# Enhancing Pigeonpea Productivity and Production in Eastern and Southern Africa

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## Summary

In ESA, Tanzanian and Malawian NARS implemented the pigeonpea research and development activities in close partnership with ICRISAT-Nairobi, farmers, NGOs, CBOs and all other major stakeholders. The project was implemented in Babati (Manyara Region), Karatu (Arusha Region) and Kilosa (Morogoro Region) districts of Tanzania. In Malawi, on-farm research and promotion activities were carried out in 14 districts spanning from Southern (Balaka, Blantyre, Machinga, Mwanza, Zomba), Central (Kasungu, Mchinji, Ntcheu, Ntchisi, Salima), and Northern (Chitipa, Karonga, Mzimba, Rumphi) regions during the Phase 1.

During this phase, a major success was on fast tracking the release of two medium duration pigeonpea varieties (ICEAP 00557 and ICEAP 01514/15) in Malawi. The new releases in Malawi were a landmark because there had been no released medium duration pigeonpea varieties in the past. With this, the number of pigeonpea varieties released in Malawi rose to six (2 short, 2 medium and 2 long duration group). In Tanzania, 2 medium (ICEAP 00554, and ICEAP 00557) and 2 long duration varieties (ICEAP 00053 and ICEAP 00932) are being evaluated under National Performance Trials (NPT) and are in final stages of the release process.

In ESA, there is very limited awareness of improved pigeonpea varieties due to a consistent failure of the public sector to supply good quality source seed. The private sector has shown little interest in seed production and most often seed is produced in high potential areas or areas with infrastructure for storage and processing far away from its area of utilization, leading to high seed costs. To overcome these constraints, investments have been made in breeder and foundation seed production, and proceeds from seed sales used to re-capitalize seed revolving funds to support subsequent seed production cycles. Foundation seed has been marketed to private companies and NGOs for further seed production and dissemination. During 2007-10, a total of 21.18 MT Breeder, and 440.2 MT Foundation and Certified seed of ICEAP 00040 (Mali in Tanzania, Kachangu in Malawi), ICEAP 00068 (Tumia), ICPL 87091(Komboa), and ICP 9145 was produced at research stations and farmer fields. In addition to this in Tanzania, 21.0 MT and 1.7 MT of seed distributed to farmers and farmers' groups, respectively, to feed into the informal seed systems.

A total of 146 Farmers' Participatory Varietal Selection (PVS) trials that included 8-9 pre-released/released varieties along with a farmer's variety as a check were conducted in Tanzania (60) and Malawi (86). A total of 3644 farmers took part in the PVS trials from Tanzania (1989) and Malawi (1655). In addition, 541 field demonstrations were organized in Tanzania (455) and Malawi (86) to quickly disseminate promising varieties and production technologies. During the PVS farmers came up with a number of preferred traits, which facilitated in short-listing of varieties for fast track varietal release. In total, 29 field days were conducted in target locations of Tanzania (6) and Malawi (23) with the participation of 2909 farmers in the two countries. During the field days farmers were asked to select preferred varieties along with preference criteria.

Training programs on pigeonpea seed production, seed storage, and utilization technologies and value chain were organized to improve the knowledge base of 6200 farmers(3700-Tanzania, 1300-Malawi), 72 extension personnel (50- Malawi, 22-Tanzania) and eight farmer groups. Information bulletin was published on improved pigeonpea technologies and seed production in Malawi (both in English and

Chichewa) and Tanzania (Swahili). One participant each from Malawi and Tanzania made a visit to ICRISAT-Patancheru and familiarized with pigeonpea breeding, seed production, crop management, including hybrid pigeonpea. Under degree training, Ms. Mayomba Maryanna Maryange from Tanzania is working on pigeonpea improvement for her PhD.

## Introduction

In ESA, pigeonpea is widely grown in Tanzania, Malawi, Kenya, Uganda and Mozambique, and to a little extent in Burundi under maize-mixed (66% area) and root-crop-sorghum/millet mixed (29%). Area and production during the last decade increased by 45.3% and 50.3%, respectively; however, productivity gains are just 3.2% only (Table 10-1).

In Tanzania, the area and production are increased almost 150% over the period of decade. The productivity changes are very minimal and erratic at a national level, however the average productivity reached almost 1 MT per ha in Northern Tanzania, wherein adoption of high yielding varieties are at higher level. In Tanzania, over 50% of the farmers in Babati district adopted new varieties (ICEAP 00040 – Mali and ICEAP 00053) and production area expanded beyond the traditional Babati district to reach the neighboring districts of Karatu, Kondoa and Mbulu. There is expansion now to new districts of Arumeru, Hai and Rombo in northern Tanzania.

In Malawi, area, production and productivity increased at the rate of 29.1%, 88% and 46%, respectively, during the last decade. The release of a new set of medium duration varieties in Malawi (ICEAP 00557 and ICEAP 01514/15) that are suitable to grow in Southern, Central and Northern regions of Malawi opened up avenues for area expansion.

Table 10-1: Area, production and productivity trends

| Year | Area (000 Ha) | Production (000 MT) | Productivity (Kg per Ha) |
|---|---|---|---|
| ESA [1] | | | |
| 2001-03 | 515.9 | 356.6 | 692 |
| 2004-06 | 733.0 | 448.4 | 611 |
| 2007 | 768.9 | 541.9 | 705 |
| 2008 | 809.5 | 522.2 | 645 |
| 2009 | 750.9 | 535.9 | 714 |
| Tanzania[2] | | | |
| 2001-03 | 65.9 | 49.4 | 750 |
| 2004-06 | 155.6 | 112.2 | 719 |
| 2007 | 164.2 | 123.2 | 750 |
| 2008 | 165.0 | 132.0 | 800 |
| 2009 | 168.0 | 126.0 | 750 |
| Malawi[1] | | | |
| 2001-03 | 141.0 | 109.4 | 776 |
| 2004-06 | 148.2 | 96.0 | 651 |
| 2007 | 161.5 | 159.4 | 987 |
| 2008 | 167.8 | 149.9 | 893 |
| 2009 | 182.0 | 206.0 | 1132 |

*[1]= data source FAO and [2]= FAO data supplemented with data from Statistics Unit-Ministry of Agriculture, Food Security and Cooperatives*

## Locations and partners

During the phase project activities were implemented in Tanzania and Malawi. A detailed account of same is presented in Tables 10-2a and 10-2b. Phase 2 also involves Uganda with major focus on Kitgum and Lira districts of Northern zone.

Table 10-2a: Target locations and partners in Tanzania

| Country | NARS Partner | Zone | Region | District | Scientists |
|---|---|---|---|---|---|
| Tanzania | SARI- Arusha; IARI- Kilosa | Northern | Manyara | Babati | Stephen Lyimo, Joseph Mligo, Rose Ubwe, Frank Mbando |
| | | | Arusha | Karatu | |
| | | Eastern | Morogoro | Kilosa | |

Table 10-2b: Target locations and partners in Malawi

| Country | NARS Partner | Region | District | Extension Planning Area(EPA) | Scientists |
|---|---|---|---|---|---|
| Malawi | DARS- Lilongwe | Southern | Mwanza | Mwanza, Thambani | Kananji GAD, Nyirenda E, Maideni F W |
| | | | Balaka | Mpilisi, Rivi-Rivi | |
| | | | Blantyre | Lunzu, Chileka | |
| | | | Zomba | Dzaone | |
| | | | Machinga | Nyambi | |
| | | Central | Mchinji | Chiosya, Mikundi | |
| | | | Kasungu | Kaluluma, Chulu | |
| | | | Ntchisi | Chikwatula | |
| | | | Salima | Chipopka, Chinguluwe | |
| | | | Ntcheu | Manjawira | |
| | | Northern | Mzimba | Manyamula, Euthini, Mpherembe, Bwengu | |
| | | | Karonga | Lupembe, Mpata | |
| | | | Rumphi | Bolero | |
| | | | Chitipa | Lufita | |

# Socio-Economics/Targeting

Baseline data collected during Phase 1 in Malawi and Tanzania provided very valuable information on several aspects of pigeonpea value-chain on production, seed systems and marketing. Summarized accounts of are presented below.

## Pigeonpea producing areas and production systems

The bulk of pigeonpea production is concentrated in the southern region of Malawi. The Blantyre and Machinga ADDs accounted for about 90% of the total pigeonpea area. Pigeonpea is widely grown as an intercrop with maize in southern Malawi, but it is mainly grown as a boundary marker in northern Malawi. In Tanzania, the major pigeonpea growing areas are Lindi and Mtwara regions in the southern zone; Kilimanjaro, Arusha, and Manyara regions in the northern zone; and Shinyanga Region in the Lake Zone. It is also grown along the coast, Dar es Salaam, Tanga and in Morogoro regions in the Eastern Zone, where it is used mainly as vegetable.

## Cropping patterns

In Malawi, over 90% of the households planted maize in the 2006/2007. Groundnut is the second most frequently cultivated crop (55%), while pigeonpea comes third and it is cultivated by 40% of the households in the sample. When it comes to the share of crop area, that 54% of the cultivated land is allocated to maize, while groundnuts and pigeonpea are allocated 17% and 15% of the total cultivated land, respectively. The average area cultivated for pigeonpea is 0.3 ha.

In Tanzania, pigeonpea is the third most important legume, after common bean and groundnut. Pigeonpea is grown by 88% of the farmers in the target areas and the average planted area is about1.36 ha, mainly through intercropping with maize.

### Available technologies

Although improved pigeonpea varieties were released as early as 1987, their dissemination and adoption by smallholder farmers remain low. Simtowe et al. (2009) reported that only 10% of the sampled farmers grew improved pigeonpea varieties in 2007, although 40% of them could potentially adopt improved varieties of pigeonpea if they were exposed to the varieties and had access to seed. The main constraint to the adoption of improved pigeonpea varieties has been the lack of access by farmers to sufficient quantity of good quality seed. The analysis on technology awareness indicated that about 74% of the households are aware of at least one pigeonpea variety. The awareness rate for improved pigeonpea varieties (ICP 9145 [released in 1987] and ICEAP 00040) is much lower. Of the two improved varieties, ICEAP 00040 is the most widely known by 20% of the farmers while ICP 9145 is only known by 8% of the farmers. Aside from the lack of awareness for some of the legume varieties, seed is a major constraint to adoption. Among pigeonpea varieties, Mthawajuni and ICEAP 00040 are the preferred varieties with overall rankings of 4.3 and 4.1, respectively (on a 1 to 5 scale: 1= poor and 5= excellent). The findings further indicate that most highly preferred varieties are liked for the three key traits they exhibit: high yield, early maturity and short cooking time. Interestingly, Mthawajuni, considered as a local variety, is preferred for its high yield, as well as early maturity, and shorter cooking time.

Three varieties were released in Tanzania, namely Mali (ICEAP 00040, long duration), Tumia (ICEAP 00068) and Komboa (ICPL 87091) in long, medium and short duration groups, respectively.

## Productivity

In Malawi, the average grain yield of pigeonpea for the period 2001-2006 was about 700 kg per ha. This is about half of the potential yield on station of about 1300 kg per ha for improved varieties. The observed yield gap suggests that there is scope for increasing pigeonpea productivity once farmers adopt improved varieties and if they follow recommended management practices. The low adoption of available new varieties is mainly attributed to the underdeveloped and inadequate seed systems, shortage of quality seed and lack of timely delivery, lack of awareness, and insufficient access to credit to farmers, among others. The improved varieties yielded about 1297 kg per ha in Tanzania while locals averaged around 1097 kg per ha. The net income (to land and family labor) was MK 9340 per ha in Malawi and Tsh 388,129 per ha in Tanzania. The net income from improved varieties was about 15-18% higher than local varieties.

## Utilization

Available estimates indicate that 65% of the pigeonpea produced is consumed on-farm, 25% is exported, while 10% is traded on the domestic markets. However, the consumption rate of 35% reported for Tanzania attributes the low on-farm consumption rates in Tanzania to the high integration of producers in the market channels.

## Marketing systems

The actors in Malawi's pigeonpea market include small- and large-scale producers, intermediate buyers, farmers' associations, processors and consumers. The most prevalent grain legume marketing system involves individual farmers selling small quantities to intermediate buyers. Other prevalent marketing systems involve (i) individual farmers selling pigeonpea to local markets, (ii) farmers organizing themselves into groups which pool together their products, identify buyers (often a company) and sell at negotiated prices, and (iii) farmers selling their grain legumes to NGOs. There are several categories of buyers which include intermediate buyers, processing and packaging companies, and other consumers of grain legumes. For example, Muli Brothers Ltd, a Malawian local company, is one of the companies involved in the marketing of pigeonpea. Malawi has the largest concentration of processing companies for pigeonpea. About 40% of the pigeonpea exports to India are processed, while 60% is exported in the form of raw pigeonpea grain. There are more than twelve pigeonpea millers in Malawi with a total milling capacity

of 20,000 MT of dhal per annum. The companies processing pigeonpea include Transglobe Produce Exports, Rab Processors and Bharat Trading Company. A processing plant was installed in Blantyre by Export Trading Company Ltd in April 2009.

## Threats and opportunities

Demand for pigeonpea continues to rise; however, there is increasing pressure on African farmers to benefit from these markets due to intense competition for export markets (mainly India) from Myanmar and other emerging producers, as well as the surging demand for other substitutes (e.g. yellow pea produced mainly in Canada and France). The findings suggest the need for faster productivity enhancement, strengthening seed delivery systems to reach farmers who continue to rely on low-yielding and disease-susceptible local varieties, and development of existing value chains and alternative pigeonpea export markets. Lo Monaco further reports that seasonal pigeonpea price variations in India offer a window of hope for African countries to export pigeonpea to India when prices are high. Lo Monaco further reports that pigeonpea prices in India are lowest in March-April, and begin to rise from July. The prices are reported to be at the peak around November-December. In Malawi pigeonpea is harvested between July and August which coincides with a period of high prices in India. Malawi could, therefore, take advantage of this window to improve its pigeonpea competitiveness. The same is the case with Tanzania; harvest season of long duration varieties in northern Tanzania coincides with lean pigeonpea availability in India.

# Fast-Tracking, Development, and Release of Varieties

## Variety development

Varietal development and evaluation in the two target counties centered on target ecologies and farmer- and market-preferred grain traits. Keeping the existing biotic and/or abiotic constraints that affect productivity in the smallholder farming systems in the region, three preliminary test sites Kabete (high altitude cool environment), Kampi Ya Mawe (purely rain fed) and Kiboko (hot spot for *Fusarium* wilt) are integral parts of pigeonpea breeding program at ICRISAT in Kenya. ICRISAT-Nairobi with large collection of regional germplasm and on-going breeding program on three maturity groups (short, medium and long) evaluated 325 new genotypes(short-72, medium-71, long-182) at the three test locations mentioned above. Simultaneously, best lines in each maturity group based on agro-ecologies in target countries supplied and evaluated. In Tanzania, Selian and Ilonga, respectively representing Northern Zone (more emphasis on long duration) and Eastern Zone (more emphasis on medium duration) evaluated 45 medium and 85 long duration genotypes. Ilonga center also evaluated 36 short duration genotypes. Similarly, in Malawi, 45 medium and 69 long duration genotypes were evaluated at central (more focus on medium) and southern regions.

Through multi-locational and multi-year evaluations, ICEAP 00673, ICEAP 01170, ICEAP 01179, ICEAP 01499/7, ICEAP 01169, ICEAP 01147, and 00671/2, possessing drought tolerance coupled with high yield were carried out under medium maturity group. In long duration-late group that are suitable for Northern Tanzania, ICEAP 01423 and ICEAP 01202 outperformed other varieties/lines. Under the long duration- normal group, ICEAP 01484, ICEAP 01511, ICEAP 01528, ICEAP 01489 and ICEAP 01485 were superior; these are suitable to Southern Malawi and mid altitude areas.

*Fusarium* wilt is one of the major diseases, constraining pigeonpea productivity in ESA. The virulence pattern existing in ESA is entirely different from that of Asia. Further, it is believed that landraces in ESA co-evolved with virulent wilt races of ESA. Hence, the landraces collected from Tanzania, Mozambique, Kenya and Malawi were evaluated in wilt sick plots at Kiboko over the years. Wilt progression data indicated that Acc 128, 125, 130, 74 and 135 (Tanzania), Acc 72 (Mozambique) and Mthwajuni (Malawi) showed less wilt incidence and high yield; accordingly, they are more potential donors in wilt resistance breeding. Multilocational evaluation of seven genotypes at Makoka, Chitala, Bvumbwe

and Chitedze in Malawi showed that ICEAP 00926 and ICEAP 00576-1 as high yielding-cum wilt resistant. Superior long and medium duration genotypes in yield evaluation trials were also screened for *Fusarium* wilt tolerance under wilt sick plot in Kenya and found that ICEAP 01203, ICEAP 01197, ICEAP 01179, ICEAP 01160 as wilt resistant genotypes and they were descendents of ICPL 87091 x 1CEAP 00020 / ICEAP 00040. Screening of one long and one medium duration trials in Tanzania and Malawi at endemic areas of wilt indicated that ICEAP 01392, ICEAP 00933, ICEAP 00040, ICEAP 00926 and ICEAP 01499/7 as wilt resistant.

## Varietal release

In ESA target countries, a total of 9 varieties have been released during the project period as per the details below (Table 10-3).

Table 10-3: List of pigeonpea varieties released in ESA

| Variety | Popular Name | Release year | Country | Average on-farm yield (kg per ha) | Yield advantage over check (%) |
|---|---|---|---|---|---|
| ICEAP 00850 | - | 2009 | Kenya | 1457 | 12 |
| ICEAP 00936 | - | 2009 | Kenya | 1380 | 10 |
| ICEAP 00557 | Mwaiwathu Alimi | 2009 | Malawi | 1192 | 28 |
| ICEAP 01514/15 | - | 2011 | Malawi | 1430 | 59 |
| ICEAP 00040 | - | 2011 | Mozambique | 1680 | 34 |
| ICEAP 00020 | - | 2011 | Mozambique | 1630 | 30 |
| ICEAP 00554 | - | 2011 | Mozambique | 1870 | 50 |
| ICEAP 00557 | - | 2011 | Mozambique | 1960 | 56 |

## Identification of farmer- and market-preferred varieties

A total of 146 Farmers' Participatory Varietal Selection (PVS) trials that included 8-9 pre-released/ released varieties along with a farmer's variety as a check were conducted in Tanzania (60) and Malawi (86). A total of 3644 farmers took part in the PVS trials from Tanzania (1989) and Malawi (1655). In addition, 541 field demonstrations were organized in Tanzania (455) and Malawi (86) to quickly disseminate promising varieties and production technologies (Table 10-4).

During the PVS, farmers looked for early maturity, high yield potential, large cream-coloured seed, resistance to *Fusarium* wilt, terminal drought tolerance, and vegetable types with green pods for local niche markets. It should be also noted that men were more interested in market traits as grain whereas women showed preference for consumption as green pods. The list of varieties preferred by farmers (Table 10-5) paved the way for fast-tracking in release and notification (ICEAP 00557 and ICEAP01514/15 in Malawi). Till date farmers knew only long and short duration varieties released so far; after learning about medium duration varieties through PVS, farmers in all the pigeonpea growing areas such as Southern (due to unreliable *chiperoni* rains), Central (early maturing varieties to meet livestock grazing demand after harvest of maize) and Northern regions (due to short growing season) they came to know about and use medium duration varieties. Similar preferences for medium duration varieties were also noticed in a few pockets of Northern Zone, which experiences early cessation of rains.

Table 10-4: Pre-release or released varieties used in PVS trials (2008-10 crop seasons)

| Country | Variety name | | |
|---|---|---|---|
| | Medium duration | Long duration | Check |
| Tanzania | ICEAP 00554, ICEAP 00557 | ICEAP 00040, ICEAP 00053, ICEAP 00576-1, ICEAP 00932, ICEAP 00933, ICEAP 00936 | Local variety |
| Malawi | ICEAP 01514/15, ICEAP 00557, ICEAP 01480/2, ICEAP 01162/21, ICEAP 01167/11 | ICEAP 00040, ICEAP 00020, ICEAP 00932, ICEAP 00576-1 | Mthwajuni |

Table 10-5: Varieties preferred by farmers

| **Country** | **Variety** | |
|---|---|---|
| | Medium duration | Long duration |
| Tanzania | ICEAP 00554, ICEAP 00557 | ICEAP 00040 (Mali), ICEAP 00053, ICEAP 00932, ICEAP 00936 |
| Malawi | ICEAP 01514/15, ICEAP 00557, ICEAP 01167/11 | ICEAP 00932, ICEAP 00576-1 |

## Seed Production and Delivery Systems

In Eastern and Southern Africa, lack of awareness and limited or no access to quality seed attributed by consistent failure of public sector in supplying good quality breeder/foundation seed in desired quantities, private sector has shown little interest in investing pigeonpea seed production and marketing, most often seed production areas are far away from its area of utilization because of isolation requirements and availability of infrastructure for storage and processing leading to high transaction seed costs. Through this project selective investments have been made to overcome these constraints in breeder and foundation seed production, and seed sale proceeds used to create seed revolving funds especially in Malawi (ICRISAT model) for future use.

Private seed companies and NGOs took the lead in acquiring Foundation Seed for further seed increase and dissemination. Most of the farmers rely on self-saved seed and access to seed of improved varieties either through informal networks. The baseline survey also points out existence of two seed supply systems, namely informal, which are usually non-market based and the quasi-formal, mainly market-based seed supply systems. The informal seed supply sources included own saved seed; gifts from family and friends; farmer-to-farmer seed exchanges and others. The importance of quasi-formal seems to increase with formal release of new farmer- and market-preferred varieties, which helps in augmentation of seed demand and seed markets for superior varieties.

During the past four years (2007-10) a total of 21.18 MT Breeder Seed and 440.2 MT Foundation and Certified seed of farmer-preferred improved pigeonpea varieties was produced at research stations and farmers' fields (Tables 10-6 & 10-7). In Tanzania, farmers and farmer groups were engaged in seed production. Twenty one MT of quality seed of four varieties (12.2 MT Mali, 7.6 MT ICEAP 00053, 0.4 MT ICEAP 00932 and 0.8 MT ICEAP 00554) was distributed to farmers during 2007-09; this covered 2653 ha in farmers' fields in seed production and subsequent seed sharing among the farming community in the project areas. Similarly, 1.7 MT of quality seed of four varieties was distributed to 15 farmers' groups and facilitated the production of 11.0 MT of quality seed (Tables 9 & 10). RECODA (Research, Community and Organizational Development Associates) in Endabash Ward in Karatu District, World Vision through Gorowa ADP (Area Development Program) in Duru and Riroda wards in Babati District and CRS (Catholic Relief Services) through Mbulu Catholic Diocese supported smallholder farmers in North and Central Karatu by buying pigeon pea seed from farmers and other sources and distributing to smallholder farmers.

Table 10-6: Various classes of quality seed produced in ESA (MT)

| Country | No. of varieties | Breeder | Foundation | Certified | Total |
|---|---|---|---|---|---|
| Tanzania | 3 | 10.80 | 54.00 | 205.50 | 270.30 |
| Malawi | 3 | 2.40 | 37.70 | 143.00 | 183.10 |
| ICRISAT-Nairobi | 9 | 7.98 | - | - | - |
| **Total** | **15** | **21.18** | **91.70** | **348.50** | **461.38** |

Table 10-7: Breeder Seed of different varieties produced at ICRISAT-Nairobi (MT)

| Variety | Tolerance & Special Trait(s) | Breeder seed |
|---|---|---|
| ICEAP 00040 | LD[1] and wilt tolerant variety released in Kenya(KARI Mbaazi-2, Tanzania (Mali), Malawi (Kachangu) and Mozambique | 2.14 |
| ICEAP 00557 | MD variety released in Malawi(Mwaiwathu Alimi) and Mozambique; and final stages of release process in Tanzania and Kenya | 1.16 |
| ICEAP 00554 | MD variety released in Mozambique and under NPT in Kenya, Tanzania and Malawi | 0.93 |
| ICPL 87091 | SD variety released in Kenya, Mozambique, Tanzania and Uganda | 0.92 |
| ICEAP 00053 | LD variety under NPT in Tanzania | 0.85 |
| ICEAP 00932 | LD variety released in Kenya and under NPT in Tanzania | 0.64 |
| ICEAP 00936 | LD variety under PVS in Tanzania | 0.6 |
| ICEAP 00020 | LD variety released in Mozambique | 0.38 |
| ICEAP 00850 | MD variety released in Kenya | 0.36 |
| **Total** | | **7.98** |

Table 10-8: Different classes of pigeonpea seed produced (MT) in Tanzania and Malawi (2008-2010 crop seasons)

| Variety | Breeder | Foundation | Certified |
|---|---|---|---|
| **Tanzania** | | | |
| Mali(ICEAP 00040) | 3.5 | 54.0 | 178.5 |
| Tumia (ICEAP 00068) | 2.8 | | 11.5 |
| Komboa (ICPL 87091) | 4.5 | | 15.5 |
| **Malawi** | | | |
| Sauma (ICP 9145) | 1.2 | - | 108.0 |
| Kachangu (ICEAP 00040) | 1.2 | 63.0 | |
| Mwaiwathu Alimi (ICEAP 00557) | 9.7 | | - |

Table 10-9: Amounts (MT) Foundation Seed of four pigeonpea varieties distributed to farmers in Tanzania

| Year | Variety | | | | Total | Area covered (ha) |
|---|---|---|---|---|---|---|
| | Mali | ICEAP 00053 | ICEAP 00932 | ICEAP 00554 | | |
| 2008 | 5.0 | 3.6 | - | - | 8.6 | 995 |
| 2009 | 3.0 | 2.0 | - | - | 5.0 | 667 |
| 2010 | 4.2 | 2.0 | 0.4 | 0.8 | 7.4 | 991 |
| **Total** | **12.2** | **7.6** | **0.4** | **0.8** | **21.0** | **2,653** |

Table 10-10: Seed distributed to farmers' groups for seed production in Tanzania (MT)

| Year | Variety | | | | Total seed distributed | Seed Produced | No. farmer groups participated |
|---|---|---|---|---|---|---|---|
| | Mali | ICEAP 00053 | ICEAP 00932 | ICEAP 00554 | | | |
| 2008 | 0.7 | 0.3 | - | - | 1.0 | 3.0 | 7 |
| 2009 | 0.38 | 0.28 | 0.02 | 0.02 | 0.7 | 5.0 | 8 |
| **Total** | **1.08** | **0.58** | **0.02** | **0.02** | **1.7** | **11.0** | **15** |

[1] LD, MD and SD refer to long-, medium- and short-duration, respectively

# Seed Production and Delivery Strategies

Various seed production and delivery strategies have been tried for various seed classes. The most effective ones are summarized in Table 10-11.

Table 10-11: Effective seed systems identified for pigeonpea production in Tanzania and Malawi

| Seed class | Malawi | Tanzania |
|---|---|---|
| Breeder Seed | Research centers | Research centres |
| Foundation Seed | Revolving seed scheme, private sector, NGOs | Farmer-Field-Schools, private sector, NGOs |
| Certified Seed | Specialized smallholder farmers | Farm organizations |
| Quality Declared Seed | Farmers, farm organizations | Farmers, farm organizations |

Two major non-governmental organizations have been identified in Tanzania (Dutch Connection and KIMAS) and three in Malawi (PLAN Malawi, CARE Malawi and MVP) which are actively involved in legume seed production and distribution. Two private seed companies in Malawi (Funwe Seeds and Seed Co) and four in Tanzania (ASA, Zenobia, Krishna, Miombo Estate) venture into commercial seed production. Three pro-poor seed delivery seed systems such as seed revolving fund facility, community seed banks, and farmer field schools were tested.

Community-based seed production and marketing systems like quality declared seed (QDS), which is tested in Tanzania for dissemination of truthfully labeled seed of high quality could be one strategy for easing the seed shortage problem, especially for open-pollinated cereals or self-pollinated legumes like pigeonpea. The private sector lacks the incentive to participate in the enhanced delivery of seed of these crops as the size of the market is small and farmers are able to use recycled seed for 3-5 years. Strengthening the on-going farmer based seed production program and revolving seed scheme by improving farmers' skills in seed multiplication can assist in increasing the supply of seed for improved varieties both within communities and to the formal seed system. The revolving seed scheme where target farmers are often organized into groups or cooperatives access a certain amount of seed of improved varieties from a supplier (e.g., NGO or Ministry of Agriculture) and return at least the same amount of seed in-kind, is an important mechanism in the absence of adequate supply of improved seed to reach all farmers. The development of a commercial seed sector should go in parallel with the development of a commercial grain market, which is poorly developed in most parts of the countries. In the absence of a commercial grain market, it is unreasonable to expect a commercial seed market to emerge. Agro-processing and other forms of value adding such as packaging would significantly increase the profitability of pigeonpea production.

## Capacity building

### Training of farmers

In Tanzania, training sessions were organized on pigeonpea agronomy with participation of eight farmer groups involved in seed production.

### Field days, farmers' fairs

In Tanzania, four farmers' field days with participation of 1554 farmers and additional 6200 farmers were trained on various pigeonpea technologies including quality seed production and processing and generated greater interest about new varieties among various stakeholders. Twenty five farmer's field days were conducted in Central and Southern Malawi with participation of 1355 farmers also generated greater awareness on quality seed. The field day events in Southern Malawi were covered on Malawi television (TVM), Malawi Broadcasting Cooperation (MBC) Zodiac Broadcasting Station (ZBS) and The Nation newspaper.

## Awareness activities

Farmers' field days, bulletins, news media (both electronic/digital and print) coverage, farmers' assessments, processing and utilization were used to disseminate the technologies. Information bulletin on various aspects of pigeonpea production, insect pest management, post harvest processing and utilization in Kiswahili "*Kilimo Bora Cha Mbaazi*" produced and distributed to farmers and other stakeholders during visits to Institute, farmers' field days, farmers assessments, *nane nane* Agricultural shows in Tanzania. The annual *nane nane* (meaning the eighth day of eighth month in Swahili) agricultural and livestock products and services show organized by the Tanzania Agricultural Society (TASO) coincides with farmers' day, a national holiday in Tanzania, on 8 August. A manual for pigeonpea production in Malawi was published in English and Chichewa. Flyers describing pigeonpea printed in Chichewa and Swahili and distributed to farmers in project sites (more than 5,000 flyers).

## Training of extension personnel

Seventy two MOA and NGO staff members were trained as master trainers on pigeonpea production technology, seed storage, business skills, and value chain (Table 10-12).

Table 10-12: Details of participation in production technology training

| Country | Training focus | Participants |
|---|---|---|
| Tanzania | Techniques for scaling up and scaling out of improved pigeon peas varieties safe storage, PVS approach and facilitation, basic data collection skills | 22 extension officers from Babati and Karatu Districts trained during planting of PVS and demos |
| | ToT training on Business skills and Value Chain | 14 stakeholders from research, extension, agro-dealers, NGOs, Agricultural Sector Marketing Programs, farmers' organizations |
| | A ToT on legumes seed production and marketing | 15 people including 5 women, representing researchers, research technicians, seed producers, extension specialists, agro-dealers and NGOs |
| Malawi | Pigeonpea on-farm trial conduction, crop management which includes quality seed production. | 50 frontline extension staff which includes 43 men and 7 women |

## Training of scientists

Stephen Lyimo from Selian Agricultural Research Institute (Arusha) and Geoffrey AD Kananji from Chitedze Agricultural Research Station-Lilongwe visited ICRISAT. Stephen Lyimo made a visit during Dec 2009 to collaborating institutions and farmers in India to familiarize with legume management technologies in general and pigeonpea and chickpea in particular including seed production, processing and utilization, and marketing. Similarly, Dr. Geoffrey Kananji visited ICRISAT Headquarters in January 2010 for training in pigeonpea breeding and crop management (Table 10-13).

Table 10-13: Details of training participants from ESA

| Name | Country | Affiliation | Year |
|---|---|---|---|
| Stephen Lyimo | Tanzania | SARI-Arusha | Dec 2009 |
| Kananji GAD | Malawi | CARS-Lilongwe | Jan 2010 |

## Degree students

One PhD student, Maryanna Maryanga Mayomba from Tanzania registered with Sokoine University working on pigeonpea for her PhD.

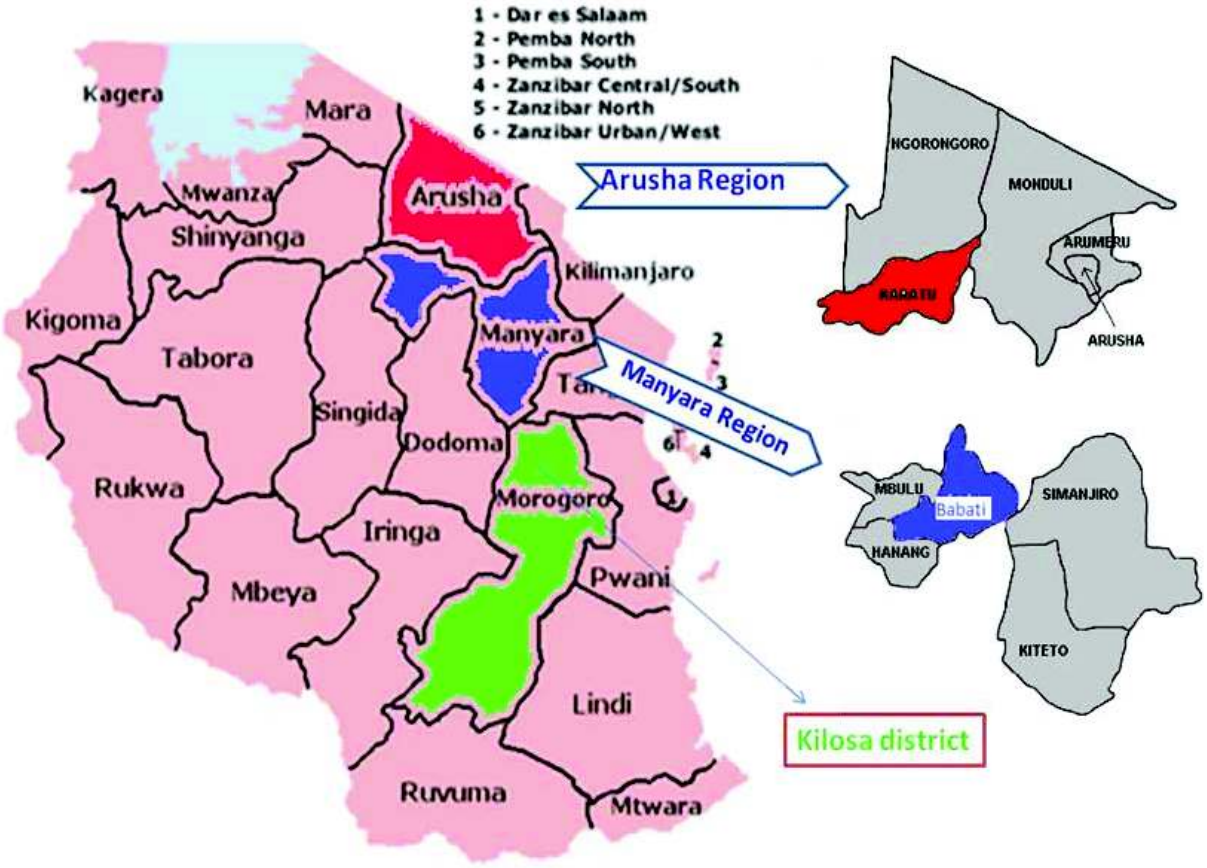
## Lessons learned

- The individual farmers are often reluctant to become seed growers due to lack of capabilities for seed processing and storage and difficulties in marketing. Community Seed Producer Associations may be promoted which will have better access to seed processing and storage facilities and marketing;
- Pigeonpea is a often cross pollinated crop because of insect(honey bees) pollination and finding appropriate isolation distance (500 m) for seed production has proved to be most difficult task. This situation further aggravated by stray and self sown pigeonpea plants, pigeonpea growing in backyards, homesteads, and social factors;
- Seasonal fluctuations in the preference for pigeonpea crop among the farmers and there by inconsistent seed demand over years;
- Farmers' awareness on improved varieties and seed availability of improved varieties are the key factors in spread of improved pigeonpea varieties;
- Conduct of PVS, field days and seed fairs are very effective in awareness creation among farmers about new varieties and generate sustained seed demand;
- Lack of proper cleaning, grading and storage facilities hampers seed production by individual farmers;
- The farmers were very keen to take up seed production provided arrangement was made for assured procurement of seed;
- Sustainable seed production by smallholders stands a better chance of success if complimented by functional seed and product markets;
- Project interventions should focus on pro-poor seed production and delivery systems that have a better chance of surviving beyond the lifespan of the project;
- Need for faster varietal testing and release systems in ESA to enhance the spectrum of varieties available to farmers;
- Business-oriented small holder farmers perform better in seed production, storage, and dissemination than food security-oriented farmers, hence these group of farmers should be involved in seed systems;
- Limited number of research and seed technicians available in ESA also hampers progress of seed dissemination;
- Efficient linkages between formal and informal seed systems are critical success factors;
- Seed production under assured growing conditions to harvest assured seed; and
- Knowledge empowerment of progressive farmers so that they can take up seed production.

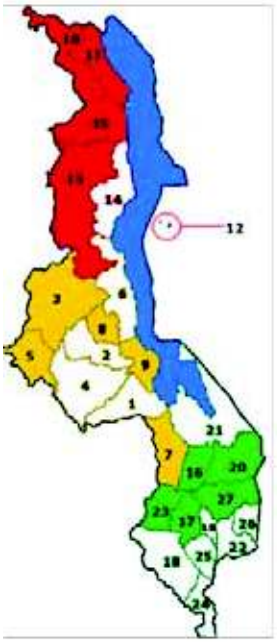
## Vision for second phase

- The activities will be expanded to new districts within the existing zones/regions in Tanzania and Malawi. In Uganda, as a new country in phase 2 project activities will be carried out in Kitgum and Lira districts of Northern Uganda;
- Establishing functional legume value-chains to stimulate seed demand;
- Seed production manuals published, awareness created through PVS, new varietal releases – fosters better seed systems in second phase;
- Strengthening linkages between researchers, seed producers, agro-dealers, private large scale entrepreneurs;

Annex 10-1: Target locations for pigeonpea in Tanzania




Annex 10-2: Target locations for pigeonpea in Malawi



| Region | District number in Map | District Name |
|---|---|---|
| Northern | 10 | Chitipa |
| | 11 | Karonga |
| | 13 | Mzimba |
| | 15 | Rumphi |
| Central | 3 | Kasungu |
| | 5 | Mchinji |
| | 7 | Ntcheu |
| | 8 | Ntchisi |
| | 9 | Salima |
| Southern | 16 | Balaka |
| | 17 | Blantyre |
| | 20 | Machinga |
| | 23 | Mwanza |
| | 27 | Zomba |