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About the Bulletin

The Bulletin of Tropical Legumes is a monthly publication of the Tropical Legumes II (TL II) project, funded by the Bill & Melinda Gates Foundation, and jointly implemented by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA) in close collaboration with partners in the National Agricultural Research Systems of target countries in sub-Saharan Africa and South Asia. TL II aims to improve the livelihoods of smallholder farmers in drought-prone areas of the two regions through enhanced grain legumes productivity and production.

Tropical legume farming in Kenya

Importance of soybean in Kenya

Soybean (*Glycine max*) production in Kenya remains low at an average of 2,000-5,000, metric tons (MT) a year. However, industrial demand for soybean products continued to grow from 50,000 MT in 2008 to roughly 120,000 MT in 2011 of soybean meal and about 150 MT of soy protein concentrates and textured soy protein (FAOSTAT, 2011). In Kenya, human consumption accounts for 10-15% (or 10,000 – 15,000 MT) per annum, meaning that a part of the domestic demand is currently being fulfilled through soybean imports (Chianu et al., 2008).

Soybean is produced in Western, Nyanza, Rift valley as well as Central and Eastern provinces over about 2,500 ha with an average yield of 0.8 t/ha. This is against a potential of 1.5 – 3.0 t/ha, depending on the location (Mahasi et al., 2011). In 1999, the Ministry of Agriculture estimated that, to attain self-sufficiency, 135,000 hectares would be required to produce over 108,000 MT, suggesting that adequate measures need to be taken to promote domestic soybean production to meet this demand. Increased awareness of on the health benefits and nutritional value of soybean by international agriculture organizations (including CIAT and IITA) in partnership with the government, has seen improvements in the development of the soybean sub-sector. This has been particularly so in Western Kenya where soybean production has increased from 46 MT in 2010 to over 1315 MT in 2011 (Kadenge et al., 2012).

Soybean research in Kenya

Initial soybean research in Kenya focused on identifying suitable varieties for different agro-ecological conditions (Chianu et al., 2008). Consequently, five soybean varieties, namely Nyala, Hill, Black Hawk, Gazelle, and EAI 3600 that have been used in the country for a long time were officially released and registered in April 2009 by Kenya Plant Health Inspectorate Services (KEPHIS), targeting specific growing areas with a yield potential of up to 2.0 t/ha.

In June 2010, two dual-purpose promiscuous varieties, TG x 1740-2F and TG x 1895-33F and one grain variety SC-1 were released. TG x 1740-2F and TG x 1895-33F are high yielding (6.5% over the mean of checks) and possess characteristics preferred by farmers and large-scale processors (Table 1).

The rapid spread of soybean rust disease and the need to have varieties with high Biological Nitrogen Fixation (BNF) potential have necessitated further evaluation of new varieties from various breeding programs. In this attempt, promiscuous varieties TG x 1904-6E, TG x 1987-10F, TG x 1987-62F, TG x 1987-18F, Namsoy 1N, Maksoy 4M and five grain varieties 835/5/30, SBH3/7/4, Sc Squire, Sc Sequel and SC S823-6-16 were evaluated through Participatory Varietal Selection (PVS). Of these, three varieties,

Table 1: Characteristics of common soybean varieties selected by the Kenyan research system.

Variety	Name of release	Year of release	Source of material	Average on-farm yield (kg/ha)	Varietal traits selected for
Nyala	Nyala	2009	Seed Co Zimbabwe	700	Early maturity, large grain size, can be intercropped with other crops
Hill	Hill	2009	KARI Njoro	850	High yielding, medium maturity, tolerant to aphids
Black Hawk	Black Hawk	2009	KARI Njoro	850	High yielding, medium maturity
EAI 3600	EAI 3600	2009	KARI Njoro	800	High yielding, early maturity, resistant to major insects
Gazelle	Gazelle	2009	KARI Njoro	1,100	High yielding, large grain size, attractive color
TG x 1740-2F	DPSB 19	2010	IITA	900	Free nodulation, grain and biomass yield, good for monocropping, high pod clearance, good pod load, medium maturity, good for making milk
TG x 1895-33F	DPSSB 8	2010	IITA	950	Free nodulation, good for intercropping, grain yield and biomass accumulation, high pod clearance, good pod load, good for making milk, attractive color
Namsoy 4M	Namsoy	In NPTs*	Makerere Uganda	1,200	High grain and biomass yield, high protein content, good for monocropping, tolerance to soybean rust
TG x 1987-62F	DPSB 96	In NPTs	IITA	1,400	High grain and biomass yield, high protein content, good for monocropping, free nodulation, tolerance to soybean rust
SC Saga	Saga	In NPTs	Seed Co Zimbabwe	1,600	High yielding, high oil content, high pod clearance, large seed size, tolerance to soybean rust, good for intercropping

* NPT= National Performance Trials.

namely SC Saga, SC S823-6-16, Namsoy 4M and TG x 1987-62F were selected by farmers and have been submitted to KEPHIS for inclusion in the National Performance Trials (NPT), in preparation for official release.

Planned phase II activities and their contribution to national efforts

In the second phase of TL II project, we will work to increase soybean production through development and dissemination of appropriate soybean management technologies, processing and utilization of soybean at household and cottage scales and ensuring access for smallholder farmers to seed of improved varieties. At the end of this project (2014), it is expected that productivity of soybean will increase to an average of 1.5 t/ha, and at least 25% of households in Western Kenya will have acquired knowledge on soybean processing and consumption of various byproducts, thereby improving their nutritional status.

Expected outcomes in production and productivity

The outcomes of phase II will be increased income and nutritional status of soybean farmers and farm practitioners and increased national soybean production greater than 2,500 MT and productivity of 1.5 t/ha. This will lead to a reduction in the soybean deficit resulting from higher demand, which should save the country some foreign exchange.

Areas for soybean cultivation

The potential areas for soybean production in Kenya are summarized in Table 2. Western province stands out as the leading soybean producing province, accounting for nearly 50% of total national smallholder planted area and production in 2011. Estimates of area potentially suitable for soybean production range from 157,000 ha (M0A, 1995) to 224,000 ha (by the Lake Victoria Basin Development Authority). While Nyanza

Table 2: Leading soybean producing districts in Kenya.

Province	District
Western	Busia, Bungoma, Teso, Butere/Mumias, Kakamega, Mount Elgon, Lugari, Vihiga
Rift valley	Nakuru, Nandi, Trans Nzoia, Koibatek, Narok, Trans, Mara, Laikipia, Bomet
Eastern	Meru, Embu, Mbeere, Machakos
Nyanza	Rachuonyo, Homabay, Gucha, Kisii, Nyamira, Siaya
Central	Kirinyaga, Murang'a, Maragwa, Nyeri

province accounts for 11–15% of Kenya's land area potentially suitable for soybean cultivation, Western province accounts for 9–13%. At the district level, Uasin Gishu, Trans Nzoia, Siaya, and Bungoma districts account for the largest proportion of land potentially suitable for soybean production. The current project however, will focus on developing soybean production in Western, Nyanza and Rift valley provinces.

Seed system

Although Kenya is considered self-sufficient in seed production, there is insufficient seed for most legume crops such as soybean. Eight varieties (6 grain and 2 promiscuous) have been released by KEPHIS targeting specific growing areas with a yield potential of up to 2.5 t/ha. Despite the progress made in the development of improved soybean varieties, their adoption by farmers remains low largely because of poor seed supply. Seed companies are reluctant to invest in production of legume seeds because of difficulties in recovering production costs since most farmers recycle seed for several years.

Most of the seeds being planted are obtained from open-air grain markets or derived from the previous year's harvest. A few players like Western Seed Company have risked their investments in soybean seed production, but the pricing is usually beyond the reach of many smallholder farmers. The situation is complicated with rampant poverty and the lack of well-organized marketing structures.

Soybean seed system strategy (2012-2014)

This seed system strategy aims to increase the productivity and production of soybean through improved access for smallholder farmers to seeds of improved soybean varieties (tolerant/resistant to biotic and abiotic stresses). A new approach known as integrated seed system where community-based seed production (now recognized by the Seed Act of Kenya) will be important. CIAT, in collaboration with the seed unit of the Kenya Agricultural Research Institute (KARI), Kakamega and KEPHIS, have initiated community-based seed production groups under the umbrella of Western Seed Growers Association. Through these groups, several tonnes of seeds of new soybean varieties have been produced and distributed to farmers in local communities. Select seed producers have been trained in seed multiplication and will be provided with foundation seed for multiplying under the supervision of the extension workers. KEPHIS is responsible for inspecting the fields and the final product as required by the Kenya Seeds and Plant Varieties Act. CIAT-Tropical Soil Biology and Fertility (TSBF) will provide technical support in seed production and marketing, including farmer training and linkages to the markets. The Community Seed Producers in charge of seed production and who also run the seed marketing enterprises, will jointly set up Community Soybean Seed Banks (CSSB) where other members of the society can access and purchase improved seeds. These community seed banks are harmonized to operate together with other established Soybean Resources Centers. The long-term goal of these activities is to link community seed producers to major seed companies on contract farming basis and let the process be self-propelling. The seed production plans are indicated in Tables 3 and 4.

Seed requirement (based on targets)

Area of 6224 ha = Seed rate mean 60 kg/ha

National demand: 373.4 t (2012-2014)

Capacity to deliver 20% additional need: 89.7 t

Productivity target: 1.8 t/ha at intervention sites and 0.8 t/ha at the national level

Total production target: 2688 t.

Opportunities, constraints, and seed plan to cover 20% additional requirement of soybean

Opportunities

- Availability of suitable soybean varieties
- Presence of experienced community-based seed growers
- Strong domestic demand for improved seeds and soybean grain
- Availability of research capacity in Kenya
- Availability of agro-dealers in Kenya
- Policy environment that enhances innovative seed system

Table 3: Seed production plan in Kenya.

Ecology	Promising varieties	Productivity (t/ha)	Seed production (t)		20% additional requirement (1.2%)	Seed production goal		
			Breeder seed	Foundation seed		Year 1	Year 2	Year 3
Western region	TG x 1740-2F	1.8	0.026	0.789	7.89	7.89	7.89	7.89
	Namsoy 4M	2.0	0.017	0.552	6.14	6.14	6.14	6.14
	TG x 1835-10E	1.5	0.008	0.210	1.75	1.75	1.75	1.75
	TG x 1895-33F	1.7	0.007	0.186	1.75	1.75	1.75	1.75
Nyanza region	TG x 1740-2F	1.5	0.018	0.448	3.74	3.74	3.74	3.74
	Namsoy 4M	1.8	0.004	0.124	1.24	1.24	1.24	1.24
	TG x 1835-10E	1.8	0.002	0.062	0.62	0.62	0.62	0.62
	TG x 1895-33F	1.6	0.002	0.046	0.41	0.41	0.41	0.41
Rift valley region	TG x 1740-2F	1.5	0.01	0.019	0.44	0.44	0.44	0.44
	TG x 1895-33F	2	0.01	0.01	0.22	0.22	0.22	0.22
	TG x 1835-10E	1.5	0.06	0.093	0.44	0.44	0.44	0.44
	Gazelle	1.8	0.02	0.032	1.55	1.55	1.55	1.55
	EAI 3600	1.5	0.03	0.046	0.88	0.88	0.88	0.88
	SCS-1	1.5	0.1	0.105	0.88	0.88	0.88	0.88
Central region	EAI 3600	1.2	0.08	0.102	0.29	0.29	0.29	0.29
	Gazelle	1.4	0.06	0.085	0.29	0.29	0.29	0.29
	SCS -1	1.5	0.03	0.046	0.14	0.14	0.14	0.14
Eastern region	TG x 1740-2F	1.5	0.07	0.102	0.36	0.36	0.36	0.36
	TG x 1835-10E	1.2	0.04	0.044	0.12	0.12	0.12	0.12
	Gazelle	1.8	0.05	0.084	0.36	0.36	0.36	0.36
	Namsoy 4M	1.8	0.01	0.026	0.12	0.12	0.12	0.12
	SCS-1	1.5	0.04	0.065	0.24	0.24	0.24	0.24
Total			0.694	3.278		29.87	29.87	29.87

- Presence of production partnership between soybean buyers, processors and farmers
- Potential for greater government support.

Constraints

- Increasing soybean import
- Fluctuation in soybean prices by season
- Insect, pests and diseases
- Small and fragmented soybean producers
- Low direct access to sources of credit
- Undeveloped soybean seeds within the seed industry
- Lack of seed storage facilities

Table 4: The certified seed production plan over three years (in MT).

Variety	Year		
	2012	2013	2014
TG x 1740-2F (DPSB 19)	12.4	12.4	12.4
Namsoy 4M	7.5	7.5	7.5
TG x 1835-10E (DPSB 8)	2.9	2.9	2.9
TG x 1895-33F	2.4	2.4	2.4
Gazelle	2.2	2.2	2,2
EAI 3600	1.2	1.2	1.2
SCS-1	1.3	1.3	1.3
Total	29.7	29.7	29.7

The seed will be produced mainly by community seed producers under the supervision of KARI seed unit and KEPHIS.

Vision of success

Raising productivity to 1.5 t/ha will increase household income by US$ 360 per year from its sale, thereby benefiting more than 6,000 smallholder farmers and reducing soybean import by 20%.

Chickpea production in Kenya

Chickpea (*Cicer arietinum*)is a relatively new crop grown by smallholder farmers in dry areas of Eastern Kenya and dry highlands of Rift valley provinces. Reports indicate that improved chickpea germplasm were introduced in Eastern and Rift valley provinces in the late 1980s (ICRISAT, 1989; Metto, 2002). However, a recent survey indicates that local accessions have been cultivated in coastal and Eastern parts of Kenya for the last 40 years (Kaloki, 2009). The crop has since spread in Kenya and is currently adapted to varied agro-ecological zones such as dry highlands, medium altitudes and also in dry lowlands with an annual rainfall range of 250-550 mm per annum (Jaetzold and Schmidt, 1983; Kibe and Onyari, 2007; Onyari et al., 2010).

Currently Kenya produces approximately 40,000-55,000 tons of chickpea from an approximate area of 18,000-20,000 ha (FAO, 2009; MOA, 2010; Kibe and Kamithi, 2007). The national average yield is estimated at 540-1200 kg/ha. Production and land acreage under chickpea has been declining over the last 10 years, but efforts in districts where TL I/II interventions occurred over the last four years (Njoro, Bomet and Koibatek, Naivasha in Rift valley) reported average yields of about 1500-3000 kg/ha (ICRISAT, 2010; Kimurto et al., 2009; Thagana et al., 2010). Data on national demand are not available, but it is estimated that approximately 70,000-100,000 tons of chickpea are consumed in Kenya annually (Economic Survey, 2010) and an unknown quantity exported through Kenya.

The crop is currently gaining in popularity and importance as a cereal-legume relay crop in the dry highlands (Bomet Uasin Gishu, Nakuru and Timau) during the short rains after wheat, maize and finger millet. Growing chickpea in relay with wheat has the potential to contain the threat of ug99 strain of wheat stem rust since it can break the lifecycle of the pathogen. It also has the potential of improving soil health through N-fixation and to contribute to food and nutritional security in dryland areas (where food insecurity stands at >60%) that occupy approximately 80% of total land area.

Currently chickpea is imported from Tanzania and processed in Kenya for export to Asia or for local consumption by the large Indian/Asian population. This reveals Kenya's great potential for chickpea production to meet local needs as well as the deficit in Southeast Asia.

Between 2004 and 2010, chickpea area increased by 11.0% with a mean of 10.0% increase in production and 41.8% increase in productivity. The increased productivity and production are expected to have resulted in greater nutritional security and income for farmers. Currently there is no data available on chickpea processing and export in Kenya, although there are several milling companies like Presco millers Ltd who process and package chickpea for local consumption in major supermarkets and for exports.

Due to chickpea's current popularity, importance in relay cropping in the dry highlands and its choice in dry lowlands as an alternative drought-tolerant legume to dry beans, projections suggest a rate of growth (ROG) in area, production, demand and yield to be 38.7%, 22.9%, 7.7% and 6.5% respectively by 2017 as compared to 20%, 6.6%, 4.6% and 6.0% respectively by 2014. It is expected that ROG for area and production will rise steadily due to promotion of chickpea in medium and large-scale farms in the Rift valley. Demand will remain fairly constant through 2017 and beyond (Table 5). This would provide opportunities for a further increase in chickpea exports.

Table 5: Current and projected status of chickpea in Kenya.

	Year			
Parameter	2004-2009	2010	2014	2017
Average area (1000 ha)	18	20	42	112
Average production (1000 MT)	50	55	71	162.4
National demand (1000 MT)	100	112	134.4	168
Yield (kg/ha)	670	950	1200	1450
Proportion sold (%)	60	60	60	60
ROG* in area (%)	11	11	20	38.7
ROG in production (%)	9.6	10	6.6	22.9
ROG in demand (%)	12	12.0	4.6	7.7
ROG in yield (%)	3.42	41.8	6.0	6.5

*ROG = rate of growth (annual); all ROGs in the first column are calculated for the period 2001-2010.

Table 6: Characteristics of chickpea varieties released in Kenya.

Variety	Year of release	Pedigree	Potential area (ha)	Average on-farm seed production potential (kg/ha)	Varietal traits
Chaina Desi 1	2012	ICCV 97105	26,325	1,500	Medium seed size, medium maturity (earliness), resistance to fusarium wilt, market opportunities
ICCV 00108 (Desi)	2011	ICCV 00108	7,300	1,500	
Saina K 1	2012	ICCV 95423	17,665	1,200	
ICCV 00305 (Kabuli)	2011	ICCV 00305	3,830	1,200	
ICCV 92944 (Desi)	-	ICCV 92944	25,300	1,500	
ICCV 97126 (Desi)	-	ICCV 97126	1,200	1,200	

Research and development

During Tropical Legumes II phase I, concerted research and development efforts through on-farm, FPVS and demonstrations on varieties and utilization resulted in the fast track release of the first set of chickpea varieties (Table 6).

In Kenya, four improved chickpea varieties, namely ICCV 97105, ICCV 00108, ICCV 95423 and ICCV 00305 were released between 2009 and 2011. Three new varieties are under evaluation by KEPHIS (ICCV 92944, ICCV 97126 and ICCV 95011).

Agro-ecology for chickpea cultivation

Chickpea is targeted as a source of protein and nutritional security and is mainly grown by smallholder farmers with an overall farm size of 1.5-2 ha/household. Large and medium-scale cereal farmers may have >5 ha/household. The crop is mainly grown in the Rift valley and Eastern provinces.

Since its introduction, chickpea spread in Kenya and is currently adapted to varied agro-ecological zones such as the dry highlands of Rift valley provinces (Nakuru, Koibatek and Uasin Gishu, Timau and Naivasha districts) where altitudes range from 1600-2500 masl with a mean rainfall of 550-1800 mm per annum; medium altitudes (Bomet, Kabete and Mbeere); and also in the dry lowlands (Baringo, Kerio valley, Machakos, Mwea and Machakos) with annual rainfall range of 250-550 mm per annum (Jaetzold and Schmidt, 1983; Kibe and Onyari, 2007; Onyari et al., 2010).

Seed systems

It has been observed that farmers in Kenya still use Ngara Local. There has been limited awareness about improved chickpea varieties due to the public sector's consistent failure to supply good quality source seed and the private sector's lack of interest to engage in legume seed production. Most often, seed is produced in high potential areas or areas where infrastructure for storage and processing are far from the area of utilization, leading to high transaction costs. Requirements for high seeding rates further limit the spread of new varieties.

Seed production targets

Total area: 81,620 ha

Seed rate mean: 90-105 kg/ha based on seed size

National demand: 7670 t (2012-14) to cover 81,620 ha

Capacity to deliver 30% total area: 32,648 ha

Total seed required to cover targeted area of 24,486 ha~: 2300 t.

Opportunities, constraints and partnerships to cover 30% of area

Opportunities

- Farmers in the target areas have recognized that chickpea is a drought-tolerant crop compared to beans and hence can be used to mitigate the effects of climate change. Furthermore, most of the improved materials have tolerance to Fusarium wilt coupled with early maturity to catch up with the huge Indian market. This creates a big demand for seed of the improved materials.
- There is a market and demand for the seed and grain inside and outside the country.
- Leldet seed company has released two varieties and taken up production of seed in small quantities.
- The four new varieties released and their seed availability through sustainable seed systems planned under TL II, the CGIAR Research Program on Grain Legumes and national-level support, will contribute significantly to seed availability.

Major constraints

Major constraints to chickpea production in Kenya are foliar disease *Ascochyta* blight, pod borer (*Helicoverpa*

Strategic partners and their roles

Table 7: Strategic partners for legume production in Kenya and their roles.

Partner	Role
CGIAR centers (CIAT Kenya, IITA)	Provide improved germplasm, guidance on appropriate farming technologies
Kenya Agricultural Research Institute (KARI)	Breed, bulk, screen and maintain germplasm; germplasm development, variety release, produce breeders' seed, dissemination; breeder, foundation and certified seed production and marketing
Kenya Plant Health Inspectorates services (KEPHIS)	Seed legislation, regulation and quality control
Seed companies (KARI Kakamega Seed Unit (KSU), Seed Co, Western Seed Co, Leldet Seed Co	Provide guidance in crop production technologies through field days, demonstrations and agriculture shows; assist in marketing of farmers' seeds
Western Seed Growers Association	Recruit and organize farmers for seed production; spearhead recognition of community seed producers through the legal framework; create awareness about soybean work through public media
Agro-dealers, Soybean Resource Centers (SRC) and farmer associations	Farmer knowledge dissemination, linkage between the farmer and consumers; enhance accessibility of farm inputs to farmers; advisory services, inputs/seed availability, loans to farmers
Smart logistics and Farm Concern (FCI)	Organize farmers into commercial groups, linkage to financial institutions, linkage to market
Equity Bank	Provide credit facilities to farmers
Promasidor, BIDCO	Provide market services and processing soybean into various products and byproducts (value addition)
Sygneta East Africa	Provide farm inputs (chemicals for control of pests and diseases)
MEA limited	Provide inputs (inoculants and mineral fertilizers)
Higher institutions of learning: University of Nairobi (UoN), Egerton University, Moi University, Maseno University, among others	Test improved germplasm for various technologies in terms of adaptability, performance and agronomic potential; UoN to explore, screen, authenticate various Rhizobia strains and do quality control; offer formal training to Masters and PhD students in seed systems and crop protection management; provide capacity building through training and technology dissemination
ICRISAT -TL-II	Fund, provide improved germplasm, capacity building, facilitate seed production and distribution, up-scaling
Extension services	Advisory services, farmers mobilization and dissemination
Local Government Authorities/policy makers	Farmers mobilization, supportive policy, funding, dissemination/up-scaling
NGOs (KENPAP), CBOs, Farmers' associations	Mobilization of farmers, group formation, facilitate access to loans, inputs and markets, advisory services
Seed companies (Leldet, Faida Seeds)	Seed production, marketing and distribution
Contract farmers	Produce quality seed
Individual farmers	Seed buyers and users, grain producers and buyers, dissemination/up-scaling

armigera), Fusarium wilt and drought. Low utilization and socio-economic and organizational constraints include limited coverage of current interventions and limited access to farmers of quality seed.

Vision of success

Seed production will be enhanced during 2012-2014 starting with the production of breeder seed and foundation seed of six major varieties to meet 40% adoption of total area in key agro-ecological zones (Tables 8 and 9). This will be achieved by involving seed companies, Non-Governmental Organizations (NGOs), Community-based organizations (CBOs) and farmers.

All activities will incorporate gender components since gender equality is key to achieving the objective of improving food security and nutrition in this project. Capacity building in seed production will involve all stakeholders (farmers, entrepreneurs, extension, NGOs, CBOs), women farmers, women's groups and their cooperative societies.

Table 8: Chickpea seed roadmap for Kenya.

Ecology (zone)	Demand (ha)	Promising varieties	On-farm yield potential (t/ha)	Seed rate (kg/ ha)	Total area to be covered (ha)		Seed production						Total seed required to reach 30% adoption (t)
							Breeder seed in 2012		Foundation seed in 2013		Certified seed in 2014		
					Zone wise	Variety wise	Area (ha)	Production (t)	Area (ha)	Production (t)	Area (ha)	Production (T)	
Rift valley	80,250	6			24,075		8.15	10.91	113	154.5	1623	2161	2261
	25,300	ICCV 97105	1.5	90		7,590	1.64	2.46	27.3	41	455	683	683
	25,300	ICCV 92944	1.5	90		7,590	1.64	2.46	27.3	41	455	683	683
	17,665	ICCV 95423	1.2	105		5,300	3.55	4.26	40.5	48.6	463	556	556
	7,300	ICCV 00108	1.5	90		2,190	0.47	0.71	7.9	11.9	131	197	197
	3,485	ICCV 00305	1.2	105		1,045	0.7	0.84	8.0	9.6	92	110	110
	1,200	ICCV 97126	1.2	90		360	0.15	0.18	2.0	2.4	27	32	32
Eastern Kenya	1,370	2			411		0.14	0.181	1.9	2.7	28	39	39
	1,025	ICCV 97105	1.5	90		308	0.07	0.11	1.1	1.7	19	29	28
	345	ICCV 00305	1.2	105		103	0.07	0.08	0.8	1.0	9	11	11
Total	81,620				24,486		8.29	11.091	114.9	157.2	1651	2200	2300

Table 9: Certified seed production plan (t) over three years.

Variety	2012	2013	2014
ICCV 97105	107	178	427
ICCV 92944	102	171	410
ICCV 95423	83	139	334
ICCV 00108	30	49	118
ICCV 00305	18	30	73
ICCV 97126	5	8	19
Total	345	575	1,380

Common bean

Kenya is the seventh highest producer of common bean (*Phaseolus vulgaris* L.) after Brazil, India, China, Myanmar, Mexico and USA. Common bean contributes Ksh 13.18 billion annually to the national economy and is a source of dietary protein, especially for the rural and urban poor. It is key to the daily diet of many Kenyans. Nutritionists characterize it as a near-perfect food because of its high protein content and generous amounts of fibre, complex carbohydrates and other dietary necessities. It also serves as a cheap source of cholesterol-free proteins. On average, 401,880 metric

tonnes (MT) of beans are consumed annually (Economic Review of Agriculture – 2009).

In Kenya common bean is widely grown and consumed particularly by medium and low-income households who are the majority in the region. It has high potential for export. However, there is no organization managing contract production for marketing.

Common beans consistently get a good price -- the average monthly prices are Ksh 3,291/bag of Canadian wonder, Ksh 3,307/bag of Rosecoco and Ksh 3,180/bag of Mwitemania (KIPPRA-MoA Report, 2007)

Trends and production projections

The area under common bean in Kenya has varied over the years with the highest being in 2005 and the lowest in 2008 (Table 10). About 610,428 ha was under the crop in 2008 representing a 28% decrease, compared to 2007. Consequently, production also declined by about 20% to register 2.9 million bags down from 3.5 million bags produced in 2007. This decline can be attributed to unfavorable weather conditions in the producing areas which resulted in a yield decline from 6 bags/ha in 2006 to a low of 2 bags/ha in 2008. In 2008, production was also probably limited by post-election violence. Hence a peaceful environment in rural areas is crucial for agricultural development. Yields are low and the average is less than 1 t/ha.

Common bean production is expected to grow at 6% and 7% in 2014 and 2015, respectively. This will be subject to availability of new varieties, favorable climate, and seed availability of new varieties. Consumption is also expected to increase by 7% annually subject to prices falling or remaining constant.

Research in Kenya

Varieties available and under production

Older common bean varieties are still under production by Kenya Seed Company and East African Seed Company. The drought-tolerant KAT has been promoted by KARI and the Ministry of Agriculture. Three seed merchants are into commercial production of the variety. Some of the new varieties released by KEPHIS are slowly finding their way into the local market.

The old bean varieties (sometimes called ruling varieties) are Mwitemania, Rosecoco, Mwezi Moja, Canadian Wonder and Red Haricot, and are aided by a good seed system. KK22, KK8 and KK15 are the other varieties for Western Kenya and root rot-prone areas.

The drought-tolerant KAT B1, KAT B9, KATX56 and KATX69 have been promoted widely in Kenya especially after the start of the Tropical Legumes project. They are being produced by three seed merchants and the Ministry of Agriculture. NGO's have strong programs promoting these beans. KATX56 is being widely adapted while KAT B1 is the most marketed and consumed variety.

Other varieties in the National Variety Lists have been released in the past few years and some of them are in the stage of breeder seed production while some have no seed system yet. Some have been taken up by seed companies for production. Active promotion is required to sow interest in the seed companies. Table 11 shows the National Climbing Bean Variety List (Species: *Phaseolus vulgaris* L.).

Table 10: Acreage and amount of common bean produced in Kenya from 2005 to 2009.

	2005	2006	2007	2008	2009
Area (ha)	1,034,477	995,391	846,327	610,428	960,705
Production (t)	375,820	531,800	383,900	261,137	465,363
Unit price per bag (Kshs)	2,500	2,540	4,400	4,500	5,134
Average yield (bags/ha)	4.0	6.0	4.8	2.0	5.4
Consumption (t)	400,450	460,000	524,400	260,000	390,000
Total value (billion Kshs)	10.44	18.02	16.29	13.10	26.54

Table 11: National Climbing Bean Variety List (Species: *Phaseolus vulgaris L.*).

Variety	Official variety release name	Year of release in Kenya	Owner(s)/ licensee	Maintainer and seed source	Optimal production altitude range (Masl)	Duration to maturity (months)	Grain yield (t/ha)	Special attributes
Flora		1996	KARI	KARI-Kakamega	1500-2200	4-5	2-2.5	Light pink pods
Vunikingi		1996	KARI	KARI-Kakamega	1500-2200	4-5	2-2.5	Red pods
Umubano		1996	KARI	KARI-Kakamega	1500-2200	4-5	2-2.5	Dark red pods
MAC 13	MAC 13 (Kenya Safi)	2012	KARI and University of Nairobi	KARI and University of Nairobi	1400-2000	3-4	1.2-1.5	Sugar grain type (cream white background with red flecks), large seeded, resistant to anthracnose
MAC 34	MAC 34 (Kenya Tamu)	2012	KARI and University of Nairobi	KARI and University of Nairobi	1400-2000	3-4.5	2-2.5	Red mottled, large wedge-shaped seeds, resistant to angular leafspot and common bacterial blight
MAC 64	MAC 64 (Kenya Mavuno)	2012	KARI and University of Nairobi	KARI and University of Nairobi	1400-2000	3-5	2-3	Dark red mottled, medium seeded, resistant to anthracnose and common bacterial blight
MN14	Kenya Madini	2010	University of Nairobi	University of Nairobi	1500-1900	3-4	2.15-2.5	High grain iron and zinc concentration, medium sized, yellow grain
MN 17	Kenya Majano	2010	University of Nairobi	University of Nairobi	1500-1900	3-4	2.2-3	High grain iron and zinc concentration, medium sized, yellow seeds
MN 19	Kenya Afya	2010	University of Nairobi	University of Nairobi	1500-1900	3-4	2.23-3.2	High grain iron and zinc concentration, medium seeded, brownish yellow seeds

Source: KEPHIS National variety List updated 2012.

Planned phase 2 activities

The activities planned for TL II phase 2 will revolve around breeding, screening and selecting for high-yielding and drought-tolerant bean cultivars. This will be combined with developing a sustainable seed production and delivery system for smallholder farmers in Kenya. This will involve drought-tolerant bean varieties that are being marketed by seed companies and KSU for which there is need to improve access to a wider range of farmers through formal seed marketing. New bean varieties coming out of breeding programs will also need to be given attention. The promotion of these drought-tolerant bean varieties will be essential to address nutritional, food security and income problems

of small-scale farmers thereby contributing to the gross domestic product of the country. Table 12 shows the common bean seed production plan to meet the project goals. Table 13 shows the potential quantity of different classes of seed (t) produced by stakeholders.

Expected outcomes

The expected outcomes of TL II phase 2 are:

- Increased access to high-yielding and better adapted bean varieties, information and crop management practices by a diversity of farmers (women and men, rich and poor) in the various agro-ecologies
- Increased utilization of high-yielding bean varieties and information
- Improved food and nutrition security and increased incomes for small-scale farmers
- Greater volume of beans consumed and traded, thereby improving the gross domestic product of the country.

Agro-ecology

In Kenya, beans are grown in a wide range of agro-ecological zones ranging from medium (800 M) to high altitude areas (2000 Masl) of the Central, Rift valley, Coast, Western, Nyanza and Eastern provinces (Wortmann et al., 1998). They are mainly grown by smallholder farmers in the high and medium rainfall areas. However, in semi-arid lands it is grown with additional rainwater harvesting. Beans are marginally grown in agro-ecological zone 5 due to prevailing heat.

Seed systems

Opportunities

- There is a good pool of new improved market-preferred common bean varieties
- There are improved technologies for bean production
- Farmers in some areas have support of several agencies in dissemination of new bean technologies and marketing
- There are seed companies willing to produce and market new improved bean varieties once they are assured of increased demand for them
- There are structures for formal and informal seed production
- Systems are in place for certified seed marketing
- Common bean is preferred and consumed in large quantities in Kenya
- Opportunities exist for improving on existing policy
- There is potential to increase bean production by paying attention to zones with larger holdings
- Marketers' and processors' interest in bean grain indirectly leads to increased seed demand.

Constraints

- Frequent changes in weather patterns in the dry lowlands and frequent drought lower bean production
- Changing rainfall patterns affect bean harvests and lower quality due to rain during harvesting
- Pests and diseases
- Insufficient use of improved technologies by farmers
- Inadequate access to improved market-preferred varieties
- Lack of adequate information for farmers and stockists limit access to improved bean varieties and technologies
- Ineffective use of dissemination pathways by partners to promote bean technologies
- Lack of structured marketing systems for bean grain
- Lack of effective farmer production and marketing groups/associations
- Increase in population leading to land subdivision and reduced land for bean production.

Farmer's seed is not recognized by the seed laws of Kenya. It is also not easy to quantify the amounts being used by farmers.

Integration of gender

The Government of Kenya developed a National Gender and Development Policy in 2000, which forms the framework for guiding different sectors and agencies. The policy guidelines address the following critical areas: (i) the economy; (ii) poverty and sustainable livelihoods; (iii) law; (iv) political participation and decision-making; (v) education and training, (vi) health and population; (vii) the media; and (viii) policy implementation and resource mobilization. They framework needs to be applied in common bean production and marketing.

Table 12: Common bean seed production to meet goals.

Seeding rate (50 kg/ha)						Seed production					
						Breeder seed in 2013		Foundation seed in 2014		Certified seed for use in 2015	Seed to reach 35% adoption (t)
Ecology	Demand (ha)	Productivity (t/ha)	Percentage	Area to be covered (ha)	Certified seed (t)	Area (ha)	Production (t)	Area (ha)	Production in (t)	Area (ha)	Production (t)
Drought-prone regions	210,000	1	KAT B1 (20%)	42,000	2,100	5.25	5.25	105	105	2,100	2,100
		1	KAT B9 (5%)	10,500	525	1.31	1.31	26.25	26.25	525	525
		1.5	KAT x 56 (65%)	136,500	6,825	17.06	17.06	341.25	341.25	6,825	6,825
		1.5	KAT x 69 (2%)	4,200	210	0.53	0.53	10.5	10.5	210	210
		1.3-1.8	KAT RM-1 (3%)	6,300	315	0.79	0.79	15.75	15.75	315	315
Medium altitude regions		2.5	Embean 14 (3%)	6,300	315	0.79	0.79	15.75	15.75	315	315
		2-2.3	Embean 118 (2%)	4,200	210	0.53	0.53	10.5	10.5	210	210
Total				210,000	10,500	26	26	525	525	10,500	10,500

Table 13: Potential quantity of different classes of seed (t) produced by stakeholders.

Stakeholder	Breeder seed (kg)	Foundation seed (kg)	Certified seed (t)	Farmer seed (t)
Kenya Seed Company	1,000	5,000	10,000	
Dryland Seed Company	200	2,000	300	
Frescho Seed Company	50	500	100	
KARI Seed Unit	200	5,000	300	
NGOs/CBOs				25,000
Total	1,450	12,500	10,700	25,000

Common beans in Kenya is a women's crop. It is grown and marketed by women in open-air markets and supermarkets. When the common bean gets more commercialized, it is likely to shift from being a women's crop to a man's crop, thereby affecting the control of resources in its production and marketing. While promoting bean technologies, partners including research institutions (national and universities), government extension service, NGOs and financial institutions need to integrate gender issues in their activities.

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