



# Bulletin of Tropical Legumes

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## About the bulletin

The Bulletin of Tropical Legumes is a quarterly publication of the Tropical Legumes III (TL III) 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 (NARS) of target countries in sub-Saharan Africa and South Asia. TL III aims to improve the livelihoods of smallholder farmers in drought-prone areas of the two regions through enhanced productivity and production of grain legumes.

*This issue will highlight critical lessons and achievements from the Seed Systems Project Component*

## Key successes

- Pluralistic and integrated seed system developed and strong linkages established in the legumes seed systems across TL III countries
- Legumes production and market opportunities increased
- Innovative seed delivery system models developed and successfully implemented
- Enhanced access to quality seed of improved legumes varieties especially by women
- Partners' skills and knowledge enhanced along the value chain of various legumes
- Enhanced awareness on improved legumes varieties through multi-media communication strategies and user friendly tools
- Increased production of certified and quality declared seed of legumes
- Rapid adoption and use of newly released legumes varieties by farmers

## The problem

Grain legumes play a paramount role in human nutrition and market economies in sub-Saharan Africa (SSA) and South Asia (SA). Legume production in these regions is dominated by smallholder farming households with limited access to inputs, including

quality seed of improved legumes varieties. Inadequate seed supply and the use of poor quality seed of older and degenerated varieties have dampened the prospects for increased legume productivity.

## Solution

Tropical Legumes III (TL III) is a collaborative project supported by the Bill & Melinda Gates Foundation, led by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and including the International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA). The project also involves 15 national agricultural research organizations/institutes and about 350 partners including private seed companies, governments, NGOs and farmer organizations. The project introduced a new approach to catalyze sustainable production and supply of quality seed of improved legumes varieties to smallholders in SSA and SA. The project has completed two phases (Phase I: 2007/8-2010; Phase II: 2010/11-2013); covered fifteen countries (India, Bangladesh, Ethiopia, Uganda, Tanzania, Kenya, Malawi, Mozambique, Zimbabwe, Burkina Faso, Ghana, Senegal, Nigeria, Niger and Mali) and six crops (chickpea, groundnut, cowpea, soybean, pigeonpea and common bean).

## Seed systems approach and processes

In each country and for each crop, the project has developed a pluralistic and integrated seed system based on a wide range of seed producers, such as individual seed entrepreneurs, seed companies, government organizations (GOs) and farmer groups (see Figure 1). These seed producers are supported by a range of public-private partners, such as NGOs, farmer organizations and public extension teams, providing complementary services, including skills and knowledge enhancement/ training, variety demand creation, seed quality control and financial and material support depending on the country, region and crop specificities.

Partners develop joint work plans for project research and implementation, and agree on roles and responsibilities. Many of the partners also signed formal Memoranda of Understanding and several incorporate TL III work plans in their own organizational yearly program plans. Seed systems activities under TL III are thus implemented as part of country-led and nationally-owned legume research for development plans and strategies. The engagement of private seed companies, individual

### Project:

Tropical Legumes III (TL III)

This work has been undertaken as part of the



RESEARCH PROGRAM ON Grain Legumes

### Investor:

Bill & Melinda Gates Foundation

### Partners:



seed entrepreneurs, NGOs, grain traders, community based organizations (CBOs), and farmers' organizations greatly enhance the prospects for sustainability of project outcomes. The NARS support and empower the partners, thus, enhancing the effectiveness including that of the private sector.

As a result, legume production and market opportunities have grown drastically, attracting an increasing number of players in establishing strong and durable linkages in the legume innovation system across TL III countries.

## Results

### Seed delivery systems models

The need for synergy informed the engagement of a wide range of partners in seed production and dissemination. During Phase I (2007-2010), nearly 500 seed producers were involved in the seed systems across several legumes. In Phase II, more than 1,700 partners were involved in legumes seed systems activities as seed producers, representing a 72% increase in the number of legume seed producers across all countries. Some of the successful seed system models include: Pigeonpea varieties and hybrids 'one village one variety' in Andhra Pradesh and Odisha, groundnut and pigeonpea seed revolving fund in Malawi; groundnut women's groups in Mali, PDKV model in Namakkal district of Tamil Nadu; common beans farmer cooperative unions in Ethiopia, farmer groups in Uganda and use of small packs by seed companies in Uganda and in Kenya, groundnut farmer field schools in Tanzania, Farmer Research Groups in Malawi and Tanzania and chickpea farmer cooperatives in Ethiopia.

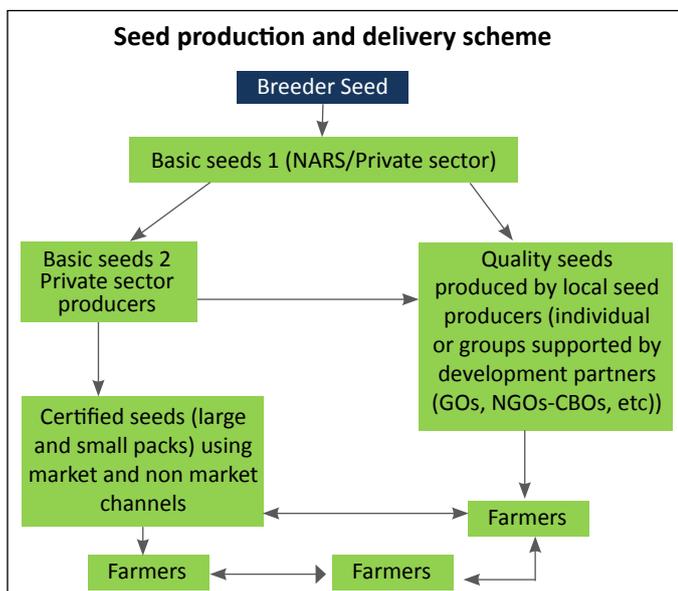


Figure 1. Integrated seed systems approach.

### Box 1. Effectiveness of innovative seed system strategies: evidence from small packs approach

Farmers want access to new varieties, and some are willing to pay for certified seed at affordable prices.

To meet this demand, seed simply has to be marketed in affordable sizes, in places farmers can easily access, and from vendors that farmers trust (or who may be held accountable to buyers). Small seed packs (sizes 0.05, 0.1, 0.25, 0.5, 1, 2, 5, 10 and 25 kg) have been extensively used in seed dissemination across all crops in all the target countries (see Table 1). More than two million farmers were reached with seed through this approach, 72.5% of them women.

The small packs approach is increasingly gaining popularity as the most efficient and cost effective means of reaching more farmers with affordable quantities of seed and a wide range of preferred varieties. In Kenya, Dry-land Seed Company Ltd and Kenya Agricultural Research Institute (KARI Seed Unit) packed and sold 89 tons of seed of drought tolerant bean varieties in 0.1 kg, 0.5 kg, 1 kg and 2 kg packs. In the case of India, a total of 115,232 tons were distributed in different pack sizes ranging from 250 g to 30 kg.

Source: TL II report, 2013

Table 1. Amount of small seed packs distributed, by crop, per country, 2007- 2013.

Country	Number of small seed packs per crop						Total
	Chickpea	Groundnut	Common bean	Soybean	Pigeonpea	Cowpea	
India	16,622	11,460	NT	NT	8,140	NT	36,222
Bangladesh	90	290	NT	NT	NT	NT	380
Ethiopia	424	NT	176,858	NT	NT	NT	177,282
Uganda	NT	NT	-	NT	40	NT	40
Tanzania	45	NT	3,045	NT	4,825	NT	7,915
Kenya	3,568	NT	108,500	35,566	NT	NT	147,634
Mozambique	NT	NT	NT	457,099	NT	9,345	466,444
Nigeria	NT	11,500	NT	308,000	NT	75,885	395,385
Niger	NT	NT	NT	NT	NT	64,399	64,399
Malawi	NT	839,500	NT	NT	500	NT	840,000
Mali	NT	6,740	NT	NT	NT	17,300	24,040
Total	20,749	869,490	288,403	800,665	13505	166,929	2,159,741

NT: Country not targeted

As a result of the concerted efforts invested in developing and implementing the seed delivery models, impressive results were achieved in terms of access to high quality legumes seed of user preferred varieties. In Phase I, 1.8 million farmers received high quality seed of one or more improved legume varieties. In Phase II, collaborative efforts were stepped up enabling more than 11 million beneficiaries to access seed (see Figure 2), more than 5 fold increase in the number of beneficiaries between Phase I and II. A total of 12.8 million farmers were able to access improved seed across the target countries (groundnut 3.5 million, chickpea 3.1 million, common bean 2.8 million, cowpea 1.4 million, pigeonpea 1.1 million and soybean 0.9 million), 61% of them women, putting 5.07 million hectares under improved varieties (Figures 3 and 4) with yield advantage 30–40% higher than previously grown local varieties.

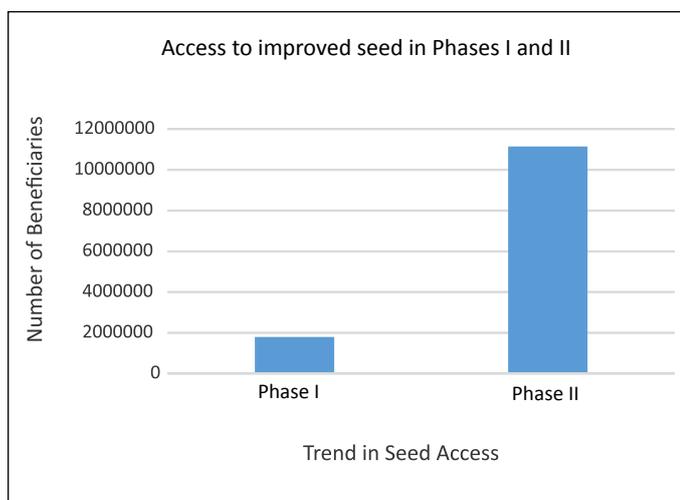


Figure 2. Trend of seed access under the Tropical Legumes III project.

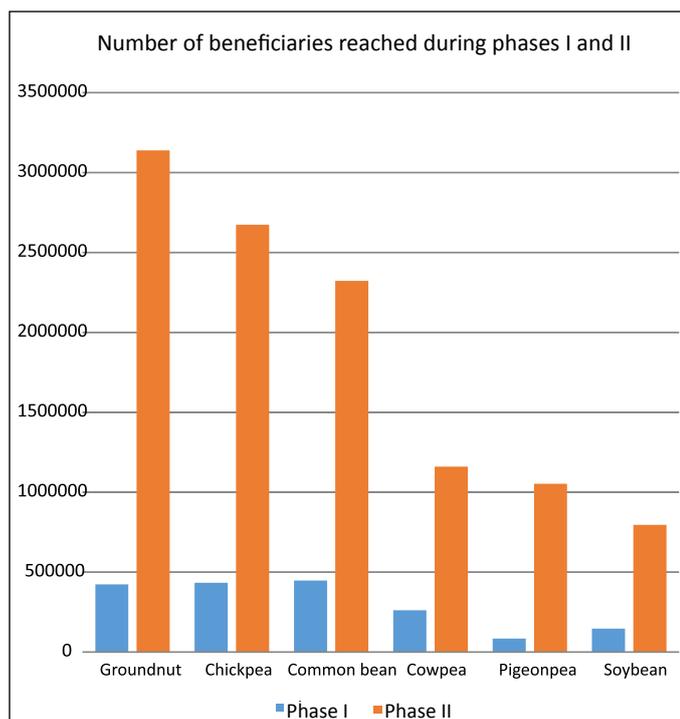


Figure 3. Number of farmers reached with improved varieties by crop during Phases I and II.

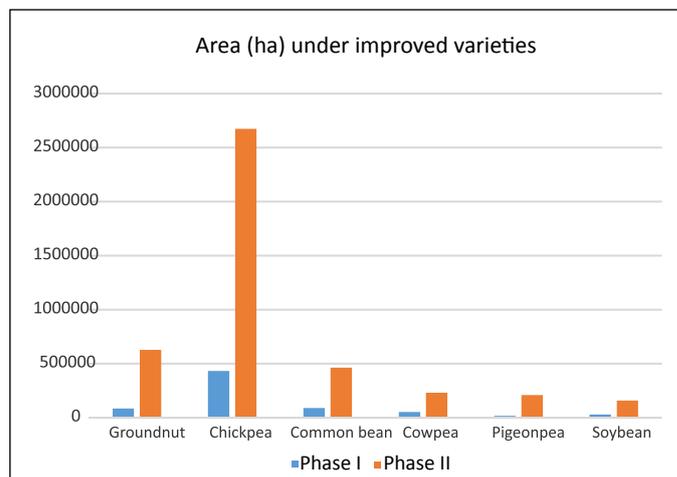


Figure 4. Number of hectares grown to improved legume seed as a result of TL III project during Phases I and II.

### Enhanced capacities

To expand and sustain the outcomes/outputs, the project engaged in building the skills and knowledge of partners/actors along the seed value chain of various grain legumes. More than 130,000 legumes seed system actors were trained between 2007 and 2013 across target countries (pigeonpea: 87,160; chickpea: 47,075; soybean: 26,677; common bean: 23,633; groundnut: 18,384 and cowpea: 8,548). Ninety percent of the trainees were legume seed farmers while public extension staff, private sector extension staff, representatives of NGOs/FBOs and legume traders constituted 10%. Notably, 54% of the individuals trained were females.

### Enhanced awareness on improved legume varieties

Multi-media communication strategies and user friendly tools for variety promotion were adapted/ developed and shared with partners across crops, countries and regions. These included training modules, manuals, leaflets/flyers and information bulletins. During the two phases of the project (2007-2014), a total of 8,000 leaflets with information on groundnut seed production (6,000 in Uganda, 2,000 in Malawi) were distributed. An additional 15,000 flyers describing groundnut were printed in Chichewa and Swahili and distributed to farmers in project sites in Malawi and Tanzania. More than 2,000 bean seed production/business manuals in four languages (Amharic, Oromifa, Swahili and Luganda) were produced and shared with partners in Ethiopia, Kenya, Tanzania and Uganda, respectively. Mass communication is also used to disseminate knowledge about new varieties and their seed source through several radio programs (12 in Ethiopia, 30 in Tanzania, 6 in Malawi, 2 in Mozambique); TV programs (7 in

## **Box 2. Efficiency of integrating formal and informal seed system models: case of Karnataka and Tamil Nadu states of India**

Two alternate seed system models were developed and promoted in partner states of India (Karnataka and Tamil Nadu) during Phase I.

The first is the Panjabrao Deshmukh Krishi Vidyapeeth (PDKV) model, involving farmers in informal seed multiplication. Improved varieties in 2 kg packs are distributed to farmers. The farmers would then multiply the seed over two seasons, producing 20 kg in the first season and 200 kg in the second season, which supplies enough seed to cover a 1 ha field in the third season. In the third season farmers save 2 kg from selected plants and repeat the cycle. This model enables farmers to attain seed self-sufficiency and it has had high adoption rates among farmers in both states, with the majority of them using their own saved seed.

The second seed system model (mixed model), is semi-formal, and has been implemented successfully in Karnataka and Tamil Nadu states of India. In this model, the University supplies basic seed to farmers, who either offered land for certified seed production for the formal seed chain or Truthfully Labeled Seed (TLS), which is produced without certification but monitored by the University, NGOs and farmer associations. Semi-formal seed systems were found to be very successful in meeting local groundnut seed demand. In Tamil Nadu, for example, the transport cost of 100 kg of pods alone is about 700 Indian rupees (INR), which is 20% of the cost of seed. Thus, the alternate seed systems reduced the costs of seed transportation by more than 10%.

Through the semi-formal (mixed) model, which is implemented in five districts of India through the project (Erode and Thiruvannamalai in Tamil Nadu and Bagalkot, Hiriya and Raichur in Karnataka), linkages were established between formal and informal seed sectors through supply of basic quality seed by the University. In Karnataka state, additional linkages are facilitated through certification of seed production plots by the state seed certifying agencies leading to certified seed production. This seed is then procured by the state seed corporations or the State Department of Agriculture for wider dissemination as TLS.

*Source: Tropical Legumes II project (2012). – Four Seasons of Learning and Engaging Smallholder Farmers: Progress of Phase I*

Ethiopia, 15 in Tanzania, 2 in Malawi, 1 in Uganda, 1 in Mozambique). In India, more than 28,000 booklets and pamphlets with information on pigeonpea were distributed to 22,250 farmers and extension personnel.

### **Increased certified and quality declared seed production**

As a result of a strong partnership supported by appropriate capacity building and availability of improved and user preferred varieties, seed production and supply was significantly enhanced. Between 2007 and 2013, slightly more than 530,000 tons of certified seed (CS) and quality declared seed (QDS) were produced as indicated in Table 2.

The total seed produced includes 71,249 tons groundnut in 12 countries (Table 3), 11,384 tons

of cowpea in 5 countries (Table 4), 55,399 tons of common beans in 6 countries (Table 5), 372,893 tons of chickpea in 5 countries (Table 6), 5,686 tons of pigeonpea in 4 countries (Table 7), and 14,146 tons of soybean in 4 countries (Table 8). Overall, India and Ethiopia produced the most seed, followed by Tanzania, Malawi, Uganda and Nigeria. Crop-wise chickpea, groundnut and common bean had the most success driven by better organized seed and crop cooperative organizations stimulated by better output markets for these crops. The truthfully labelled seed class in India, quality declared seed in Tanzania and seed revolving fund in Malawi supported by the Malawi government policy of legume seed subsidy had a significant catalytic contribution to the big success observed in these countries.

### Box 3: Women thriving in men's world as a result of enhanced access to quality seed: Evidence from Central Rift Valley, Ethiopia

In Central Rift Valley of Ethiopia, beans are an important cash crop and are predominantly a man's enterprise. Inadequate and non-gender equitable access to bean seed as well as the use of poor quality seed of older and degenerated varieties have thwarted attempts to increase bean productivity and marketing prospects.

A gender responsive impact driven seed systems approach was designed to accelerate the supply of quality seed of market demanded varieties to both women and men farmers. Access to seeds of improved marketable varieties opened market opportunities for farmers who also enhanced their crop management practices. Between 2008 and 2012, with support from TL III, CRS-Meki Diocese received 13.7 tons of basic seed of two canning bean varieties (Awash 1 and Awash Melka) from the Ethiopian Institute of Agricultural Research (EIAR)–Melkassa and the seed was availed to 186 (102 male and 84 female) seed entrepreneur farmers who produced 133.5 tons of quality declared seed. In addition, TL III and EIAR provided complementary support such as training of trainers on improved bean pre- and post-harvest management practices as well as business management skills.

Through public-private partnerships EIAR and other bean value chain actors in Ethiopia, including seed producers, bean exporters and local traders, development partners like Catholic Relief Services ((CRS)–Meki Catholic Diocese secretariat) were engaged.

Mrs Milko Bati, a 38 year widow of Tuka Kabele (Lungano village), was among the seed entrepreneurs; the mother of six received 150 kg of seed of the variety Awash Melka.

The bean seed enterprise and additional income from production and marketing of beans has radically improved Milko's household – economically, nutritionally and socially. Having been economically empowered through the sale of beans, Milko has constructed a new house for her family – moving from her initial grass-thatched-mud-walled house (see photo 1) to a spacious permanent house (see photo 2) worth Birr 16,500 (US\$921.8). Feeding her family has become more affordable. With the high yields achieved from improved bean varieties, her household income has drastically increased – and most expenses greatly offset by the proceeds from the sale of beans. Apart from meeting her family cash needs, the additional income is invested in other diversified enterprises to support bean production and the family welfare. For instance, she increased her herd from one cow in 2008 to four by 2012 (see photo 3); the family is more nutritionally secure through inclusion of milk in their food basket. The family has also acquired other assets, including three pairs of oxen, three donkeys, four sheep, ten goats, ten chicken – thanks to proceeds from bean sales. Moreover, Milko no longer spends sleepless nights pondering on her six children's school fees – the children earlier had to work on neighbors' fields to earn a living and cash for fees – since the beans, chicken, goats, sheep, and herds of cattle are her "Automated Teller Machine" (ATM). The significant impact on and turn-around in her household livelihood has prompted Milko to increase her bean crop progressively from 5.25 ha in 2008 to 8.25 ha in 2012. Her ambition does not stop there, using the proceeds from bean sales in 2012, she bought a plot to build a commercial building at Meki trading center.

Milko's social status has also risen in the neighborhood, especially among fellow women to whom she sells or donates bean seed as a kind gesture. About 58 female farmers and 5 male farmers have benefited from her generosity.

To thousands of bean farmers in Ethiopia including Milko and her neighbors, white pea beans are white gold.



Milko's old grass thatched house.



New permanent house.



Herd of cattle purchased from bean sales.

Source: Ethiopian Institute of Agricultural Research (EIAR)–Melkassa 2013.

**Table 2. Trend of seed production in tons across countries, by crop (2008-2013).**

Country	Groundnut	Cowpea	Beans	Chickpea	Pigeonpea	Soybean	Total
Ethiopia			27702	158471			186173
Kenya			5657	1461		341	7459
Malawi	18431		3216		1787	122	23556
Mozambique	133	774				4823	5730
Tanzania	25455	2	2268	1412	1488		30625
Uganda	578		15183		39		15800
Zimbabwe			1373				1373
Mali	1380	751					2131
Niger	1420	6146					7566
Nigeria	2562	3712				8860	15134
Burkina Faso	613						613
Ghana	417						417
Senegal	3						3
India	20092			211411	2371		233874
Bangladesh	166			137			303
<b>Total</b>	<b>71250</b>	<b>11385</b>	<b>55399</b>	<b>372892</b>	<b>5686</b>	<b>14146</b>	<b>530757</b>

**Table 3. Groundnut seed production in tons across project countries 2007–2014.**

Groundnut													
Year	Mali	Niger	Nigeria	Burkina	Ghana	Senegal	Uganda	Tanzania	Malawi	Mozambique	India	Bangladesh	Total
2008	48	12	20	80	10	0	0	35	256	0	619	0	1079
2009	60	27	41	78	12	0	0	150	550	0	1252	0	2170
2010	68	76	89	71	15	1	0	191	2002	0	2710	0	5222
2011	272	153	112	75	12	1	56	3479	3981	4	4238	2	12383
2012	313	368	946	77	13	1	68	6240	4653	20	3614	6	16317
2013	520	540	1062	85	10	1	206	7448	4811	43	4041	88	18856
2014	99	245	293	147	346	0	248	7912	2178	66	3619	70	15222
<b>Total</b>	<b>1380</b>	<b>1420</b>	<b>2562</b>	<b>613</b>	<b>417</b>	<b>3</b>	<b>578</b>	<b>25455</b>	<b>18431</b>	<b>133</b>	<b>20092</b>	<b>166</b>	<b>71249</b>

**Table 4. Cowpea seed production in tons across project countries 2007–2014.**

Cowpea						
Year	Mali	Niger	Nigeria	Tanzania	Mozambique	Total
2008	1	275	305	0	15	596
2009	19	335	446	1	42	842
2010	15	353	241	1	50	661
2011	99	1271	1360	0	121	2851
2012	246	949	673	0	219	2087
2013	221	1197	337	0	254	2009
2014	150	1765	350	0	73	2338
<b>Total</b>	<b>751</b>	<b>6146</b>	<b>3712</b>	<b>2</b>	<b>774</b>	<b>11384</b>

**Table 5. Common bean seed production in tons across project countries 2007–2014.**

Common bean							
Year	Ethiopia	Kenya	Uganda	Tanzania	Malawi	Zimbabwe	Total
2008	267	362	0	0	0	0	629
2009	1685	452	0	0	0	0	2137
2010	5759	429	0	0	0	0	6188
2011	2723	560	1060	527	858	350	6078
2012	5032	690	3539	660	598	353	10872
2013	5318	1574	4197	712	753	459	13013
2014	6918	1590	6388	370	1006	211	16483
<b>Total</b>	<b>27702</b>	<b>5657</b>	<b>15183</b>	<b>2268</b>	<b>3216</b>	<b>1373</b>	<b>55399</b>

**Table 6. Chickpea seed production in tons across project countries 2007–2014.**

Chickpea						
Year	Ethiopia	Kenya	Tanzania	India	Bangladesh	Total
2008	457	0	0	13413	0	13870
2009	1031	0	0	17857	0	18888
2010	1865	0	0	17429	0	19294
2011	34678	87	131	22794	0	57690
2012	38969	123	244	3234	65	42635
2013	47546	256	252	136685	72	184811
2014	33924	995	785	0	0	35704
Total	158471	1461	1412	211411	137	372893

**Table 7. Pigeonpea seed production in tons across project countries 2007–2014.**

Pigeonpea					
Year	Uganda	Tanzania	Malawi	India	Total
2008	0	41	23	0	63
2009	0	76	67	7	150
2010	0	89	53	69	211
2011	1	212	220	162	594
2012	0	362	800	1014	2177
2013	0	587	509	1120	2217
2014	38	122	115	0	275
Total	39	1488	1787	2371	5686

**Table 8. Soybean seed production in tons across project countries 2007–2014.**

Soybean					
Year	Nigeria	Kenya	Malawi	Mozambique	Total
2008	258	10	4	43	315
2009	274	23	60	204	561
2010	717	47	58	515	1337
2011	898	52	0	856	1806
2012	1868	65	0	1100	3032
2013	3847	73	0	657	4577
2014	1000	70	0	1447	2517
Total	8860	341	122	4823	14146

## Rapid adoption and use of newly released varieties

Impressive results have been achieved in the process of release of improved varieties, adoption and retention. During Phases I and II, a total of 170 varieties were released, of which 91 varieties are still being used in production (see Figure 5), representing 53.5% retention. This resulted from rigorous and well-coordinated research for development – with clear focus on end user preference. The process was also enhanced by sound collaboration between the TL III Project, NARS, NGOs, farmers, farmer organizations, seed companies as well as local seed and grain dealers.

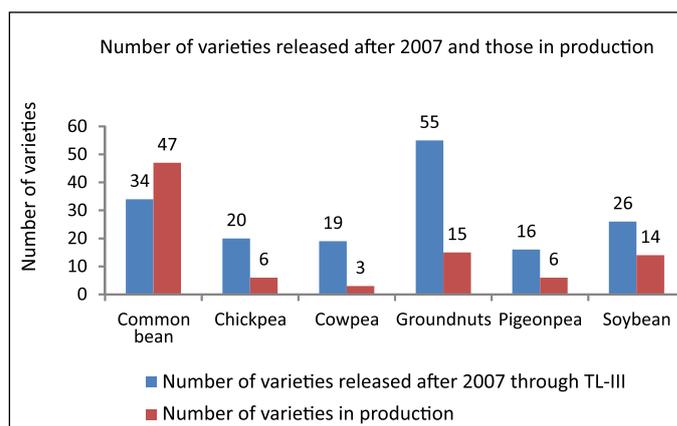


Figure 5. Variety release and seed production.

Contacts: To contribute or participate in Tropical Legumes III:

Emmanuel Monyo, Email: [e.monyo@cgiar.org](mailto:e.monyo@cgiar.org)

Tel +254 207224566 Mobile: +254729176844

Webpage: [www.icrisat.org/tropicallegumesII](http://www.icrisat.org/tropicallegumesII)

For more information on this specific article kindly

contact: [j.c.rubyogo@cgiar.org](mailto:j.c.rubyogo@cgiar.org) or

[e.monyo@cgiar.org](mailto:e.monyo@cgiar.org)