

Community Seed Production of Chickpea (*Cicer arietinum* L.) and Lentil (*Lens culinaris* Medic) in Ethiopia

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Abstract

Chickpea (*Cicer arietinum* L.) and lentil (*Lens culinaris* Medic) are the most important grain legumes covering 21.3% of the total acreage (1.6 million ha) and 24.1% of production (23.2 million tons) of all pulse crops in Ethiopia (CSA 2012). They are grown by more than 1.7 million farmers; are major staple food legumes and are a good source of dietary protein (17 %, 23%). These crops require low input for production and can maintain and restore soil fertility (can fix up to 60 kg N /ha/year). Moreover, they are high potential crops for domestic and export markets and considered to be strategic crops for national food security and agricultural development in the country. Two different types of seed supply systems, formal and informal (community seed production) are known in Ethiopia. To date the majority chickpea and lentil producers obtain their seed for planting informally from own saved seed or through local exchange. The informal seed system for chickpea and lentil currently operates at the individual farmer or community level and depends on local knowledge of plant and seed selection, sourcing, retaining and management, as well as local diffusion mechanisms. It is, therefore, important to continually search for solutions to improve the availability of, access to and use of quality seed required by farmers. In this paper, we provide an overview of community seed production and delivery systems of chickpea and lentil operating in the country; review the initiatives and document best approaches to improve the availability of improved quality seeds to farmers in order to maximize productivity of these crops in Ethiopia.

1. Introduction

Chickpea (*Cicer arietinum* L.) and lentil (*Lens culinaris* Medic) are among the most important pulse crops predominantly grown in the crop-livestock based farming systems of the central, north and northwest highlands of Ethiopia where Vertisols are dominant. The total area under chickpea and lentil amounts to 231,000 ha and 110,000 ha and the corresponding production was 400,200 tons and 128,000 tons respectively (CSA, 2011/2012). The crops are known to be an important source of dietary protein for those who cannot produce or cannot afford costly livestock products. Chickpea and lentil contribute a significant portion of the total value of pulse exports (Shiferaw *et al.* 2007).

Despite the importance of chickpea and lentils, the national average seed yield of these crops are very low, 1.73 ton/ha for chickpea and 1.13 ton/ha for lentil (CSA 2011/12). On the other hand, the national chickpea and lentil programs have undertaken considerable research to improve the productivity of the crop in the country. Since 1974, the national crop improvement program has developed and released several varieties of chickpea (24) and lentil (11) with their full production packages. The yield advantage of improved varieties is two to three folds more than farmers' local varieties. Some of these improved varieties were also identified to meet local and export market standards owing to their important quality. However, the productivity of these crops remained very low in farmers' fields, compared to released improved varieties with potential yield of 4 t/ha for chickpea and 2 t/ha for lentil in large-scale production.

One of the major causes of low crop yields is the limited awareness and access of farmers to seeds of new crop varieties. Two different types of chickpea and lentil seed systems, i.e., formal and informal are known in Ethiopia. Key actors in the formal sector include public institutions such as the Ethiopian Institute of Agricultural Research (EIAR), the Ethiopian Seed Enterprise (ESE), Ministry of Agriculture, and the newly emerging private agricultural enterprises whereas farmers and NGOs are key actors in informal sector.

In community seed production, the informal seed system offers many opportunities for improving the seed security of small-scale farmers for it is built on farmers' knowledge and capacities. Hence, in community seed production, the majority of seed demand in Ethiopia is fulfilled by the informal sector, which is estimated to be 80–90% (Bishaw *et al.*, 2008). On the other hand, the informal seed system has gone largely unrecognized, unappreciated and undocumented while the formal seed sector has been unsuccessful in meeting farmers' needs in less favorable and marginal areas where production conditions are often complex and more risk prone. It is important to continually search for solutions to improve the availability, access and quality of the seed farmers need.

This paper, is therefore, aimed at providing an overview of the current community seed multiplication and delivery systems of chickpea and lentil operating in the country and reviewing initiatives in the area and documenting best approaches to improve the availability of improved quality seeds to farmers in order to maximize productivity.

2. Seed delivery systems

The seed multiplication and delivery systems for chickpea and lentil in Ethiopia involve variety development and release, seed production and distribution. The key actors in this process are researchers, farmers' extension workers, traders, etc. Generation and transfer of new technologies are critical prerequisites for agricultural development, particularly for an agrarian-based economy such as Ethiopia. Thus, seeds of improved varieties of chickpea and lentil are an essential input for increasing crop production and productivity. In Ethiopia, two distinctive but interacting seed delivery systems are now recognized for chickpea and lentil: the formal and informal sectors.

3. Performance of formal seed system

The formal seed system of chickpea and lentil is composed of institutional and organizational arrangements consisting of all enterprises and organizations that are involved in the flow of modern varieties from agricultural research to the farming communities. These include several interrelated components such as variety development, release and registration, seed multiplication and processing, seed quality control and certification, and seed marketing and distribution. The formal seed multiplication system was and still is used as a major source of Breeder and Foundation seed of new varieties (technology transfer channel) obtained from the national research system (EIAR, regional research institutions and higher learning institutes). However, when it comes to meeting the commercial seed demand (certified and quality declared seed) this sector supplies less than 10% of the country's potential seed demand per year (CSA 2012). The contribution and efforts made by the Debre Zeit Agricultural Research Center (DZARC) toward the production of Breeder and Pre-Basic seed has been remarkable (Tebkew *et al.*, 2009). Amounts of chickpea Breeder and Basic seeds produced by DZARC are summarized in Table 1. The commercial seed multiplication is mainly done by ESE and other regional seed enterprises such as Oromia Seed Enterprises, Amhara Seed Enterprises etc.

Table 1. Amount of breeder and foundation seed of chickpea produced at DZARC from 2008–2014 (MT)

Year	Arerti	Shasho	Mariye	Habru	Ejere	Natoli	Kutaye	Teji	Chefe	Acos D.	Minjar	Total
2008	1000	285	2	20	10			10				1327
2009	1950	300	3	30	20			20	25			2348
2010	2400	256		100	25			25	30			2836
2011	2434	300	4	200	36	4	10	35	40	13		3076
2012	2500	200		200	30	5	15	31		15		2996
2013	3000	170		149	43	3	13	43	25	20	5	3471
2014	3000	487		300	35	15	10	35		30	15	3927
Totals	16284	1998	9	999	199	27	48	199	120	78	20	19981

Formal systems are externally regulated through the application of rules and regulations governing both the production and distribution of seed, which is largely controlled by Ethiopian and Regional Seed enterprises but is increasingly being undertaken by specialized companies operating along commercial lines (Jones *et al.* 2006). These companies tend to market seed through appointed distribution and retail channels. The ESE produces, processes, distributes, and markets improved seed including chickpea and lentil based on the official demand projection of the regional bureaus of agriculture. The enterprise produces seeds of chickpea and lentil on its own farms and through contracts with public and private farms, cooperative unions, and smallholder farmers and distributes it to the ultimate users. Chickpea and lentil breeder seeds are supplied to ESE from the national agricultural research centers to produce Pre-Basic and Basic on its own farms located in different regions of the country. The Basic seed is distributed to individual farmers and cooperatives for multiplication of certified seed that is sold to the agricultural office and cooperatives for distribution to different regions. The Ethiopian seed system reforms show limitations of focusing on supply or regulation in isolation, and ignoring the social actors in local seed systems. The participation of the private sector in the chickpea and lentil seed business is negligible. As a business institution, the ESE works in more than 90% of the cases with cereals (hybrid maize, wheat, sorghum). Hence, legumes in general and chickpea in particular are served in less than 7% of its seed demand (Fikre *et al.*, 2014). Therefore, the major actors in the seed system of chickpea are the informal seed sector (seed grower associations, unions, individual farmers etc.).

4. Informal community based seed production and delivery system

The informal seed system comprises individual private farmers who select and save their own seed or exchange seed with others through traditional means such as gifts, bartering, labor exchange, cash transactions or social obligations. It may also include a diversity of local level seed production initiatives organized by farmers' groups or NGOs working under no legal norms and certification schemes (Cromwell 1992, Bishaw 2004). In Ethiopia, the informal seed system accounts for 90% of the seed used by smallholder farmers (Bishaw 2008). Community seed production of chickpea and lentil currently operates at the individual farmer or community level and also depends on indigenous knowledge of plant and seed selection, sourcing, retaining and management, as well as local diffusion mechanisms. Informal systems are short, simple and less externally regulated and are particularly important in serving the needs of smallholder farmers who use own-saved seed from the previous harvest and/or seed accessed from friends, relatives and local markets.

The shortage of varieties is a serious technical constraint. Seed of many chickpea and lentil varieties are not produced by the informal seed system. Many improved varieties are not known by the farmers and seed production in the formal seed sector is limited to a very few varieties. Additional constraints relate to low seed extension and popularization and seed promotion by various organizations compared to the vast number of farming communities in the country. Community seed production seeks to augment supply through more decentralized on-farm seed multiplication, but decisions on what to multiply remain largely top-down, and not responsive to demand with the exclusion of small-scale seed merchants who possess great potential to meet seed demand in rural areas (Mcguire 2005).

Cognizant of the forgoing gaps in the formal seed system, efforts have been made in seed multiplication and delivery coupled with pre-scaling up of improved lentil and chickpea technologies. Currently there are six Community Seed Producer associations at Ada, Lume and Gimbichu who are major suppliers of chickpea and lentil seeds in the country. Farmers also realized that producing improved seeds is a very lucrative business. In this regard, the contribution of the pre-scaling activities so far undertaken at research center (DZARC) and the national (EIAR) level to strengthen the informal seed sector to be the major supplier of chickpea and lentil seed in the country has been remarkable (Tebkew *et al.*, 2009).

5. Approaches on strengthening informal community seed production

5.1. Pre-scaling of technologies

The agricultural technology generation and transfer process as a system has many actors (researchers extension workers, traders, etc.) playing key roles in maintaining its holistic nature (Eshete *et al.*, 2006). Each player has their role in strengthening the informal seed sector, which, in turn, improves the agricultural productivity, production and farmers' livelihoods. For example, the DZARC has developed many chickpea and lentil varieties but their adoption in the production domain was low or non-existent (Tebkew *et al.*, 2009).

In order to reverse this situation, the DZARC and EIAR in collaboration with different partners initiated pre-scaling of chickpea and lentil technologies in selected woredas and nationwide, respectively. The partners include Regional Research Extensions Advisory Council (REAC), researchers, farmers, administrative officials, extension workers, local NGOs, and traders. They made successful progress in testing, adapting and promoting different chickpea and lentil technologies suitable for small-scale farming systems. So far efforts and progress made by DZARC at the zonal level and by EAIR at national level are summarized as follows.

5.2. Pre-scaling in target districts by DZARC

A pioneering work on lentil pre-scaling out was started by the DZARC in 2005/06 using the high yielding, rust resistant lentil variety 'Alemaya', with early planting (late July/early August), use of ridge and furrow practices to drain the excess water, and one to two hand weeding. The pre-scaling activities were implemented in major lentil producing areas in Gimbichu and Berehe – Aleltu weredas of East Shewa Zone of Oromiya Region (Eshete *et al.*, 2006).

The activities include identification and evaluation of main stakeholders, organizing formal stakeholder meetings, sharing of experiences and setting common vision and objectives, defining functions and identifying roles, task sharing with clear responsibilities and signing memoranda of understanding with detailed action plans by the center. Moreover, trainings on quality seed production and agronomic practices were also given to the participants.

Some of the outstanding results of chickpea and lentil pre-scaling activities (at the center level) which have considerable contribution towards strengthening the seed multiplication and delivery system of chickpea and lentils to the present level and changing the farmers' livelihoods to the present level in the country are presented in Tables 2 and 3.

The scaling up was very successful because the improved lentil variety Alemaya is now widely grown by farmers and brought great impact in changing the livelihoods of the farmers. Joint work of all stakeholders in the value chain (researchers, managements of the research center and EIAR, woreda administrators of Gimbichu and Berehe- Aleltu technical group of woreda administration); and the high demand for lentil and chickpea in the local market also made a great contribution to

Table 2. Lentil technology pre-scaling by DZAR in East Shewa

Year	Participating farmers	Area covered in hectare	Average yield in t/ha	Total yield obtained in tons
1998/1999	700	350	2	700
1999/2000	700	400	2	800
2000/2001	468	117	2.4	280.8
2001/2002	142	35.5	2.2	78.1
2002/2003	200	50	2.1	105
Total	2210	952.5		1963.9

the successful acceptance of lentil and chickpea scaling up by farmers (Eshete *et al.*, 2006). Indeed, such technology adoption process has become a model by which almost all farmers incorporate technology into their farming systems. Likewise, similar efforts and progress on chickpea crop have been made at the center level, as presented in Table 3.

Table 3. Chickpea technology pre-scaling by DZARC in East Shoa and Gurage zone

Year	Participating farmers	Area covered (ha)	Average yield (t/ha)	Total yield (t/ha)
1998/1999	1200	600	3	1800
1999/2000	2120	800	3.5	2800
2000/2001	1500	700	3.5	2450
2001/2002	734	183.55	3.8	697.5
2002/2003	1733	741	3.6	2667.6
Total	7287	3024.55	-	10415.1

5.3. Pre-scaling at national level by EIAR

EIAR initiated the pre-scaling of chickpea and lentil technologies in four major regional states which include Amhara, Oromia, South and Tigray. Encouraging results have been recorded through the scaling up of two improved chickpea varieties (Arerti and Habru) and one lentil variety (Alemaya) in four pilot intervention regions (Tables 4 and 5). In general, the results of the nationwide pre-scale up activities in chickpea and lentil have further demonstrated the possibility of bringing about significant changes in the productivity of Ethiopian agriculture.

Table 4. Chickpea technology scaling up at national level, 2009/2010 and 2010/2011

Region	2009/2010				2010/2011			
	Seed distribution in tons	Area covered in ha	Participant farmers	Variety	Seed distribution in tons	Area covered in ha	Participant farmers	Variety
Tigray	9.25	71.15	285	Habru & Arerti	17.5	125	500	Shasho & Arerti
Amhara	42.6	328	100	Habru & Arerti	22.5	61	642	Shasho & Arerti
Oromia	19.2	148	592	Habru & Arerti	24.4	174	697	Arerti
SNNP	4.25	32.7	131	Habru & Arerti	8	57	228	Arerti
Total	75.3	579.85	1108		72.4	417	2067	

Source: Kebebew *et al.* 2011

Table 5. Lentil technology scaling up at national level, 2008/09 – 2009/10

Region	Seed distribution in tons	Area covered in ha	Participant farmers	Variety
Tigray	5.6	70	285	Alemaya
Amhara	26.2	237	950	Alemaya
Oromia	7.6	92.75	380	Alemaya
SNNP	7	205	80	Alemaya
Total	46.4	604.75	1695	

Source: Kebebew *et al.* 2011

5.4. Seed Roadmap Approach for Chickpea Seed Availability

One strategy that has helped chickpea seed production to increase significantly is the Seed Road Map approach initiated by the ICRISAT-led Tropical Legumes Project. With all functional key stakeholders in place, the informal seed system dominated chickpea commercial seed production by partners is summarized in Table 6.

Table 6. Commercial Seed (Certified and QDS) of chickpea produced with partners in Ethiopia disaggregated by variety and year (MT)

Year	Arerti	Shasho	Mariye	Habru	Ejere	Natoli	Kutaye	Teji	Chefe	Acos D.	Minjar	Total
2008	4000	600	0	360	5	10	10	5	5	5		7008
2009	6640	996		664								10309
2010	9520	952		560								13042
2011	10400	1560	26	910	26	13	26	26		13		15011
2012	14640	2196	18.3	1281	36.6	18.3	36.6	18.3		18.3		20275.4
2013	16000	2000	12.5	1800	50	25	25	25	25	25	12.5	22013
2014	23200	3480	29	2030	29	29	58	29		58	29	30985
Total	84400	11784	85.8	7605	146.6	95.3	155.6	103.3	30	119.3	41.5	118643.4

5.5. Training of key stakeholders in the seed value chain

Another method through which chickpea seed production has spread out is through capacity building of various seed stakeholders. Farmers in particular have moved forward to form farmer's groups, some of which have even evolved into more formal private seed companies. Table 7 below summarizes some of the trainings conducted since 2006.

Table 7. Number of farmers and other stakeholders trained on chickpea technology and production since 2006

Type of trainee	Number of trained personnel								
	2006	2007	2008	2009	2010	2011	2012	2013	Total
Researchers	8	15	12	17	22	27	33	42	176
Research technicians	22	35	45	55	63	73	45	39	377
Farmers	250	470	603	934	1785	2175	2000	3024	11241
Agricultural experts	35	41	33	63	88	83	121	117	581
Development Agents	120	169	210	336	375	480	354	285	2329
Farmers Cooperative unions	5	10	15	28	20	13	12	13	116
Community Seed producers		2	6	10	12	13	14	12	69
Others	35	63	79	153	263	200	185	215	1193
Total	475	805	1003	1596	2628	3064	2764	3747	16082

6. Some outcomes of community based seed promotion

So far progress made in improving the chickpea and lentil seed multiplication and delivery system showed that using improved technologies has changed farmer's livelihoods. Thus, improving the seed multiplication, delivery system and thereby scaling up/scaling out of improved production technologies will have an impact on the livelihoods of the farmers as well as to other actors in the

value chain. The value chain approach will help to transfer technologies that are needed by the market and help to change farmers' behavior in applying what they have known in one value chain to others.

7. Lessons Learnt

Institutional linkage and intensive communication between all stakeholders are important for technology scaling up to promote easy access of farmers to improved seeds. Although complementarities between the formal and informal, the informal community based seed sector is more essential for adequate quality seed multiplication of improved chickpea and lentil technologies dissemination under Ethiopian conditions.

8. The way forward

The following issues need attention for strengthening the community based seed multiplication and delivery system of chickpea and lentil in the country.

- Organizing more farmers into seed out-growers and linking them with markets and distribution system needs attention.
- Implementing formal seed certification system in the country is essential to maintain the seed legalization for seed out-grower farmers and farmers' groups/associations
- Scale up the success stories to other parts of the country needs great emphasis in the future.

9. References

- Bishaw Z.** 2004. Wheat and Barley Seed Systems in Ethiopia and Syria. PhD thesis Wageningen University. ISBN: 90-8504-035-3
- Bishaw Z, Sahlu Y and Belay S.** 2008. The status of the Ethiopian seed industry. *In* Farmers, seeds and varieties: supporting informal seed supply in Ethiopia (Thijssen MH, Bishaw Z, Beshir A and de Boef WS, eds.). Wageningen, The Netherlands: Wageningen International.
- Bishaw Z, Yonas S and Belay S.** 2008. The status of the Ethiopian seed industry. *In* Farmers, Seeds and Varieties (Marja HT, Zewdie B, Abdurahman B and Walter S, eds.). The Netherlands: Wageningen International.
- CSA. Central Statistical Authority of Ethiopia.** 2011/2012. Annual Agricultural Sample Survey Report. Addis Ababa, Ethiopia.
- Cromwell E, Friis-Hansen E and Turner M.** 1992. The seed sector in developing countries: A framework for performance analysis. London, UK: ODI. 107 pp.
- Eshete A, Aliy S, Solomon A, Seid A, Negussie T and Geletu B.** 2006. Improved Lentil Technologies Improve farmers' Livelihoods in Gimbichu Wereda, East Shewa. Successes with Value Chain (Tsedeke A, ed.). Addis Ababa, Ethiopia: EIAR.
- Fikre A, Eshete M, Ganga-Rao NVPR and Silim S.** 2014. Chickpea Strategy for Ethiopia. *In* Grain Legumes Strategies and Seed Roadmaps for Select Countries in Sub Saharan Africa and South Asia (Monyo ES and Gowda CLL, eds.). International Crops Research Institute for the Semi-Arid Tropics. Tropical Legumes II Project Report. 284 pp.
- Jones R, Audi P, Shiferaw B and Gwata E.** 2006. Production and Marketing of Kabuli Chickpea Seeds in Ethiopia: Experiences from Ada District. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Report for Project on Improving Productivity and Market Success (IPMS) of Ethiopian Farmers.
- Kebebew A, Fikre A, Alemu D and Adefris T/Wold,** eds. 2011. Proceedings of crop technology scaling up. Addis Ababa, Ethiopia: EIAR.
- McGuire S.** 2005. Getting Genes: Rethinking seed system analysis and reform for sorghum in Ethiopia. PhD thesis, Wageningen University.

Shiferaw, B, Jones R, Silim S, Tekelewold H and Gwata E. 2007. Analysis of production costs, market opportunities and competitiveness of *desi* and *kabuli* chickpea in Ethiopia. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Report for Project on Improving Productivity and Market Success (IPMS) of Ethiopian Farmers

Shiferaw B and Hailemariam T. 2007. Structure and functioning of chickpea markets in Ethiopia: Evidence based on analysis of value chains linking smallholders and markets. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Working Paper 6 for Project on Improving Productivity and Market Success (IPMS) of Ethiopian Farmers. 55 pp.

Tebkew Damite, Asnake Fikre, Kebebew Assefa and Lijalem Korbu, eds. 2009. Improved chickpea (*Cicer arietinum* L.) technologies and seed production in Ethiopian Institute of Agricultural Research. Debre Zeit, Ethiopia: EIAR.