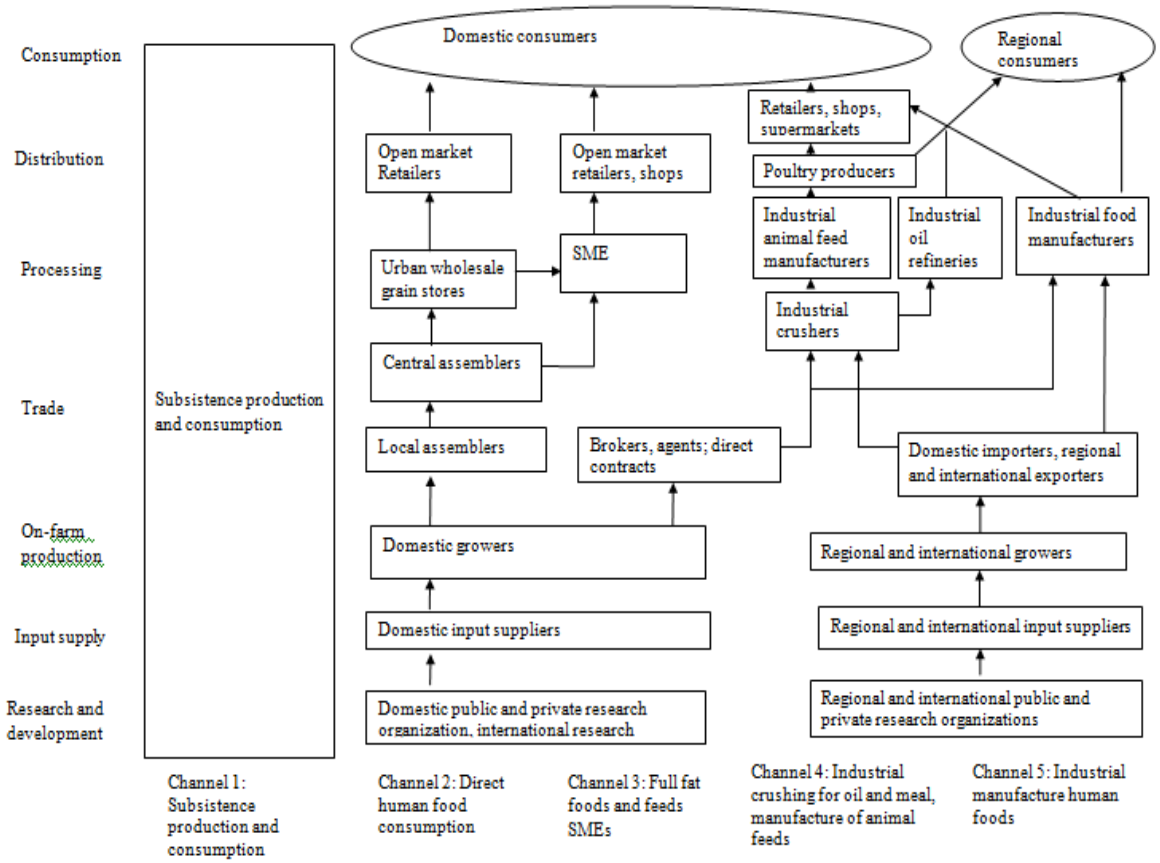


Figure 2. Grain legumes value chain, 2011
Source: Author's representation based on interviews with value chain participants

Figure 5.2: Value chain for grain legumes in Rwanda.

There are only few seed producers in Rwanda and the supply of grain legume seed does not meet the demand. During the two cropping seasons in 2010, RADA produced certified seed 148 tons of certified bush bean seed, 25 tons of certified climbing bean seed and 121 tons of certified soyabean seed. This is sufficient to plant only about 1% of the bean and 3 % of the soyabean area. Common bean varieties supplied to farmers are mostly the bush beans varieties RWR1668 and RWR2154. Soyabean varieties are mostly Peka6, 449/6/16 and Bossier. These varieties are early maturing, which is preferred by the farmers.

Fertilizers, agrochemicals and inoculants are imported. Fertilizers are imported by the government, which then sells the fertilizers through auctions to private distributors. Private firms sell fertilizers at subsidized prices through agro-dealers. The fertilizer subsidy is designed so that, with a coupon, farmers pay 50% of the market price and the other 50% is paid by the government. IFDC is implementing programs to assist the government to exit importation and strengthening distribution by private firms. Various organizations promote the use of Rhizobium inoculations, which are being imported from MEA in Kenya. IFDC is also putting in place institutional arrangements for inoculants to be marketed through agro-dealers.

Table 5.2: Actors in the commercial marketing channels.

Actor[1]	Role
ISAR	Research: Common bean and soyabean breeding, crop management and soil microbiology
PABRA, CIAT, ECABREN, IITA, INTSOY (University of	Research: bean and soyabean crop improvement research

Illinois)	
Ministry of Agriculture Extension, CIALCA, agrodealers	Participatory technology development, agricultural extension, information and communication, famer training and capacity development
NGOs (Troicare, Duhamic ADRI, CRS, ARDI, CARITAS)	
Farmers' organizations (cooperatives, outgower and contract farmers)	Extension, bargaining power, linking farmers to input supply and output markets
Crop Intensification Program	-Start in 2007 (government imported seeds for maize, potatoes and wheat from Kenya and Tanzania) -Now own seed production
ISAR and the Seed Development Unit from RADA	Produce foundation seed
RADA	-Produces certified and quality declared soyabean and common bean seed -Distributes seeds to the farmers, based on estimated areas that farmers plan to plant to different crops, through farmer associations and cooperatives and local and international NGOs
MINIAGRI	Estimates areas that farmers plan to plant to different crops
IFDC	-Organizing local seed growers, strengthening seed producers' associations and working with members to establish commercial seed businesses -agro-dealer development program in June 2010 to identify agro-dealers, train them in business management and product knowledge and strengthen their capacity by linking them with input suppliers, banks and financial institutions
PReFER (IFDC)	assist the government to exit importation and strengthening distribution by private firms. PReFER works in collaboration with the Catalyze Accelerated Agricultural Intensification for Social and Environmental Stability (CATALIST) and Rwanda Agro-dealer Development Program supported by the Alliance for a Green Revolution in Africa (AGRA)
ISAR, the Clinton Hunter Development Initiative and AGRA	promoting the use of Rhizobium inoculants through on-farm demonstration plots
IFDC	agro-dealer development, putting in place institutional arrangements for inoculants to be marketed through agro-dealers

[1]Acronyms: PABRA: Pan Africa Bean Research Alliance CIAT: International Center for Tropical Agriculture ECABREN: East and Central Africa Research Network INTSOY: International Soyabean Program MINIAGRI: Ministry of Agriculture and Animal Resources RADA: Rwanda Agricultural Development Authority PReFER: Privatization of Rwanda's Fertilizer Import and Distribution System IFDC: International Fertilizer Development Center

5.4 Trade flows

Farmers in the major surplus production areas sell to local assemblers in village markets during market days. For common beans, farmers most commonly do not sell the whole marketable surplus at once but rather bring small quantities to the marketplace depending on their requirements for cash in order to hedge against low prices that occur after harvest. Rural food deficit farmers buy grain for food and for seed from village markets.

Local assemblers aggregate small quantities of produce into bulk loads (resulting in co-mingling of different varieties) and sell to central assemblers. Central assemblers are commonly agents of terminal wholesalers in urban markets and buy from several village markets in the country and further afield in border towns with Tanzania, Burundi, Kivu and Uganda. They bag and aggregate the parcels into 2-5 ton truck loads and transport the produce to wholesale markets in urban centers, where they sell to wholesalers. Wholesalers in turn store and sell bags to urban retailers, consumers and processors. Retailers then break up the bags and sell to final consumers in small loads in retail municipal markets.

Legume grain flows from surplus production areas to centers of consumption through transport corridors. Most of the trade is informal and this makes it difficult to accurately quantify the grain flows. Common bean and soyabean are transported to Rwanda by boat across the lake from South Kivu (from Biravia) and by truck from North Kivu (from Masisi and Rutschuru through Goma), Uganda (from Mbarara, Kasese and Kabale) and Tanzania (from northwest and southern regions through Mwanza). Depending on seasonal price differences and opportunities for spatial arbitrage, this trade flow reverses during the year. Common bean is transported from Rwanda to Burundi, South Kivu, North Kivu, Uganda, Kenya, South Sudan and Somalia. The bulk of the groundnuts are imported from Tanzania (from Kahama). Some of the groundnuts are transported to Burundi and South Kivu.

Because domestic production of soyabean is insufficient to meet demands, the bulk of soyabean is imported as grain from DRC and Uganda. Groundnut is imported from Uganda and Tanzania. The urban households and institutional buyers pay premium prices for “single variety” common beans. The export markets have a preference for white, yellow, red mottled and khaki beans. By contrast, rural households mostly consume mixed varieties. For groundnut the mostly traded varieties are the red and white varieties. Soyabean processors prefer physically large-sized grains that have a yellow color, which is best for maize-sorghum-soyabean blended flour.

Gross marketing margin analysis shows that the price spread more than doubles from the farm-gate to terminal wholesale markets (Table 5.3). This suggests that it is profitable to transfer the grains from sources to the destination and that the unitary gross returns are high for local assemblers, central assemblers, wholesalers, processors and exporters.

Table 5.3: Prices of grain legumes (US$/kilogram)and unitary gross margins at different marketing stages (Rwanda, 2010).

Stage	Bean (Bugesera)	Soyabean (Bugesera, Kamonyi)	Groundnut (Luvungi)	Soyabean (Goma)	Soyabean (Uganda: Mbarara, Kabare)
Certified seed	0.84	0.84	1.35		
Farm gate	0.30	0.34	1.00	0.35	
Seed to grain price ratio	2.78	2.50	3.88		
Local assembly	0.34	0.47	1.50	0.52	
Central assembly	0.42	0.51	1.52	0.57	
Urban wholesale market	0.67	0.84	1.69	0.65	
Processing plant gate soyabean grain price				0.84	0.84
Processing plant gate soyabean flour price				2.11	2.11
Conversion factor soyabean grain to flour				0.84	0.84
Farm price in processing of plant gate equivalent				2.52	2.52
Transport	0.08	0.08	0.07	0.04	0.04
Local assembler's gross margin	0.03	0.13	0.50	0.17	0.00
Central assembler's gross margin	0.08	0.03	0.02	0.04	0.00
Urban wholesaler's gross margin	0.25	0.34	0.17	0.09	0.00
Processor's gross margin				1.68	1.68
Farmgate to terminal market spread	2.22	2.50	1.69	1.88	

Co-integration analysis of monthly prices of common bean, groundnut and soyabean in Rwanda Francs per kg for the period from January 2004 to September 2011 in retail markets in Kigali, urban and rural Eastern province show that price movements reflect each other (Figure 5.3). There is evidence that these markets compete with each other. Price co-integration analyses show that the

markets are well connected because of inter-spatial physical arbitrage and responding to the same economic signals from the main consumption centre.

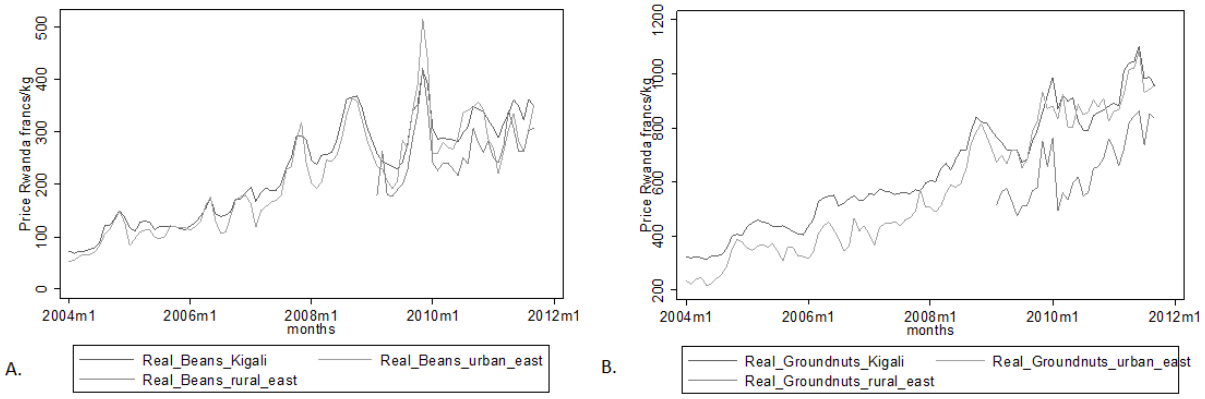


Figure 5.3: Monthly prices of A) common bean and B) groundnut in Rwandan Francs per kilogram in retail markets in Kigali, urban and rural markets in the Eastern Province, Rwanda, January 2004-September 2011.

Due to periodic differences in supply and demand, there are seasonal fluctuations in prices (Figure 5.4). Common beans and soyabeans are harvested from June to August and from January to February. The drop in prices during harvesting in June to August is higher than during January to February, due to generally higher production in the March to May cropping season. Seasonal annual prices have been trending upwards from 2004 to 2011.

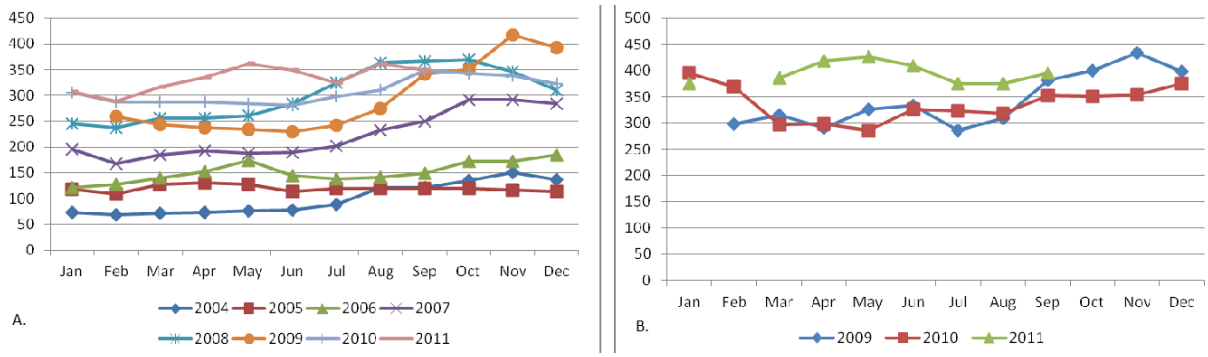


Figure 5.4: Seasonal price movements in Rwandan Francs per kilogram for A) common bean (2001-2011) and B) soyabean (2009-2011).

When prices are lowest, processors buy and store quantities of soyabeans, to meet the requirements for production during the offseason period. This suggests that there are profitable returns to storage at the local and central assembly levels by exploiting economies of scale. Wholesale traders handle an average annual throughput of 500 tons of beans and 150 tons of soyabeans. MINIAGRI implemented a post-harvest handling and storage project from 2009 to 2012 to put in place storage and equipment facilities for managing the increased marketable surpluses resulting from the Crop Intensification Program and to permit farmers to avoid post-harvest price collapse. MINIAGRI also started in 2010 trading in beans for the national strategic food reserve. If storage becomes profitable for private firms, the government will transfer to them the responsibility for managing the strategic grain reserves. NGOs supporting the development of processing plants are assisting farmers to establish storage at community level and empowering them to influence market prices.

5.5 End-markets

The end-markets for grain legumes consist of five segments: rural households net food buyers; urban households; institutional buyers such as restaurants, schools, prisons, hospitals and the World Food Programme (WFP) Purchase for Progress (PFP); informal processors; formal processors; and

exporters. WFP Purchase for Progress annually purchases around 2,000-3,000 tons of beans directly from farmers' cooperatives for distribution to refugee camps and school feeding programs.

Informal processors consist of household enterprises that process the dried grains into flour, roasted nuts and peanut butter and sell to final consumers through open air retail markets. Informal soyabean processors consist of household enterprises that make animal feeds for their poultry, pork and dairy enterprises and for sale to other farmers.

Formal food processors precook and pack common beans; and roast and pack groundnuts, peanut butter and flour. They sell these products through supermarkets, grocery stores and tuck shops. Table 5.4 gives an overview of the formal soyabean processors in Rwanda. In addition, Mount Meru-SoyCo is investing in a large-scale solvent extraction plant with an annual capacity of 36,000 tons for producing stock feeds.

Table 5.4: Formal soyabean processors in Rwanda.

Soyabean processors	Products	Tons of grain annually processed
Sosoma Industries	Maize-sorghum-soyabean blended flour	300-400
COCOF (Muhanga)	Tofu, soymilk, composite flour, soy flour and soya tea	25-30
IPFG (Nyamagabe)	Tofu, soymilk, composite flour, soy flour and soya tea	
Ruhango processors	Tofu, soymilk, composite flour, soy flour and soya tea	
Rulindo district oil expressing	Edible vegetable oils and cake	
Sobab feed manufacturing	Livestock feed manufacturing	
Mt. Meru Soyco	Procurement, transport, storage, crushing , processing, manufacture and distribution of edible vegetable and soyabean meal for manufacturing livestock feed	

The export market consists of informal traders that transport the dry common bean grain across border and sell in wholesale markets in urban areas in DRC, Burundi, Uganda, Southern Sudan, Kenya and Somalia. However, beans are also being imported from DRC, Tanzania and Uganda depending on the season.

Because common bean is a food staple and has differential demand, the value chains are characterized by ad hoc coordination among farmers, local and central assemblers, wholesalers, retailers, and processors. However, the WFP purchases through contracts with grain traders and is beginning to coordinate the value chains. The WFP P4P is piloting forward deliverable contracts with cooperatives. Because soyabean is still a new crop and grown by few farmers, the value chains are better coordinated than those for common bean. Formal soyabean processors are beginning to actively coordinate the value chains by necessity. Processors advertise in the newspapers and radio for traders to deliver soyabean and issue tenders to competitive suppliers, usually wholesalers in Nyabugogo terminal market in Kigali. TROCAIRE supported Sosoma to experiment with forward deliverable contracts with cooperative funded under Duhamic-ADRI, COCOF and ARDI projects. To stimulate production of soyabeans, the Clinton Hunter Development Initiative supported MOUNT MERU-SOYCO to set up production contracts with farmer cooperatives.

The business enabling environment affecting the grain legume value chains is characterized by little government bureaucracy and red tape when conducting transactions, strong public sector investment in research, education and extension systems to improve food security, strong legal and regulatory capacity, good public infrastructure, strong investment in ICT to enable Rwanda to become the "Silicon Valley" of Sub-Saharan Africa, low inflation and a cooperative business culture. The government emphasizes the development of agricultural cooperatives. This will permit farmers to pool their resources, aggregate capital and achieve better economies of scale in information acquisition, input procurement, farming and output marketing.

The horizontal linkages are focusing on strengthening collective action among farmers through farmers' groups, cooperatives and district-federated associations. The Government is placing emphasis on the development of cooperatives and farmer associations to reduce transactions and increase the efficiency of supply of certified seed, fertilizers, agrochemicals and inoculants. The government also stimulated participatory technology testing, dissemination and capacity building of farmers as well as product assembly, bulking, transportation and storage of products and access to credit and micro-finance. The cooperatives and associations support value addition through grading, storage and processing. These organizations are being supported by NGOs. Farmers' associations have established a warehouse receipt system linked to savings and loan cooperative societies in urban areas. Farmers deliver and store grain in warehouse depots under the inventory credit system. Members of the association and micro credit cooperative jointly manage the inventory in storage. Farmers can receive credit secured against their grain deliveries. Traders buy and collect grain directly from depots. This increases benefits to farmers through value added by reducing transaction costs, removing middlepersons, and avoiding post-harvest price collapse.

Turning to supporting markets, the Government is expanding investments in seasonal and long-term micro-financing. In addition, the Government is implementing the eRwanda project to expand use of ICT, is strengthening agricultural market pricing information through the e-SOKO project and is facilitating the private firms and farmers' organizations to access national and regional markets (Ministry of Agriculture and Animal Resources, 2012). Farmers use mobile phones to access prices collected by MINAGRI.

With the emphasis placed on cooperatives, value chain governance is based on cooperative bargaining and integration. Large traders still have the power to define the terms of contract in their supply chains based on their better access to capital, better access to information about different product markets and better knowledge about potential for spatial arbitrage and profitable trade. Grading systems, standard weights and measures, and legal trading codes have hardly been used, but cooperatives are increasingly using standardizing grades, weights and measures.

5.6 Opportunities and Constraints

Rwanda is one of the countries with the highest per capita consumption of common bean. In addition, processing and manufacturing of human food and stock feeds by cottage and industrial plants is increasing. Consequently, this increases the demand for grain legumes raw materials, especially soyabean for poultry and dairy feed production. Opportunities for upgrading thus lie in production and process innovation to respond to unmet and increasing demands in end markets in local, national and regional urban centers and substitution of imported foods.

However, there are quite some factors that constrain effective legume production (Table 5.5). Prevailing low yields, lack of supply systems and lack of coordination in the markets (e.g. identify potential demands and offer information and incentives to farmers and other market participants, or the lack of standard measures) are amongst the most problematic. In addition, the technical and financial capacity of farmers to organize cooperatives is limited and effective farm gate prices are low and volatile. Because of the high opportunity cost of land and other crop enterprises that are more profitable than grain legumes, Rwandese farmers have higher unit production costs compared to growers in DRC and Uganda. This makes growers in Rwanda uncompetitive pricewise with growers in these countries. Besides, there are limited post-harvest storage facilities to add value to farmers' products and help farmers avoid post-harvest price collapse. Also, there are only few formal processing plants. Furthermore, researchers' recommendations cannot be practically implemented with the resources and risks faced by most farmers. Most extension use demonstration plots to extend technologies, which is ineffective because only a few farmers visit demonstration plots. On top of that, there is a lack of knowledge of the effectiveness and efficiency of alternative government policy interventions to have impact on outcomes of interest. For example, the government is placing emphasis on transforming farmers associations to be organized as cooperatives. However, cooperatives are demanding in terms of organizational and financial management and farmers have limited technical skills and financial capacities. Some cooperative members do not honor forward deliverable production contracts.

Table 5.5: Summary of opportunities, constraints and specific areas for research interventions related to the legume value chains.

Opportunities	-meeting increasing demands in end-markets and farm households' own consumption. -expand edible oil production and substitute imports. -exporting processed foods to Burundi, Uganda and DRC.
Constraints	1. low farm yields and lack of capacity to supply raw grains in large quantities 2. lack of supply systems for certified seed of appropriate varieties, fertilizers, pesticides and inoculants 3. poor extension and information dissemination systems 4. the lack of organized marketing, low and highly variable farm gate prices 5. lack of post-harvest storage 6. lack of micro-financing and credit 7. lack of small, medium and large scale processing to add value to farmers products 8. lack of evidence-based policy making
Requirements/research interventions	(a) increasing productivity, profitability and competitiveness of legume on-farm production and expanding volume of production of marketable surpluses through closing yield gaps through resolving on-farm production constraints. (b) improving product quality and consistency of delivery. (c) increasing market access and efficiency. (d) improving institutional and policy environment.

Respondents indicated that increasing on-farm productivity requires increasing the country's capacity in breeding to select high yielding varieties adapted to the country's agro-ecologies; supporting ISAR to increase inoculants production; increasing the efficiency of use of inputs, especially fertilizers and inoculants, by farmers; expanding the availability and affordability of certified seed of improved varieties, fertilizers, agrochemicals, inoculants and microfinance; and extension delivery mechanisms that advise farmers to use practices that produce quality products with traits that buyers are willing to pay premium prices; strengthening agro-dealer development programs in input and output marketing and demonstration plots; and providing credit to farmers through the trade through agro-dealers. Interventions are also needed to improve post-harvest management, collection centers and storage of grains using warehouse receipt systems among cooperatives, banks, agro-dealers, and manufacturers. This will help shorten the marketing chain and improve efficiency. Interventions are required to better organize products markets and provide market information systems about marketable surpluses and areas with these surpluses; demand and characteristics of products for which buyers are willing to pay premium prices. Research is required to assist farmers to process soyabeans into value-added products for home consumption and sale, including milk and meat. Research is also required to evaluate policies that work and result in success.

To respond to market opportunities, respondents identified that value chain participants have to innovate to improve efficiency, product quality, productivity, profitability and competiveness and add operations to increase value added across the value chains. These can be increased through organizing associations of farmers and agro-dealers and public-private partnership models. These institutional arrangements expand farmers' access to market information about varietal and grain quality characteristics preferred in different end-markets and awareness about practical production technologies; input markets (seeds, fertilizers, inoculants, pesticides, tools); output markets (forward deliverable contracts, storage, processing); micro-finance; and technical training and capacity building. They also strengthen bargaining power through producer cooperatives and traders' associations, improve information flows, price discovery and margins through vertical and horizontal integration and shorten the long marketing chains between farmers and consumers. There are on-going initiatives that work on these issues (Table 5.6).

Table 5.6: Examples and initiatives or organizations working on strengthening the grain legume value chains.

	Role
Trocaire	Financial support to local NGOs
Local NGOs (Duhamic ADRI, COCOF, IPFG and ARDI)	support on-farm production, storage, processing, and marketing. support cooperatives in capacity building and management. establish processing plants (Sosoma, COCOF, and IPFG) and supporting micro-financing institutions
Farmers' associations	working with individual farmers, who receiving inputs, technical assistance, and competitive market prices from partners.
Warehouse receipt systems	buy grain from their members and add value through bulking, grading, sorting and storage and collective selling+ avoid post-harvest price collapse and improving returns to their investments + pay back credit for inputs after harvest
Clinton Hunter Development Initiative	value addition through establishing large-scale processing facilities for oil extraction and stock feeds
IFDC	training agro-dealers to diversify to diversify into agricultural output marketing and increase efficiency through better economies of scale and scope between input selling and purchasing of farm output

6 Ghana

6.1 Role of the target grain legumes in smallholder farmers' strategies for incomes, food security, nutrition, sustainable natural resource management (NRM) and gender equity

In Ghana, cowpea, groundnut and soyabean play roles that vary from important to very important in smallholder farmers' strategies for incomes, food security, nutrition, NRM and gender equity. Common bean only plays a minor role. Cowpea is both a food security and a cash crop. Because of its short duration it can be grown in two months and harvested to give break-even yields even with little rain and stored and consumed when households ran out of other foods. The dry grain is a daily staple for the majority of the population and the green leaves of cowpea are eaten as vegetables. The dried haulms are used as livestock feed. Cowpeas is cultivated by both men and women, but dominated by women in post-harvest processing and marketing. Cowpea is utilized as flour to make traditional home meals such stews, soups, bean cake, and kose. Cowpea is also utilized as whole grain to prepare gari and beans and wakye. These foods are often sold in street food markets.

Also groundnut is one of the first maturing crops during the hungry season. Farm households can quickly harvest, boil or roast and eat them as fresh nuts. The vines are sold for livestock feed. In addition, groundnuts can be sold as dry grain to oil mills for processing into oil and groundnut cake. Surplus production can be easily sold for cash. In addition, groundnut can be easily stored in the shell and eaten during the extreme hunger periods. Within households, groundnut is mainly used to make soup or stew in the meals. Groundnut is a women's crop and helps achieve gender equity because women dominate most production and processing operations, including planting, weeding, harvesting, stripping, processing and marketing.

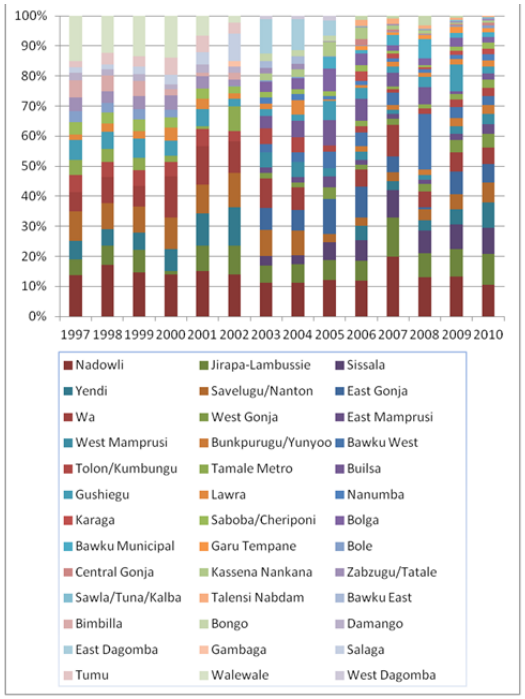
Soyabean has become one of the most important commodities for generating cash incomes to farmers, more than maize and rice. Several processing plants have been recently established, increasing the demand. Although farmers do not eat soyabean traditionally, it is becoming an important crop for household food security. Soyabean is mainly a women's crop and can thus be used to bridge gender gap. However, men are taking over control of the crop because it is bringing cash income and it has a ready market.

6.2 Production by geographical area

Although cowpea and groundnut are grown throughout Ghana, marketable surplus production is geographically concentrated. Cowpea, groundnut and soyabean production is concentrated in the Northern Region, Upper West and Upper East. More than 50% of the cowpea is produced in six districts. More than 60% of groundnut is produced in a dozen districts and roughly 70% of soyabean production is concentrated in eight districts (Figure 6.1). Due to the lower rainfall, sandy and loamy soils, low insect, pest and disease pressure - conditions favouring the production of these legumes compared to other areas - farm households in these areas have a traditional culture of growing legumes. Because of their role in improving household food security, several NGOs and development projects are promoting cowpea, groundnut and soyabean in the drought prone areas of the country.

6.3 Trends in area planted, yields and production

During the past 15 years, cowpea, groundnut and soyabean acreage, yield and production have fluctuated with an upward trend (Figure 6.2). These trends are being driven by the development, release, availability and adoption of quality seed of improved varieties; availability of markets and increasing market demand by urban consumers; increased prices, profitability and incentives for farmers to grow the crops.



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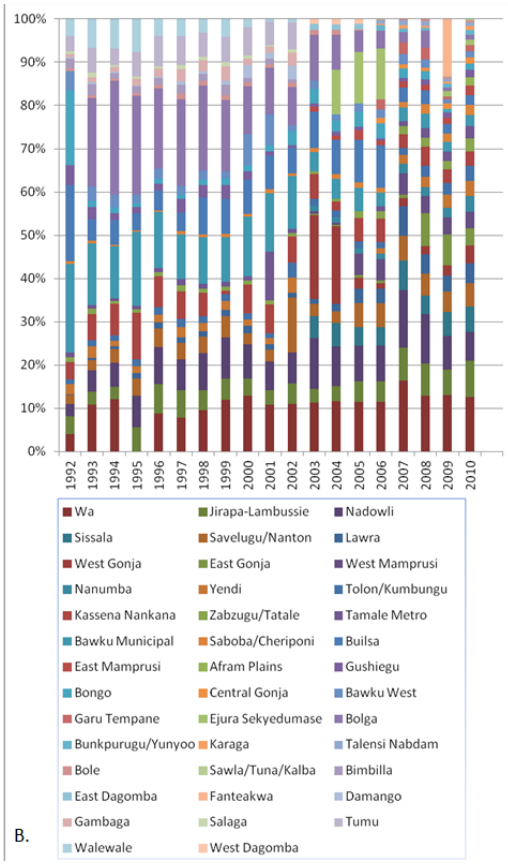

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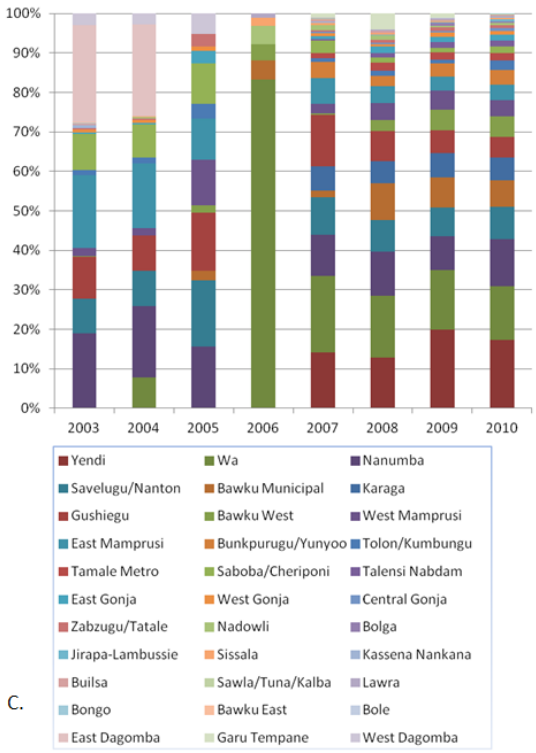

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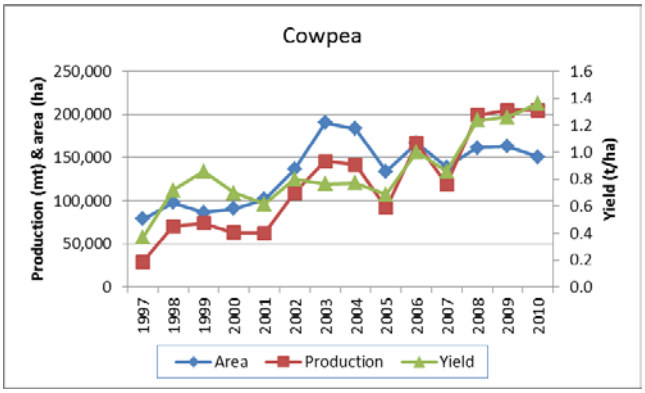
Figure 6.1: Shifts of production shares of the districts for A) cowpea (1997-2010), B) groundnut (1992-2000) and C) soyabean (2003-2010). Source: Statistics, Research and Information Directorate (SRID), Ministry of Food and Agriculture.



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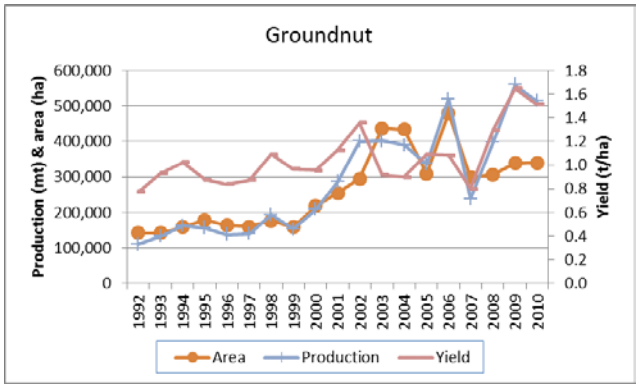

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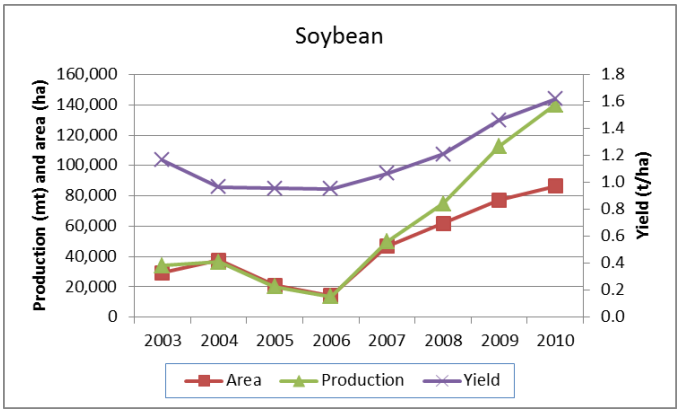


C.

Figure 6.2: Trends in aggregate area, yields and production of A) cowpea (1997-2010) B) groundnut (1992-2010) and C) soyabean (2003-2010). Source: Statistics, Research and Information Directorate (SRID), Ministry of Food and Agriculture.

During the 1980s and 1990s the Ghana Grains Development Project (GGDP) was implemented and helped to improve yields through development and release of improved varieties, agronomic, grain storage and seed production technologies; seed multiplication and distribution; and extension. Since the 1980s, 19 cowpeas varieties have been released (Appendix II). In addition, the Peanut Collaborative Research Support Program (PCRSP) has been implemented since 1982. The program has contributed to increasing yields through development and release of rosette and leaf spot resistant varieties, crop management, aflatoxin management, post-harvest management and food processing technologies. The project is currently implementing interventions across the whole value chain to exert a market pull for improved technologies. Because of market preferences, Nkariesani is more widely adopted than Kpaniete although Kpaniete gives higher yields. However, production of groundnuts is erratic.

Soyabean was first introduced in Ghana in 1909 (Shurtleff and Aoyagi, 2009) and taken up by farmers in the Northern Regions (Plahar, 2006). During the late 1960s and early 1970s the Council for Scientific and Industrial Research (CSRI) intensified soyabean research to improve animal and human nutrition and increase food security. These investments failed to have impact because (1) households had a lack of knowledge about utilization of soyabeans in traditional dishes, (2) there was a lack of processing industries, (3) the production technologies were unprofitable and (4) there was a lack of market for the produce. Between 1975 and 1977 there was a major campaign to use soyabean as poultry feed. During the late 1980s and 1990s public-private partnerships were used to implement interventions under different projects, targeted at the simultaneous processes of consumption oil extraction and the production of cake for animal feed and utilization in preparation of home meals. The interventions included selection soyabean varieties based on nutritional composition and relative ease of processing; appropriate technologies for production of soy-based weaning and high protein-energy

foods; the development of new commercial products and recipes for household preparation of meals; breeding and crop management; seed multiplication and distribution; and extension, especially by Women in Agricultural Development (WIADs), NGOs and processors. The interventions increased awareness which in turn induced farmers to go into soyabean production in the 1990s. Following the establishment of large scale soyabean processing plants, soyabean grew into a commercial crop in the 2000s. The increase in yield is being driven by the development and release of two pod-shattering resistant varieties: Jenguma and Quarshie. These varieties are interesting because farmers harvest soyabeans late as they prioritize harvesting staple food grains first.

6.4 Structure and dynamics underway in the grain legumes value chains

In Ghana, there is a high degree of commercialization of the grain legumes (Table 6.1). The most important areas of high consumption are mainly urban centers in the central, western and southern regions. The bulk of the cowpea, groundnut and soyabean enter commercial trade from the surplus producing area in the northern areas to centers of high consumption in the southern urban markets through Techiman and Tamale markets. These are entrepôts for moving grains from food sheds to urban consumption centers: Kumasi, Sekondi-Takoradi, Obuasi and Accra.

Table 6.1: N2Africa baseline data showing degree of commercialization of grain legumes in Ghana.

Legume type	% farmers selling some of the produce	% that net selling households on average market	Mostly sold as
Cowpea	>60	>54	Dried grain
Groundnut	80	60	40% dried, 60% fresh
Soyabean	81	60	Dried grain

The value chain of grain legumes in Ghana consists of four main channels: (1) subsistence production and consumption; (2) dried unprocessed grains sold to nearby and long distance markets for direct household consumption; (3) dried grains sold for industrial processing; and (4) manufacturing of edible vegetable oil, food and feed products. The non-commercial channel consists of the subsistence production and consumption chain. The share output of subsistence production and consumption is 32% for cowpeas, 48% for groundnuts and 49% for soyabeans.

The starting point of commercial value chains is crop improvement research. Research is carried out by the Crops Research Institute (CRI), the Savannah Agricultural Research Institute (SARI), Food Research Institute (FRI) and the universities. To date 19 cowpeas, 10 groundnuts and 8 soyabeans varieties have been released (Appendix III). Most of the released varieties were derived from crosses with pedigrees from IITA and ICRISAT.

Up until 2011 the Grain and Legumes Development Board (GLBD) was the only organization mandated to multiply breeders to foundation seed. A new seed law has been passed permitting private companies to source breeder seed directly from the research stations and carry out foundation seed production. Individual seed growers and companies multiply foundation seed to certified seed. Growers and companies focus on maize and rice. The seed companies are still emerging and small in scale. Most companies are receiving technical and financial support from AGRA. They include Savannah Seeds Services, M and B, Heritage Seeds, Lexbog CLSD, Alfa Seed and Antuqua Wa. Pannar is operating through Wienco Agriculture.

All seed growers and companies are registered with Ministry of Food and Agriculture (MOFA) Seed Inspection Unit to ensure that growers use management practices that meet the standard for certified seed. The bulk of the seed is sold through the MOFA block farming program, agricultural development projects such as N2Africa, AGRA Soil Health, MiDA and NGOs such as ADRA. The seed is given to farmers for free. Alternatively, seed companies themselves sell seed directly to customers from the warehouses of the Seed Inspection Unit or through agro-dealers. Agro-input dealers repackage the seed into smaller pockets and sell together with fertilizer. During 2010, around 6,165 tons of certified

seed were produced. More than 70% of the seed was maize; 24% was rice; and the remainder was cowpea and soyabean.

All fertilizers used in the country are imported. Fertilizer import is dominated by Yara and distribution is done by Wienco. The government runs a fertilizer subsidy program. First the subsidy program was based on vouchers, but due to difficulties with the voucher system, in 2008 the government changed the program to one where farmers pay low and uniform prices for fertilizer. With this system, one 50-kilogram bag of NPK 15:15:15 cost 27 Cedis in 2010 and 30 Cedis in 2011. A 50-kilogram bag of urea cost 25 Cedis in 2010 and 29 Cedis in 2011 (1 US$ = 1.4930 Ghana Cedi). Due to this subsidy program fertilizer use has recently expanded for maize and rice directly targeted under the program, but also for soyabeans, which are not directly targeted (Figure 6.3). However, due to seasonal differences between the Northern and Southern regions, there are logistical problems delivering the right product to the right place at the right time.

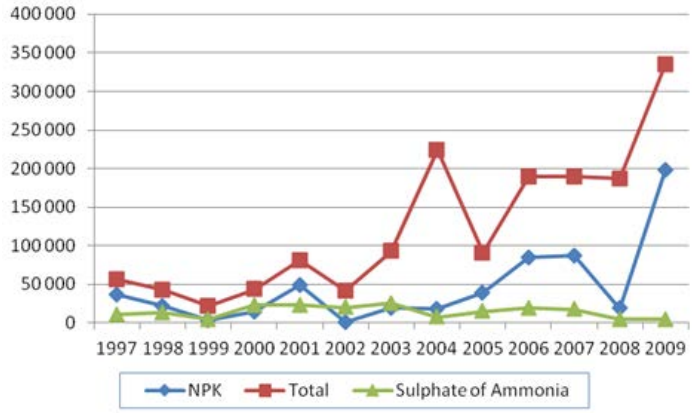


Figure 6.3: Annual fertilizer imports (mt), Ghana, 1997-2009, Ghana, 2003-2010. Source: Ministry of Food and Agriculture, Crops Services Directorate, Accra.

6.5 Trade flows

Farmers sell legume grain to local traders in village markets. Local traders assemble the small lots into larger volumes, transport to central markets and sell to storers and grain merchants in urban markets. The grain merchants sell on wholesale to long-distance trade and local retailers. Also, wholesalers in urban markets in high consumption centers travel to the surplus regions to buy grain directly from farmers in village markets during market days. There is increasing specialization and farmers are increasingly selling to aggregators and commission agents rather than local traders. Besides pre-financing farmers, aggregators and commission agents supply services such as tillage, threshing, shelling, assemble, clean, sort and grade, repack, store and sell to long distance traders, poultry farms, and industrial processing companies. Aggregators are increasingly becoming dominated by farmers' marketing associations. These are supported by IFDC and the Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance (ACDI/VOCA). The aggregators are often located in wholesale markets in urban centers. These include Wa, Yendi, Nkoronza, Bawku, Bolgatanga, Tamale and Techiman.

Excess demand for cowpea, groundnut and soyabean in Ghana drives cross border trade flows along export corridors from food sheds in Togo (Northern part), Burkina Faso (Pouytenga and Bobo-Dioulasso), Benin, Niger and Cote D'Ivoire (Korhogo). Most of the trade is informal. This makes it difficult to accurately record and quantify the flows. Aggregators also (informally) buy from farmers in local markets in neighboring countries or purchase grain along the borders. Differences in rainfall seasons, and thus also in harvest seasons, results in price differences, which in turn drive trade flows. Trade flows also occur because transportation is done by trucks that move consumer goods from the port of Tema up north and return empty as back haulages. Grain flows into Ghana get reversed during some seasons and years. Traders sometimes buy groundnuts and soyabeans in Ghana and send them to Niger, Mali and Burkina Faso.

Because most of the cowpeas entering commercial trade are directly consumed by households as a food staple, the bulk of cowpeas are moved from the surplus producing areas to consumption centers by small scale traders. There is no formal industrial processing of cowpea and large traders do not buy cowpea unless they are procuring for large scale processors when they get contracts to supply cowpea-maize blended flour to the World Food Program Purchase for Progress which distributes it through school and refugee feeding programs.

Groundnut channels are dominated by informal traders and most of the production is consumed without processing by formal commercial firms. There are no bulk buyers and former industrial scale groundnut oil mills are collapsing because of lack of supply of raw materials. Much of the groundnut which is commercially processed is transformed by small and medium scale enterprises (SMEs) to make edible oil for cooking, cake for kuri kuri (a form of biscuit) and paste for preparation of home meals. These cottage industries use locally fabricated machines. Ghana Nuts buys groundnut on a small scale and in some years. Premier Foods also buys groundnut on a small scale for making home foods. Other companies which process, pack and market groundnut on a small scale include Nourisher Processing, Burger Food Industries, Glomart and Foodtech.

Soyabean channels are dominated by both informal and formal small, medium and large scale processors. Informal channels supply soyabean for direct human consumption and small scale poultry feed manufacture. Most of the soyabean formally marketed is used by the poultry industry, where feed milling is often integrated. About 30% of the soyabean grain annually marketed by farmers is purchased directly by poultry farmers themselves. In addition, poultry farms buy soyabean meal and cake from domestic processors. Because domestic supplies are erratic, poultry farmers also import soyabean cake and meal and poultry feed from global suppliers who import mostly from Argentina and Brazil. Most of the poultry farms are located in Ashanti, Brong Ahafo and Greater Accra. There also exists a poultry belt in the Doma area that extends into Cote D'Ivoire. The latter area is close to the wheat and maize milling industries, whose by-products can be used for feeds. Due to cheap imports of poultry meat and eggs there is a sharp decline in production of broilers. Currently the commercial poultry industry consists of mainly layers. In 2009 there were 5.6 million broilers and 21 million layers. Fish farms also buy soyabean for production of on-farm fish feeds. However, fish feeds are mostly imported from Europe. Agricare produces feed for aquaculture.

Besides poultry and fish feed production, soyabean is also used for production of foodstuffs for human consumption. Six major soyabean processing firms buy soyabeans for crushing into edible oil and cake and meal. Also they produce soyabean-maize blend, textured soyabean products such as soyabean kebab, milk, Tom Brown and weaning mix foods for children (Table 6.2). Ghana Nuts is the only company with a solvent plant. The other companies have mechanical pressing plants. Respondents reported that these small companies' mechanical expressers do not produce quality products. Soyabean crushing firms also sell soyabean cake and meal to poultry feed manufacturers and farmers. The crushing firms are mostly located in Accra and Kumasi. They sell feed through depots and distributors located throughout the country.

Table 6.2: Processing firms in the formal soyabean markets.

Purpose	Processing company	Annual capacity (tons)
Food	Ghana Nuts	70,000
	Golden Web	5,000 – 15,000
	3K&A	5,000 – 15,000
	Royal Danmark	5,000 – 15,000
	Gyasi Oils	5,000 – 15,000
	50-100 small companies	1,000 – 3,000
Poultry feed	Sydals, Topman, Akate, Asutuare, Mfum, Chicks and Chicken, AG, Asamoah and Yamoah, Jerusalem, Dormaa Ahenkro, Darko, and Jockers	
Fish Feed	Agricare	

Processing firms procure soyabeans through their commission agents who, in turn, buy from farmers in local markets. Processing firms also buy through marketing companies such as Savanna Farmers Marketing Company. Recently, processing firms have started procuring soyabeans through production contracts with farmers through the Ghana Agricultural Development and Value Chain Enhancement Program (ADVANCE). About 60-70% of the soyabean grain annually marketed by farmers is sold through this channel. Small companies sell crude oil in the open market to market women who retail it mixed with palm oil and to paint manufacturing firms. Large processors refine crude soyabean oil, brand and sell it mostly through supermarkets. Large processors also export soyabean oil and meal to Cote D'Ivoire and Burkina Faso. Soyabean oil is also imported in bulk, mostly from Argentina, and then rebottled. Soyabean meal is also imported from Argentina. In addition, there is an influx of imports of refined vegetable palm olein from Malaysia. Also soyabean grain is imported, mainly from Brazil and Argentina. If the processors were to rely solely on local production they would only operate for a few months because supply of soyabean grains is not enough to meet their annual requirements. In addition to relying on imports, the processing companies have also diversified to processing other commodities, including cotton seed, palm kernel, copra and shea nuts.

6.6 Business enabling environment

The government is intervening through the block farming program, where small farm holdings are organized into large blocks to achieve better efficiencies with large machinery. This is targeting maize, rice, soyabean and sorghum. The government provides tractor mechanization services, certified seed of improved varieties, fertilizers and extension to farmers, to be paid for after harvest.

Because cowpea and groundnut are food staples, their value chains are characterized by ad hoc coordination among farmers, local and central assemblers, wholesalers, retailers, processors, importers, exporters and consumers. In contrast, soyabean value chains are being increasingly coordinated by agricultural development projects and the National soyabean Alliance (Table 6.3).

Table 6.3: Organizations and initiatives coordinating and working in the soyabean value chain.

	Organization/Initiative	**Role**
IFDC	AGRA-funded project linking farmers to markets (FTM)	Determine monthly crop area, expected yield and production and location through surveys. Using a web-based platform with GIS mapping of farmers' fields, farmer-based organizations and agro-dealers to determine requirements such as seed, fertilizer and tractor tillage services are worked out (room for inoculants?). Then the logistics for supply, stocking and delivery of inputs are worked out and inputs moved to retail outlets. Fields of 30,000 soyabean farmers have been mapped.
IFDC	MIR Plus	Develop village level value chain clusters
IFDC	Ghana Agricultural Dealers Development Project (GADDP)	Develop input dealers through training and to access bank credit to purchase inputs, map their locations and link them to suppliers and end-users
IFDC	Agriculture Value Chain Mentorship Program	Works on technical issues of integrated soil fertility management, training of input dealers, build the capacity of SMEs for marketing inputs such as fertilizers, seeds and chemicals
IFDC	Millennium Development Authority (MiDA) project	Focuses on Commercial Development of Farmer-Based Organizations (CDFO) through training farmers in commercial agriculture; improving access to irrigation; and improving post-harvest handling and value chain services.
ACDI/VOCA	Ghana Agricultural Development and	Value chain development approach to link players including seed growers, small and medium scale enterprises buying

	Value Chain Enhancement Program (ADVANCE)	grain from farmers, farmer groups, banking, equipment sales, information technology as well as production systems
ACDI/VOCA	Ghana Grains Council	Increases smallholder participation in certified warehouses by expanding local and central assembly, post-harvest handling and storage. The system allows farmers and traders to establish warehouse to store and monitor grain stocks for maize, soyabeans and cowpeas. Ghana Grains Council will regulate the market and quality
	National Soyabean Alliance (currently dormant)	Brings together partners to develop the soyabean value chain and key players along the value chain.

The horizontal linkages are focusing on strengthening collective action for better coordination of investments among farmers through farmers' groups and marketing companies and trade associations. For example, Savanna Farmers Marketing Company was established by a non-governmental organization, the Association of Church Development Projects (ACDEP), in 2004 to improve production by smallholder farmers and started marketing in 2008. Savannah Marketing Company improves the capacity of farmers to negotiate, aggregate produce and sell through structured channels. In 2010, the company had 9,500 farmer-members marketing over 12,000 tons of grains. The company links farmers to value chains by increasing marketed surplus and improving quality by using tarpaulins for threshing cowpeas and soyabeans. Savanna operates by establishing close business relationship with farmers through regular meetings and organizes farmers into formal farmers' based organizations and gets them registered as cooperatives, including linkages to rural banks for credit. Trade associations include Seed Producers Association of Ghana (SEEDPAG), Ghana Agri-inputs Dealer Association (GAIDA), Ghana Oil Mills Association, Ghana National Association of Poultry Farmers, and Ghana Feed Millers Association.

6.7 End-market opportunities for generating grain legume-led growth, constraints and Areas for prioritizing agricultural research-for-development interventions

Value chain respondents reported that opportunities for upgrading the value chain in order to generate grain legume-based growth, lie in production and process innovation to respond to unmet and increasing demands. The demands are derived from end markets in local, national and regional urban centers and substitution for imported vegetable oils, soyabean cake and meal, poultry feed, poultry meat, eggs and food products for human consumption. Therefore, respondents identified that value chain participants have to innovate to improve efficiency, product volume, consistency, quality and productivity, profitability and competiveness and add operations to increase the value added across the chains. These interventions can be implemented through strengthening associations of farmers, seed firms, agro-dealers, processors, and poultry feed manufacturers and building value chain participant councils such as the National Soyabean Alliance for coordinating investments.

Respondents argued that the prime mover would be organizing farmers into associations so that they can aggregate the small lots of produce they harvest into truckloads, generate economies of scale and improve product quality through on-farm sorting and grading. Some respondents argued that establishing cooperatives in different geographical areas to buy, clean, grade, store and sell products can better link farmers to value chains. Also, promoting contract farming can permit farmers to increase yields through more timely access to inputs and extension. At the same time contract farming allows processing companies to more efficiently procure raw materials of consistent quality, reducing the risk of failing to get stocks. Warehouse receipt systems were identified as an initial step in setting up a commodity exchange to improve coordination of the value chains. The Ghana Grains Council is recruiting existing aggregators that can own warehouses, training aggregators and supporting construction of warehouses through Warehouse Development Fund. The system allows farmers and

traders to establish warehouse to store and monitor grain stocks for maize, soyabeans and cowpeas. Transactions will be guaranteed by warehouses receipt system.

However, several constraints were mentioned regarding exploiting opportunities for grain legume-led growth identified through the end market analysis (Table 6.4). Erratic production and the lack of capability to supply raw materials to end users and meet their volume, consistency, quality, and price requirements is caused by a variety of reasons. Smallholders use basic technologies without mechanization, mostly use recycled seed and apply insufficient fertilizers and agrochemicals. In addition there are biotic yield-reducing pests and diseases, especially in the case of cowpea. Also the production of groundnut is constrained by rosette and late leaf spot. Abiotic yield-limiting constraints include drought, soil fertility, and climatic change. Climatic change is resulting in erratic rainfall that makes it difficult the start and ending of the rainfall season, the amount and distribution of rainfall and soil moisture levels. Also management issues can be traced back to low production. For example planting methods to get the optimum spacing and plant population; soil fertility management to apply the right type of fertilizers; harvesting time to reduce crop losses resulting from shattering; harvesting method to avoid shelling by beating the pods with sticks on the ground, winnowing by hand and bagging the grain with stones and soil; and insect pests and disease control. Most farmers do not take time to sieve and clean grain before selling to the market, resulting in poor quality grain.

Some respondents cited as the second most important constraint unavailability and unaffordability of certified seed of improved varieties, fertilizers, tractor and machinery services, labour and agrochemicals. Fertilizer dealers do not stock straight fertilizers appropriate for grain legumes such as single superphosphate (SSP) and triple superphosphate (TSP) unless these are ordered and supplied on request. Farmers in remote areas have poor access to fertilizers because most agro-dealers are in urban areas. Tractors are limited, difficult to move around and supplied to farmers too late to plough and plant during the cropping season.

In addition, there is a lack of effective government extension services. It was reported that agricultural extension workers are inadequate in providing knowledge on production technologies especially to women farmers. Public researchers have limited resources to carry out on-farm demonstrations.

Output marketing is a constraint because farmers incur high transaction costs to participate in markets and traders incur high logistics and distribution costs to buy and aggregate products from smallholders scattered over wide geographical areas each producing and selling small quantities. Because traders have market power, they capture the bulk of benefits. Because farmers receive low effective farm-gate prices and prices are volatile, they have poor incentives to expand investments in improving production and quality. Aggregating groundnuts, cowpeas and soyabeans is difficult because farmers sell to traders who come to buy or individually take the produce to the market. Even farmers group may fail to generate economies of scale and benefit members In addition, farmers sometimes dishonour production and marketing contracts, especially when the spot market price falls below the forward deliverable contract price.

Some respondents reported that the lack of financing is a constraint, with farmers not having enough cash to acquire inputs. Also, farmers are failing to get a competitive rate of return on their investment. Getting credit from banks is difficult due to the time-lag. By time the money is released the season is finished. In addition, there is a lack of crop insurance and banks find it difficult to finance agriculture because they do not want to lose their money. Microfinance institutions charge high annual interest rates between 40-50 % and the Venture Capital Trust Fund 16 %. Because of low productivity and yields, farmers are unable to repay credit.

Finally, there are policy constraints. These result from inconsistencies in agricultural policies being implemented to increase agricultural production and stimulate growth, especially seed and fertilizer subsidies, output marketing, trade and genetically modified cultivars (GMOs), and agricultural production statistics. Amongst others, fertilizer under the subsidy program is delivered to farmers after the season has already started and farmers have planted. Voucher-based coupons have been used but these failed to work. Another constraint is the lack of grades and standard weights and measures used for marketing.

Table 6.4: Summary of opportunities and constraints in the legume value chains.

Opportunities	- Supply grain legume deficit rural areas in the southern parts - Growing urban markets - Estimated aggregate installed capacity of soyabean processing plants of around 400,000 tons (against 30,000-60,000 tons annually marketed) estimated consumption is on 200,000 tons -To substitute for imports requires an annual production of 30,000 tons of soyabeans.
Constraints	1.erratic production and the lack of capacity to supply end-markets with quality products; 2.the lack of input supply systems for certified seed, fertilizers, agro-chemicals, tractor and machinery hire services and labour; 3.weak extension services; 4.poor access to output markets and farmers' capacity to participate in markets 5.difficulties honouring contracts; 6.lack of financing; 7.competition from imports; 8.policy inconsistencies.

Value chain participants mentioned several research interventions needed to resolve the constraints (Table 6.5). The interventions need to be targeted to different leverage nodes across different stages of the whole chains. The nodes for leveraging investments are (a) farmers associations and cooperatives such as the Savanna Farmers Marketing Company; (b) seed companies through SEEDPAG; (c) agro-dealers through GAIDA; (d) commodity traders and commission agents through the Ghana Grains Council, warehouse receipt system and commodity exchange; (e) agribusiness processors through Ghana Oil Mills Association; (f) poultry farmers through Ghana National Association of Poultry Farmers; (g) animal millers through Ghana Feed Millers Association; and (h) the agricultural research institutes, including CRI, SARI and FRI.

Table 6.5: Priority research interventions to resolve the constraints.

Priority research intervention	**How**
changing agricultural production systems to permit farmers to intensify and commercialize and increase yields, profitability, production and marketable surplus	to identify profitable sole, intercropping and rotation cropping system options; develop early maturing and higher-yielding varieties that resist drought, pests and diseases and that are adaptable to microclimates; right type of fertilizers and inoculants to apply; crop management practices that leverage ecological factors specific to the environment; appropriate pesticides and pest control practices and regulatory services especially for cowpeas; mobile planters and harvesters for reaping and shelling; tarpaulins for threshing; and storage practices especially for cowpeas and groundnuts.
improving agricultural input supply markets	informal community and formal seed multiplication schemes linking research institutes, seed companies and farmers associations. Private agro-dealer systems to supply fertilizer, agrochemicals, and tractor and machinery hire services.
improving extension systems	training of extension staff in production technologies, post-harvest, home utilization and marketing.
investments to improve output marketing systems	-institutional arrangements such as the National Soyabean Alliance to monitor members' behaviour and enforce rules for production and marketing contracts - hub and spoke or nucleus farm model, working with organized farmer groups.[1]

agricultural policy analysis and research	improve agricultural seed and fertilizer subsidies; provide crop insurance; regulate marketing and warehouse receipt systems and provide credit linked with warehouse receipt systems to deal with seasonal price volatility and support a commodity exchange; stabilize market prices; and provide better information particularly concerning planted area, yields, production and availability of marketable surpluses.

[1]Large scale commercial nucleus farms are established with machinery and facilities at the center of organized farmers. The nucleus farms forward contract with processors and provide tied extension and credit for smallholders to obtain tractor and machinery services, seeds, fertilizers, and agrochemicals. After harvesting, the nucleus farms purchase, aggregate, clean, sort, store and deliver the crops to processors in large trucks. Banks can provide credit to nucleus farmers to aggregate for their farmer groups because they know the processors that will eventually purchase and use the products.

7 Eastern DRC

7.1 Role of the target grain legumes in smallholder farmers' strategies for incomes, food security, nutrition, sustainable natural resource management (NRM) and gender equity

The four target grain legumes play roles that vary from important to very important in smallholders' strategies for incomes, food security, nutrition, NRM and gender equity. Common bean is the second most important staple food after cassava throughout the eastern part of DRC. Farm households grow common beans primarily for their own food consumption and for sale. Cowpea is less preferred for food, has a low market demand and poorer market prices and is a less important crop in Eastern DRC. In addition, it has higher opportunity costs of production because of less favorable altitude, climate, soils, pests and diseases. Groundnut on the other hand is important for incomes and very important for nutrition, NRM and gender. Groundnut is easily marketable, fetching higher market prices than other legumes, and can be eaten fresh, roasted and as flour as a condiment during cooking. Although soyabean is a new crop it has now become an important food and cash crop. Soyabean sells easily, fetches a higher price in the market than common beans and gives good cash incomes. Soyabean is a crop for both men and women and is rapidly increasing in importance because of dissemination and diffusion of information and knowledge of its growing, utilizing and marketing.

Production of these grain legumes is dominated by smallholders. 50-80% of common bean, groundnut and soyabean is grown in mixtures intercropped with cassava and maize. Only a small proportion of farmers exposed to project interventions in the past use certified seed of improved varieties, inorganic fertilizers, agro-chemicals and inoculants. Farmers use hand power in all farming operations. There is no use of draft animal and tractor power.

In eastern DRC, smallholder farmers can be grouped in four different types based on the area they cultivate: 1) sub-family farms ranging from 0.0-0.4 hectares, below levels that produce optimal efficiency; 2) small family sizes ranging from 0.401-1.0 hectares, guaranteeing subsistence levels; 3) moderate family farms ranging from 1.01-1.6 hectares, achieving subsistence levels with marketable surpluses and 4) large farms exceeding 1.6 hectares, generating marketable surpluses. About 47% of sample households are sub-family farms, 16 % small family farms, 8% moderate family farms and 30% large farms. Proportionately more sub-family and small farms crop their cultivated area to the main staple food crops (cassava and common beans). By contrast, moderate and large farms have higher proportions of households prioritizing cash crops, including bananas, coffee, soyabeans and groundnuts. Fewer sub-family and small farms sell part of their total common bean production to the market. Surprisingly much soyabean is consumed locally at household level. Only 43% of soyabean growing sample households reported that they sell part of their harvest to the market. Virtually all households reported that they use the residues for compost manure and benefit from biological fixation of nitrogen.

7.2 Production by geographical area and trends

The most important areas of production for common bean are Kabare, Kalehe, Idjwi and Walungu. These areas have high altitude, clay fertile soils and a climate favorable for bean production and unused arable land for expanding farm sizes and for livestock production. Livestock provides farmyard manure for maintaining soil fertility. In addition, the areas have two growing seasons per year. The most important area of production for cowpea is Kabare, with black volcanic soils. However, cowpea production is low since it is not used for food and market demand is low. For groundnut, major areas of production are the sandy soils of Bunyakiri, Kabare, Kalehe, Idjwi and Nyangezi. Turning to soyabean, the most important production areas are Birava, Kabare North, Kalehe, Katana, Idjwi and Uvira, which have volcanic soils. Project interventions to promote soyabean production, utilization and marketing have been implemented in these areas.

Table 7.1 summarizes the area cropped, average yields and annual aggregate production for groundnut, bean and soyabean. The area planted to common bean, groundnut and soyabean has

trended upwards during the past decade. The civil wars from 2002-2004 resulted in a transitory decrease in cultivated area. The recent upward trend is being driven by the return to peace; better security of property rights; increasing domestic and regional demand for food because of population, urbanization and income growth; and the development, release and dissemination of improved varieties, crop management and post-harvest management technologies. Twelve bush and 18 climbing bean varieties were released and made available by INERA-Mulungu to farmers mostly through NGOs in two waves (Appendix IV). The first wave was from 1990 to 1996 with support from the United Nations Program for Development (PENUD). The second wave was from 2005 to 2010 with support from CIALCA. Also seven soyabean varieties were released and made available to farmers through two waves, one in1988 and one in 2004/2005 under CIALCA. In addition, five groundnut varieties and one cowpea variety have been released. The improved technologies were developed by the Institut National pour l'Etude et la Recherche Agronomiques (INERA) and the Consortium of International Agricultural Research (CGIAR) Centers. There is increasing awareness and adoption by farmers of improved crop management and varieties because of interventions implemented by the Food and Agriculture Organization (FAO), the Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA), International Fertilizer Development Center (IFDC), International Fund for Agricultural Development (IFAD) and non-governmental organizations (NGOs) such as CARITAS, ACF, International Red Cross, Louvain Développement and others.

The yield of common bean, groundnut and soyabean has fluctuated over the past decade with no upward trend. This is because most farmers are still using local varieties. Households have little access to certified seed of improved varieties because there is a lack of formal seed multiplication and marketing system. Farmers use grain that they purchase from the informal markets as seed.

Table 7.1: Area (ha), yield (ton/ha) and total annual production (tons) for groundnuts, beans and soyabeans, South Kivu, 2001-2006. Source: Annual reports of the provincial division of agriculture in South Kivu from 2001- 2005.

Year	2001	2002	2003	2004	2005	2006
Area groundnuts	37 480	23 173	32 786	20 399	69 790	99 276
Production groundnuts	29 847	15 681	27 059	16 717	61 385	94 175
Yield groundnuts	0.80	0.68	0.83	0.82	0.88	0.95
Area beans	111 251	79 292	74 089	61 310	116 267	142 059
Production beans	84 502	65 338	59 347	44 523	93 564	103 259
Yield beans	0.76	0.82	0.80	0.73	0.80	0.73
Area soyabeans	8 906	3 744	4 309	3 895	4 131	22 904
Production soyabeans	4 781	2 270	2 791	1 968	2 251	12 757
Yield soyabeans	0.54	0.61	0.65	0.51	0.54	0.56

7.3 Structure and dynamics underway in the grain legumes value chains

There is some degree of commercialization among farm households (Table 7.2). The main consumption centers are the urban areas (Bukavu, Uvira, Kamaniola) and mining centers (Walikate, Bunyakiri) in South Kivu; other provinces in the country (Kisangani, Kinshasa), Rwanda (Kibuye, Cyangugu, Bugarama, Kigali) and Burundi (Bujumbura, Gitega).

Table 7.2: N2Africa baseline data showing degree of commercialization among farm households.

Legume type	% farmers selling some of the produce	% that net selling households on average market	Mostly sold as
Common bean	23	43	Dried grain
Groundnut	55	65	Dried grain
soyabean	43	60	Dried grain

Figure 7.1 reports the mapping of the value chains. This shows that the value chain is organized into five main channels: (1) subsistence production and consumption; (2) dried grain sold through rural markets and wholesale and retail urban markets for direct human food consumption; (3) dried grain for processing into human foods by cottage industries; (4) dried grain for manufacturing of human foods by formal processors; and (5) exports to Rwanda and Burundi. The subsistence production and consumption chain accounts for the bulk of the trade flows. The rural and urban direct human food and cottage food-processing value chains account for a small share of the trade flows. There are no large scale industrial processing plants for packing beans, crushing groundnuts and soyabeans into oil and cake and manufacturing animal feeds and human foods.

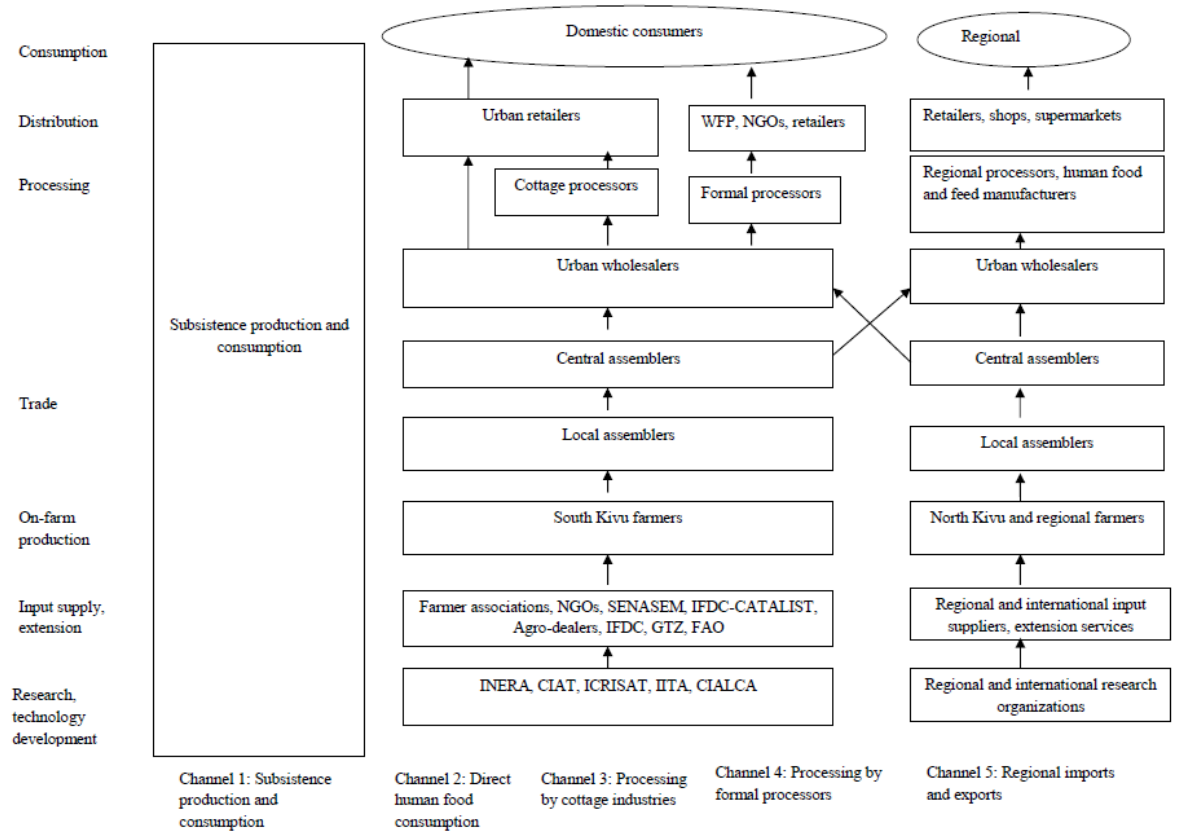


Figure 7.1: Grain legume value chain, South Kivu, DRC, 2011.

Commercial marketing channels start with agricultural research, technology development and extension. Table 7.3 sums the actors involved in the commercial channels in the legume value chains. There are no multiplication programs for groundnut seed because past projects were unsuccessful. Groundnut seed growers found it more profitable to sell the crop to the fresh grain market rather than for seed. Most certified seed is distributed through free hand outs by the FAO, IFAD and NGOs. Farmer members of associations are supported to pack and sell seed to other farmers through rural village markets and agro-dealer shops. Because of poorly developed markets for certified seed of improved varieties, farmers' associations producing seed prefer to sell to development organizations and NGOs for distribution to farmers. INERA has in the past conducted research on soil microbiology, including Rhizobium inoculants. Currently the station is not carrying out research on soil microbiology.

Fertilizers, agrochemicals and inoculants are imported. IFDC started the Catalyze Accelerated Agricultural Intensification for Social and Environmental Stability (CATALIST) agro-dealer development program in 2009 to train agrodealers and subsidize inputs. Up to now none of the agro-dealers are selling Rhizobium inoculants. However, it would be possible to introduce inoculants to agro-dealers for marketing to farmers.

Table 7.3: Actors in the commercial channels in the legume value chains.

Actor	Role
INERA de Mulungu	Crop breeding (mainly focused on biofortified common beans) and seed multiplication. Producing breeder and foundation seed.
CIAT, ICRISAT, IITA and regional research stations	Evaluate germplasm.
CIALCA, GTZ, FAO and NGOs	Produce breeder and foundation seed in collaboration with INERA.
SENASEM (National Service of Seed)	Inspecting fields of farmer associations and certifying seed.
FAO, IFAD and NGOs	Distributing certified seeds though free handouts.
IFDC: CATALIST	-Agro-dealer development program, started in 2009 -Training on inputs such as fertilizers, seeds, pesticides and veterinary products -To date 210 agro-dealers have been trained in South Kivu -Contributed to the development of the fertilizer market through subsidizing part of the taxes and transport linked to importations -In the Ruzizi plain, CATALIST subsidized 50% of the purchases by the first 5 input shops in order to encourage the creation of input shops
CIALCA	Supporting farmer association-owned agro-dealers, which sell certified seed produced by the associations and fertilizer

The end-markets of grain legumes consist of five segments: rural households which are net food buyers; urban household consumers; institutional buyers such as restaurants, hospitals, schools, army barracks and prisons; informal processors; formal processors; and exporters to Rwanda and Burundi. Rural and urban households and institutional buyers use the grains directly for preparation of home meals and food rations. Informal processors consist of household enterprises that process the dried grains into flour, roasted nuts and butter and sell to final consumers through urban retail markets. Formal soyabean processors consist of two food manufacturing plants. Murhesa factory, with an annual capacity of 70 tons, produces soyabean and maize-sorghum-soyabean blended flour, selling to the World Food Programme (WFP) and NGOs for their feeding programs. Centre Olame, with an annual capacity of 10 tons (flour), manufactures soyabean-sorghum-maize flour, biscuits and bread, which are marketed through retail shops and supermarket chains. The export market consists of informal traders that transport the dried grain across border and sell in wholesale markets in urban areas in Rwanda and Burundi.

In periodic village markets, farmers in the main production areas sell to rural food deficit farmers and to collectors, who aggregate quantities into bulk loads. Local assemblers in turn sell to central assemblers from terminal wholesale markets in urban areas. Central assemblers buy from several village markets in Kivu and further afield in North Kivu, aggregate the produce into truck loads, negotiate with truck owners and transport these to urban wholesale markets. This business is dominated by women traders. Central assembly collectors are wholesalers in terminal markets or their agents. They transport the produce in hired trucks or by boat through Lake Kivu to entrepôts in the urban centers, store and sell to processors and retailers in 100-115-kilogram bags. Retailers break up the bags and sell to final consumers in small lots in retail markets. Gross marketing margin analysis shows that the price spread nearly doubles from the farm-gate to terminal wholesale markets (Table 7.4).

Table 7.4: Prices of grain legumes (US$/kilogram) and unitary gross margins at different marketing stages, South Kivu, DRC, 2011. Source: Authors' survey.

Stage	Bean (Kabamba)	Soyabean (Kabamba)	Groundnut (Luvungi)	Beans (Goma)	Soyabean (Goma)	Soyabean (Biravia-Kibuye)
Certified seed	1.50	1.75	2.00			1.75
Farm gate	0.70	0.66	1.00	0.33	0.35	0.73
Seed to grain price ratio	2.16	2.65	3.88			2.39
Local assembly	0.93	0.88	1.32	0.50	0.52	0.88
Central assembly	0.99	0.99	1.43	0.56	0.57	0.90
Urban wholesale market	1.10	1.10	1.54	0.68	0.65	1.01
Processing plant gate soyabean grain price					0.80	
Processing plant gate soyabean flour price					2.00	
Conversion factor soyabean grain to flour					0.84	
Farm price in processing of plant gate equivalent					2.40	
Transport	0.08	0.08	0.07	0.05	0.04	0.10
District tax			0.24			0.02
Market tax	0.00		0.00			0.01
Local assembler's gross margin	0.24	0.22	0.32	0.17	0.17	0.15
Central assembler's gross margin	0.05	0.11	0.11	0.06	0.04	0.02
Urban wholesaler's gross margin	0.11	0.11	0.11	0.12	0.09	0.11
Processor's gross margin					1.60	
Farmgate to teminal market spread:	1.58	1.67	1.54	2.05	1.88	1.38

Grain flows from high production areas to centers of consumption through transport corridors. Common beans and soyabeans are transported to Rwanda across the lake and Burundi through Uvira. Depending on the season and rainfall, common beans are also transported from Rwanda to South Kivu. Most of the common beans, groundnuts and soyabeans consumed in South Kivu come from Masisi and Rutschuru in North Kivu through Goma. Goma is an entrepôt for moving produce from food sheds to urban consumption centers. Common beans, groundnuts and soyabeans from Goma are transported to Kinshasa and Kisangani, Uganda, Rwanda, Kenya and South Sudan Kenya. Groundnut is transported from Tanzania to South Kivu through Burundi and Rwanda. Groundnut is also transported from Malawi to Tanzania, Rwanda and DRC. This is because different areas have different growing and harvesting periods, which results in seasonal price differences and trade flows (Figure 7.2). In drought years there is reversal in sales. Generally, prices of produce drop after harvest. Because there is more rainfall and production during the March to May cropping season, the drop in prices following this season is higher than the drop in prices following the October to December season. However, the price fluctuations also much depend on the rainfall received, the demand and conflicts in the area. Processors buy and store quantities of soyabeans during harvesting when prices are at their lowest. They buy quantities that are sufficient to cover the next six month production period. This suggests that there are profitable returns to storage at the local and central

assembly levels by exploiting economies of scale. Wholesale traders hold average stocks per firm of around 3 metric tons of groundnuts and 4 metric tons of soyabeans. These take about a week to sell.

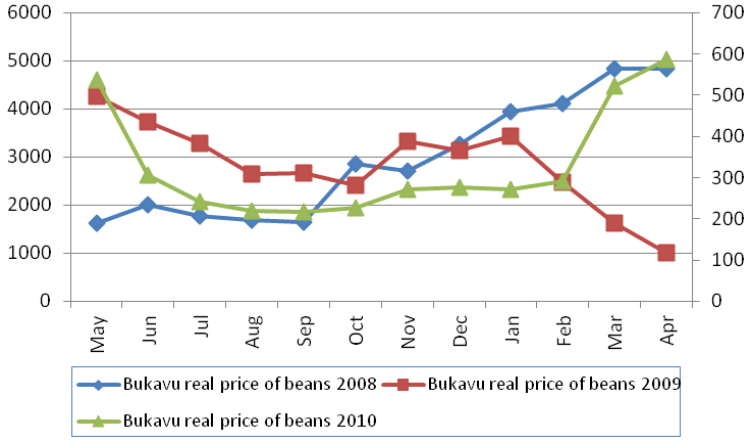


Figure 7.2: Seasonal price movements in real prices of beans in Congolese Franc per kilogram in 2008, 2009 and 2010. Source: FAO, Bukavu.

Co-integration analysis of monthly prices of common beans from May 2008 to July 2011 in wholesale markets in the Uvira and Bukavu markets show that price movements reflect each other (Figure 7.3). Price co-integration analyses show that the towns are well connected because of inter-spatial physical arbitrage and respond to the same economic signals from the main consumption centres.

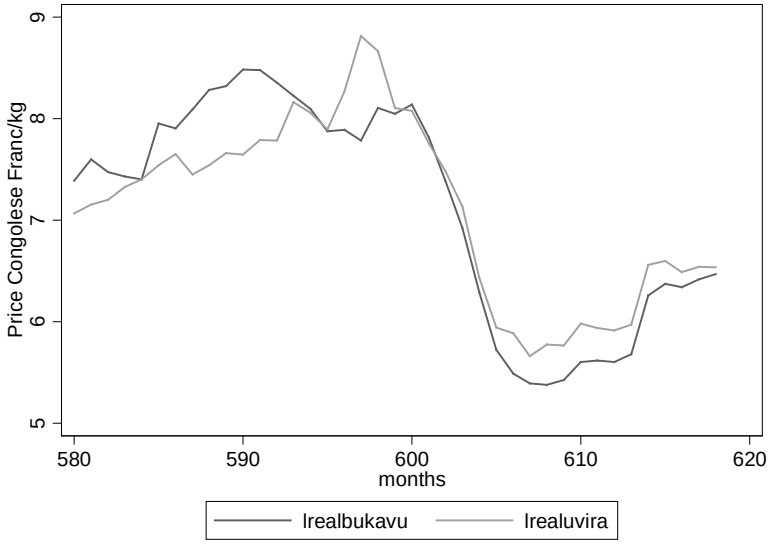


Figure 7.3: Co-integration of monthly prices of common beans in Congolese Francs per kilogram for the period from May 2008 to July 2011 in wholesale markets in Uvira and Bukavu.

Vertical linkages are characterized by ad hoc coordination among farmers, local and central assemblers, wholesalers, retailers, and processors. The urban wholesalers and central assemblers are beginning to actively coordinate the value chains, driven by requests from processors, who contact urban wholesalers to inform them about volumes needed and conditions of delivery. The processing factories are exploring contracts with farmers. Farmers also contact local assemblers by cell phone to come and buy beans from their locations when they aggregated surpluses to sell.

Organizing local markets is difficult because of differences in demand. The rural and urban households and informal processing market segments pay higher prices for pure varieties compared to mixed varieties. The Rwandese market has a preference of Muduku bean variety. By contrast, the

Bukavu market has a preference for M'sole variety. The formal soyabean processing segment prefers varieties with large grain size (Imperial variety).

Value chain governance is characterized by arms-length transactions. There is unequal bargaining power between farmers and traders. Most farmers sell to collectors in village markets and have relatively little access to market information. This adversely affects their bargaining power. The traders move both around in districts in South Kivu and other provinces such as North Kivu. They have cell phone contact with other traders in Uganda, Rwanda, Burundi, and Tanzania. They have more knowledge about potential for spatial arbitrage and profitable trade. There are no grading systems, standard weights and measures, and legal trading codes. This increases transaction costs as buyers have to physically inspect each bag during transactions. Farmers sell to local assemblers in local units. Local assemblers sell to central assemblers in bags. Central assemblers and urban wholesalers sell to processors in kilograms. The different measures often result in malpractices and cheating of farmers.

The business enabling environment affecting the grain legume value chains is characterized by bureaucratic red tape; weak research, education and extension systems; weak legal and regulatory capacity; poor public infrastructure; weak information and communication systems; high inflation; business culture focusing on maximizing short-term profits; and social norms that differentiate roles by gender. Most businesses are informal household enterprises. This limits their ability to grow, attract investment and hire more workers. For example, the government extension workers make little contact with farmers. Most of the extension advice being made available to farmers is through extension agents employed by NGOs with support from FAO, GTZ, IFAD and IFDC.

The horizontal linkages are focusing on strengthening collective action among farmers through farmers' groups, cooperatives and district-federated associations. These are being supported by NGOs and development organizations to increase the efficiency of supply of certified seed, fertilizers, agrochemicals and inoculants; participatory technology testing, dissemination and capacity building of farmers; product assembly, bulking, transportation and storage of products; and access to credit and micro-finance. CIALCA for example is supporting Farmers' associations. CIALCA established a warehouse receipt system linked to savings and loan cooperative societies in urban areas. In addition, central assemblers organized groups with a formal committee for consolidating loads during transportation to better achieve capacity utilization when hiring trucks.

Turning to supporting markets, there is no government credit for seasonal and long term financing. Farmers finance seasonal purchases of inputs. Central assemblers and wholesale market traders finance grain purchases and transport into the terminal market using their own funds. Microfinance organizations are experimenting with inventory credit.

7.4 Opportunities

Value chain respondents reported that opportunities for upgrading lie in production and process innovation to respond to unmet and increasing demand in end markets in domestic and regional urban centers. These include mining areas in Kivu, urban centers in Rwanda and Bukavu. However, value chain participants have to innovate to increase productivity and profitability of production and marketing and adding value to farm products. Training and assisting both farmers' groups to increase productivity and quality and training and assisting processors were identified as important means to meet market demands.

Seven constraints on smallholders exploiting end-market opportunities were reported (Table 7.5). At the farm level yield per hectare and production capacity to supply sufficient quantities to operate cooperatives and warehouse at minimum efficient scale is limited by poor soil fertility, rainfall variability, pests and diseases and lack of knowledge of improved soil fertility management and genetic technologies. At the higher order system the lack of systems for supplying certified seed of improved varieties, fertilizers, agrochemicals, and rhizobia inoculants is constraining. In addition, there are not enough active coordinators to organize the markets, identify potential demands and offer information and incentives to farmers and other market participants to meet the demand. Farmers have a lack of countervailing power to bargain and farm gate prices are low. There are no large-scale processors and exporting firms to coordinate the value chains by necessity. There are no grain storers to add value to farmers' products and help farmers avoid post-harvest price collapse. There is a

liquidity constraint because of unavailability of microfinance and credit which induces farmers to sell immediately after harvest when prices are at their lowest. In addition, there is poor government policy support (research, extension, agricultural production statistics, market information, and market regulations) and poor infrastructure including roads and electricity.

Value chain participants interviewed in this study identified several research interventions to resolve the constraints, exploit opportunities and generate impact at scale based on trends and interventions that have most impacted smallholder farming over the last 10 years. Respondents argued that because of strong complementarities among components these interventions need to be targeted at leverage nodes throughout the value chain.

Table 7.5: Opportunities, constraints and research interventions required to overcome the constraints in the legume value chains in DRC.

Opportunities	- Meeting increased market demand - Adding value through increased on-farm productivity, input market access and output market access, cleaning, sorting, grading and storage and contract bargaining - Adding value to farmers' products and provide a vent for surplus through manufacturing of oil and livestock feed products and developing the poultry industry to substitute for imported foods
Constraints (in decreasing order of importance)	1.low on-farm productivity to support agricultural cooperatives and warehouse receipt systems; 2.lack of supply systems for certified seed of improved varieties, fertilizers, agrochemicals and inoculants; 3.the lack of organized marketing and low farm gate prices; 4.lack of large scale processing to add value to farmers products; 5.lack of post-harvest storage; 6.lack of micro-financing and credit; 7.lack of government policy support and infrastructure.
Requirements/ research interventions	- Training and assisting farmers' groups, associations and agricultural cooperatives - Training and assisting processors - Increasing productivity, profitability and competitiveness of legume on-farm production by relaxing on-farm constraints through capacity building of farmers, making available at affordable prices certified seed, fertilizers, agrochemicals, inoculants, microfinance and development and dissemination of improved varieties, crop and post-harvest management practices through farmer groups - Organizing markets, grain storage and sale and better prices through farmers' cooperatives and district-federated associations, assemblers, urban wholesalers and exporters - Adding value to farmers' products through establishing large scale processors and stimulating the development of the poultry industry; - More efficient supply of microfinance and credit through interlocking markets with savings and credit organizations; - Improving government policies especially research and extension, market information, market regulations

8 Nigeria

8.1 Role of the target grain legumes in smallholder farmers' strategies for incomes, food security, nutrition, sustainable natural resource management (NRM) and gender equity

Whereas common bean is mainly absent in the agricultural production and consumption system in Nigeria, cowpea, groundnut and soyabean play roles that vary from important to very important. Farmers generally grow these legumes as cash crops and sell them to buy staple cereals, explaining why households place emphasis on legumes in their farming system. Cowpea, groundnut and soyabean are grown by both men and women and therefore important for gender equity, especially when women make the decisions about quantities sold and retained for home consumption, processing and utilization for home meals and spending of sales income.

Farmers rank cowpea very high for cash farm incomes and allocate it a significant proportion of their cultivated area. Farmers sell cowpea to buy staples, but also consume cowpea themselves. In addition, farmers rearing livestock use cowpea haulms as hay to feed animals. Groundnut is grown more as a cash crop for industrial processing into oil than as a food crop. Groundnut has readily available markets and fetches high prices. Soyabean is a relatively new crop compared to cowpea and groundnut. Consequently few households can utilize it for preparation of home meals. The crop is grown mostly for cash. However, households are increasingly recognizing the high nutritive value of soyabean.

8.2 Production by geographical area

Although cowpea and groundnut are produced throughout the country, marketable surplus production is geographically concentrated. Due to lower rainfall and favourable soil conditions, cowpea production is concentrated in the northern states with Borno, Bauchi and Zamfara accounting for more than 50 % of the national output. Twelve other northern states account for 42% of national production (Figure 8.1). Groundnut production is also concentrated in the northern and middle belt states where soil and climatic conditions are suitable for groundnut. Bauchi, Niger, Benue, Kaduna, Taraba, Borno and Zamfara account for 76 % of the national output. Soyabean production is also concentrated in the Northern Guinea Savannahs in the middle belt states with Benue, Kaduna, Kano, Taraba, and Katsina accounting for 86% of the country's output. Here, alluvial soils, higher rainfall and altitude favour soyabean production.

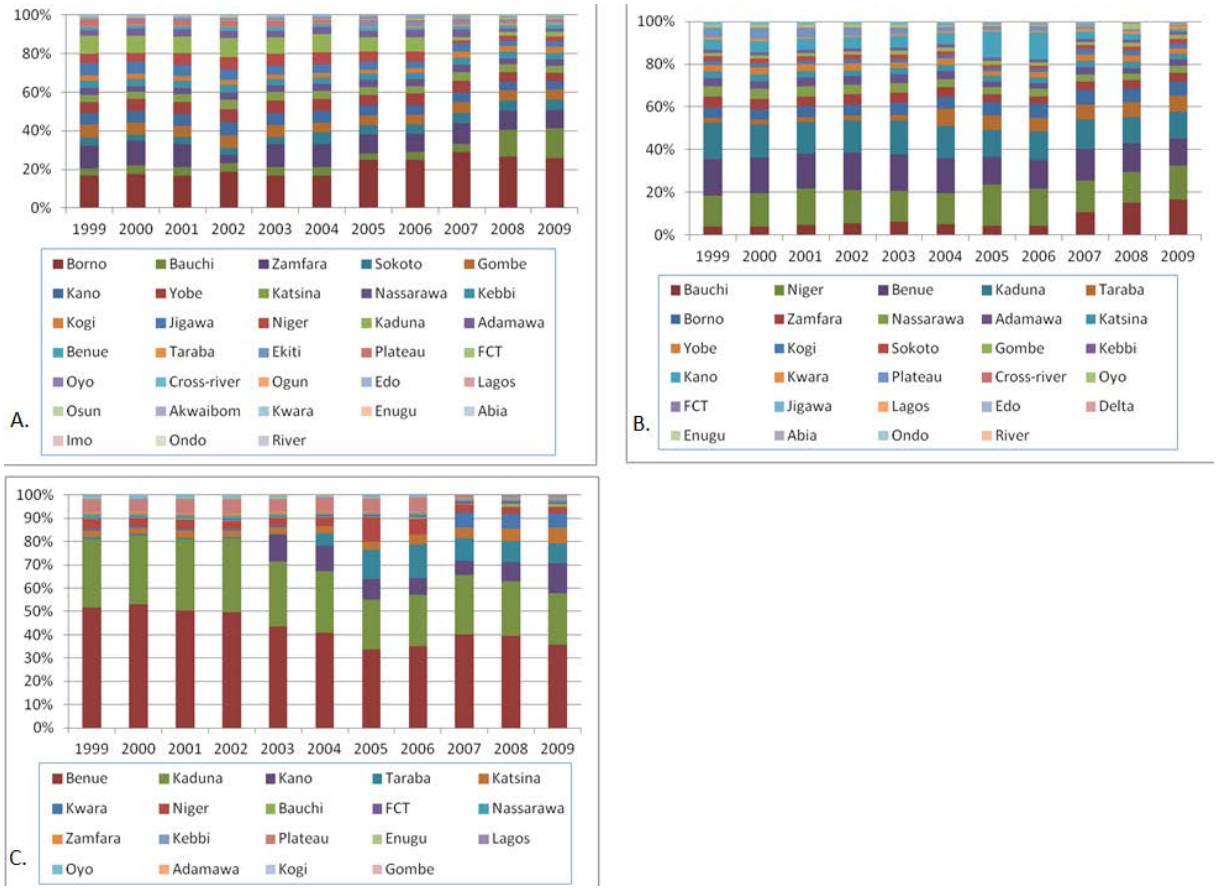


Figure 8.1: Shifts of legume production shares in the Nigerian states from 1999-2009 for A) cowpea, B) groundnut and C) soyabean. Source: Federal Ministry of Agriculture and Rural Development, 2010.

8.1 Trends in area planted, yields and production

From 1995 to 2000, cowpea and groundnut area, yield and production have decreased (Figure 8.2). However, starting in the mid-2000s, cowpea and groundnut area and production have drifted with an upward trend again. These trends are being driven by the development, release, availability and adoption of quality seed of improved varieties, insecticides, storage systems including the Purdue Improved Cowpea Storage (PICS) bags; availability of markets; and high product prices. In the early 1980s the system of Agricultural Development Projects (ADPs) was put in place and used to multiply and distribute quality seed of new varieties of crops. In particular the cowpea variety TVX-3236 was bulked up and made available to farmers and increased cowpea production in Kano. During the 1990s the International Institute of Tropical Agriculture (IITA) and the Institute for Agricultural Research (IAR) scientists worked with farmers to bring into use new varieties and cropping systems. The new cowpea varieties include IT90K-277-2, IT97K-499-35 and IT98K-131-2. These interventions were supported by several development projects focusing on improved crop-livestock integration, including Purdue, BMZ, AGRA and Gatsby projects. Although there have been investments to multiply and distribute groundnut varieties developed by the International Institute for the Semi-Arid Tropics (ICRISAT) and IAR researchers through projects such as the Groundnut Germplasm Project (GSP) and Tropical Legumes-II (TL-II), the cultivars still remain on the shelf. This is because it is particularly difficult to develop a seed system for groundnuts.

In contrast, soyabean area, yield and production have trended upwards already from 1995. Soyabean can be cultivated with little cash inputs such as seed, fertilizer and insecticides, has diversified on-farm and off-farm uses and fetches high prices. Since it is higher yielding and does not have disease problems such as the rosette virus, soyabean is starting to replace groundnut. Compared to cowpea,

the crop has few storage pest problems and low costs of purchasing chemicals. Soyabean rust is still not a major constraint.

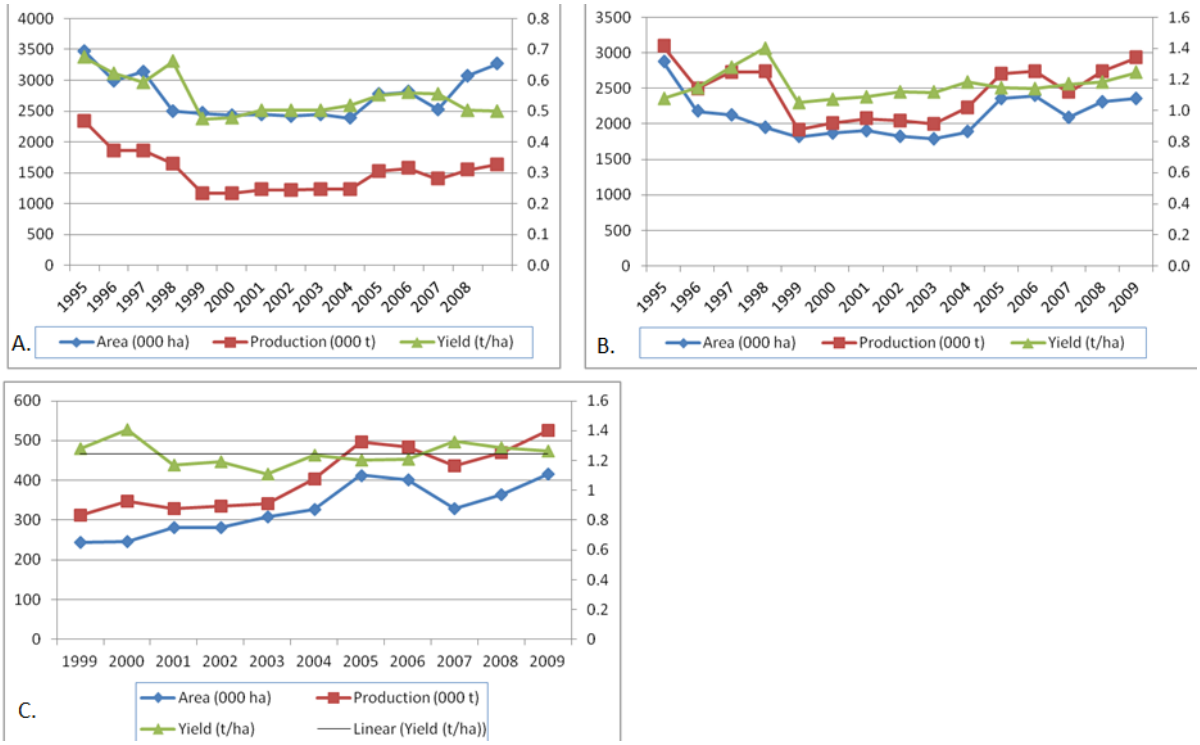


Figure 8.2: Trends in aggregate area, yields and production of grain legumes in Nigeria between 1995-2009 for A) cowpea, B) groundnut and C) soyabean. Source: Federal Ministry of Agriculture and Rural Development, 2010.

Starting in 1981, IITA and IAR researchers began to release and promote the new Tropical Glycine Crosses (TGX) varieties for cultivation by farmers, including freely nodulating ones. The new varieties increased yields and the competitiveness of soyabeans in the production system. IITA and the national program expanded extension to demonstrate the nutritional importance and utilization of the crop for preparation of household meals, including weaning foods (akamu), akara, moi-moi, soyabean milk and cheese. This increased awareness, which in turn increased production. In 1985/86 the Benue State government established a large scale soyabean processing plant located in the major growing area: Taraku oil mill. The plant reduced marketing costs incurred by farmers, eliminated middlemen, and provided them with a ready market. These interventions further expanded soyabean production by farmers. Soyabean grew into a major industrial crop in the 2000s following the establishment of specialized soyabean processing plants in other states.

Recently, IITA and IAR researchers have released and made available to farmers early maturing varieties that can be profitably grown in marginal areas where previously soyabean was unknown. For example, under TL-II new early maturing and adaptable soyabean varieties have been made available to farmers initially through on-farm research. These include TGX-1835-10E, TGX-1870-10E, TGX-1904-6F, TGX-935-3F, TGX-1951-3F and TGX 1987-62F.

8.2 Structure and dynamics underway in the grain legumes value chains

Cowpea, groundnut and soyabean are highly commercialized (Table 8.1). The centers of final consumption are mainly urban areas in the southern states.

Table 8.1: N2Africa baseline data showing degree of commercialization among Nigerian farm households.

Legume type	% farmers selling some of the produce	% that net selling households on average market	Mostly sold as
Cowpea	86	51	Dried grain
Groundnut	91	62	Dried grain
soyabean	85	58	Dried grain

The mapping of the value chains shows four main channels: (1) subsistence production and consumption; (2) dried unprocessed grains sold to nearby and long distance markets for direct household consumption; (3) dried grains sold for industrial processing; and (4) manufacturing of edible vegetable oil, food and feed products. The non-commercial channel consists of the subsistence production and consumption chain. The share output of subsistence production and consumption is 56% for cowpeas, 53% for groundnuts and 51 % for soyabeans.

Cowpea channels are dominated by informal traders and household cottage industries. Cowpea is mainly consumed as dried grain, either as flour or splits. Historically groundnut was produced for the export market through the Northern Marketing Board, which was the sole buyer of groundnuts, at a price determined by the government. The groundnuts were processed before export. This explains why the processing industry started small and grew large over time. Small, medium and large scale groundnut oil mills developed located mainly in the major producing areas, especially in Kano. Similarly, small, medium and large scale soyabean oil mills have developed around groundnut processing centers in Kano, Zaria and Jos. In 1986 the government abolished commodity boards. Kano, Zaria and Jos continue to process more than 90% of the groundnut and soyabean and transfer the derivative products to urban markets.

Commercial marketing chains have as their starting point agricultural research and technology development and dissemination. Table 8.2 summarizes the actors in the research and seed sector. To date 25 cowpea, 23 groundnuts and 20 soyabean varieties have been officially released (Appendix V).

Table 8.2: Actors in the commercial marketing chain.

Actor	Role
IAR, National Cereals Research institute and universities	-Cowpea, groundnut and soyabean research -Producing breeder and foundation seed
IITA and ICRISAT	-Providing germplasm -Producing breeder and foundation seed
National Agricultural Seeds Council (NASC)	-Producing breeder and foundation seed -Supporting seed companies -NASC inspectors are the only agents in the country that can issue a certification tag for seeds
Premier Seeds	Seed company with breeding and adaptive research programs (mostly maize)
Nationally Coordinated Research Project (NCRP)	Coordinating testing of varieties through multi-location on-station and participatory on-farm trials, before official registration and release.
State Agricultural Development Programme (ADPs)	Agricultural extension, community seed production, fertilizer and seed subsidy program
Seed companies (Premier Seed, Maina Seed, Seed Project, Champion Seed, Nagari Seeds, Maslaha	-Multiply foundation seed to certified seed through contracts with outgrowers -Clean, size, treat, store and package seed in 2, 5, 10 and 50 kilogram-packs

Seed, Alheri Seed, Da-all Green Seed, and Value Seed)	-Large seed companies provide fertilizers and seed on credit to their seed growers
State governments (through farmers' associations and NGOs)	Selling seed (mainly maize, groundnut and soyabean) to farmers at subsidized prices
North-West Agro Input Dealer Association (NOWAIDA) (IFDC supported)	-Agro-dealer development programs starting in 2002 in Kano -800 individual agro-dealers and 20 companies involved -Training in business management skills; fertilizer knowledge application; seed production certification; and crop chemicals -Technology dissemination through demonstration and field days on farms managed by agro-dealers -Testing of farm implements, soil test kits to determine fertilizer requirements, bucket drip irrigation, and hand-powered tillers -Linking agro-dealers to microfinance banks and input suppliers through credit guarantee and group lending -Communication, input demand creation and product ordering that can promote agro-dealer businesses -Aiming to change the fertilizer subsidy system to a more transparent and efficient system based on vouchers and agro-dealers distributing fertilizers to farmers

Because of consistently high effective demand, seed companies focus on producing and marketing seed of hybrid maize, open-pollinated varieties of maize and rice. However, they are also beginning to invest in soyabean seed production because of the expanding market for the commodity. Seed companies also produce cowpea seed. However, due to a lack of demand, firms do not produce groundnut seed. Because of a general lack of seed supply by seed firms, state ADPs are implementing community-based seed multiplication and distribution. These are implemented through on-farm trials and demonstrations to enable farmers to learn that quality seed of new varieties performs better than farmer-saved seed. Despite these investments, the uptake of certified seed by farmers is only between 2-5%. The volume of commercially traded seed from all the seed companies and ADPs is around 8,000 tons per annum. Thus, there is a limited awareness of quality seed of improved varieties among farmers.

All fertilizers and inoculants are imported. Fertilizer companies also sell through the government fertilizer subsidy program. Under the subsidy program, fertilizer is directly distributed to farmers' organizations by government officials. Farmers' group members collect their allocation from government stores and arrange for transportation to their locations. The government procures fertilizers from suppliers at 7,000 to 8,000 Naira per 50-kilogram bag. The fertilizer is supposed to be sold to farmers at 1,500 Naira per 50-kilogram bag. However, most farmers fail to access the fertilizers because dealers buy them and re-sale to the government. This is because the price of fertilizer on open market is very high. In 2011 fertilizer was sold at 6,000 Naira for 50-kilogram bag. This explains why NOWAIDA is advocating for the voucher-based system of fertilizer distribution through agro-dealers.

Farmers sell their produce to local and central assemblers in periodic markets. Local and central assemblers sell to commission agents and merchants. Merchants buy during the harvest season and store in warehouses, with an annual capacity as high as 50,000 tons per firm. The merchants sell to processors, farmers and consumers. The merchants are often located in major central markets such as Dawanu in Kano, Funtua and Dandume in Katsina, Giwa in Zaria and Kaura in Zamfara. Processing firms sometimes act as merchants buying, storing and selling grain to other processors instead of crushing it. This depends on relative prices of soyabean cake, meal and oil to grain prices and availability. Traders enter these markets during the peak of harvest when prices are at their lowest

from November to March and supply consumers, farms, and firms in southern parts of the country and processing firms.

The bulk of the cowpea enters commercial trade from the surplus producing areas in the north to high centers of consumption in the southern urban markets through Dawanu market in Kano, the entrepôt for legume grain flows. Cowpea processing is dominated by household enterprises and SMEs. In addition, formal industrial processing firms are emerging. These include Kitchen Friendly and Convenient Home Foods. The processing firms mostly produce cowpea flour for instant preparation of home foods. These include cake (akara), moi-moi, pan cake, buns, chin-chin, bread, porridge and beans soup. The processors use dry dehulling milling and produce better quality products compared to traditional processing that uses soaking. Processors sell mostly to urban consumers through supermarkets, local stores and open air markets.

Groundnut channels are dominated by both informal and formal small, medium and large scale processors. Informal markets supply groundnut for edibles such as roasted snacks. The groundnut raw materials for the informal market mostly flow through Dawanu market and are bought and sold by volume on a per bag basis. Formal markets supply groundnuts for production of vegetable oil and cake for manufacturing animal feed. The groundnut raw materials for the formal market mostly flow through the Tafawa Balewa and are bought and sold by weight on a per trailer basis. The installed annual aggregate capacity of SMEs and large scale processing plants for groundnut in the country is more than one million tons. However, industrial processors get inadequate raw materials. In addition, the groundnut oil channel is uncompetitive due to e.g. cheap imported palm olein from Malaysia. Currently, most of these factories are processing sunflower, groundnut, cotton and soyabean seeds depending on their location. However, some do not operate at all. Through wholesalers and retailers, oil mills market oil mainly to urban markets. Wholesalers buy by drums. In turn, wholesalers sell to retailers and retailers sell to final consumers by bottle. There are no exports out of Nigeria. All of the production is consumed in the country. Whereas poor households buy cheap imported palm oilen, groundnut oil is for rich households. Some processors sell crude oil or mix groundnut oil with other oils to reduce prices.

In contrast, soyabean channels are dominated by farm-based animal feed mills and industrial processors. The poultry industry is the major consumer of soyabean grain and derivatives, including soyabean cake and meal. Poultry farmers directly buy soyabean that they use for making roasted full fat feed using their own feed mills or use soyabean cake and meal for on-farm preparation of feed. The farms are mostly located in the South West along the Lagos-Ibadan axis. Fish farms also buy soyabean for production of on-farm fish feeds. Fish farming is mostly located in South West Lagos, Oyo, Ondo, Osun, Kwara, Ogun, Edo, and Niger State. In addition, industrial oil mills produce soyabean cake and meal for manufacturing animal feed as the main and vegetable oil for human consumption as by-product. Table 8.3 lists the key actors in groundnut and soyabean milling and processing.

Soyabean processing initially grew through old factories switching from crushing groundnuts to soyabean using mechanical expelling in order to maintain production going during months when there was a lack of groundnuts. During the late 1980s, solvent plants were introduced to extract more oil compared to mechanical plants. However, early generation solvent plants were inefficient and processors had difficulties finding solvents. During the early 2000s solvent extraction technology simplified and more processors invested in solvent extraction dedicated to soyabeans. Because of increased supply of soyabean in the past five years and the market for soyabean cake growing faster than for groundnut cake, most oil mills crushing groundnuts are now crushing soyabeans. The aggregate annual installed capacity of soyabean processing plants is around 700,000 tons. Soyabean oil requires deodorizing and degumming after expelling to remove the odour and make it acceptable to consumers. Many oil mills do not have refining facilities for removing odour. Therefore, they sell crude oil to specialized firms such as SunSeed and Grand Cereals. These companies refine, package and sell through brand labels, mostly through supermarkets. Soyabean is a high cost product for well off households. It is mostly consumed in the south western states because consumers have higher disposable incomes, are more cosmopolitan and health conscious.

Table 8.3: Key actors in groundnut and soyabean milling included in the survey, Nigeria, 2011. Source: Author's survey.

Oil Mill	Location	Ground nut milling	Annual production (mt)	Soyabean milling	Annual production (mt)	Solvent plant	Mechanical plant	Notes
Alh Aminu Dawaki Oil Mill	Kano	Yes	15,000	Yes	10,000	No	Yes	
Fortune Oil Mill	Kano	Yes	17,000 - 20,000	Yes	30,000-90,000	Yes	Yes	Installed capacity 100,000 tons per year
Yakassai Oil Mill	Kano	Yes	3,000	Yes	1,000 - 3,000	No	Yes	
Grand Cereal Oil Mill	Jos	Yes	36,000	Yes	100,000	Yes	No	Poultry feed, flour and fish feed
P.S.Mandrides Plc	Kano	Yes	6,000	Yes	5,000	No	Yes	Not used for years
Sharada Oil Mill	Kano	Yes		Yes		No	Yes	
Tahir Oil Mill	Kano	Yes	2,000	No		No	Yes	Not working for some years now
Alh Rogo Makama Oil Mill	Kano	Yes	2,000 - 3,000	No		No	Yes	Into cotton seed milling for now
Nigeria Oil Mill	Kano	Yes				No	Yes	Sold to Bua Flour Mill
Talamiz Oil Mill	Kano	Yes	10,000	Yes	6,640	Yes	Yes	The oil mill has been closed down
Sunseed Oil Mill	Zaria and Yola	No		Yes	70,000	Yes	No	Operational in Yola and Zaria factories
Falke Oil Mill	Kaduna	No		Yes	6,000 - 8,000	Yes	No	The oil mill is new
Hule Oil Mill	Benue	Yes	772	Yes	5,280	No	Yes	Production contracts with farmers
Taraku Oil Mill	Benue	Yes		Yes	Installed capacity 30,000 tons	Yes	No	Capacity utilization low. Plant has been privatized and is under new management
Karma Foods Industries Ltd	Abuja - Keffi Road	No		Yes	Planned capacity is 70,000 tons	Yes	No	Plant is not in operation, they are still installing the machines
Gerawa Oil Mill	Kano	Yes	10,000	Yes	10,000	Yes	No	The oil mill is leased out to Grand Cereal
Sharna Farms Ltd	Abuja Keffi Road	No				Yes	No	Just finished building the solvent plant
Karami Oil Mill	Kano	Yes		No		No	Yes	Stopped production for the past 5 years
Sarauniya Oil Mill	Kano	Yes	13,000	No		No	Yes	The new name is Nagudu Oil Mill (operated for 2 years 2008-2009)
Wadata Agro-allied Oil Mill	Kano	Yes	3,120	No		No	Yes	
I.A.M Oil Ltd	Kaduna	Yes	1,560	No		No	Yes	

After extracting oil, mills sell the cake and meal to poultry farms and feed mills. Residue cake and meal is the product that generates the most revenue for processors. There are both SMEs and large scale industrial feed manufacturers. Most SMEs use hand roasting and mix ingredients with shovels. They often own locally fabricated grinding mills. However, the large firms Grand Cereals, Premier Feeds, Top Feeds and Animal Care are the leading poultry feed manufacturers. They market branded feeds through distributors located throughout the country. Because most poultry farms are in the Lagos and Ibadan axis, the bulk of the sales are in this area. Beyond poultry feed Grand Cereals recently installed a fish feed plant with annual capacity of annual capacity of 23,000 tons.

Respondents estimated that about 500,000 tons of groundnuts are annually marketed through formal processors. This is below the installed aggregate capacity of processing plants exceeding 1 million tons. Respondents similarly estimated that 300,000 tons of soyabeans are annually marketed through formal processors compared to an installed aggregate capacity of processing plants exceeding 700,000 tons. The substantial deficit between domestic requirements and production explains why poultry farms and feed companies import soyabean cake and meal to meet their demands.

8.3 Trade flows

Because of excess demand for cowpea, groundnut and soyabean in Nigeria and different harvesting seasons, there are cross border trade flows from Niger, Benin Republic, Cameroon, and Burkina Faso. Most of the trade is informal, making it difficult to accurately record and quantify the flows. With the seasonal trade flows, cowpea from Gombe and Bauchi are the first grains to be delivered to Dawanu market around September. Cowpea from Jigawa and Kano is delivered next. Cowpea from Borno is supplied during October to November. Cowpea from Niger is delivered from December to July. Cowpea flows from Niger get reversed during poor rainfall seasons. Regional flows from Niger occur through three corridors: (1) Konglom to Kano (2) Jibia to Kano; and (3) Baure (Jigawa) to Kano to Dawanu.

In August, the first groundnut comes from the Benue-Taraba axis. By the end of September groundnut is supplied from the Nassarawa – Lafia axis, then the Niger State axis, followed by Sokoto-Kebi, then Katsina, and finally groundnut is supplied from Kwara. When the harvest season in Nigeria ends in February-March, traders start to procure groundnuts from the Chad-Cameroon axis. Regional grain trade flows from Chad occur through Jemera or Bama to Maiduguri to Kano. Grain flows from Cameroon take place through Baga to Maiduguri to Kano. The bulk of the grain is sourced from Chad because there are less tariff and non-tariff barriers to trade. By contrast, procuring grain from Cameroon results in high tariff and non-tariff barriers. Grain trade flows from Benin Republic follow two routes. The first is from Benin to Kebbi State to Niger State to Kaduna State to Kano. The second is from Benin to Niger to Katsina and then Kano. Traders do not use the Niger-Katsina corridor because of delays. These trade flows over long distance occur because traders use backhaul truck freight. Backhaul freight has lower rates than head haul loads. Trade is also facilitated by paying and getting paid through cell phone.

Although banned, frozen chicken and eggs are also imported into Nigeria, especially through Benin Republic. Nigeria exports poultry feed and eggs to neighboring countries.

8.4 Opportunities, constraints and areas for prioritizing agricultural research-for-development interventions

Value chain respondents reported that opportunities for upgrading the value chain in order to generate grain legume-based growth lie in production and process innovation to respond to unmet and increasing demands in end markets in local, national and regional urban centers. In addition, imported vegetable oils and foods can be substituted. In order to utilize these opportunities, value chain participants need to innovate to improve efficiency, product volume, consistency, quality and productivity, profitability and competiveness and add operations to increase value added across the value chains. This can be implemented through strengthening associations of farmers, seed firms, agro-dealers, processors, poultry feed manufacturers and organizing these into value chain participant councils for collective action. Organizing farmers into commodity groups, linked to sources of credit where produce is sold, was perceived as the most cost effective way to expand farmers' access to

market information about varietal and grain quality characteristics preferred in different end-markets; input markets (seeds, fertilizers, inoculants, pesticides, tools); output markets (forward deliverable contracts, storage, processing); micro-finance; and technical training and capacity building. Farmers' organizations also strengthen bargaining power through producer cooperatives and traders' associations, improve information flows, price discovery and margins through vertical and horizontal integration and shorten the long marketing chains between farmers and consumers. Processing companies reported that they are searching for more efficient ways to source raw material of consistent quality. Contract farming was reported as an institutional arrangement with significant potential for processing companies to efficiently procure raw materials of consistent quality.

Value chain participants reported eight constraints on opportunities for grain legume-led growth identified through the end market analysis, going beyond agricultural production systems to vertical and horizontal coordination, related to agricultural input supply, extension advice, market access and factors in the business environment. Representatives argued that a major constraint is the lack of capability to supply raw grain materials to end users (large volumes, consistency, quality, and price), mainly due to lack of mechanization and use of non-commercial farming methods. Further constraining farmers' capacity to provide adequate supply is the lack of capacity to supply agricultural inputs. In addition, there are biotic factors, such as pests and diseases, and abiotic factors, such as drought and inherent low soil fertility, which limit yield. Respondents also cited crop management efficiency gaps by farmers, including time and method of planting, intercropping, weed control, soil fertility management, fertilizer use, and water and pest management. Because of these constraints the yield per hectare is low. Consequently farmers require high selling prices to earn a competitive return on their investments.

In addition, government ADP extension services are ineffective ways to exchange technologies. Low salaries and incentives lead to poor staff motivation and morale. Consequently, cooperative societies, farmers' organizations and agro-dealers are emerging as important sources of information for farmers and work with farmers as a team. However, farmers will likely adopt a technology only if they know the information is from reliable source such as the ADP, seed companies, or agricultural research organizations such as IARs. Although the cooperative societies, farmers' organizations and agro-dealers provide the majority of the information to farmers, they are not necessarily an effective way of extending new technologies.

The market linkages for cowpea, groundnut and soyabean are currently very basic and poorly organized and coordinated. There are no on-farm value adding activities such as cleaning, sorting, grading, storage and warehousing to permit farmers to get the value of their crop. There is co-mingling of varieties. There is much information asymmetry between farmers and traders. This results in high transaction costs. Besides, there is high seasonal price volatility and farmers often sell immediately after harvest, when liquidity constraints are greatest, but prices are lowest.

In addition, there is a general lack of finance for farming activities. Contracting is constrained by a lack of trust among farmers and traders. Also traders and millers have poor access to finance and interest rates are high. In addition, processors are forced to hold large inventories of raw materials as a result of irregular and inadequate supply.

Furthermore, there is increased competition from imports. Oil millers have high operation costs due to expensive raw materials and poor electricity supply and struggle to compete with vegetable oil imports whether legal or illegal from Malaysia and Indonesia .

Finally, there are some policy inconsistencies. There is a lack of accurate statistical data on area, yield and production of grain legume crops, stocks held by the National Food Reserve Agency and imports. Most farmers are failing to obtain access to fertilizer under the current seed and fertilizer subsidy programs. There are no standard grades and weights. Traders, poultry farmers and processors incur high costs transporting, cleaning and sorting grains and changing specifications for different batch runs.

Table 8.4: Summary of opportunities, constraints and research requirements related to the legume value chains in Nigeria.

Opportunities	-Meeting households own consumption demands -Increasing demand from urban markets for processed foods and livestock and fish products, especially increasing demand for soyabean raw materials to substitute for imports (including poultry meat and vegetable oil) . -Feed for fish farming -Rehabilitate groundnut production and processing for the domestic and international interest in groundnut oil to resume the 1950s-1970s annual exports of 50, 000 tons to earn foreign exchange. -Expand poultry feeds and eggs to neighboring countries -If production of cowpeas, groundnuts and soyabeans were to double, demand would still exceed supply
Constraints (in decreasing order of importance)	1. the lack of capabilities to timely and consistently supply end-markets with products in large volumes at quality and competitive prices; 2. the lack of input supply systems for certified seed of improved appropriate varieties, fertilizers and agro-chemicals; 3. weak extension services; 4. the lack of organized output marketing and price volatility; 5. the lack of financing; 6. increased competition from imports; 7. poor government policies.
Requirements/research interventions	(a) changing production systems to increase yield per hectare, marketable surplus and drive down unit costs of production; (b) agricultural input supply market development; (c) improving output markets; (d) strengthening micro-finance markets; (e) capacity building of farmers' organizations for collective action to participate in markets; (f) policy innovations.
Nodes for leveraging investments	-Farmers associations and cooperatives; -Seed companies through the Seed Association of Nigeria (SEEDAN); -Agro-dealers through their associations such as North-West Agro Input Dealer Association (NOWAIDA); -Commodity traders and commission agents through their associations such as Tafawa Balewa and Dawanu Marketers' Associations; -Agribusiness processors through their associations such as the Oil Processors Association of Nigeria and Small Oil Milers Association; -Poultry farmers through their associations such as the Poultry Association of Nigeria; -Fish farmers through their association; -The agricultural research institutes and faculties of agricultural universities. -The National Soyabean Association, when this has been revitalized and expanded to other commodities

Table 8.4 also includes specific research interventions to tackle the constraints. Because of strong complementarities among components research interventions to resolve constraints requires a value chain approach to target interventions to different leverage nodes across different stages of the whole chain.

Changing the agricultural production systems to increase yield per hectare in order to increase production of marketable surplus and reduce the unit costs of overheads and selling price of farmers, was ranked as the priority intervention. Most respondents argued that interventions are needed to double yields from the current levels below 1,000 kg per ha to above 1,800 kg per ha. These include increasing the availability and affordability of quality seed of improved varieties, fertilizers, agro-chemicals, inoculants, machinery and equipment; screening of varieties that better tolerate drought, low soil fertility, pests and diseases and end-market preferred traits that are adapted to local growing conditions; improving production technology, including efficiency and use of inoculants, phosphate fertilizers, planting and harvesting, drying and shelling on tarpaulins instead of beating the dry pods on ground and mixing grain with sand.

The development of agricultural input supply markets was identified as the second most important area for targeting investments. This includes establishing community based seed systems and seed associations for farmers to access quality seed of improved varieties. This also includes setting up agro-dealer development programs to get seeds, fertilizers, inoculants, machinery and equipment closer to farmers and lower transaction costs in getting inputs to farmers.

Improving linkages of farmers with end-users through lowering transaction costs and improving marketing efficiency was reported as a priority intervention. Needed interventions cited include institutional arrangements for improving market coordination and integration of rural and urban markets. Priority investments include technology for post-harvest management and value addition storage, processing and utilization to expand incomes earned by farmers through on-farm cleaning, grading and sorting and utilization. Market information services were perceived as critical for reducing information asymmetry between traders and farmers and improving farmers' bargaining power within marketing arrangements.

Development of microfinance to expand access to credit and finance by farmers, traders and processors was indicated as an important area for targeting investments. Recommendations were made to adapt banks to improve services to their customers through group lending and warehouse receipt systems-based lending instead of conventional collateral-based lending methods.

In addition, collective action to strengthen farmers' organizations at grass roots level to help them participate in markets was identified as a priority area. This includes capacity building of farmers' organizations to enable them to carry out higher levels of contracting and increasing market intelligence of poor farmers, including information for farmer management practices, price variation, and how to produce for specific markets. This also includes putting in place collecting centers within walking distance of farmers' locations, inspection, grading and sorting, storage, competitive pricing and timely payment. Training farmers in product assembly, sorting, grading, storage, pest control, capacity to warehouse and to supply cheaper materials for industry which will enable processors to lower costs of foods was identified as a particularly important area.

Finally, policy innovation was identified as a priority area in order to expand availability and affordability of certified seed of improved varieties, fertilizers, agrochemicals through voucher-based subsidy systems. Government regulations are needed to support better communication between farmers, traders and processors, bring farmers closer to processors and improve marketing efficiency. Recommendations were made for public sector interventions to help establish a warehouse receipt system to enable farmers to avoid post-harvest price collapse and then build the commodity exchange on this institutional foundation instead of the top-down approach currently being used by the Abuja Securities and Commodity Exchange. A few respondents recommended licensing traders in order to trade and protect investments in contract farming. Lastly, suggestions were made for legislation to protect agribusiness processing firms from imports of vegetable oils.

9 Malawi, Mozambique, and Zimbabwe

9.1 Role of the target grain legumes in smallholder farmers' strategies for incomes, food security, nutrition, sustainable natural resource management (NRM) and gender equity

Common bean, groundnut, cowpea and soyabean play roles that vary from important to very important in smallholder farmers' strategies for incomes, food security, nutrition, NRM and gender equity in the three countries.

In Malawi, common bean is very important for cash, food security, nutrition and gender equity, especially in the highlands. Common bean is one of the crops farmers rely on a daily basis for food as a relish and for cash. Cowpea is very important for farm incomes, food security, nutrition, NRM and gender especially in the low rainfall southern region, where the production of cowpea is high and where it forms an important of the diet since there is a lack of alternative vegetable protein crops. Cowpea can be intercropped with cereals. Also cowpea is a woman's crop, unless there is a cash market, which induces greater participation by men. Groundnut is the most commonly grown legume, throughout the country, and is a very important crop. Peanut butter manufacturing and international markets drive the high demand. Soyabeans are also very important because there is a high derived demand resulting from the urban demand for edible oil and soyabean cake for poultry feeds. This permits farmers to generate high cash incomes. Soyabeans are important for food security and nutrition because farm households have been trained in preparation and human food products, including corn-soyabean blended flour which is marketed through retail shops. Soyabean can be intercropped and this helps in NRM. When soyabean is commercialized capacity building on gender permits both men and women to play roles in ensuring that they both capture the benefits.

In Mozambique, common bean is the second most important cash crop after maize in the intermediate and high altitude areas. Those areas are suitable for common bean production and the crop plays an important role in household food security, nutrition, NRM, and gender equity. Overall, cowpea is unimportant for incomes because market prices are low. This does not encourage farmers to grow cowpea as a cash crop. However, in certain (low rainfall) areas cowpea is grown in larger quantities and there it is important for food security, nutrition, NRM and gender equity. Groundnut is more important for incomes than common bean and cowpea because it has an international market. Soyabean is a new cash crop in Mozambique and with its good market prices, it spreads rapidly in the areas where it has been introduced. However, soyabean is not important for household food security and nutrition because it is not directly used in the human food chain. Instead, it is indirectly used through soyabean meal for feeding poultry. In addition, most farmers do not yet know the value of soyabean for human nutrition. In the future soyabean is expected to play a strategic role in crop rotation and will hopefully combat soil fertility depletion as farmers expand the cultivated area under soyabean. Soyabean is regarded as a woman's crop and therefore plays an important role in gender equity.

In Zimbabwe, common bean plays important roles in farm incomes, nutrition and gender equity, but overall it is an unimportant for food security and NRM. Beans are grown mostly during the off-season, when there is less pest and disease pressure, in areas where there is irrigation. Common bean is difficult to store because it gets easily attacked by weevils. Beans are regarded as a woman's crop. Also cowpea is not very important for cash, food security, nutrition, NRM and gender equity. This is because there are no organized commercial marketing systems for cowpea. Consequently, farmers grow cowpea mostly in small plots for their own consumption. Because the crop is grown mostly for subsistence requirements, it is grown as a secondary intercrop with cereals and farmers do not invest in improved management practices and off-farm inputs. Although cowpea potentially is a good Nitrogen fixer, it is only grown in small plots. Groundnut has a potential important role in farm income, food security, nutrition, NRM and gender equity. However, this potential is constrained by the lack of supply of quality seed of improved varieties. Soyabean plays a very important role in farm incomes and NRM in Zimbabwe because the derived demand for poultry and pig feed cannot be satisfied and the crop is good for leaving residual Nitrogen. However, soyabean has an unimportant role in food

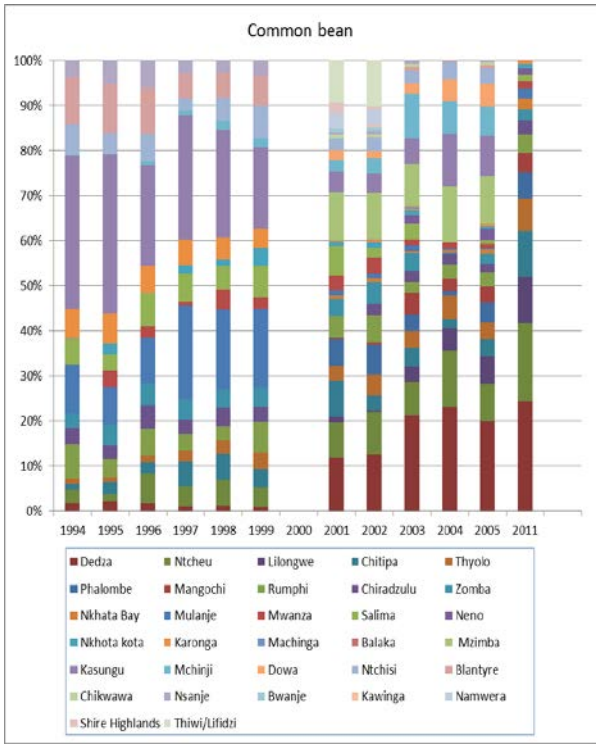
security and nutrition through direct consumption because it requires processing and the knowledge thereof is limited.

9.2 Production by geographical area

In Malawi, common bean production is concentrated in the higher altitude and higher rainfall agro-ecologies. More than 70% of the total production is located in Dedza, Ntcheu, Lilongwe, Chitipa and Thyolo (Figure 9.1). Cowpea production is concentrated along the lake shore and Shire Valley. The bulk of the crop is produced in Mangochi, Chikwawa, Phalombe, Machinga and Thyolo. Groundnuts are grown throughout country, with key production zones in the center of the country in Dowa, Mchinji, Ntchisi and Lilongwe as well as in the northern districts in Mzimba and Rumphi. Soyabean production is concentrated in the center of the country in Ntchisi, Mchinji, Lilongwe, Dedza, Kasungu and Dowa and in the northern districts in Mzimba. These production patterns are explained by different soils and climates in different areas, resulting in different comparative advantages for production of different crops; preferences of different legumes for home consumption; and grain legume development projects.

In Mozambique the most important production areas are concentrated in Niassa, Tete and Zambezia for common bean; Nampula, Zambezia and Cabo Delgado for cowpea; Gaza, Manica and Zambezia for groundnut; and Zambezia (Gurue), Tete (Angonia) and Manica (Chimoio) for soyabean (Figure 9.2). The common bean production areas have a combination of soils, rainfall and temperature which is favorable for bean production. In addition, the agro-ecological conditions permit growing two crops per year. For cowpea, lower rainfall and poorer soil and local diets of households favor its production in the northern coastal provinces. Groundnut production is concentrated in the southern areas which have lower rainfall areas and sandy soils and where groundnut it is a traditional staple. Soyabean is a new crop in all regions. The soils and rainfall favor its production in the above mentioned areas. Agricultural development projects targeted at soyabeans have to date been implemented in the areas in Gurue, Angonia and Chimoio and Niasa.

In Zimbabwe, common bean production is concentrated in Manicaland, Mashonaland West, Mashonaland Central, and Mashonaland East. The most important production areas of cowpea are Masvingo, Manicaland, and Matabeleland North. Groundnuts are mostly grown in Manicaland, Masvingo, Midlands and Mashonaland East. The main producing soyabean production areas are Mashonaland Central and parts of Mashonaland West and Mashonaland East. These production patterns have emerged because of different favourable climates and soils and grain legume development projects which have not been implemented uniformly throughout the country. In the past, commercial farmers often cultivated both common bean and groundnut. Common bean was planted after harvesting groundnuts and with their short growing period were still able to mature from the residual moisture as they have a short growing period.



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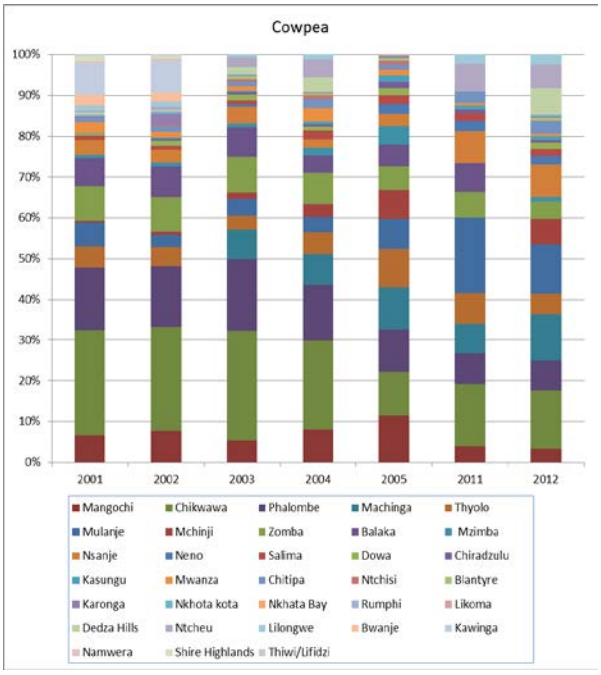

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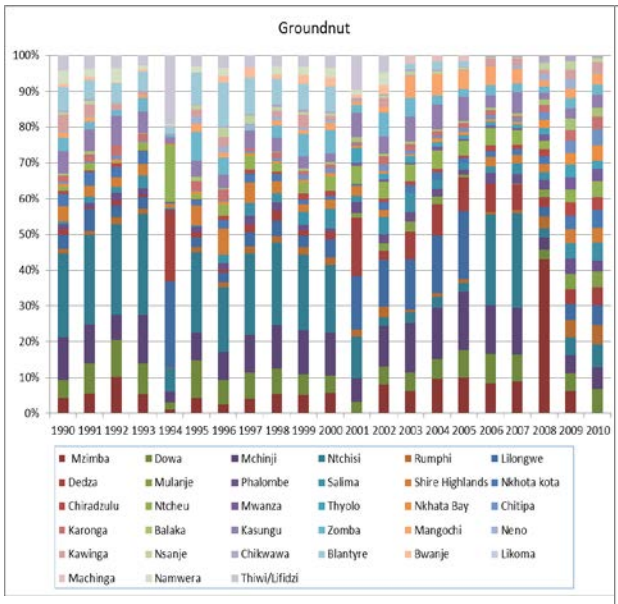

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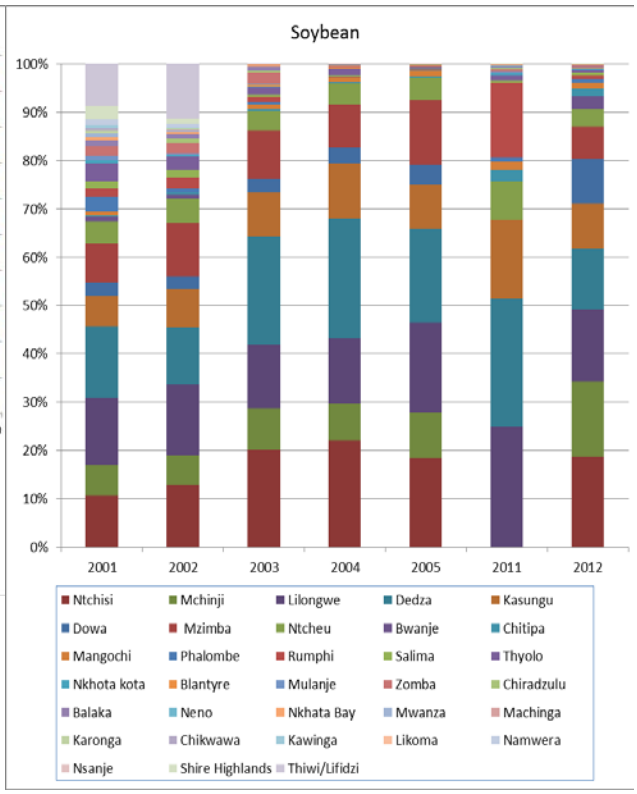

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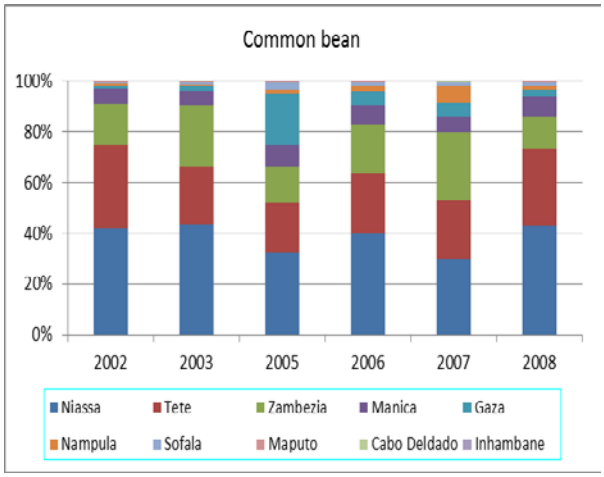
Figure 9.1: Shifts of legume production shares in the Malawian districts for A) common bean, B) cowpea, C) groundnut and D) soyabean. Source: Ministry of Agriculture and Food Security.



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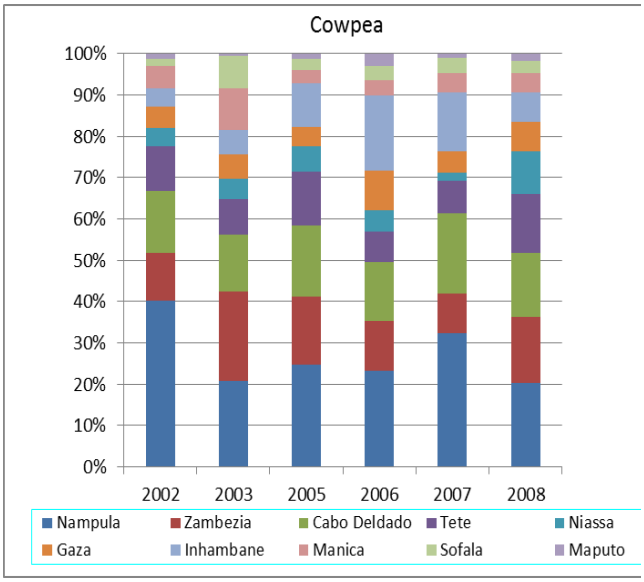

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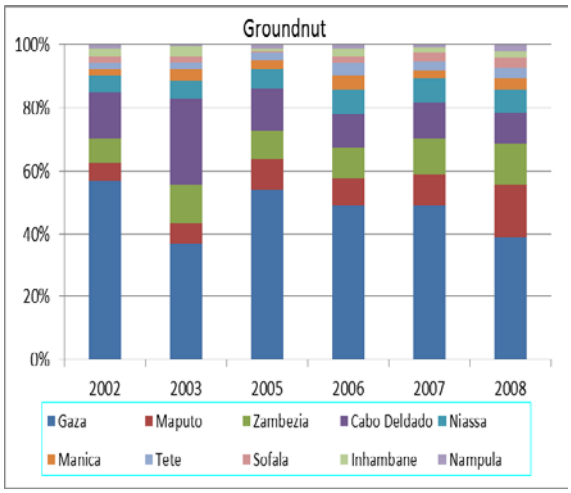

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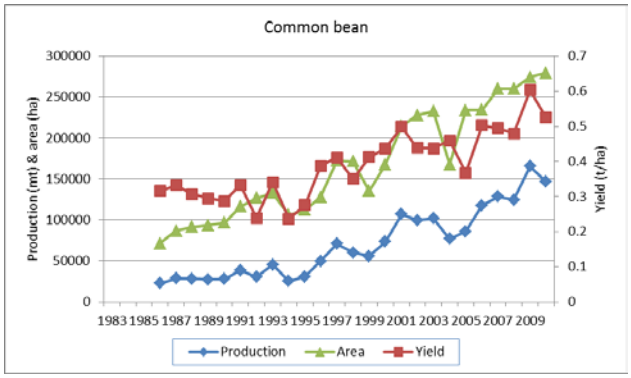
Figure 9.2: Shifts of legume production shares in the Mozambican provinces from 2002-2008 for A) common bean, B) cowpea, C) groundnut. Source: Source: Trabalho de Inquerito Agricola, 2002-2008 .

9.3 Trends in area planted, yield and production

In Malawi, the area, yield and production of common bean, groundnut and soyabean have fluctuated with an upward trend (Figure 9.3). These trends are being driven by an increasing demand for those crops resulting from growth of population and incomes, and changing lifestyles, especially in the urban areas; availability of markets, increasing market prices and commercialization of the commodities; the development, release, availability and adoption of quality seed of improved varieties and crop management methods; projects working with farmers to increase production of grain legumes in certain areas; and the agricultural input subsidy program promoting groundnut, soyabean, and pigeon pea through improving farmers' access to certified seed of improved varieties. In contrast, respondents explained their belief that cowpea area, yield and production have remained flat because farmers are not motivated to produce marketable surplus because of low commercial demand and uncompetitive farm gate prices.



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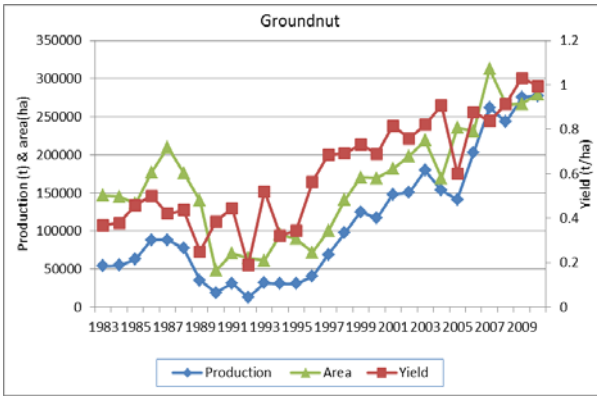

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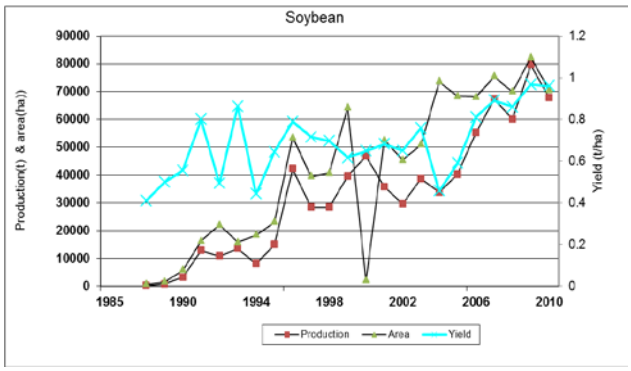

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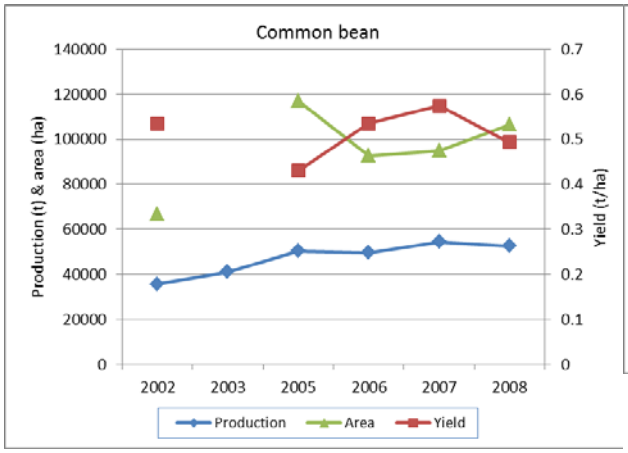
Figure 9.3: Trends in aggregate area, yields and production of grain legumes in Malawi between 1995-2010 for A) common bean, B) groundnut and C) soyabean. Source: Ministry of Agriculture and Food Security.

In Mozambique, the area and production of common bean, cowpea, groundnut and soyabean have fluctuated during the past 10 years with an upward trend (Figure 9.4). Yields have been stable at around 500-600 kilograms per hectare for common bean and less than 500 kilograms per hectare for cowpea and groundnut. In contrast, soyabean yields have trended upwards from an average of 500 to 1,000 kilograms per hectare in the last five years. The upward trends in area and production were driven by increases in both local and export demands, import substitution and increasing producer prices; the return to peace following the ending of civil war in 1992; natural disasters such as late start to the season and floods in central provinces; and investment by agribusiness firms in procurement of raw materials and promotion of production. Soyabean was introduced only after Independence in 1975 in Gurue in Zambezia. In the 1980s a Brazilian agribusiness farming firm began to evaluate improved soyabean varieties and to support production on mechanized state farms and not on smallholder farms. But soyabean production was cut off in1980s as a result of the civil war until peace in 1992. Production was restarted in 2004/05 with smallholders in Chimoio, Niasa and Angonia. In 2009 TehnoServe began to promote soyabean production in collaboration with agribusiness farming firms in order to supply raw materials for the rapidly expanding poultry industry. Currently farm households are taking up and expanding the area planted to soyabean because of the competitive farm gate price.

The stagnating yields of common bean, cowpea and groundnut are being driven by recycling of seed because of the lack of seed supply systems; soil nutrient mining because farmers are not using inorganic fertilizers; lack of release of new varieties and production technologies until recently; and the lack of new agricultural development projects promoting these crops. The upward trend in soyabean yield is being driven by the use of fresh seed of new varieties; farmers starting to use fertilizer on soyabeans; and accumulation of knowledge for producing the crop.



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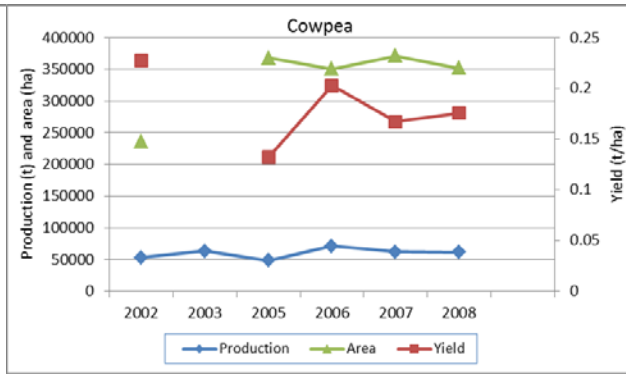

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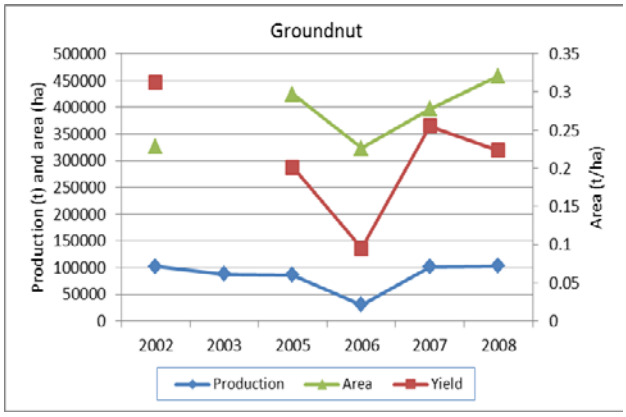

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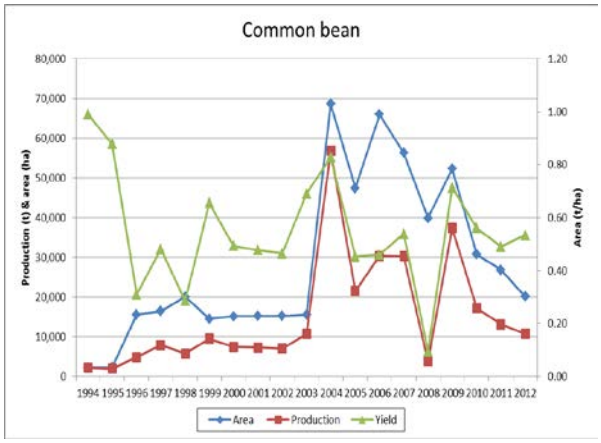
Figure 9.4: Trends in aggregate area, yields and production of grain legumes in Mozambique between 2002-2008 for A) common bean, B) groundnut and C) soyabean. Source: Trabalho de Inquerito Agricola, 2002-2008.

In Zimbabwe, the production of common bean, groundnut and soyabean dramatically increased in the early to mid-1990s following implementation of agricultural market liberalization and structural adjustment programs (Figure 9.5). However, area, yield and production sharply declined especially during the 2006-2007 period following implementation of the land reform program and macroeconomic instability. This resulted in weakening of extension system; escalation in prices of fertilizers and agricultural chemicals; lack of finance; lack of production and unavailability of certified seeds of improved varieties; and low and uncertain prices. Since 2008, groundnut and soyabean area, yield and production hav been trending upwards again because of the general economic recovery enabling farmers to obtain access to seed and fertilizers; entry of new farmers; increasing commercialization of smallholder farmers; production and availability of certified seed of improved varieties. However, groundnut farmers are still facing challenges obtaining access to seed because there is no seed production and distribution supply by formal seed firms.



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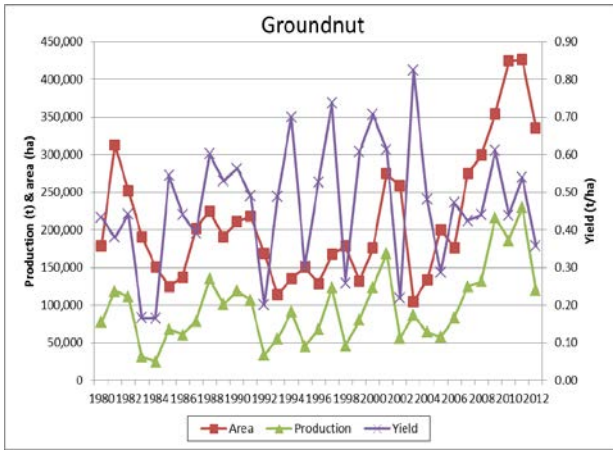

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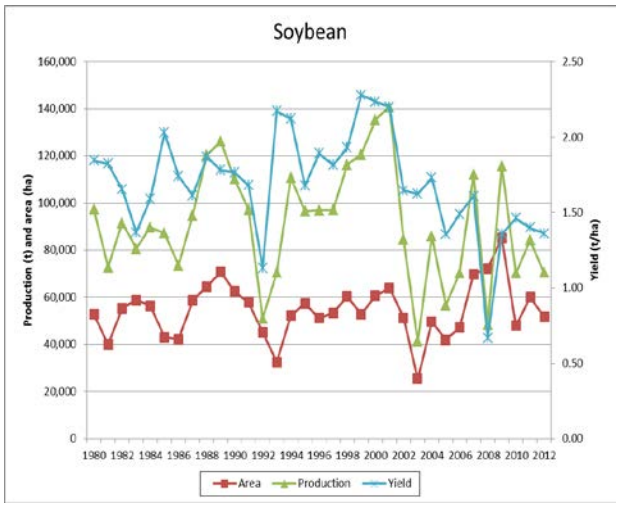

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Figure 9.5: Trends in aggregate area, yields and production of grain legumes in Zimbabwe between 1980-2012 for A) common bean, B) groundnut and C) soyabean. Source: Ministry of Agriculture, Mechanisation and Irrigation Development.

9.4 Structure and dynamics underway in the grain legume value chain

In Malawi, Mozambique and Zimbabwe cowpea, groundnut and soyabean are highly commercialized (Table 9.1). Between 40-100% of the farmers growing these crops sell some of their production to the market within 12 months after harvesting. These households market 50-90 % of their total production. The bulk of the grain legumes is sold as dried grain. The main consumption centers are the urban areas. Yet, surprisingly much soyabean is consumed locally at household level. Clearly these farm households depend on grain legumes as a major source of protein.

Table 9.1: N2Africa baseline data showing degree of commercialization among Malawian, Mozambican and Zimbabwean farm households.

Crop	Country	Malawi	Mozambique	Zimbabwe
Common bean	% farmers selling some of the produce	42.4	81.6	52.1
	% that selling households on average market	48.1	65.8	67.3
Cowpea	% farmers selling some of the produce	50.9	57.4	21.7
	% that selling households on average market	52.7	60.8	61.6
Groundnut	% farmers selling some of the produce	75.1	57.1	27.6
	% that selling households on average market	64.1	61.8	52.4
Soyabean	% farmers selling some of the produce	65.6	100.0	43.3
	% that selling households on average market	69.7	87.4	53.1

The pathways of the value chain from source to end-markets are organized into 5 main channels: (1) subsistence production and consumption; (2) dried grain sold through rural markets and wholesale and retail urban markets for direct human food consumption; (3) dried grain for processing into human foods by cottage industries; (4) dried grain for manufacturing of human foods by formal processors; and (5) exports to regional urban centers.

Cowpea value chains are dominated by the subsistence production and consumption pathway. Common bean value chains are dominated by the rural and urban direct human food consumption. The groundnut value chain is dominated by urban cottage food processing and regional and international export. Finally, the soyabean is dominated by industrial processing for protein for manufacture of poultry feed and human food and edible vegetable oil.

Commercial marketing chains include paths that carry out agricultural research and technology development and extension and paths that manufacture, distribute and market inputs to farmers and paths that procure, assemble, warehouse, transport, process, wholesale and retail products. Different stages have players of varying sizes and scales of operation. The chains for soyabean and groundnut are more organized and coordinated than those of common bean and cowpea. This is because there are more active coordinators in the chains of crops for industrial processing and export, which have well identified end-markets and smaller numbers of farmers, compared to those for staple food consumption. Table 9.2 summarizes the actors and organizations engaged in the value chains that have significant influence with smallholder farmers to bring about improved efficiency, productivity, profitability and competitiveness in order to foster economic growth and poverty reduction.

Table 9.2: Actors that play a role in the commercial legume value chains in Malawi, Mozambique and Zimbabwe.

Actor	Role and influence	Country		
		Malawi	**Mozambique**	**Zimbabwe**
Agricultural research, national crop improvement programs	-Conduct agricultural research and technology development; crop variety release and registration of Plant Breeders' Rights; produce breeder and foundation seed; seed inspection and certification; seed regulation; market regulation (grades and standards)	Department of Agricultural Research Services (DARS): National Bean, Cowpea, Groundnut and Soyabean Breeding Programmes; Bunda College of Agriculture; Seed Services	Instituto de Investigação Agrária de Moçambique (IIAM), SNS, USEBA	Department of Research and Specialists Services: Crop Breeding Institute, Seed Services
CGIAR crop improvement programs	-Breeding, providing germplasm; produce breeder, foundation and certified seed	CIAT, IITA, ICRISAT	CIAT, IITA, ICRISAT	CIAT, IITA, ICRISAT
Agricultural extension	-Conduct participatory technology development; agricultural extension; farmer training and capacity development; implement agricultural input subsidy program	Department of Agricultural Extension	National Directorate for Rural Extension (DNER)	Department of Agricultural and Technical Extension Services
Large-scale seed companies	-Conduct agricultural research, produce breeder, foundation and certified seed; promote and market seed	Monsanto, Seed Co, Pannar, Pioneer, Seed Trade Association of Malawi (STAM),	Semoc, Pannar	Pannar, Seed Co
Small-scale seed companies and community-based seed schemes	-Multiply breeder seed to foundation seed and to certified seed through contracts with outgrowers and distribute through different outlets for sale to farmers	ASSMAG, Funwe, Demeter, Seed Tech, Pantochi, Peacock, NASFAM	Associacocd Nacional de Extension Rural (AENA), JNB Investments, Lozane	ARDA, AgriSeeds, Progene Seed, Prime Seeds, Sandbrite Seeds
Fertilizer companies	-Import, manufacture, distribute and sell fertilizers; conduct research, demonstrations and promotions	Farmers' World, Omnia, Export Trading, Mulli Brothers, ADMARC, SFFRFM, Malawi Fertilizer Company, Transglobe, Coin Tech, Agora, Farm Chem, Rab Processors, ATC, Sealand, Nyiombo, Optichem		Windmill, ZFC, Omina

Agro-dealers	-Carry out downstream delivery of seed, fertilizer and agro-chemicals and services to farmers; seed fairs and demonstrations; product assembly; train agro-dealers and credit guarantee to link to input supply firms	RUMARK CNFA, Agricultural Input Dealers' Association of Malawi (AISAM), agents of seed and fertilizer companies	IFDC AIMS, CNFA, agents of seed and fertilizer companies	Zimbabwe Agricultural Market Development Trust (AGMARK), CNFA, ACFD, CARE, agents of seed and fertilizer companies
Farmers' organizations	-Organize farmers, on-farm technology testing, dissemination, collective action to internalize transaction costs in input purchasing and output assembly; develop skills such as negotiating, accounting and banking to participate in marketing, outgrowers and contract production	National Smallholder Association of Malawi (NASFAM), Farmers' Union of Malawi (FUM), Grain Legume Association of Malawi (GALA), farmers' clubs, associations, cooperatives, outgrowers and contract producers	IKURU, coopertatives, outgrowers, contract farmers	Zimbabwe Farmers Union (ZFU), Zimbabwe Commercial Farmers' Union (ZCFU), Commercial Farmers' Union (CFU), commodity associations, clubs, cooperative, outgrowers, contract farmers
NGOs	-Sensitize, train farmers, link farmers to markets, build capacity to participate in markets, train farmers certified seed production and marketing	Plan, World Vision, Total Land Care, Concern, Action Aid, CADECOM,Catholic Relief Services, CARE, Save the Children, Africare	TechnoServe, CLUSA, World Vision, Care, Save the Children, Africare, INGC	Care, World Vision, Africare, Plan, Commutech
Small scale traders: local buyers, itinerant and fixed establishment	-Make personal visits to rural areas, buy, assemble produce and bulk into truckloads, and arrange for transport to central markets	Local buyers, rural taders, urban wholesale market traders; traders from Rwanda and Burundi	Local dealers, rural taders, urban wholesale market traders	Local buyers, rural taders, urban wholesale market traders
Large scale traders, warehouse operators	-Employees or brokers go out to rural areas, set up buying points, buy directly from farmers, assemble, transport, store, clean, sort, grade, warehouse, fumigate and sell to packers, processors, manufacturers	NASFAM, Rab Processors, Farmers' World, AGORA, CP Feeds, Mulli Brothers, Export Trading, Transglobe, H.M.S. Foods and Grains, Senwes Grain Link, Agricultural Development and Marketing Corporation (ADMARC), Chinese companies	IKURU, DECA, Export Trading, Olam, Patel Trading, Gani Commercial, Chinese companies	Olam, Reapers, GMB, Staywell, Origen, MIC, Nettrade, Croplink, Intergrain, Surface Investment, National Foods, Olivine, Blue Ribbon, Agrifoods, Crest Breeders, Export Trade
Commodity exchange	-Coordinate and regulate producers, buyers, processors, importers and exporters in liberalized markets	Agricultural Commodity exchange (ACE), Grain Traders and Processors Association (GTPA)		former ZIMACE, AMA

Packers, processors	-Buy, pack, process, package and sell to wholesalers and retailers	Tambala, Rab Processors, NASFAM	Gani Commercial	National Foods, Profoods,Victoria, Olivine, Blue Ribbons, GMB, Mama Foods, Profoods, Cairns Foods, Nutresco, Lyons, Charhons, Pot-O-Gold, Savonuts, Galvins
Small and medium scale enterprises	-Buy, clean, store, process human food products (e.g. maize-soyabean blended flour, soya milk, peanut butter, packaged roasted nuts, peanut oil) using traditional technology and hand-powered machines. The problem is that soyabean has trypsin inhibitor that can be dangerous if not done well.	Blessings Hospital, St. Gabriel's Hospital, Likuni Hospital, NGO-supported farmers' groups; peanut butter and roasted nuts cottage industries	Peanut butter and roasted nuts cottage industries	Peanut butter and roasted nuts cottage industries
Oil crushers	-Buy grain, extract oil and sell cake and meal to stockfeed manufacturers	CP Feeds, Kukoma, Lever Borthers	Sanam Oil, Abilio Antunes	Agrifoods, Surface Investments, National Foods, United Refineries, Olivine, Banwax, Export Trading
Stockfeed manufacturers	-Mill livestock feeds, distribute and sell to farmers	CP Feeds, Alpha Milling, Charles Stewart-Lenzie Mills, Transglobe, Ndatani, Granite Feeds, Central Vet Feeds, Hua Feng, Greenland Feeds, Poultry Producers' Association of Malawi	Meadow Feeds, Higest, Novo Horizontes, Franco King, Abilio Antunes, CIM, Crane Feeds	Agrifoods, National Foods, Blue Ribbon, Windmill, KC Feeds, Irvines, Profeeds, Lunar Chickens, Lake Harvest, Ice Feed,
Human Food manufacturers	-Extrude grains into full fat meal for manufacture of human food e.g. soya soup, meat, chunks, mince, maize-soyabean blends. Sell mostly to NGOs for school and emergency feeding programs	Rab Processors, Export Trading Ceba Foods, Alpha Milling, Transglobe, Valid Nutirtion	Joint Aid Management (JAM)	National Foods, Blue Ribbon Foods, Cairns, Lyons, Willards, Mama, Capital Foods, Export Trading
Exporters/Importers	-Export to Zimbabwe, Mozambique, Tanzania, DRC, Burundi, Kenya, South Africa.	Farmers' World, Export Trading, AGORA, Mulli Brothers, Transglobe, Rab Processors, Tambala, H.M.S. Foods and	Export Trading, Olam, Gani Export, Patel Trading, IKURU	Olam, Export Trading, Olivine, National Foods

		Grains, CP Feeds, Chinese companies	(Fair Trade)	
Open air whole sale and retail markets, supermarkets, institutional buyers	-Terminal markets receive products for retail to urban households; supermarkets own brand products	Municipal markets, PTC, Chipiku, Makro, Shoprite, WFP P4P, hospitals, schools, prisons	Municipal markets, Shoprite, WFP P4P, hospitals, schools, prisons	Municipal markets, Bon Marche,OK, SPAR, TM, FAVCO, hospitals, schools, prisons

Varieties developed and released to farmers in Malawi include 20 common bean varieties, 3 cowpea varieties, 12 groundnut varieties and 20 soyabean varieties (Appendix VI). In Mozambique 20 common bean varieties, 16 cowpea varieties, 12 groundnut varieties and 13 soyabean varieties have been released (Appendix VI). In Mozambique, most of the released varieties were derived from selections and crosses with materials from CIAT, IITA and ICRISAT. This is because Mozambique has weaker national crop improvement programs. In Zimbabwe, 6 common bean varieties, 5 cowpea varieties, 18 groundnut varieties and 39 soyabean varieties have been released (Appendix VII).

9.5 Trade flows

Because of differences in demand and supply of common bean, cowpea, groundnut and soyabean among different markets in different countries resulting from differences in population, income growth and food preferences, production costs, technology and weather, there are cross border trade flows. However, most of the trade is informal, which makes it difficult to accurately record the flows.

Malawi exports cowpea to Zimbabwe, Botswana and South Africa, averaging 1,500 tons grain per annum in some years and as high as 10,000 tons per annum in other years. Also, Malawi formally exports common bean, soyabean and soyabean cake and meal to Zimbabwe, Mozambique, Zambia and South Africa. In addition, there are unrecorded informal cross-border exports of groundnut and soyabean from Malawi to Democratic Republic of Congo, Rwanda, Burundi, Kenya, and Tanzania. Additionally, there is an export demand to Zimbabwe, South Africa, and the United Kingdom amounting to 30,000 tons per year. Depending on annual production of marketable surpluses resulting from differences in rainfall and technology, seasonal price differences and opportunities for spatial arbitrage, these trade flows are reversed.

Cowpea is informally exported from Zimbabwe to Botswana and South Africa. These trade flows over long distance occur because traders use backhaul truck freight. Backhaul freight has lower rates than headhaul loads.

9.6 Opportunities, constraints and areas for prioritizing agricultural research-for-development interventions

In Mozambique common beans are commercially marketed through informal channels from the surplus-producing areas in Zambezia, Nampula and Angonia. Common bean sells very well in the major urban areas, including Maputo, Beira, Nampula and Chimoio, with urban and export demand (to South Africa and some canning beans to Portugal). There is intra-industry trade because common bean is also imported out of season from South Africa and Swaziland. With only a small demand, cowpea is both informally marketed to urban markets and formally exported to India, Indonesia, Philippines, Malaysia and some other African countries, including Angola and Sudan. The export for the latter two countries largely consists of WFP purchases for feeding programs. Demands for groundnut are larger, both urban and export. Because there are unfulfilled orders, exports could still grow up to 25,000 tons. The domestic poultry feed and the edible vegetable oil manufacturing industries have the highest demand for soyabean. Currently the poultry industry is annually demanding 20,000 tons and the edible vegetable oil manufacturing industry around 30,000 tons. A corn soyabean blend-manufacturing factory in Beira annually utilizes 500 tons depending on tenders. These industries have sufficient annual capacity to absorb the country's annual total production of soyabeans in the coming 10 years.

In Malawi common bean is informally marketed to urban markets, mostly through institutional buyers such as schools, hospitals, prisons, police, army barracks, and colleges. Although export markets in South Africa and Zimbabwe demand around 30,000 tons per year, these are very particular on quality and require specific varieties. Because smallholders usually grow varieties in mixtures and do not use grades and standards during purchasing from farmers they do not meet these requirements. Consequently, Malawi exports about 1,500 tons of mixed beans per year. Cowpea is mostly consumed by rural households and there is little urban demand. However, there is a varying export demand from Zimbabwe, Botswana and South Africa plus small demand to Asia, where cowpea is processed as Mung dhal. There is much domestic urban demand for groundnuts for raw nuts, grounded powder added to vegetables, roasted nuts and, peanut butter products. There are

unrecorded informal cross-border exports to Rwanda, Burundi, Kenya, and Tanzania and export demand from Zimbabwe, South Africa, and United Kingdom. However, formal exports average between 2,000 and 3,000 tons per year, much lower than demands. This is because there is inadequate production and the logistics to export take too long, thereby resulting in high aflatoxin levels. Poultry and fish feed manufactures as well as edible vegetable oil and human food manufacturing firms create a total domestic demand for soyabean of 55,000 tons per year. In addition, there is formal export demand to Zimbabwe, Zambia, and South Africa and informal cross-border exports to Mozambique, Rwanda, Burundi, DRC, and Tanzania. Aggregate demand far exceeds aggregate supply.

In Zimbabwe for common bean the urban domestic market is the largest one. Most of the demand comes from institutional buyers: boarding schools, teachers' colleges, nursing colleges, hospitals, prisons, army barracks, police and NGOs for feeding programs. In addition, there is a small urban demand for canned beans. Because demand exceeds production, the excess demand is met through imports from Malawi, Zambia, South Africa and China. Currently domestically sourced common beans are unable to compete with imported beans from China. Chinese beans service as high as 10,000 tons per year. For cowpea the formal domestic markets are not developed and there is little local urban demand. The small demand is met through open-air urban wholesale and retail markets. Informal cross border exports exist to Botswana and South Africa. There is an untapped export market demand to Asia of 40,000 to 50,000 tons per year. For groundnut, peanut butter has been a major turning point. Before the economic decline, formal peanut butter manufacturing firms demanded 20,000 tons of kernels per year. Since 2006, the market has been extremely subdued. Currently, formal peanut butter processors are demanding around 5,000 tons of shelled nuts per year. However, there has been a sharp increase in informal farm and off-farm based peanut butter processing enterprises. Because of a shortage of groundnuts, the urban demand for peanut butter is met through imports from Malawi and paste from South Africa. The export market demand for groundnuts to South Africa and the United Kingdom is around 35,000 tons of shelled nuts per year in unfulfilled export orders. The demand for soyabeans is derived from the stock feeds, fish farming, edible vegetable oil and human food manufacturing firms. Because the edible vegetable oil industry is uncompetitive against imports, the bulk of the oil production is for the cake for the feed industry. The aggregate annual demand for the feed industry is 150,000 tons. Capacity utilization is low because the installed annual capacity is 450,000 tons. Domestic soyabean production is estimated by the industry to be around 40,000 tons this year. Fish farming firms are demanding 2,000 tons per annum for manufacture of feed. The excess demand was met through imports from Malawi and Zambia last year. Because of production shortfalls in Malawi and Zambia this year and restrictions on imports, the excess demand is being met through imports of soy cake from India. This is because the Ministry of Agriculture is requiring that imports be GMO-free. Therefore companies have to import GMO-free soyabean cake from countries such as India. Because GMO-free soyabeans are more expensive than GMO products, this has increased raw materials costs and induced companies to invest in expansion of domestic soyabean production in order to substitute for imports.

Value chain participants reported that opportunities with significant potential to expand grain legume-led growth for common beans, cowpeas and groundnuts lie in sale of dried grains to domestic urban and export markets. For soyabeans, opportunities lie in grain sold to domestic poultry feed millers for import substitution. Aggregate market demand far exceeds current supply for the four legumes in the three countries.

Table 9.3: Production, exports and demand for the common grain legumes in Mozambique, Malawi and Zimbabwe.

	Mozambique	Malawi	Zimbabwe
Common beans – urban domestic demand	10,000	15,000	20,000 – 30,000
Common bean – export demand	1,000 – 2,000	30,000[1]	
Cowpea - domestic demand	5,000 – 10,000	Mostly consumed by rural households, no urban demand	No developed market
Cowpea – export	5,000 to Asia 240 to other African countries	1,500 – 10,000 to Zimbabwe, Botswana and South Africa 300 to Asia	untapped export market demand to Asia of 40,000 to 50,000
Groundnut – domestic urban demand	10,000 – 12,000		
Groundnut – domestic processors		15,000 – 20,000	
Groundnut – annual export	8,000 – 9,000 to Asia (could exceed 25,000 due to unfulfilled orders.)	2,000 – 3,000[2]	
Soyabean – domestic production			40,000
Soyabean – domestic demand	20,000 poultry 30,000 edible oil industry	35,000 – 40,000 poultry 4,000 – 5,000 fish farming 10,000 -15,000 edible oil and food	150,000 feed industry[4] 2,000 fish farming
Soyabean - export		30,000 to Zimbabwe, Zambia, and South Africa[3]	

[1] Export markets in South Africa and Zimbabwe demand around 30,000 tons per year. However, these are very particular on quality and require specific varieties such as brown speckled sugar beans. The requirements are difficult for smallholders to meet because varieties are grown in mixtures and grades and standards are not used during purchasing from farmers. Consequently Malawi exports mixed beans of about 1,500 tons per year.

[2] There is export demand to Zimbabwe, South Africa, and United Kingdom amounting to 30,000 tons per year. But actual formal exports average between 2,000 and 3,000 tons per year. This is because there is inadequate production and the logistics to export take too long, thereby resulting in high aflatoxin levels.

[3] There are informal cross-border exports to Mozambique, Rwanda, Burundi, DRC, and Tanzania. Aggregate demand far exceeds aggregate supply.

[4] Capacity utilization is low because the installed annual capacity is 450,000 tons

9.7 How smallholders can be better linked to market opportunities?

Respondents reported several mechanisms for better linking smallholder farmers to the domestic, regional and market opportunities. These include mobilizing and organizing farmers into community level producer and marketing groups and commodity associations; organizing commodity associations into federated district and national associations; leveraging agro-dealer networks; providing market information and intelligence and training in farm budgeting so that farmers become knowledgeable of the costs of production of different commodities in order to optimize returns to their investments and bargain with buyers; and adding value to products through storage sorting and grading and agro-processing; and facilitating large scale commercial farming firms to create gravity to complement NGOs bringing in technology.

In Mozambique the most commonly reported practical and cost-effective mechanism was establishing and maintaining farmers' associations and cooperatives in order to reduce high transaction costs and achieve economies of scale and efficiencies in testing and delivering technology, certified seed of improved varieties, fertilizers and inoculants, agrochemicals, farm equipment and machinery hire services, irrigation, microfinance, and extension and training services; strengthening the bargaining power of farmers when negotiating prices and terms of contract with input sellers and commodity traders; and local assembly, grading and sorting, certification, bulking, storage, transportation and agro-processing of the products. Farmers get organized as members of associations. In turn, associations are organized as members of cooperative such as IKURU for cleaning, sizing, grading and classification of commodities. Farmers need to be linked to services that carry out classification in order to resolve the problem in Mozambique that commodities are not classified. Cooperatives and associations permit on-farm technology testing and dissemination and more efficient supply of pure seed of new varieties for common bean, cowpea, groundnut and soyabean that have the traits for which buyers are willing to pay premium prices; and assembly, bulking, transportation, storage and value addition of farm products. Some respondents expressed their belief that supply can be expanded through large scale commercial farming firms such as ReidoAgro that operate farm sizes of 3,000 to 5,000 hectares of soyabeans. These farming firms act as centers of gravity for delivering quality seed of improved varieties, machinery services, and technology and local assembly and marketing of products to satellite smallholder farmers with experience, thereby permitting them to expand from 1 to 2 hectares to 20 to 30 hectares and improve yields and income growth. Leveraging the network of agro-dealers established through CNFA and seed companies can expand technology testing and dissemination and building up of demand for inputs by farmers and marketing channels to respond to the increasing demand.

Similarly, in Malawi respondents consistently reported farmers' clubs and organizations and associations such as the Grain Legumes Association (GALA) as the most practical and cost-effective way of linking smallholders to markets. Because of small landholdings and volumes of production that are dispersed over a wide geographical area, farmers' clubs, associations, and cooperatives are strategic for achieving efficiencies in input distribution, micro-credit, on-farm technology testing and dissemination, assembly, bulking, sorting and grading, transportation, storage and agro-processing of products. For example, the National Farmers' Association of Malawi has community-level clubs that group farmers for technology delivery, testing and dissemination; provision of market information and intelligence and farm inputs; bulking and contracting; and product assembly, storage, transportation, agro-processing and distribution to markets. Similarly, the Famers Union of Malawi has affiliate associations for the various crops. Some multinational commodity trading firms are investing in reduction of transaction costs and marketing efficiencies through contracting and bulking products through the associations in order to shorten the long marketing chains, bring smallholders closer to end-markets and permit them to increase their share of value added, thereby improving profitability and expanding investments in crop production. Leveraging agro-dealer networks expands access to trade credit through guarantee schemes and credible reputation capital, creates demand through on-farm demonstrations and enables assembly, bulking, storage, transportation and selling of farm products to processing and exporting firms. Government extension services are constrained by inadequate operational funds, low extension worker to farmer ratio, poor incentives and morale, lack of accountability to farmers and inadequate supervision. Seed companies are currently marketing as high as 80% of their sales through agro-dealers. This is partly due to the empowerment of agro-dealers to sell seed through investments by CNFA, IFDC and AISAM in training in business management and technical product knowledge and linking trained agro-dealers to input supply firms and credit institutions. It is also partly due to the government input subsidy through which seed companies are only selling certified seed of improved varieties of grain legumes. Because of economies of scope of bundling inoculants with seed, inoculants will likely be commercially distributed through agrodelears. The Seed Trade Association of Malawi (STAM) has put in place an effective system for reducing poor quality and adulterated seed. The Malawi Agricultural Commodity Exchange (MACE) and the Agricultural Commodity Exchange (ACE) provides market intelligence and market information to farmers organized into commodity associations at the community level to help with their decision making when selling their products.

In Zimbabwe, following the liberalization of agricultural markets with the introduction of the United States dollar currency in 2008, end-use markets have become competitive. Organizing farmers into

producer and marketing groups was identified as the most practical and cost-effective way of linking smallholders who are producing in small quantities in dispersed locations to markets. Producer groups form marketing groups in order to reduce transaction costs of farmers each marketing a small volume; generate and achieve economies of scale; increase efficiency of input distribution, assembly, bulking, transportation and storage of products; strengthen bargaining power of farmers vis-à-vis middlemen; and bring farmers closer to consumers.

Over the past decade, Zimbabwe lost structured agricultural support services. However, this collapse has created an exciting interest for investors to get involved. Because the country did not lose infrastructure and expertise and there is a high cash liquidity constraint, there is interest in contract farming to provide farmers with support to finance, technology, seed, fertilizer, agrochemicals, technical advice and market information. This explains why some multinational commodity trading and agricultural processing firms are investing in developing production and marketing contracts with both commercial and smallholder farmers to ensure that they procure sufficient quantities of quality products from domestic sources. Companies contracting smallholder farmers are experimenting with alternative contractual arrangements. One arrangement provides inputs through contracts with farmers' groups and associations and the group, in turn, contracts with individual members. The other arrangement provides inputs on contract with an individual agro-dealer who, in turn, subcontracts to smallholders. Farmers deliver products to the agro-dealer and the dealer delivers to the company. Much of the interest is in soyabeans because there is a large shortage in the country. The Zimbabwe National Soya Association was organized in May 2011 by seed, fertilizers, brokers, crushers, processors and stock feed manufacturing firms to coordinate investments and development interventions in soyabean production and marketing targeting a planted area of 62,500 hectares and production of 100,000 tons during the 2011/2012. Because most smallholders are located in low rainfall areas and have sandy soils that are marginal for soyabean production and lack of technical knowledge about how to grow soyabean, the association is placing emphasis on production by resettled farmers.

Some respondents explained their belief that although most smallholders are currently not growing soyabean, the crop will likely become a major smallholder crop in the future in much the same way that cotton started as a large scale commercial farmer crop but it is now a smallholder crop. This explains why Progene Seeds-Sustainable Agricultural Trust (SAT) is investing in more efficient production and supply by smallholders of sugar bean, soyabean, cowpea and groundnut. SAT is working with broking firms on soyabean and implementing extension and training to support production for sale to processors as part of the Zimbabwe National Soya Association's target.

9.8 Constraints on grain legume-led growth

The major constraints on expanding grain legume-led growth include low yields and poor access to inputs, extension services and markets. The key constraints include poor access to markets and low bargaining power of farmers; lack of market coordination; lack of micro finance and credit; low yields and quality of products; poor access to inputs including quality seed of improved varieties; poor access to extension services; lack of improved post-harvest management and storage technologies; poor government market regulations; and high transaction costs. The incidence and severity of constraints and priority research interventions to resolve the constraints vary with the stage of development of the value chains of grain legumes in the country.

9.9 Conclusion and implications for the N2Africa project in Zimbabwe, Malawi and Mozambique

The survey reveals that the four target grain legumes have important and very important roles in smallholder farmers' strategies for incomes, food security, nutrition, NRM and gender equity in Mozambique, Malawi, and Zimbabwe. Significant domestic, urban, regional and international market opportunities exist for generating farm level growth incomes, thereby improving food security, nutrition, sustainable management of natural resources and gender equity. Aggregate market demand far exceeds current supply for the four legumes in the three countries.

Smallholder farmers can be linked to these market opportunities by strengthening farmers' groups and commodity into farmers associations federated into national farmers' unions. However, there are several constraints on exploiting the opportunities for legume-led growth. The N2Africa project can help overcome some of these constraints by focusing on increasing area and yields. Besides, overcoming the constraints also needs:

- Developing the supply systems of certified seed of improved varieties for cowpea, beans, groundnuts and soyabeans to ensure that seed is made available in large enough quantities and that it is has good quality. The supply of soyabean seed needs to focus on rust resistant varieties.
- Evaluating whether or not inoculants offer real benefits to farmers under different farmers' circumstances, whether or not inoculants are complements or substitutes with inorganic fertilizers; the risk-return tradeoffs among different crops (soyabeans, beans, cowpeas, groundnuts) and crop varieties (for example soyabean rust resistant varieties, market popular bean, cowpea and groundnut varieties); and tradeoffs among inoculants and different fertilizers (N-P-K compounds, straight phosphate, potassium, Nitrogen). There is a need to match the strains of inoculants to specific varieties for different crops in specific contexts.
- Evaluating alternative institutional arrangements for demonstrating benefits at a large scale of inoculants to farmers by enabling them to observe the difference between inoculated and un-inoculated crops given that public extension services are severely constrained. For example using commercial mechanisms such as seed companies and agro-dealers networks or institutional mechanisms such as NGO and farmer groups' networks.
- Developing, testing and promoting practical feasible and cost effective ways of getting inoculants to farmers, including how inoculants are produced, the media used to fit farmers' conditions and the survival of bacteria from factory to farms, the quality of inoculants, and the efficiency of inoculation. For example using high technology sophisticated inoculants producing laboratories and refrigerators and cooler boxes (and distilled water and sugar) or low technology simple methods such as delivering inoculants to selected farmers or agro-dealers in the villages and then subsequently to other farmers using the soil from the plots or pots previously grown with inoculated crops.
- Developing, evaluating and promoting more commercial systems for production and distribution of certified seed coupled to the delivery of inoculants (such as soils). For example, using government agricultural input subsidies to stimulate commercial seed production by seed companies and sale through agro-dealers (as in Mozambique supported by CNFA and Pannar and Semoc) and in Malawi supported by RUMARK and AISAM) or NGO input distribution using vouchers redeemable through agro-dealers (as in Zimbabwe supported by Care, CNFA and ACFD). Agro-dealers need training and capacity building in inoculants technology and product handling and to become engaged in the testing and demonstration of inoculants for demand creation and aggregation of orders for forwarding to inoculants producing laboratories and distribution of inoculants to farmers.
- Develop, field test and promote delivery of inoculants to farmers as a seed treatment by seed companies through joint research with companies in Mozambique (SEMOC, Pannar, J.N.B. Investments), Malawi (Seed Co, Demeter, Pannar, Peacock, Funwe, Seed Tech) and Zimbabwe (Seed Co, Pannar, AgriSeeds, Sandbrite, Progene, and Pannar).
- Developing, testing, evaluating and promoting institutional arrangements for better integrating N2Africa interventions with on-going development investments to link farmers to markets through farmers' association in Mozambique (CLUSA and IKURU), in Malawi (GALA, NASFAM, FUM), in Zimbabwe (ZFU-Union Project, the Zimbabwe National Soya Association and SAT in Zimbabwe).

Appendix I - Common bean, cowpea, groundnut and soyabean varieties officially released in Kenya

SOURCE: Kenya Plant Health Inspectorate Services

Crop	Name of Variety	Origin/ Source	Optimal production altitude range (meters above sea level)	Grain yield (t ha-1)	Special attributes
Common bean	Mwitemania (GLP 92)	KARI/KSC	900-1600	1.2-1.5	Drought tolerant
	Rosecoco (GLP 2)	KARI/KSC	1500-2000	1.8-2	High yield; Wide adaptation; Attractive seed colour; Good taste
	Mwezi Moja (GLP1004)	KARI/KSC	1200-1600	1.2-1.5	Good performance in dry areas; Early maturity; Tolerant to drought and bean fly
	Canadian Wonder (GLP 24)	KARI/KSC	1200-1800	1.3-1.8	Moderate resistance to angular leaf spot
	GLP-92 Pinto bean	KARI/KSC	100-1500	1.2-1.7	Wide adaptation; Resistant to halo blight
	GLP-585 Red haricot	KARI	1500-2000	1-1.5	Suitable for high rainfall areas; Resistant to bean common mosaic virus
	GLP-X 1127 New Mwezi Moja	KARI/KSC	1000-1500	1-1.5	Wide adaptation; Resistant to bean common mosaic virus; Tolerant to rust
	Kat/Bean 2	KARI	1200-1800	1-1.2	Tolerant to shading
	Kat X 16	KARI	900-1600	1.5-1.8	High yielding
	Kat X 56	KARI	900-1800	1.5-1.8	High yielding
	Kat X 69	KARI	1200-1800	1.5-1.8	High yielding
	KK 22 (RWR 719)	KARI	1500-1800	1.8-2	Tolerant to root rot
	Kat/Bean 1 (Katheka)	KARI	1000-1800	1.2-1.5	Early maturity
	KK 8 (SCAM-80/15)	KARI	1500-1800	1.8-2	Tolerant to root rot
	KK 15 (MLB 49/879)	KARI	1500-1800	1.8-2	Tolerant to root rot
	Kat-Bean 9	KARI	900-1600	1-1.8	Tolerant to heat
	Wairimu Dwarf	Kenya Seed Co	500-1700	1.5-1.75	Early, Heat tolerant; Good for maize intercropping; Excellent cooking qualities
	New Rose coco	University of Nairobi	1100-2000	1.3-2.3	Upright growth habit; Early; Moderate resistance to rust; Common bacteria blight; Angular leaf spot; Anthracnose; Bean common mosaic virus and necrotic virus; Large grains
	Miezi Mbili	University of Nairobi	1000-2000	1.2-2.26	Large grain; Early; Resistant to floury leaf spot; Halo blight;

					Angular leaf spot; Anthracnose; Bean common mosaic virus and common bacterial blight
	Kenya early	University of Nairobi	1100-1900	1.07-2.15	Large grain; Early; Moderate resistant to halo blight; Angular leaf spot; Anthracnose,; Bean common mosaic virus and common bacterial blight
	Kenya Red Kidney	University of Nairobi	1000-2100	1.09-2.8	Large grain; Moderate resistant to halo blight; Angular leaf spot; Anthracnose; Bean common mosaic virus and common bacterial blight
	Super Rose Coco	University of Nairobi	1000-2100	1.14-2.8	Medium maturity, Moderate resistant to halo blight, Angular leaf spot, Anthracnose, Bean common mosaic virus & common bacterial blight
	Kenya Wonder	University of Nairobi	1030-2000	1.13-2.09	Large grains; Moderate resistant to halo blight; Angular leaf spot; Anthracnose; Bean common mosaic virus and common bacterial blight
	Kenya Sugar Bean	University of Nairobi	1000-1900	1.08-1.81	Early; Large grains; Moderate resistant to halo blight; Bean common mosaic virus and common bacterial blight
	Kabete Super	University of Nairobi	1300-2000	1.05-2.47	Large grain; Resistant to floury leaf spot; Halo blight; Angular leaf spot; Anthracnose; Bean common mosaic virus and common bacterial blight
	Chelalang	Egerton University	1800-2200	1.2-2.2	
	Tasha	Egerton University	1500-2000	1.1-2.1	
	Cianku	Egerton University	1500-2150	1-1.9	
Cowpea	HB 48/10E	KARI	0-1200	1.2-1.4	Tolerant to viral disease
	27-1	KARI	600-1200	1.5-1.8	Dual purpose
	ICV 11	ICIPE	1-1500	2.2	Pest tolerant
	MTW 63	IITA	1-1000	2.5	Pest tolerant
	MTW 610	IITA	1-1000	2.5	Large seeds
	Machakos 66 (M66)	KARI	1200-1500	1.5-1.8	Dual purpose; Deep green min ribs
	K 80	KARI	1200-1800	1.8-2	Dual purpose; Tolerant to thrips; Silvery mind ribs
	KVU-419 (Kunde 419)	KARI	0-1200	1.2-1.5	Drought tolerant; Extra early
	KCP 022	KARI	0-1200	1.2-1.5	Super early
	Kunde 1	Western Seed Co	Below 2000	1.2-2.5	Dual purpose
Groundnut	LTD12991	LELDET	1000-1600	2.5	Tolerant to rosette and leaf spot; Small tan seed; Spanish variety
	LTD90704	LELDET	1000-1600	2.8-3	Tolerant to rosette and drought; Large tan seed with average 42%

					oil content; Virginia variety
	LTD93437	LELDET	1000-1600	2.5	Tolerant to rosette, Suitable for confectionery
	LTD99568	LELDET	1000-1600	2.5-3	Tolerant to rosette; Medium size suitable for confectionery
Soyabean	Black Hawk	KARI	800-1700	1.8	18% oil content
	EAI 3600	KARI	800-1700	0.5-2.5	17.8% oil content
	Gazelle	KARI	1200-2400	0.8-2.1	22% oil content
	Hill	KARI	1200-2000	1.8	20.7% oil content
	Nyala	KARI	1200-2400	0.7-2.5	17% oil content
	DPSB 19	KARI/IITA	900-2400	0.6-1.7	Dual purpose (high biomass, high yield and free nodulating); High yield, 6.53% over the mean of checks; High biomass (1.5-3.0t/ha); Rust resistant; Nodulates with indigenous population of rhizobia in Kenya soils to fix atmospheric nitrogen; Good for making soyabean milk; High pod clearance (13.2 cm), hence easy to harvest using combine harvester if necessary; High pod load (28 pods per plant); Attractive creamy seed coat Good for intercropping; Medium seed size
	DPSB 8	KARI/IITA	900-2400	0.5-2.6	Dual purpose (high biomass, high yield and free nodulating); High yield, 6.53% over high yield, 7.71 % over the mean of checks; High biomass (2.5-3.0 t/ha); Nodulates with indigenous population of rhizobia in Kenya soils to fix atmospheric nitrogen; Good for making soyabean milk; High pod clearance (9.1 cm) hence easy to harvest using combine harvester if necessary; High pod load 33 pods per plant ;Attractive creamy seed coat; Good for monocropping; Large seed size

Appendix II – Common bean and soyabean varieties released in Rwanda.

Source: Rwanda Institute of Agricultural Research (ISAR)

Crop	Variety code	Variety name	Year released	Origin
Common bean: Bush varieties	1378/4	Urugezi 1	Before 1990	ISRA
	1378/4	Urugezi 2	Before 1990	ISAR
	RWR 221	Rwandarugari	Before 1990	ISAR
	RWR 221	Kilyumukwe	Before 1990	ISAR
	PVA 1438	Peveya 8	Before 1990	CIAT
	PVA 1438	Mutiki 2	Before 1990	ISAR
	PVA 1438	Bataf	Before 1990	Holland
	PVA 1438	Saxa	Before 1990	Holland
	RAB 487	Kimaranzara	Between 1990 and 2000	CIAT
	SCAM 80	Ingobokarugo	Between 1990 and 2000	CIAT
	CM/15			
	RWK 10	Rwaka	Between 1990 and 2000	ISAR
	RWR 1668	Sine	Between 1990 and 2000	SAR
	RWR 1312 I	Kilyugaramye	Between 1990 and 2000	SAR
	RWR 1802	Ndamirabana	Between 1990 and 2000	SAR
	RWR 1783		Between 1990 and 2000	SAR
	RWR 719		Between 1990 and 2000	SAR
Common bean: Climbing bean	G2333	Umubano	Before 1990	CIAT
	G685	Vununkingi	Before 1990	CIAT
	Flora de Mayo	Flora	Before 1990	CIAT
	Puebla 444	Puebla	Before 1990	CIAT
	Criolla			
	59/1-2	Ngwinurare	Before 1990	ISAR
	G859	Muhondo 6	Before 1990	CIAT
	G859	Gisenyi 2 - bis	Before 1990	ISAR
	G859	Urunyumba 3	Before 1990	ISAR
	G2331	Mamesa	Between 1995 and 2001	CIAT
	NG224-4	Ikinyamanza	Between 1995 and 2001	CIAT
	CAB 19	Akezakarigura	Between 1995 and 2001	CIAT
	CAB 2	Nyiramata	Between 1995 and 2001	CIAT
	CAB 28	Karera	Between 1995 and 2001	ISAR
	RWV 524	Masoyinyana	Between 1995 and 2001	CIAT
	RWV 259	Amakwamire	Between 1995 and 2001	ISAR
	Melage	Bubeluka	Between 1995 and 2001	ISAR
	Bubeluka			
	Melage	Decelaya	Between 1995 and 2001	CIAT
	Bubeluka			
	RWV 167	Ndamirabashonji	Between 1995 and 2001	ISAR
	RWV 377	Munezero	Between 1995 and 2001	ISAR
	LAS 405	Binezeza	Between 1995 and 2001	ISAR
	LAS 405	Cajamarica	Between 1995 and 2001	ISAR
Common bean: Bush beans	RWR 1180		2010	ISAR
	RWR 2245		2010	ISAR
	RWR 2076		2010	ISAR
	RWR2154		2010	ISAR
	R617-17A		2010	ISAR
Common bean: Climbers for high and mid-altitude	RWV 2070		2010	ISAR
	GASILIDA		2010	ISAR
	RWV 1129		2010	ISAR

	RWV 1892		2010	ISAR
	MAC 28		2010	CIAT
Common bean: Climbers for low altitude	MAC 9		2010	CIAT
	MAC 49		2010	CIAT
	MAC 44		2010	CIAT
Soyabean		Peka6	1986	India
		449/6/16	1986	Zimbabwe
		Bossier	1986	United States
		Duiker	1986	Zimbabwe
		Ogden	1987/88	United States
		TGM1781	1987/88	IITA
		Soprosoy	2000	
Soyabean (not officially released)		Marksoy	2008/09	Uganda
		Namsoy	2008/09	Uganda
		Yezutima	2005	Burundi

Appendix III – Cowpea, groundnut and soyabean varieties officially released in Ghana.

Source: Authors' surveys

Crop	Variety	Year released	Institution that released variety	Scientists who developed	Source of germplasm
Cowpea	Amantin	1983			
	Soronko	1983			
	Vallenga	1986		I.D.K. Atokple	IITA
	Asontem	1987			
	Bengpla	1992		I.D.K. Atokple	IITA
	Ayiyi Asetenapa	1992			
	Bengpla	1992		I.D.K. Atokple	IITA
	Boafo				
	Adom	Early 1990s	CRI	Hans Dapaah	IITA
	Asetenapa	Early 1990s	CRI	Hans Dapaah	IITA
	Apaagbala	2003	SARI	I.D.K. Atokple	Ghana/IITA
	Marfo-Tuya	2003	IITA	I.D.K. Atokple	Ghana/IITA
	Nhyrira	2006	CRI	Hans Dapaah	IITA
	Tona	2006	CRI	Hans Dapaah	IITA
	Padi Tua	2008	SARI	I.D.K. Atokple	Ghana/IITA
	Songotra	2008	IITA	I.D.K. Atokple	Ghana/IITA
	Bawutawuta	2008	IITA	I.D.K. Atokple	Ghana/IITA
	Zaayura	2008	SARI	I.D.K. Atokple	Ghana/IITA
Groundnut	Chinese	1930s			China
	Manipinta	1930s			
	Sinkazie	1970	CRI		ICRISAT
	F-mix	1986	SARI		ICRISAT
	Adepa	2005	CRI		ICRISAT
	Nkosour	2005	CRI		ICRISAT
	Jenkaah	2005	CRI		ICRISAT
	Asivivi	2005	CRI		ICRISAT
	Nkariesani	2006	SARI		ICRISAT
	Kpaniete	2006	SARI		ICRISAT
Soyabean	Salintuya I	1985	SARI		IITA
	Salintuya II	1985	SARI		IITA
	Anidaso	1992	CRI		IITA
	Bengbie	1992	CRI		IITA
	Nangbnar	2005	CRI		IITA
	Ahoto	2005	CRI		IITA
	Jenguma	2003	SARI		IITA
	Quashie	2003	SARI		IITA

Appendix IV – Common bean, cowpea, groundnut and soyabean varieties officially released in Eastern DRC.

Source: INERA Programme National Légumineuses (PNL/INERA- Mulungu), South Kivu, DRC

Crop	Variety name	Year released	Germplasm source
	Nakaja	Before 1985	INERA
Common bean: Bush	Nain de Kyondo	Before 1985	ECABREN
	Kirundo	1986-1990	Burundi
	Ri-matata	1985	INERA
	Maharagi-soja	1986-1990	CIAT
	Rubona5	1986-1990	CIAT
	Mwamafutala	1991-1995	Rwanda (RWR362)
	Simama	1986-1990	CIAT
	Ndombolo	1991-1995	CIAT
	Muduku (AND620)	1995-2000	CIAT
	CodMLB001	2010	INERA
	Hm21-7	2010	CIAT
Common bean: Climbing	Ituri-matata Aliya	1986-1990	ECABREN
	Kihembe	1986-1990	CIAT
	VCB81012	1991-1995	CIAT
	VNB81010	1991-1995	CIAT
	M'sole	1991-1995	CIAT
	LIB1	1991-1995	CIAT
	M211	1991-1995	INERA
	G59/1-2	1996-2000	CIAT
	N'ntangazo	1991-1995	CIAT
	Vuninkingi	1996-2000	CIAT
	PVA1438	1991-1995	CIAT
	Kiangara	1996-2000	CIAT
	VCB81013	1991-1995	CIAT
	MLV6-06-90B	1996-2000	INERA
	Namulenga	2012	INERA
	CodMLV059	2012	INERA
	MNC 154	2013	CIAT
	SMC 21	2013	CIAT
Cowpea	VITA007	2005	IITA
Groundnut	JL24	2003	
	Red Beauty	2003	
	G17	2005	
	A65	2005	
	TATU1	2005	
Soyabean	Sable	1985	
	Imperial	Before 1988	IITA

	Oribi	Before 1988	
	Davis	Before 1988	
	Peka06	2004/05	CILCA
	SB24	2004/05	CILCA
	SB19	2004/05	CIALCA

Appendix V – Cowpea, groundnut and soyabean varieties officially released varieties in Nigeria

Source: National Centre for Genetic Resources and Biotechnology Moor Plantation, Ibadan, Nigeria

Crop	Name of Variety	Origin/ Source	Developing Institution	Year of Release	Year of Registration
Cowpeas	West Bred	Florida U.S.A	IAR&T, Ibadan	1986	1991
	Ife Brown (Irawo)	O.A.U. Ife	IAR&T and faculty of Agriculture OAU Ife	1970	1991
	Dinner	Nigeria (Local selection)	F.D.A.R., Moor Plantation Ibadan	1971	1991
	Nigerian Brown 7 (NB7)	Nigeria (Local selection)	F.D.A.R., Moor Plantation Ibadan	1987	1991
	Kudi	Nigeria (Local selection)	NCRI, Badeggi	1984	1991
	K-28	Nigeria (Local selection)	NCRI, Badeggi	1985	1991
	L25	Nigeria (Local selection)	NCRI, Badeggi	1985	1991
	Ife Bimpe	Nigeria (Mutant of Ife Brown)	I.A.R. & T. Ibadan	1985	1991
	SAMPEA-1	Nigeria	I.A.R. Samaru Zaria	1978/79	1996
	SAMPEA-2	Nigeria	I.A.R. Samaru Zaria	1978/79	1996
	SAMPEA-3	Nigeria	I.A.R. Samaru Zaria	1978/79	1996
	SAMPEA-4	Nigeria	I.A.R. Samaru Zaria	1978/79	1996
	SAMPEA-5	Nigeria	I.A.R. Samaru Zaria	1978/79	1996
	SAMPEA-6	Nigeria	I.A.R. Samaru Zaria	1978/79	1996
	TVX-3236	IITA Ibadan	IITA Ibadan	1982	1996
	IT81D-994	IITA Ibadan	IITA Ibadan	1985	1996
	SAMPEA-7	Nigeria	I.A.R., Samaru Zaria	1986	1996
	IT84S-2246-4	IITA Ibadan	IITA Ibadan	1991	1996
	IT89KD-374	I.A.R., Samaru Zaria	IITA Ibadan	1991	1996
	IT90K-76	I.A.R., Samaru Zaria	IITA Ibadan	1991	1996
	IFH-101	I.A.R & T Moor Plantation Ibadan	I.A.R & T Moor Plantation Ibadan	1985	1996
	Popse-1	I.A.R & T Moor Plantation Ibadan	I.A.R & T Moor Plantation Ibadan	1985	1996
	SAMPEA-8	IITA Kano Station	IITA Ibadan & IAR Zaria	2005	2005
	SAMPEA-9	IITA Kano Station	IITA Ibadan & IAR Zaria	2005	2005
	SAMPEA-10	IITA Kano Station	IITA Kano/ IAR Zaria	2008	2008
Groundnut	SAMNUT-1	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1960	1991
	SAMNUT-2	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1960	1991
	SAMNUT-3	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1970	1991
	SAMNUT-4	Bombey Senegal	I.A.R. Samaru Zaria	1970	1991
	SAMNUT-5	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1970	1991
	SAMNUT-6	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1970	1991
	SAMNUT-15	Florida U.S.A	I.A.R. Samaru Zaria	1970	1991
	SAMNUT-7	I.A.R. Samaru Zaria	I.A.R. Samaru	1980	1991
	SAMNUT-8	I.A.R. Samaru Zaria	I.A.R. Samaru	1980	1991
	SAMNUT-9	Introduction	I.A.R. Samaru	1980	1991
	SAMNUT-10	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1980	1991
	SAMNUT-11	Introduction	I.A.R. Samaru Zaria	1980	1991
	SAMNUT-12	Introduction	I.A.R. Samaru Zaria	1988	1991
	SAMNUT-13	Introduction	I.A.R. Samaru Zaria	1988	1991
	SAMNUT-14	Introduction from Senegal wile original material came from Argentina via Hungary	I.A.R. Samaru Zaria	1988	1991
	SAMNUT-16	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1988	1991
	SAMNUT-17	Introduction	I.A.R. Samaru Zaria	1988	1991
	SAMNUT-18	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1988	1991
	SAMNUT-19	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1992	2001
	SAMNUT-20	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria	1992	2001

	SAMNUT-21	I.A.R. Samaru Zaria	I.A.R. Samaru and ILRI-ICRISAT	2000	2001
	SAMNUT-22	I.A.R. Samaru Zaria	I.A.R. Samaru Zaria and ILRI-ICRISAT	2000	2001
	SAMNUT-23	ICRISAT Kano	ICRISAT Kano & I.A.R. Samaru Zaria	2000	2001
Soyabean	Malayan	Nigeria	Northern Region Ministry of Agric & Natural Resources	1937	1991
	M-351	Nigeria	I.A.R Samaru Zaria	1983	1991
	SAMSOY-1	Nigeria	I.A.R Samaru Zaria	1983	1991
	SAMSOY-2	Nigeria	I.A.R Samaru Zaria	1983	1991
	TMG-344 Hemon	Uganda	IITA & I.A.R. & T Ibadan	1984	1996
	TGx-306-036C	Nigeria	IITA & I.A.R. & T Ibadan	1984	1996
	TGx-536-02D	Nigeria	IITA & I.A.R. & T Ibadan	1985	1996
	TGx-713-09D	Nigeria	IITA & I.A.R. & T Ibadan	1985	1996
	TGx-849-313D	Nigeria	IITA & I.A.R. & T Ibadan	1989	1996
	TGx-1019-2EB	Nigeria	IITA & I.A.R. & T Ibadan	1990	1996
	TGx-1019-2EN	Nigeria	IITA & I.A.R. & T Ibadan	1990	1996
	TGx-923-2E	Nigeria	IITA & I.A.R. & T and N.C.R.I	1990	1996
	TGx-1485-1D	IITA Ibadan	IITA Ibadan	1990	1996
	TGx-1440-1E	IITA Ibadan	IITA Ibadan	1990	1996
	TGx-1448-2E	Nigeria	IITA/N.C.R.I	1992	1996
	TGx-1835-10E	IITA	IITA/N.C.R.I	2008	2008
	TGx-1740-2F	IITA	IITA/N.C.R.I.	2008	2008
	TGx-1904-6F	IITA	IITA/N.C.R.I.	2009	2009
	TGx-1987-10F	IITA	IITA/N.C.R.I.	2010	2010
	TGx-1987-62F	IITA	IITA/N.C.R.I.	2010	2010

Appendix VI – Common bean, cowpea, groundnut and soyabean varieties officially released in Malawi.

Source: Department of Agricultural Research Services, Ministry of Agriculture and Food Security.

CROP	Variety	Year Release	Institution that released variety	Germplasm Source
Common bean: bush	Nasaka (253/1)	1970s	Bunda College of Agriculture	local germplasm
	Bwenzilaana (373)	1970s	Bunda College of Agriculture	local germplasm
	Kamtsilo (4991/1)	1970s	Bunda College of Agriculture	local germplasm
	Sapelekedwa (600/1)	1970s	Bunda College of Agriculture	local germplasm
	Kalima (PVA 692)	1970s	Bunda College of Agriculture	Colombia
	Napilila (CAL 143)	1995	National Bean Breeding Programme	CIAT
	Maluwa (CAL 113)	1995	National Bean Breeding Programme	CIAT
	Nagaga (A 197)	1995	National Bean Breeding Programme	CIAT
	Sapatsika (DRK 57)	1995	National Bean Breeding Programme	CIAT
	Mkhalira (A 344)	1995	National Bean Breeding Programme	CIAT
	Kambidzi (A 286)	1995	National Bean Breeding Programme	CIAT
	BCMV-B2	2005	Bunda College of Agriculture	
	BCMV-B4	2005	Bunda College of Agriculture.	
	BC-D/O (19	2005	Bunda College of Agriculture.	
	KK03/KK25/68S-f	2011	Legume Improvement Program	local populations
	Mal/KK25/9/S-F	2011	Legume Improvement Program	local populations
	KK25/Mal/112/S-F	2011	Legume Improvement Program	local populations
	Nag25/Mal/168/S-F	2011	Legume Improvement Program	local populations
	KK25/Nag/184/S-L	2011	Legume Improvement Program	local populations
	Mal/KK35/443/S-L		Legume Improvement Program	
Common bean: Dwarf	VTT924/4-4	2009	National Bean Breeding Programme	
	NUA 45	2009	National Bean Breeding Programme	Rich in Iron and Zinc
Common bean:	Kanzama (97/1)	1970s	Bunda College of Agriculture	Selected from a local germplasm collection

Climbing				
	Namajengo (336)	1970s	Bunda College of Agriculture	Selected from a local germplasm collection
	Chimbamba (25-2x8-7)	1993	National Bean Breeding Programme	Bunda College of Agriculture
	Bunda 93 (21-5)	1993	National Bean Breeding Programme	Selected from a local germplasm collection
	Sugar 131	2002	National Bean Breeding Programme	
	UBR (92) 25	2002	National Bean Breeding Programme	
	KK25/Mal/19/S-F	2011	Legume Improvement Program	local popualations
Cowpeas	Sudan-1	1992		Sudan
	IT82E-16	2003		IITA
	Mkanakaufiti (IT99K-494-6)			IITA
Groundnut	Chalimbana	1968	National Groundnut Breeding Programme	Chipata, Eastern Provice, Zambia
	Malimba	1968	National Groundnut Breeding Programme	Gambia
	Mani Pintar	1968	National Groundnut Breeding Programme	Bolivia, South America
	RG1	1975	National Groundnut Breeding Programme	Chitedze
	Chitembana	1980	National Groundnut Breeding Programme	Chitedze
	Mawanga	1980	National Groundnut Breeding Programme	Bolivia (SAC 58).
	CG7 (ICGMS 42)	1990	National Groundnut Breeding Programme	ICRISAT
	Nsinjiro (ICGV-SM 90704)	1999	National Groundnut Breeding Programme	ICRISAT
	Kakoma (JL 24)	2000	National Groundnut Breeding Programme	ICRISAT
	Baka (ICG 12991)	2001	National Groundnut Breeding Programme	ICRISAT
	Chitala (ICGV-SM 99568)	2005	National Groundnut Breeding Programme	ICRISAT
	Chalimbana 2005 (C851/7)	2005	National Groundnut Breeding Programme	Chitedze
Soyabean	Davis	1987	National Soyabean Breeding Programme	United States of America (USA)
	Bossier	1987	National Soyabean Breeding Programme	USA
	Impala	1987	National Soyabean Breeding Programme	South Africa
	Nasoko (427/5/7)	1987	National Soyabean Breeding Programme	Zimbabwe
	Kudu	1987	National Soyabean Breeding Programme	South Africa
	Santarosa	1993	National Soyabean Breeding Programme	USA
	501/4/12	1993	National Soyabean Breeding Programme	Zimbabwe
	491/6/7	1993	National Soyabean Breeding Programme	Zimbabwe

	Ocepera-4	1993	National Soyabean Breeding Programme	Argentina
	Duocrop	1993	National Soyabean Breeding Programme	USA
	Solataire	2003	SeedCo Zimbabwe and SeedCo Malawi	Zimbabwe
	Soprano	2003	SeedCo Zimbabwe and SeedCo Malawi	Zimbabwe
	Makwacha	2008	National Soyabean Breeding Programme	IITA
	Tikolore (TGx 1740-2F)	2011	National Soyabean Breeding Programme	IITA

Appendix VII – Common bean, cowpea, groundnut and soyabean varieties released in Mozambique.

Source: National Seed Services, Instituto de Investigação Agrária de Moçambique, Ministerio da Agricultura

Crop	Variety	Year	Germplasm source
Common beans	ESN 2	1995	CIAT
	Encarnado	1995	CIAT
	Unvoti	1995	CIAT
	ICA Pijão	1995	CIAT
	Enselini	1995	CIAT
	Multi-manteiga	1995	CIAT
	Bónus	1995	CIAT
	PVA 773	1995	CIAT
	Diacol Calima	1995	CIAT
	Carioca	1995	CIAT
	INIA 10	1995	CIAT
	INIA 12	1995	CIAT
	Sugar 131	2011	CIAT
	Cal 143	2011	CIAT
	A222	2011	CIAT
	NUA45	2011	CIAT
	AFR703	2011	CIAT
	VTT 923/10-3	2011	CIAT
	VTT 924/4-4	2011	CIAT
	VTT 925/9-1-2	2011	CIAT
Cowpeas	INIA 16	1995	IITA
	IT 812	1995	IITA
	INIA 73	1995	
	INIA 36	1995	
	IT 18	1995	IITA
	IT 855	1995	IITA
	INIA 41	1995	
	INIA 46	1995	
	Timbawene violeta	1995	
	Timbawene creme	1995	
	Timbawene moteado	1995	
	Nhassenje	1995	
	IT 82E-16	2011	IITA
	IT 97K-1069-6	2011	IITA
	IT 00K-1263	2011	IITA
Groundnuts	ICGM 285	1995	ICRISAT
	Bebiano branco	1995	Mozambique
	Sellie	1995	South Africa
	RMP 12	1995	Burkina Faso
	Nametil (ICGV-SM 90704)	2002	ICRISAT
	Mamane (ICG 12991)	2002	ICRISAT
	ICGV-SM 99541	2011	ICRISAT

	ICGV-SM 99568	2011	ICRISAT
	ICGV-SM 01513	2011	ICRISAT
	ICGV-SM 01514	2011	ICRISAT
	CG 7	2011	ICRISAT
	JL 24	2011	ICRISAT
Soyabeans	TGx 1485-1D (Sana)	2011	IITA
	TGx 1740-2F (Wamini)	2011	IITA
	TGx 1904-6F (Zamboane)	2011	IITA
	TGx 1908-8F (Wima)	2011	IITA
	TGx 1937-1F (Olima)	2011	IITA
	OCEPARA-4	2011	Malawi
	427/5/7	2011	Malawi
	H 7	2011	China
	H17	2011	China
	Solitaire		SeedCo (Zimbabwe)
	Santa		SeedCo (Zimbabwe)
	Storm		SeedCo (Zimbabwe)
	Safari		SeedCo (Zimbabwe)

Appendix VIII – Common bean, cowpea, groundnut and soyabean varieties released in Zimbabwe.

Source: Crop Breeding Institute and Seed Services and authors' surveys of seed companies

CROP	Variety	Year of release	Maintainer	Germplasm source
Common bean	Iris	1996	Crop Breeding Institute	
	PAN148	2000	Pannar Seed	
	Bounty	2006	Seed Co	
	Cardinal	2007	Progene Seeds	
	Speckled Ice	2007	Progene Seeds	
	NUA 45	2010	Crop Breeding Institute	
Cowpea	CBC1	1996	Crop Breeding Institute	IITA
	CBC2	2003	Crop Breeding Institute	IITA
	CBC3	2003	Crop Breeding Institute	
	PAN311		Pannar Seed	
	IT18	2004	Seed Co	
Groundnut	Valencia	1966	Crop Breeding Institute	USA
	Bob White	1974		Zimbabwe
	Natal Common		Crop Breeding Institute	South Africa
	Makulu Red		Crop Breeding Institute	Zambia
	Jacana	1966	Crop Breeding Institute	USA
	Egret	1971	Crop Breeding Institute	
	Plover	1973	Crop Breeding Institute	USA
	Flamingo	1974	Crop Breeding Institute	
	Swallow	1976	Crop Breeding Institute	
	Falcon	1980	Crop Breeding Institute	
	Heron	1983	Crop Breeding Institute	
	Flamingo	1982	Crop Breeding Institute	
	Jesa	1999	Crop Breeding Institute	
	Teal	1999	Crop Breeding Institute	
	Ilanda	2006	Crop Breeding Institute	
	Tern	2005	Crop Breeding Institute	
	Nyanda	2000	Seed Co	
	SC Orion	2004	Seed Co	
Soybean	Rhosa	1966	South Africa (Potchefstroom)	
	Bragg	1972	Crop Breeding Institute	
	Oribi	1973	Crop Breeding Institute	
	Buffalo (fodder)	1974	Crop Breeding Institute	
	Impala	1977	Crop Breeding Institute	
	Kudu	1977	Crop Breeding Institute	
	Sable	1980	Crop Breeding Institute	
	Duiker	1982	Crop Breeding Institute	
	Roan	1985	Crop Breeding Institute	
	Gazelle	1988	Crop Breeding Institute	
	SCS1	1990	Seed Co	
	SC Nondo	1992	Seed Co	
	Nyala	1992	Crop Breeding Institute	
	SC Sonnet	1994	Seed Co	
	Soma	1995	Crop Breeding Institute	
	Soprano	1996	Seed Co	

SC Solitaire	1997	Seed Co
SC Sonota	1997	Seed Co
SC Soprano	1998	Seed Co
SC Viking	1999	Seed Co
Bimha	1999	Crop Breeding Institute
Mhofu	1999	Crop Breeding Institute
Nyati	1999	Crop Breeding Institute
PAN891	2000	Pannar Seed
SC Scorpio	2000	Seed Co
SC Storm	2000	Seed Co
SC Safari	2001	Seed Co
SC Santa	2005	Seed Co
SC Siesta	2005	Seed Co
SC Serenade	2006	Seed Co
SC Edamame	2007	Seed Co
SC Saga	2008	Seed Co
SC Squire	2008	Seed Co
SC Sequel	2009	Seed Co
SC Status	2012	Seed Co

List of project reports

1. N2Africa Steering Committee Terms of Reference
2. Policy on advanced training grants
3. Rhizobia Strain Isolation and Characterisation Protocol
4. Detailed country-by-country access plan for P and other agro-minerals
5. Workshop Report: Training of Master Trainers on Legume and Inoculant Technologies (Kisumu Hotel, Kisumu, Kenya-24-28 May 2010)
6. Plans for interaction with the Tropical Legumes II project (TLII) and for seed increase on a country-by-country basis
7. Implementation Plan for collaboration between N2Africa and the Soil Health and Market Access Programs of the Alliance for a Green Revolution in Africa (AGRA) plan
8. General approaches and country specific dissemination plans
9. Selected soybeans, common beans, cowpeas and groundnuts varieties with proven high BNF potential and sufficient seed availability in target impact zones of N2Africa Project
10. Project launch and workshop report
11. Advancing technical skills in rhizobiology: training report
12. Characterisation of the impact zones and mandate areas in the N2Africa project
13. Production and use of Rhizobial inoculants in Africa
18. Adaptive research in N2Africa impact zones: Principles, guidelines and implemented research campaigns
19. Quality assurance (QA) protocols based on African capacities and international existing standards developed
20. Collection and maintenance of elite rhizobial strains
21. MSc and PhD status report
22. Production of seed for local distribution by farming communities engaged in the project
23. A report documenting the involvement of women in at least 50% of all farmer-related activities
24. Participatory development of indicators for monitoring and evaluating progress with project activities and their impact
25. Suitable multi-purpose forage and tree legumes for intensive smallholder meat and dairy industries in East and Central Africa N2Africa mandate areas
26. A revised manual for rhizobium methods and standard protocols available on the project website
27. Update on Inoculant production by cooperating laboratories
28. Legume Seed Acquired for Dissemination in the Project Impact Zones
29. Advanced technical skills in rhizobiology: East and Central African, West African and South African Hub
30. Memoranda of Understanding are formalized with key partners along the legume value chains in the impact zones
31. Existing rhizobiology laboratories upgraded
32. N2Africa Baseline report
33. N2Africa Annual country reports 2011

34. Facilitating large-scale dissemination of Biological Nitrogen Fixation
35. Dissemination tools produced
36. Linking legume farmers to markets
37. The role of AGRA and other partners in the project defined and co-funding/financing options for scale-up of inoculum (banks, AGRA, industry) identified
38. Progress Towards Achieving the Vision of Success of N2Africa
39. Quantifying the impact of the N2Africa project on Biological Nitrogen Fixation
40. Training agro-dealers in accessing, managing and distributing information on inoculant use
41. Opportunities for N2Africa in Ethiopia
42. N2Africa Project Progress Report Month 30
43. Review & Planning meeting Zimbabwe
44. Howard G. Buffett Foundation – N2Africa June 2012 Interim Report
45. Number of Extension Events Organized per Season per Country
46. N2Africa narrative reports Month 30
47. Background information on agronomy, farming systems and ongoing projects on grain legumes in Uganda
48. Opportunities for N2Africa in Tanzania
49. Background information on agronomy, farming systems and ongoing projects on grain legumes in Ethiopia
50. Special Events on the Role of Legumes in Household Nutrition and Value-Added Processing
51. Value chain analyses of grain legumes in N2Africa: Kenya, Rwanda, eastern DRC, Ghana, Nigeria, Mozambique, Malawi and Zimbabwe

Partners involved in the N2Africa project

Caritas Rwanda

Bayero University Kano (BUK)

Diobass

Eglise Presbyterienne Rwanda

Resource Projects-Kenya

Sasakawa Global; 2000

Université Catholique de Bukavu

University of Zimbabwe