Cowpea

Production, Marketing and Utilization in Ethiopia

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Research Report 121

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Ethiopian Institute of Agricultural Research

Cowpea

Production, Marketing and Utilization in Ethiopia

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Forward

The Ethiopian Institute of Agricultural Research (EIAR) is undertaking a large number of research activities across the country's vast agro-ecologies in agriculture and related areas. The institute is mandated to generate technologies that address the needs of beneficiaries and agricultural development needs. Research results are of minimum benefit unless used for teaching and development goals. Research results for development need to be shared in usable forms among which research report is a well-established tradition among research and academic societies to that we are obliged to uphold it. Likewise, the development in modern communication platforms such as internet and information communication technologies (ICT) are pluses to disseminate research results quickly and efficiently highly contributing to multiply our efforts.

Research report is at the heart of research communication and popularization of varieties research results including laboratory works, on station or on field study by undergoing a rigorous peer review procedure. The document is of a high value for researchers in the EIAR and that is why our researchers' promotion policy attaches three quarters points of a journal article to it.

I would like to encourage all researchers to produce documents from their projects of all sorts of funds for the benefit of research and development ends. I strongly advise EIAR researchers to withstand the temptation of producing low quality journals for so hasty and easy 'publishing' at the expense of high quality and utility publications produced under peer-reviewed documents of this type. I must take this chance to acknowledge and appreciate the team of multidisciplinary who produced this report under the name *Cowpea production, marketing and utilization in Ethiopia.* Cowpea is an important crop in marginal areas which are susceptible to the ongoing climate change to which cowpea may contribute to mitigate the problems among the poor women and men farm households as the crop is among climate smart ones.

Mandefro Nigussie, PhD
EIAR General Director

Preface

Ethiopia is the origin of a number of food crops. Some of them are performing well under the ongoing climate change. Cowpea is one of a few crops in this aspect. Historically cowpea has secondary origin in Ethiopia. In this paper, we report on this dryland leguminous crop production-cum-utilization, which received a meager research and development attention in the country. Data employed in this paper came from large cowpea growing households across the crop growing areas in Ethiopia. The information included socio-economic aspects and seeds collection from land races and new varieties. The seeds collected were maintained as germplasm resources for the crop improvement. The information included in this paper is deemed useful in the research and development of cowpea—a crop of multiple benefits. The paper touches the production to consumption continuum, the information included can be utilized by people across wide disciplines involved in research and development. Likewise, the paper highlights on cowpea producer households' members participation in terms of gender roles and benefit sharing in cowpea production, storage, marketing, and utilization in the crop values chain understanding.

The authors are grateful to the Ethiopian Institute of Agricultural Research for hosting this work and facilitating the field survey and report writing. Our special thanks go to farmers and local Agricultural Development Agents for their cooperation in the data collection. The authors are indebted to Mr Yohannes Fekadu for his help in software data management and analysis.

We are obligated to The McKnight Foundation for providing financial support for conducting this survey under a project 'Enhancing Cowpea Productivity and Production to Support Nutrition, Food Security and Income of Poor Farmers in Drought-Prone Areas of Ethiopia Research Grant Number 13-349'.

The authors

Introduction

In Ethiopia, cowpea is grown in drier pockets of the Rift Valley, and in the eastern and northeastern part of the country. It is also an important crop in low rainfall areas of southern especially, in Konso, Derashe, Humbo, Hamerbako, Loka Abaya, Ofa, and Loma Districts (Reddy and Kidane 1993). The average yield of cowpea was 400 kg ha^{-1} from growing local landraces and traditional practices (communication with agricultural experts) which is comparable to the world average yield (379 kg ha^{-1})

(Mahalakshmi, et al. 2007). Improved varieties, on the other hand, yield 2200–3200 kg ha^{-1} under rainfed conditions (MoA 2012). Similar to that of West and Central Africa, cowpea is one of a few legumes which play a vital role in the livelihood of smallholder farmers and a source of cheaper protein in the dry areas of Oromia, Amhara, Tigray, Southern Nations, Nationalities and Peoples Region, Somali and Gambella Region. It also provides green or dry fodder feed of high quality straw (Singh et al. 2003).

Cowpea significantly contributes to the sustainability of cropping systems and soil fertility improvement in marginal lands by providing ground cover, fixing nitrogen, and suppressing weeds whereas certain cowpea varieties cause suicidal germination to *Striga hermonthica* (Singh et al. 2003) a parasitic weed of crops such as sorghum and maize. Thus, it is a vital crop in the semi-arid areas of Ethiopia, where other food legumes do not perform well.

Even though Ethiopia is a secondary center of diversity for cowpea, little is known about its production, productivity, utilization and distribution of grown landraces/varieties. Previous studies in cowpea those with cowpea producing countries in Africa and elsewhere without making any mentions about Ethiopia (Mahalakshmi et al. 2007). That is because of scantly information available on cowpea production in Ethiopia. Similarly, lowland Pulse Research Program of the Ethiopian Institute of Agricultural Research (EIAR), which in charge of with cowpea research in the country, depends on the imported germplasm. Comprehensive information about cowpea production, marketing and consumption in Ethiopia was scanty and this work based on a unique countrywide study of large number of cowpeas growing farm families.

Considering the potential of cowpea in terms of drought tolerance, compatibility for intercropping, supply of low cost and quality protein, high potential for income generation for farmers, information regarding production, marketing and consumption of the crop is indispensable. At the same time, information about cropping systems, cultural practices, constraints of production, utilization and benefits are vital in reformulating breeding and production objectives and making sound decisions for the improvement of cowpea research and development.

Materials and Methods

Data sources and data collection tools

Data for this study were obtained principally from the primary sources using questionnaire interview. The interview was conducted in dry season of 2014 by trained and experienced enumerators under the close supervision of the authors. The survey areas were selected based on local knowledge of experts on production of cowpea since there was no sub-national or national data on cowpea production and area. The sample frame was developed in collaboration with local informants (from respective agricultural development offices and local leaders) in the major cowpea growing regional administrative states in Ethiopia. Five regional states were selected: namely, Amhara, Gambella, Oromia, Southern Nations, and Nationalities and People Region (SNNPR) and Tigray. From those states, nine zones and one special district were selected for the study (Table 1), The average proportion of women was 28 % of the respondents. The percentage of women respondents was as high as 80 % in Gambella, where the crop is considered as women's crop since women are highly involved in the production to food preparation of cowpea.

As a principal survey tool, questionnaires were developed, pre-tested, revised and administered using local languages. The questionnaires covered comprehensive information about the households, including administrative and geographic locations, land holding, socio-demographics, livestock ownership, seed system, production system and crop management, extension and training services, gender roles and production constraints. Cowpea seed samples obtained from the households were described appropriately.

Table 1 Administrative locations and areas of surveyed cowpea farm households

Regional state	Zone	District	District area (ha)†	Number respondents
Amhara	North Wollo	Lasta	112,716	40
	Oromo Special	Bati	113,216	40
	South Wollo	Kalu	85,154	40
Gambella	Agnuwak	Abobo	311,617	43
		Etang special	18,834	42
Oromia	East Hararghe	Babile	59,564	31
		Fedis	72,079	24
		Gursum	59,850	25
	West Hararghe	Mieso	186716	24
SNNPR	-	Derashe Special	69,938	39
		Konso Special	227,379	40
	South Omo	Bena Tsemay	292,276	36
		North Ari	152,062	39
Tigray	Central Tigray	Kola Tenben	136,583	40
		Tanqua Abergele	143,596	40
		Abergele	176,665	40
		Wereilehi	126,756	40
Total			2,345,001	623

Source: Authors' Field Survey in 2014 and †CSA (Central Statistics Authority) (2014).

Data analysis and presentation

The data were collected, coded, entered and analyzed using Statistical Package for Social Sciences (SPSS) software version 20. The results were presented using convenient tables and graphs.

Results and Discussion

Socio-economic characteristics

As shown in Table 2, The average age of cowpea growers was 42 (±12) years and have long experience (average 12 years) in farming. The age dependency ratio was higher (129 %[1]) compared to the national age dependency ratio of 102 (ERSS 2013). The participation of women-headed households in cowpea farming was sufficiently high (28 %) as compared to their participation in other field crops, for example maize (14 %) (Bedru and Nishikawa 2017). The percentage of female-headed households' participation in cowpea production was the highest in Gambella (80 %) followed by that in Oromia. The %ages of female-headed households in the rest of the regions were less than 20 %. The majority (87.6 %) of the household heads were married while a few of them were single, widowed or separated. The average family size was 6.33, which was higher than the country average of 5.1 (ERSS 2013) indicating that cowpea area supporting a large population of Ethiopian smallholder farm households. On average, a cowpea grower household constitutes equal member of male and female at the ratio of 1.01.

Table 2 Demographic characteristics of cowpea grower farm households

Respondent description	Cowpea growers (%)					Total (%)
	Amhara	Gambella	Oromia	SNNPR	Tigray	
Sex and age						
Male	84.5	20.0	66.3	83.8	81.7	71.9
Female	15.5	80.0	33.7	16.2	18.3	28.1
Age (year)	45 (±11)	39 (±12)	36(±11)	41 (±11)	43(±11)	42(±12)
Marital status						
Married	93.8	61.2	100.0	92.2	89.2	89.1
Separated	1.2	9.4	0.0	1.3	6.7	3.2
Single	1.2	5.9	0.0	0.6	1.7	1.6
Widowed	3.8	23.5	0.0	5.8	2.5	6.1
Total	**160**	**85**	**104**	**154**	**120**	**623**

Source: Authors' field survey, 2014

Educational status

Education is a vital factor in production decision and access to new techniques of crop management. Abay et al. (2016) documented that education significantly influences the adoption decision on agricultural technologies, chemical fertilizers and improved seed. The literacy level of a household decision maker, measured by years of formal schooling, was low. A larger proportion of the farmers were illiterates except in Tigray

[1] *Age dependency ratio is the proportion of people under 15 and above 64 years to the people of age15–64 years.*

regional state where a significant proportion can read and write. The percentage of educated cowpea farmers was low in Amhara and Oromia Region the most populous regional states in Ethiopia (Figure 1). Even though there was no established clear relationship between using new technologies for cowpea production and the literacy level of household head, literacy has an obvious and positive influence on access to new crop production technologies and its importance will increase in the years to come. That is because a large body of information is and will be available in printed or written form. Information communication technologies of the day also require more literacy for effective communication using electronic media and other communication outlets.

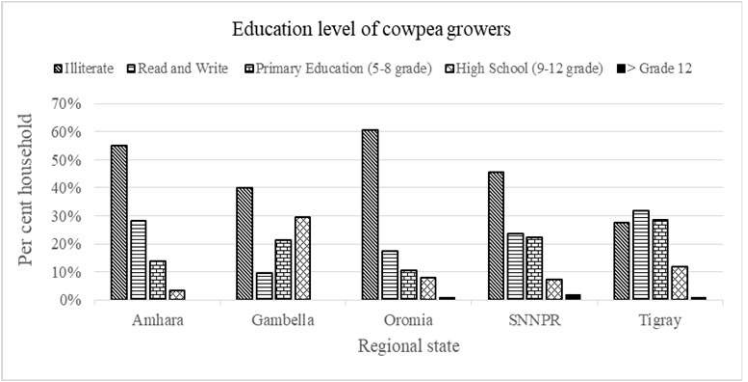

Figure 1 Education level of cowpea growing households
Source: Authors' field survey, 2014

Landholding

Two-thirds of cowpea growers own 0.51–1.50 ha. Only 15 % of cowpea growing households own two or more hectares of farmland. The land allocated to cowpea production constitutes 10–15 % of the total farmland of a cowpea grower household, which was a significant for farmers growing at least four crops (Figure 2). The average land holding size of the farmers was 1.43 ha (standard deviation SD=1.18 ha)[2]. There is also strong and positive ($p < 0.01$) correlation between area planted to cowpea and total area cultivated[3] by a farm household.

[2] *Areas of cowpea production at any administrative level was not available since district level crop production areas reports included cowpea area in common bean or not reported when the crop planted under a mixed cropping system.*
[3] *Total area cultivated is equivalent to the land owned in the survey areas except in Gambella. In Gambella, since shifting cultivation is practiced the cultivated area is less than the land* owned. *In this particular study, area cultivated was considered since the questionnaires were designed based on the experience of permanent cultivation (a predominant practice). In Gambella, the area planted to crops was considered as land privately owned and large areas of grazing land area communal.*

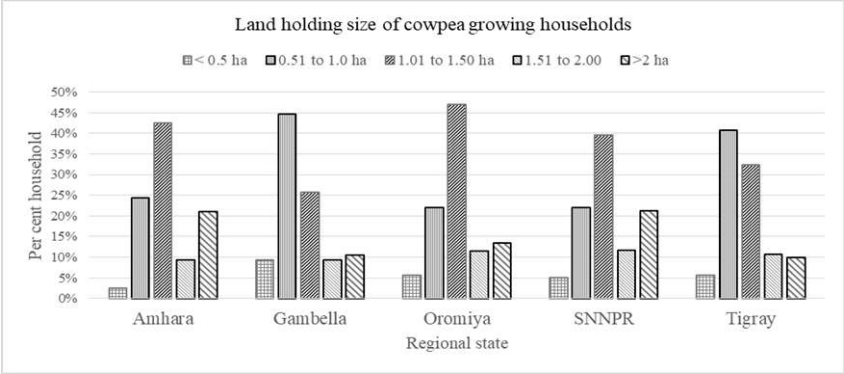

Figure 2 Landholding size of cowpea producer households
Source: Authors' field survey, 2014

Farmland allocated to cowpea production

As shown in Figure 3, a significant proportion of farmland was allocated to cowpea production. Farmers allocated an average of 0.08–0.25 ha of their farmlands to cowpea growing. A sizable proportion (two-third) of farmers reported their growing cowpea using intercropping with maize and sorghum. A few of them plant in a relay cropping. There was a significant difference in areas planted to cowpea across the regional states: a larger area was allocated to cowpea production in Amhara regional state while relatively smaller area (0.08 ha) was allocated to the crop in Gambella regional state (Figure 3). The areas allocated tend to be dependent on the part of crop consumed. Major grain consumers allocated larger plots to cowpea while users of leaves and pods (as vegetable) allocated smaller plot. The piece of land allocated to cowpea production has a significant difference across regional states as perceived by growers. In Amhara, a relatively large plot of land is assigned to cowpea while in Gambella a small plot of land is assigned to cowpea production. The areas allocated to the crop tend to relate to the part used, soil fertility and moisture. For instance, Gambella has reliable moisture and people consume cowpea in the form of vegetable whereas in other regional states the crop is grown primarily for its grain. The average grain productivity of the crop observed to be low (0.8 tons per hectare) on farmers' field as compared to the yield on farm demonstration research station. The average yield recorded on demonstration plots on farmers' field was 1.7–2.1 tons per hectare for the improved varieties whereas average yield of cowpea on research plot was 2.2–3.2 tons ha^{-1}. These suggest a high possibility of boosting the current cowpea yield by two to three folds using locally available technologies.

Relating human technical capital, cowpea farmers have rich experience in the crop farming (extending from 1–50 years) with an average of 12 years. This may form a fertile ground in the promotion of new cowpea technologies and improving the crop production. Annual cowpea production in the survey area estimated to be 55,600 tons

produced on 69,500 ha which would have a significant contribution to the food security of farming communities' particularly residing in semi-arid area where food insecurity is prevalent.

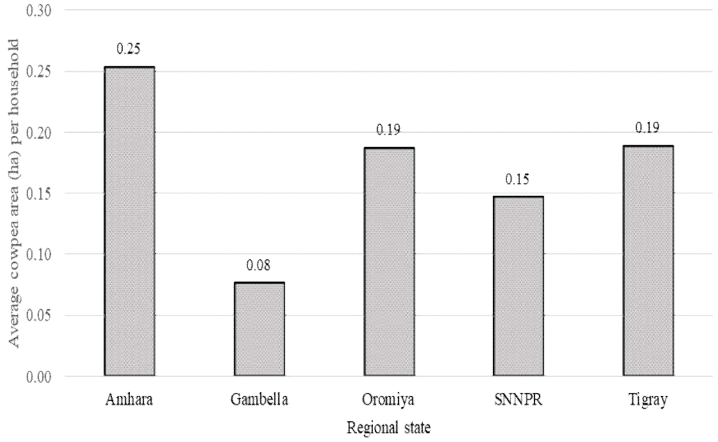

Figure 3 Average area (ha) allocated to cowpea production in Ethiopia
Source: Authors' field survey, 2014

Purposes of cowpea production

Farmers grow cowpea for household food, animal feed, cash income and medicinal uses (to a lesser extent 4.8 %). Alemu (2015) documented that medicinal value of cowpea to rank fifth in cowpea utilization whereas a quarter of the farmers were reported to have used the leaves and grains of cowpea for the treatment gastric discomfort, malaria and liver diseases. On the other hand, grain harvest is the driving reason for growing cowpea in Oromia and Amhara regional states while grain and leaves are more important products in SNNPR and Tigray than the two regional states. Grain, leaves and green pods were used across all the regional states. Grain and leaves were used by a significantly higher proportion of growers in Gambella than they were in other regional states. Consumption of green pods was not important in itself as its use is related to growing cowpea for other purposes. Growing cowpea as a feed was reported to be more significant in Oromia and SNNP regional states. Cowpea straw is used for animal feed. Straw use is associated with the total size of tropical livestock units (TLUs) owned, except in Gambella which own a relatively larger number of tropical livestock units[4] although they hardly use the straw as livestock feed. That may

[4] *The average total tropical livestock unit (TLU) is: in Amhara (2.26), Gambella (12.40), Oromia (3.97), SNNPR (6.15) and Tigray (0.30)*

be due to availability of vast grazing land in Gambella regional state. All parts of cowpea are consumed although there was a difference in proportion across the regional states (Table 3). The major cowpea recipes are fosese, kukurfa, nifro and soups from cowpea alone or by mixing it with other crops.

Table 3. Parts of cowpea consumed in Ethiopia

Part used	%Users (%)				
	Amhara	Gambella	Oromia	SNNPR	Tigray
Only grain	13	1	19	9	20
Only leaves	1	9	–	1	2
Grain and leaves	26	51	22	25	34
Green pod	–	1	–	–	–
Grain, leaves and green pod	50	38	37	50	31
Grain and straw	5	–	22	15	1
Grain and green pod	5	–	–	–	12

Source: Authors' field survey, 2014

Seed security

Seed is a basic input in crop production and it will continue to be the major driver in the technology promotion. We highlight the perception of farmers about cowpea seed, availability, access and sufficiency of cowpea seeds planted. Availability and access to seed are essential elements for farm households. Smallholder farmers obtain seeds from multiple of informal sources, namely, home saved, local market, and another farmer. In the case of the crop under study, research centers are major formal source for the seeds of improved varieties. Home-saved seed was the predominant seed source for cowpea production. Almekinders et al. (1994) narrated that home-saved seed has the advantages of known quality, cheap, and readily available.

In terms of cowpea seed source, there was a significant difference in the proportion of farmers served from the major seed sources across the administrative regions. For instance, farmers in Amhara, Tigray and SNNP regional states state mainly use the home-saved seed. Next to home-saved seed, local markets and Agricultural Development Offices stand in the second and third positions, respectively as cowpea seed sources. Local seed markets were more important in Gambella, Oromia and SNNP than the other seed sources. Farmer-to-farmer, i.e. relatives, friends and neighbors cowpea seed exchange found to be meager as cowpea seed source (Table 4). Farmer-to-farmer seed dissemination, however, reported to be high for field crops. For example, one-third of maize seed planted in the Ethiopia Central Rift Valley (CRV) (Bedru and Nishikawa 2017) and in Nigeria were sourced through farmer-to-farmer seed exchange (Daniel and Adetumbi 2006). Non-Government Organizations (NGOs) were reported to be hardly involved as a facilitator in cowpea seed sourcing. This may

be because of cowpea seed was not widely available among formal seed sources where NGOs play a catalyzing role between formal and informal seed dissemination systems.

Table 4. Cowpea seed sources for farmers

Seed source	%Seed dissemination (%)					Total
	Amhara	Gambella	Oromia	SNNP	Tigray	
Home-saved seed	83.1	62.4	53.8	74.7	77.5	72.2
Local market	7.5	30.6	19.2	13.6	0.0	12.7
Another farmer	1.2	7.1	2.9	8.4	0.0	3.9
Agricultural development office	5.0	0.0	5.8	1.3	20.8	6.6
Research station	0.6	0.0	18.3	0.6	0.0	3.4
Home-saved seed and another farmer	0.6	0.0	0.0	0.0	1.7	0.5
Home-saved seed and agricultural office	1.2	0.0	0.0	0.0	0.0	0.3
NGO	0.6	0.0	0.0	0.0	0.0	0.2
Home-saved, local market and research centers	0.0	0.0	0.0	1.3	0.0	0.3

Source: Authors' field survey, 2014

Seed unavailability and insufficiency were not reported to be issues in cowpea seed supply system. For instance, 68 %%of farmers use home-saved seed, 19.7 % get it from the local market (within 30-minute walking distance) and the remaining 12.2 % of the farmers accessed seed from a distance of more than 30 minutes' walking distance from market when major cowpea seed sources are related for the seed of cowpea planted for the previous harvest. Likewise, the majority reported that sufficient cowpea seed is obtained for their annual cowpea production. Eight two % of respondents have access to their preferred (familiar) varieties of cowpea. Similarly, the predominant majority of cowpea producers (91.5 %) obtained cowpea seed easily when the landraces are concerned. However, the farmers lack information about improved varieties of cowpea. This was clear evidence from farmer's heavy reliance on the landraces for easy accessibility of their seeds. The grain productivity of landraces is low (about one-fourth of improved varieties). On the other hand, the local seed system and local landraces are flexible; the local varieties combine a high degree of yield stability with a low yield potential (Almekinders et al. 1994). The landraces were maintained though the ancient way of introduction and selection from the local genetic pool. This selection from local genetic pool by farmers has proven to be very slow (Almekinders et al. 1994). Such sluggish process may not catch up with high population pressure like Ethiopia whose population growth is fast increasing at 2.85 % per annum (CIA, 2018) and under shrinking land holding, climate variability and change challenges. This suggests the need for the introduction of new varieties using modern approaches and enhancing the land races.

Major cowpea landraces grown and variety preference criteria

Both the landraces and, in a lesser coverage, improved cowpea varieties are grown across Ethiopia. There are six released cowpea varieties: Bekur (838 689 4), Asrat (ITS 92KD-279-3), IT (98K-131-2), Bole (85D-317-2), 82D-889 and Kanketi (IT99k-1122) (MoA 2012). There were a number of landraces planted in the country and the name of these landraces in all the regions appeared in more than three local names (Table 5). These varieties have been grown for long in these regional states. Cowpea varieties are preferred on the bases of their early maturing, short cooking time, high yielding and accessibility (Table 6).

Table 5 Names of major cowpea varieties

Amhara	Gambella	Oromia	SNNPR	Tigray
Adagura	Gnmgori	Atara yusuf	Eliata	Adangura
Kimete	Woka	Atera Babile	Honata	Adongor
Serekula	Rapo	Bole†	Kechenete	Leham Ater
Jergadie	Wenu	Kanketi †	Woka	
Chekele	Boho	Black eye pea†	Ohoda	
		Kechine	Aeoa	
			Alita	

†Released varieties fromMelkassa Research Center
Source: Authors' field survey, 2014

Description of cowpea collections

Since Ethiopia is a secondary center of diversity for cowpea, a variety of the crop types with different color, shape and size are grown. To document the available genetic resources, cowpea seed samples were collected from the survey areas. The specific locations for the collection are shown in Table 6 and Fig 1. Seed colors were adopted to describe the collections. The collections are under physiological characterization by growing on experimental fields. Those materials may serve as a core landrace germplasm source or the lowland pulse-breeding program in the country and beyond. The seed color descriptors used based on IBPGR (1983). Table 6 Locations of cowpea landrace seed collection and their color descriptors

Table 6 Locations of cowpea landrace seed collection and their color descriptors

Region	Zone	District	Latitude	Longitude	Altitude (m)	Specific location	Number of samples
Amhara	Oromia	Bati	11^0 1100	40^0 0100’	1502	Melkaugo Kebele	4
	South Wollo	Dese Robit	11^0 08 09'	39^0 38 27	2493	Dese Robit market	1
	South Wollo	Haik	11^0 09 10	39^0 54 52	1500	Serekula, Degan	1
	South Wollo	Haik	11^0 16 49	39^0 40 51	2054	Serekula	1
	South Wollo	Kalu	NA†	NA	NA	Harbu Kebele	5
	North Wollo	Lasta	11^0 58 23–11^0 59 48	38^0 54 11–38^0 59 53	2000–2175	Bert village, Shumshuha, Godu Mender	4
	North Wollo	Lasta	NA	NA	NA	Shumshuha	1
	North Wollo	Lasta	11 59 53	38^0 58 02	1999	Enkol beret Kebele	1
	North Wollo	Lasta	12^0 00 37–12^0 10 03	39^0 00 08–58^0 59 06	2030–2195	Lawober, Yohannis amba, Medage, Bilal Segno-market	6
	North Wollo	Raya Kobo	12^0 04 09	39^0 37 48	1466	Aradum Kebele	1
	Waghimra	Sekota	12^0 31 13–12^0 32 57	39^0 02 61	2042–2112	Tiya and Weleh Kebeles	2
	Waghimra	Abergele	13^0 02 48	38^0 59 16	1367	Nirak Kebele	1
	North Shewa	Shewa Robit	18^0 00 02–18^0 00 04	39^0 53 42–39^0 54 09	1274–1286	Shewa Robit RC and market	3
	Waghimra	Abergele	NA	NA	NA	Kebeles 01 and 03	2
Oromia	East Hararghe	Babile	09^0 12 35–09^0 34 19	42^0 06 11–42^0 19 14	1619–1674	Babile town Kebele	4
		Biya Aale	09^0 33 06–09^0 33 58	42^0 06 04– 42^0 06 22	1644–1718	Belea Kebele	3
		Gursum	09^0 17 22–09^0 17 36	41^0 50 07–42^0 26 43	1813–2439	Gera town, Awoday kebele	3
	West Hararge	Habro	08^0 84 83	04^0 03 13.2	1761	Near Gelemso high sch.	1
		Mieso	9°14 00	$40^0$45 00	1394	Asebot	1
		Odabultum	08^0 54 08–08^0 55 29	40^0 40 19–40^0 46 44	1692–1779	Kara kurkura,Badesa town	2
		Chiro	09^0 05 16	40^0 51 50	1730	Chiro town market	1
	East Shewa	Boset	08^0 37 09–08^0 37 26	39^0 24 13–39^0 24 53	1865–81	Dongore	3
Gambella	Agnuwak	Abobo	07^0 53 01	34^0 34 03.4	480	Abobo Kake Kebele	1
		Gambella	08^0 15 10	34^0 35 22	450	Gambela market	1
		Gambella	08^0 15 14	34^0 35 22	450	Gambela market	1
		Itang	08^0 11 24-–08^0 11 47	03^0 15 50–$03^0$46 07	426–38	Itange Village, near R.Baro	4
SNNPR	Gamogofa	Arbaminch	NA	NA	NA	Arbaminch market	3
	Segen People	Konso	05^0 17 01–$05^0$21 26	37^0 22 19– $37^0$29 07	1200–1483	Naleya Segen, Altayede, Karatan market	4
	South omo	South Ari	05^0 51 13	03^0 63 24	1435	Yetnebersh Kebele	1
		South Ari	05^0 50 42	36^0 32 56	1441	Geza Kebele	1
	Wolayta	Sodo Zuria	06^0 46 40	37^0 46 14	NA	Zarena Kebele	1
		Humbo	06^0 42 06–06^0 42 25	37^0 42 26– 37^0 46 14	1591	Gelch andTebeua market	3
Tigray	Central Tigray	Abiyi Adi	13^0 31 09	39^0 01 49	1490	Hadash Teki kebele	1
		Bargelle ARC	13^0 37 32	38^0 59 59	1645	NA	1

Region	Zone	District	Latitude	Longitude	Altitude (m)	Specific location	Number of samples
		Kola Tamben	NA	NA	NA	New Kebele	2
		Kola Tamben	13^0 37 45	38^0 55 39	1746	Bege Shera Kebele	1
		Kola Tamben	NA	NA	NA	Derneteb Kebele	1
		Maerey	13^0 16 12	38^0 59 47	1555	Tanqua Abregene	2
		Tangua	13^0 13 56–$13^0$17 13	38^0 59 34–$38^0$37 39	1562–1633	Megierey, Yechilla, Hadnet Lemlem,	6
		Zongwi	NA	NA	NA	Agricultural Office	1

† NA: not available

Source: Authors' field survey, 2014

Production environment and management

Cowpea is grown in different types of soils. A higher proportion of farm households grow cowpea on fertile to marginally fertile soils. A few farmers reported their growing cowpea on soils of low fertility (Table 7). Though cowpea is a leguminous crop, which performs on marginal land, it shows that farmers grow it on available soil types probably because the soils of those areas are of low fertility and the rainfall is largely erratic. There are differences across the regional states in the type of land allocated to cowpea. For instance, in Gambella, cowpea farm households allocate fertile alluvial soil in valley bottoms and riverbanks. Here the cowpea farms are planted and managed by women. The soils in SNNP is considered to be of good fertility gradient since farmers in this region practice intercropping, rotation and practice erosion control practices as contrasted to Amhara, Oromia, and Tigray regional states where the soil has been worked for many years and the environment is semi-arid and soil fertility management is hardly practiced.

Table 7 Farmers' opinion on fertility status of land allocated to for cowpea production

Perceived soil fertility	Amhara (%)	Gambella (%)	Oromia (%)	SNNPR (%)	Tigray (%)	Total (%)
Fertile	23.8	80.0	85.6	37.7	21.7	44.8
Medium	52.3	18.8	14.4	47.4	51.7	40.1
Marginal	23.1	1.2	0.0	14.9	22.5	14.1
Medium and marginal	0.0	0.0	0.0	0.0	0.8	0.2
Fertile, medium and marginal	0.6	0.0	0.0	0.0	3.3	0.8

Source: Authors' field survey, 2014

Land preparation for cowpea production

Land preparation is vital in food crop production, particularly for fine seeded crops to facilitate germination and good root growth. In fragile soils those prone to erosion, use of minimum or zero tillage is recommended (Dugje et al. 2009). In Ethiopia, the frequency of land tillage is an indicator for how important the crop is to the farm household. Concerning tillage frequency in cowpea production, only a single farmer from SNNPR reported growing it without plowing lands. Thirty % of cowpea growers practice one-time tillage while about two-thirds of the farmers plow their cowpea plots two to three times. Only a few (7 %) farmers plow more than three times (Table 8). Land preparation for cowpea production by the majority farmers falls within the research recommendation of 2–3 times tillage.

Table 8 Frequency of tillage for cowpea production

Tillage frequency	Amhara	Gambella	Oromia	SNNPR	Tigray	Total (%)
None	–	–	–	1	–	–
One time	34	51	1	20	49	30
Two times	28	46	25	44	19	32
Three times	31	2	56	32	26	30
More than three times	7	1	18	5	6	7

Source: Authors' field survey, 2014

Planting and inputs for cowpea production

Planting method is an important agronomic practice in food crop production. Planting cowpea is usually practiced using either broadcasting or row planting. Row planting of cowpea is recommended since it facilitates crop management practices during hoeing, weeding, fertilizer application and harvest. The survey result revealed that 62 % of cowpea growers do hoeing and 92 % do weed up to three times. Most (64 %) of the farmers primarily grow cowpea by broadcasting while a reasonable proportion (one-third) grow the crop in row planting. Farmers who planted cowpea by broadcasting reported that they do so because it is a long-held tradition, or because they are not familiar with row planting (61.9 %) while 4.3 % reported that row planting is time consuming, labor intensive and land extensive. There was a significant difference among the administrative regional states in their adoption of row planting. The higher proportion of farm households in Gambella[5] and Oromia grow cowpea by using row planting whereas in Amhara, SNNPR and Tigray broadcasting is still the dominant planting method. The reason for use of row planting in Oromia is more likely due to improved variety demonstration practices namely in West and East Hararghe Zones (Figure 5). The average seeding rate used for cowpea was 19 kg/ha. This is within the range of seeding rate (12–25 kg/ha) recommended by International Institute of Tropical Agriculture–IITA (Dugje et al. 2009). Chemical fertilizer use is changing positively where 28 % of cowpea grower households reported to use chemical fertilizer (mainly di-ammonium phosphate/DAP) since traditionally the crop was grown without fertilizer since cowpea is a nitrogen fixing legume.

[5] *In Gambella row planting is common because of hoe farming. Farmers also plant in fertile land along the river bank, after the river water recedes towards the end of the rainy season.*

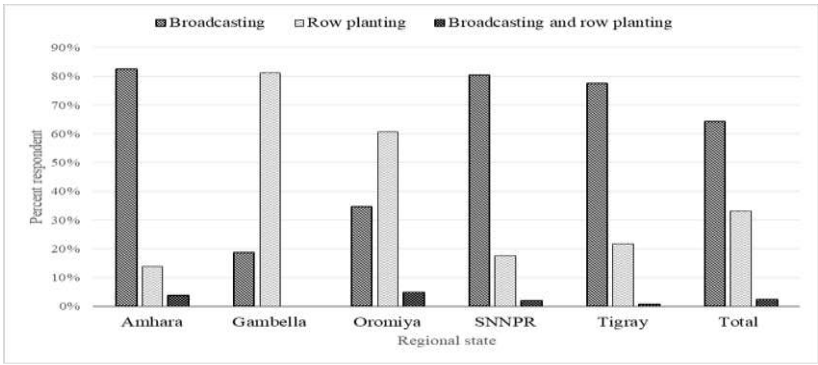

Figure 5. Cowpea planting techniques in Ethiopia
Source: Authors' field survey, 2014

Production system

Cowpea production was practiced under varying cropping systems. These include sole cropping, intercropping and mixed cropping. Sole cropping is practiced by the majority (59 %) cowpea growing households whereas a significant (33 %) of farm households practiced intercropping with sorghum and maize (Table 9). Mixed cropping of cowpea was practiced to a lesser extent. The production system across the regional states has significant differences. Cowpea was planted using sole cropping in Gambella. Both intercropping and sole cropping were used in Amhara, Oromia, SNNP and Tigray regional states. Intercropping of cowpea was usually done with cereals such as sorghum and maize though a few farmers in Oromia and SNNP reported intercropping cowpea with groundnut and common beans. Mixed cropping here denotes planting of cowpea with other crops such as maize and sorghum randomly scattered in small amounts.

Table 9. Cowpea cropping systems

System	Use (%)					Total (%)
	Amhara	Gambella	Oromia	SNNPR	Tigray	
Sole	59	100	46	53	49	59
Intercropping	31	–	46	34	35	31
Sole and intercropping	6	–	4	7	13	6
Mixed	3	–	2	4	2	2
Sole and mixed	1	–	—	1	2	1
Intercropping and mixed	—	–	2	1	—	1
Mixed alley cropping	—	–	—	1	—	—

Source: Authors' field survey, 2014

Extension service

In Ethiopia, extension service has been an essential component in agricultural technology dissemination in which three extension workers are assigned to a kebele

(the smallest administrative unit). The three development agents trained in complementary areas critical for rural livelihoods, i.e., crop production, livestock farming and natural resources management. Extension service here refers to extension visit, demonstration, training or field days organized by agricultural research or development workers. A mere four % of cowpea growing farmers have ever participated in a cowpea demonstration or field days whereas only 20 % of farmers have received training relating to cowpea production. Similarly, one-fifth of the farm households in the five regional states have received extension visits though the service was low in SNNP and Gambella (Figure 6). This can be due to the introduction of new cowpea varieties to the farming community in the other regional states as contrasted to SNNP and Gambella, which grow local varieties.

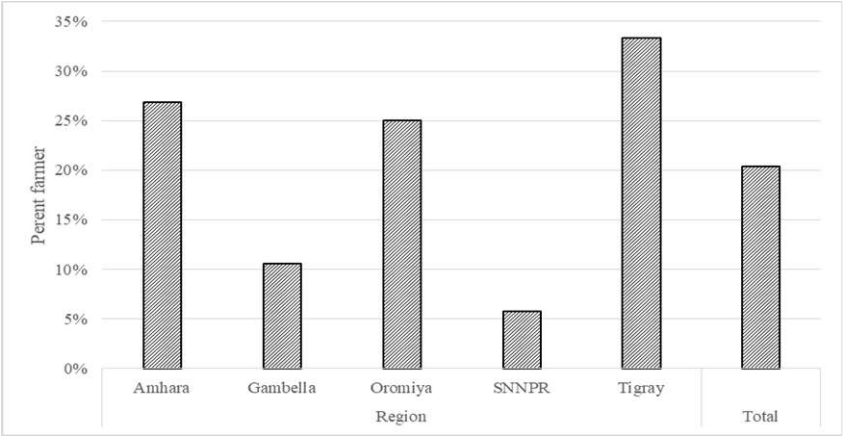

Figure 6. Farmers receiving extension visit on cowpea production in Ethiopia
Source: Authors' field survey, 2014

Marketing

Cowpea is a cash crop for farmers. The majority (61.2 %) of farm households reported selling at least part of their cowpea produce in the local market from their previous harvests. Most of the farmers (73.3 %) appreciated market prices of cowpea while about a quarter of the cowpea farmers complained that the price of cowpea was low. There is a significant difference among regional states concerning the parts of the cowpea marketed. Grain marketing was more important in all the regional states except Gambella. Gambella was unique since marketing of fresh leaves was the most important here than in any other regional states (Table 10). The average price of a kilo of cowpea from previous harvest at the time of the survey was 12 Birr[6] (SD=6). This price is comparable to that of common bean price (part of commodity exchange market)–a widely marketed legume in Ethiopia.

[6] *The exchange rate in the dry season of 2013 was 1 USD = 18.4865 ETB.*
Source: https://www.exchange-rates.org/Rate/USD/ETB/3-31-2013

Table 10 Parts of cowpea marketed in Ethiopia

Part marketed	Measure	Amhara	Gambella	Oromia	SNNPR	Tigray	Total
Whole grain	Number	98	5	60	48	94	305
	%	100	7	100	87	100	80
Fresh leaves	Number	—	25	—	1	—	26
	%	—	34	—	2	—	7
Split grain	Number	—	—	—	5	—	5
	%	—	—	—	9	—	1
Whole grain and fresh leaves	Number	—	43	—	1	—	44
	%	—	59	—	2	—	12

Source: Authors' field survey, 2014

Gender roles

All sorts of household members are involved in cowpea production activities starting from variety selection, though planting, harvesting, storing, marketing and utilization. The major crop production activity can be categorized into pre-planting, planting, harvest and post-harvest. The number of female-headed cowpea grower households was significantly high in Gambella and Oromia regional states (Table 11). For the purpose of analysis of gender division of labor, house members were categorized into men, women, and youth, i.e., people aged 10 to 17. Both men and women play vital roles in variety selection and seed sourcing except in Oromia. The adult men play a predominant role in pre-planting activities of cowpea production followed with that of adult women then youth (Table 11). Gender in cowpea production decision-making process has a remarkable difference across the regional states.

Table 11 Participation of farm households' members in cowpea preplanning activities

Activity	Participant	Amhara (†N=160)		Gambella (N=85)		Oromia (N=104)		SNNPR (N=154)		Tigray (N=120)		Total (N=623)	
		N	%	N	%	N	%	N	%	N	%	N	%
Selecting variety	Women	59	36.9	61	71.8	35	33.7	67	43.5	43	35.8	265	42.5
	Men	140	87.5	31	36.5	73	70.2	110	71.4	109	90.8	463	74.3
	Youth	4	2.5	4	4.7	1	1.0	1	0.6	1	0.8	11	1.8
Seed sourcing	Women	74	46.3	60	70.6	32	30.8	62	40.3	59	49.2	287	46.1
	Men	141	88.1	29	34.1	80	76.9	116	75.3	97	80.8	463	74.3
	Youth	3	1.9	3	3.5	7	6.7	4	2.6	1	0.8	18	2.9
Land preparation	Women	43	26.9	58	68.2	12	11.5	43	27.9	47	39.2	203	32.6
	Men	142	88.8	40	47.1	98	94.2	142	92.2	110	91.7	532	85.4
	Youth	63	39.4	45	52.9	26	25.0	47	30.5	39	32.5	220	35.3

†N denotes the number of respondents; the % shows proportion of households reported to involved in the activity indicated.
Source: Authors' field survey, 2014

Cowpea production requires the attention of men, women and youth when it is on field than before planting and after harvesting. Women in 56–81 % of the households are involved in planting to threshing activities. The presence of women is typically higher in Gambella (where women in 88 % of farm households participate in threshing).

Youth participate in planting to threshing activities in 40 % of households across the regional states. Weeding, cultivation (hoeing) and harvesting to threshing are fairly equally shared among men and women farm households involved in cowpea production (Table 12).

Table 12 Participation of household members in cowpea field management

Activity	Participant	Regional state										Total (623)	
		Amhara (†160)		Gambella (85)		Oromia (85)		SNNPR (154)		Tigray (120)			
		N	%	N	%	N	%	N	%	N	%	N	%
Planting	Women	76	48	68	80	62	60	76	49	69	58	351	56
	Men	151	94	37	44	96	92	137	89	110	92	531	85
	Youth	71	44	41	48	28	27	55	36	49	41	244	39
Weeding	Women	132	83	67	79	57	55	132	86	110	92	498	80
	Men	137	86	43	51	89	86	123	80	111	93	503	81
	Youth	93	58	53	62	27	26	93	60	63	53	329	53
Hoeing	Women	74	46	56	66	44	42	121	79	70	58	365	59
	Men	88	55	31	36	94	90	125	81	77	64	415	67
	Youth	62	39	31	36	28	27	80	52	40	33	241	39
Harvesting	Women	130	81	74	87	64	62	136	88	99	83	503	81
	Men	149	93	28	33	91	88	125	81	112	93	505	81
	Youth	100	63	51	60	36	35	88	57	61	51	336	54
Threshing	Women	73	46	75	88	65	63	117	76	72	60	402	65
	Men	142	89	19	22	64	62	106	69	107	89	438	70
	Youth	76	48	37	44	28	27	64	42	52	43	257	41

†Figures in the bracket show the total number of respondents
Source: Authors' field survey, 2014

Storage

Since the storage of cowpea is challenging, women use different storage materials, including various containers (e.g. jute sacks, clay pots, plastics, and calabash (*Lagenaria siceraria*) '*qil'*–in Ahmaric) for seed storage. Women mainly perform the marketing of cowpea grain and other products though men were also taking a significant share. There were remarkable differences among regional states with respect to the role of gender. Women in Gambella play a leading role in marketing cowpea products as compared those in other regional states (Table 13).

Table 13 Participation of household members in cowpea post-harvest management

Activity	Participant	Amhara (†N=160)		Gambella (N=85)		Oromia (N=104)		SNNPR (N=154)		Tigray (N=120)		Total (623)	
		N	%	N	%	N	%	N	%	N	%	N	%
Marketing grain	Women	93	58	39	46	63	61	49	32	72	60	316	51
	Men	27	17	4	5	12	12	32	21	46	38	121	19
	Youth	4	3	16	19	4	4	3	2	2	2	29	5
Marketing leaves	Women	1	1	57	67	–	–	5	3	3	3	66	11
	Men	–	–	2	2	–	–	–	–	2	2	4	1
	Youth	–	–	16	19	–	–	–	–	–	–	16	3
Food preparation	Women	156	98	82	96	98	94	145	94	100	83	581	93
	Men	–	–	1	1	–	–	4	3	3	3	8	1
	Youth	22	14	16	19	20	19	34	22	17	14	109	17
Marketing Processed product[7]	Women	24	15	–	–	4	4	2	1	18	15	48	8
	Men	6	4	–	–	1	1	2	1	12	10	21	3
	Youth	–	–	–	–	–	–	–	–	1	1	1	–
Storage	Women	152	95	70	82	66	63	110	71	103	86	501	80
	Men	105	66	10	12	88	85	56	36	71	59	330	53
	Youth	1	1	1	1	3	3	–	–	–	–	5	1

†N denotes the number of respondents
Source: Authors' field survey, 2014

Challenges of production and management

Cowpea producer households face a number of challenges. A household may face one or multiple constraints in their cowpea production. The first challenge was insect pest (on field and in storage). Bruchids, at times, start attacking the crop on the farm immediately from its physiological maturity and continue through its storage period. Bruchids, if left uncontrolled, cause to a complete loss of cowpea grain harvest. Cowpea weevil (*Callosobruchus maculatus*) is a diverse field-to-storage pest ranked as the principal post-harvest pest of cowpea in the tropics (Tiroesele et al. 2015). The second challenge is weed[8] of both broad leave and grass types. Weed is devastating in cowpea production since cowpea is a weak competitor of weed at the early stage and harbors insect pests, which reduce the grain quality, and grain and fodder yield (Dugje et al. 2009). The third challenge was storage for keeping the seed of cowpea for a long time, until the planting.

Bruchids are disastrous to cowpea and farmers face huge losses to it including loss of seed. Traditionally farmers keep cowpea seed in a number of different ways. Examples include hanging selected pods in the kitchen (near a fire place), mixing the seed with ash, mixing with small cereals (tef and/or millets), keeping in cooler places, keeping in airtight containers such as plastic bottle and sealed clay pots. At the time writing this paper, special bag developed through research, viz. Purdue Improved Crop

[7] *Processed products are split grain and flour.*
[8] Concerning weed species closer study is needed by competent experts. At the time of this study because of the season there was no chance to see the type of weeds affecting cowpea.

Storage (PICS) hermetic bag was introduced to Mieso area and observed to be effective in controlling cowpea bruchids. Though the use of botanicals in controlling cowpea bruchids was not reported during this study, Brisibe et al. (2011) presents evidence from Nigeria that application of wormwood (*Artemisia annua*) and neem (*Azadirachta indica*) produced significant insecticidal effect. They can be used as environmentally friendly products for controlling bruchids during storage of cowpeas with no adverse effects on mammalian consumers. Similarly, Swella and Mushobozy (2007), from their research in Tanzania, documented that black pepper powder and coconut oil sufficiently protect cowpea against bruchids damage. Similar work from Botswana revealed that chilies and garlic produced a significantly negative effect on cowpea weevil and recommended it to be included in the management of cowpea grain bruchids (Tiroesele el al. 2015). The fourth challenge of cowpea was drought. Though cowpea is a drought-tolerant crop, critical moisture shortage, which happens intermittently, can seriously affect cowpea yield to the level of total yield loss. The fifth challenge was disease. Diseases of leaves and other parts of the crop are important production constraints. As to the details of disease type and level of damage, an in-depth study while the crop is in the field is required since oral report from questionnaire survey did not yield a complete picture. Studies elsewhere indicated that certain fungal diseases such as stem and root rots and leaf spot are serious ones while mosaic and mottle symptoms are viral diseases of cowpea, which may cause up to 90 % yield loss (Fatokun et al. 2002). The sixth challenge is low soil fertility. A few farmers reported the issue of low soil fertility and finally inputs (fertilizer and improved seed) shortage as part of cowpea production challenges (Figure 7).

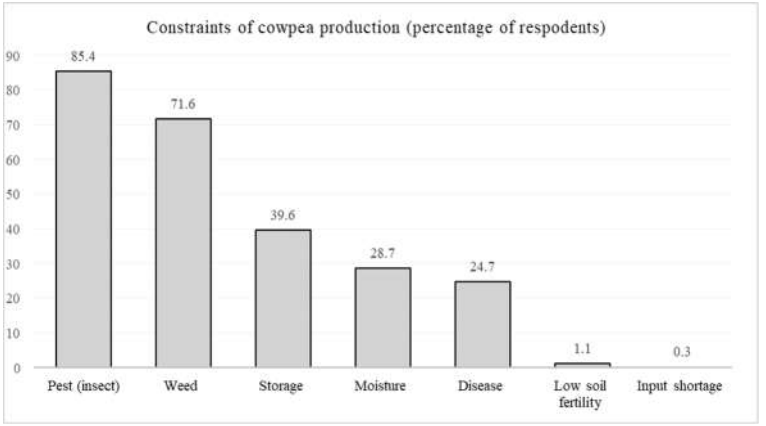

Figure 7 Constraints of cowpea production in Ethiopia by percentage of respondents
Authors' field survey, 2014

Cowpea food and other pulses

Pulses were one of the most consumed crops in all study areas. Among the pulses, cowpea was far more popular than other pulses. Forty % of the respondents use cowpea product in their food basket (Figure 8). Beans, faba bean and ground nut were also popular next to cowpea. Field pea, lentil and chickpea were popular to lesser extent. Respondents consume different cowpea parts (Table 15). Grain and green pod are most popular parts of cowpea for consumption in Amhara, Oromia and Tigray regional states. Farm households consume mainly grain or both cowpea grain and green pod. However, the situation in Gambella and SNNP regional states was different from the rest regional states. In those regions, apart from the consumption of cowpea grain and green pod, they also consume cowpea leaves as vegetable. Therefore, during addressing cowpea research and variety promotion, cowpea leaf quality as food vegetable needs to be taken in to consideration. The amount of cowpea consumption differs among the regional states. Cowpea consumption ranges between 48.6 and 64.7 kg across cowpea producing regional states (Table 15). This is a good indicator to promote cowpea in the targeted areas particularly for home consumptions and the surplus produce for market.

Table 14. Cowpea consumption across regional states (% respondents) in Ethiopia

Cowpea part	Amhara	Gambella	Oromia	SNNPR	Tigray	Mean
Grain	52.3	0.0	48.1	10.7	48.6	31.9
Leaves	0.0	3.5	0.0	1.3	0.0	1.0
Grain & leaves	0.0	51.8	0.0	20.0	1.9	14.7
Grain, leaf & green pod	0.0	44.7	3.8	51.3	2.8	20.5
Grain and green pod	47.7	0.0	48.1	16.7	46.7	31.8

Source: Authors' field survey, 2014

Table 15 Average cowpea consumption per household (% respondents) in Ethiopia

Amount (kg)	Amhara	Gambella	Oromia	SNNPR	Tigray	Average
Less than 25	12.3	10.6	13.7	20.3	20.6	15.5
25–50	33.1	24.7	30.4	31.1	28.0	29.5
51–100	29.2	37.6	32.3	20.9	15.0	27.0
101–200	16.9	22.4	20.6	17.6	21.5	19.8
201–300	4.5	3.5	1.0	4.6	6.5	4.1
301–400	1.9	1.2	1.0	3.4	4.7	2.4
401–500	0.6	0.0	1.0	0.7	2.8	1.0
> 500	1.3	0.0	0.0	1.4	0.9	0.7
Sum	99.8	100	100.0	100.0	100	100

Source: Authors' field survey, 2014

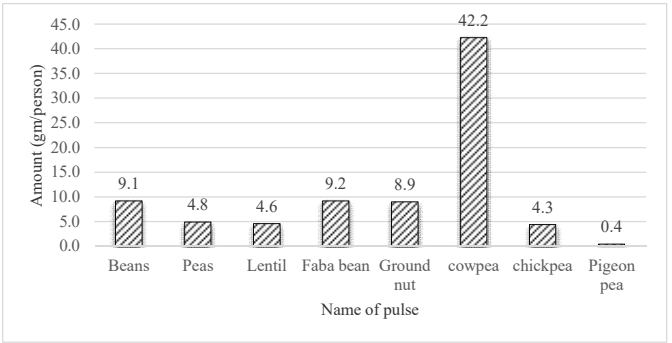

Figure 8 Mean (g/person) annual pulse food consumption in cowpea production areas in Ethiopia
Source: Authors' field survey, 2014

Food consumption frequency

A 24-hour recall was collected by asking respondents to recall the food types they consumed during the past 24 hours before the interview day. Respondents were asked to remember the major food types they consumed in the past two days (Table 17). Above 60 to 80 % of the respondents consumed one of pulses product in different forms. However, the percentage of respondents varies from one regional state to another. While 80 %, in the last two days, in Amhara Region consumed pulses; it was only 61 % of respondents who consume pulses in Gambella during same period. Fifty % of the respondents in Gambella consumed fish in the same days. However, meat consumption across regional states except in Gambella was too low. Interestingly, potato and sweet potato came in to the picture during 24-hr recall. Half of the respondents in Oromia and above one third of respondents in Amhara and Gambella consumed potato or sweet potato in different processed forms. Vegetable was consumed by large proportion of households in Gambella (61.2 %) followed by Oromia and Amhara (53.8 % and 36.9 % respectively). Low consumption of fruits in any form was observed during 24-hr recall in all regional states except in Gambella.

Table 16 Major food consumption during 24hr across regional states (% respondents)

Region	Number of respondents	Cereal	Pulse	Meat and fish	Potato and sweet potato	Vegetable	Fruit
Amhara	160	100	80	26.25	34.4	36.9	11.25
Gambella	85	100	61.2	51.8	30.6	61.2	42.3
Oromia	104	100	64.4	5.77	53.8	53.8	3.84
SNNPR	154	100	70.8	8.4	18.8	18.8	19.5
Tigray	120	100	70	42.5	19.7	19.7	10
Total	623						

Source: Authors' field survey, 2014

With regard to consumption frequency of cowpea, 19 % of respondents consume cowpea products daily. Eighty % of the respondents indicated that they consume cowpea products at least once per week (Fig 9). The data showed that cowpea was the frequently consumed pulse type in the targeted regional states and districts.

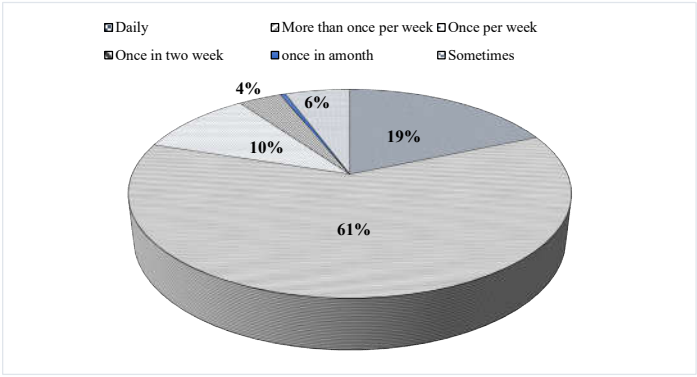

Figure 9. Average cowpea food consumption frequency
Source: Authors' field survey, 2014

Table 17 Synthesis of cowpea production, marketing and potential areas for intervention

Descriptor	Status	Intervention
Variety and use	Farmers use local varieties across crop production agro-ecologies. The dissemination of improved varieties is low. Still landraces are used across regional states for food, feed, and cash income though there are slight differences across regional states in their cowpea use. Gambella is unique for its consumption of leaves.	Cowpea can be used for multiples purposes: for food, feed and forage. In Gambella regional states fresh leaves and green pods are intensively consume as vegetables. Hence, breeding needs to focus on area-specific needs of users.
Agronomic practices	Cowpea grows sole and or in intercropping with maize and sorghum. Planting is mainly done in broadcasting, which usually requires higher seed per unit area. Chemical fertilizer use (type and rate) is not well established.	Introduction and promotion of improved agronomic practices such as row planting, identifying suitable varieties of cowpea and complementary crop for intercropping is essential. The rate of chemical fertilizer use has to be identified.
Seed systems	Availability, access and utilization of cowpea in local varieties were not an issue except for weevil damage. Farmers mainly use seeds from their previous harvests or buy from local markets. Such seed system faced challenges during drought occurrence since it may create a loss of germplasm.	The supply of improved variety seeds was is scanty. Mechanisms need to be designed to improve the availability and accessibility of improved seeds using different options such as mini packets and community-based seed multiplication. Likewise, establishing linkage between formal and non-formal seed systems of cowpea is vital.
Diseases and insects	Weevil is the most important insect pest of cowpeas. Foliar disease is also reported as a major cowpea production constraint.	Mechanisms for control of bruchids need to be designed. More study on important insect pests and disease pests of cowpea need to be conducted.
Food types	Preparation of local food recipes of various types across regional states are based on the cowpea part used, local tradition and preparation methods. The major recipes	Introduce and promote variety of recipes across regional states to improve use of cowpea products to enhance food and nutritional security of cowpea growing households.
Gender division of labor	Men, women and youth share roles from cowpea production to consumption continuum. The contribution of women in pre-harvest and post-harvest activities is high where men's role is dominant in planting. In Gambella, women's	Participation of men and women in cowpea production is complementary. There are certain aspects of cowpea production to consumption value chain in which the role of one gender is more dominant over the other across the country. Hence, this needs to be taken into consideration in the crop research

Descriptor	Status	Intervention
	involvement across cowpea production, marketing and consumption was predominant to the level the crop named as women's crop.	and extension works.
Technology transfer	A few demonstrations, training and field days were conducted across the country. Oromia Regional had better access to extension service of cowpea in contrast to the other regions	Extension service of cowpea need attention across the nation since the crop is climate smart. For this, the Extension approach may need to generate complete information
Data source	This report the only emerging document on cowpea production, marketing and consumption in Ethiopia although the country is a secondary center of diversity for cowpea.	Panel data need to be collected over a period of 5 to 10 years to monitor changes in research, production and development of cowpea to draw lessons and guide future research on, and development of, the crop.

Source: Authors' synthesis

Conclusion

Cowpea is an essential crop in dryland areas across wide areas where the land races predominant. Cowpea farmers allocated a significant proportion (10–15 %) of their farmland to cowpea production from their average holding of 1.43 ha. Cowpea produced for food, feed and income generation. The crop production has received low attention of extension service; use of new varieties and improved practices was insignificant. Regarding seed sources, home-saved seed was the most important source for cowpea production, followed by farmer-to-farmer seed exchange and local market. Most of the farmers (two-thirds) plant cowpea using the broadcasting method while a reasonable proportion (about one-third) plant it in a row. Sole cropping, intercropping and mixed cropping were important cowpea cropping systems. Sole cropping was the major cropping practice in cowpea farming whereas a significant number of farmers practiced intercropping. Production and productivity of cowpea was low as farmers harvest about a quarter of the potential of the crop compared on the crop's performance on research station

The production of cowpeas involves all categories of household members. Both men and women participate in planting, weeding, hoeing, harvesting and threshing, sharing almost an equal burden except in pre-harvest activity related to land preparation. Post-harvest activities, including processing, are considered as women's responsibility. Cowpea production is constrained by both biotic and abiotic stresses: insect pest, diseases, leaf and grass weeds, storage and drought. Boosting cowpea production and productivity is vital to food and nutritional security of households in dryland cowpea producing areas of Ethiopia. Hence, research and development endeavors need to focus on solving those bottlenecks while capitalizing on the landraces and indigenous knowledge cowpea farmers.

The average amount of cowpea consumption per household member (six members) was about 14 kg year^{-1}. If the amount divided to all days of a year, the consumption per household member is 39 g (~8 gm protein). A daily protein requirement per one-kilogram body weight is 0.8 g. Therefore, with this low amount of cowpea consumption, people at the target areas are not meeting the daily requirement of protein intake. Moreover, due to low intake of fruits, variety of vegetables and animal origin products, the fulfillment of daily requirements of macro and micro nutrients are under risk. Therefore, boosting the productivity and production of cowpea and promotion of nutrient rich crops will enhance food availability nutritional status and health of the population in the target areas.

References

Abay KA, G Berhane, G Taffesse, A Seyoum, B Koru, and K Abay. 2016. Understanding Farmers' Technology Adoption Decisions: Input Complementarity and Heterogeneity. Paper Submitted to CSAE (Center for the Study of African Economies) Conference 20–22 March 2016, Oxford, UK. Economic Development in Africa.

Sisay Alemu 2015. Cowpea *Vigina Unguculata* (L) Walp.) (Fabaceae) Landrace Diversity in SouthernEthiopia. M.Sc. Thesis submitted to the Department of Plant Biology and Biodiversity Management, Addis Ababa University.

Almekinders CJM, N P Louwaars, and G H De Bruijn. 1994. Local seed systems and their importance for an improved seed supply in developing countries. *Euphytica* 78:207–16. doi:10.1007/BF00027519.

Bedru, B Abdi and Y Nishikawa. 2017. Understanding smallholder farmers' access to maize seed and seed quality in the drought-prone Central Rift Valley of Ethiopia, *Journal of Crop Improvement* 289-310. *doi:10.1080/15427528.2017.1302031*.

CSA (Central Statistical Agency). 2014. The Federal Democratic Republic of Ethiopia Central Statistical Agency Agricultural Sample Survey 2013/2014 (2006 Ethiopian Calendar) Volume I Report on Area and Production of Major Crops (Private Peasant Holdings, *Meher* Season). Statistical Bulletin 532. May, 2014. CSA. Addis Ababa, Ethiopia.

Daniel I and J Adetumbi. 2006. Maize seed supply systems and implications for seed sector development in Southwestern Nigeria. *Journal of Sustainable Agriculture* 28:25–40. doi:10.1300/J064v28n02-04.

Directorate Plant Production. 2014. Production Guidelines for Cowpea. Department of Agriculture, Forestry and Fisheries Directorate Plant Production, Communication Services. Pretoria, South Africa. P. 16. www.daff.gov.za.

Dugje, I.Y., L.O. Omoigui, F. Ekeleme, A.Y. Kamara, and H. Ajeigbe. 2009. Farmers' Guide to Cowpea Production in West Africa. IITA, Ibadan, Nigeria. P. 20.

Ethiopia Rural Socioeconomic Survey (ERSS). 2013. Survey Report. Central Statistical Agency and the World Bank, May 7th, Addis Ababa.

Food and Agriculture Organization (FAO). 2010. Report on the Second State of the World's Plant Genetic Resources for Food and Agriculture. Rome: FAO.

Fatokun, C.A., S.A. Tarawali, B.B. Singh, P.M. Kormawa, and M. Tamò (editors). 2002. Challenges and opportunities for enhancing sustainable cowpea production. Proceedings of the World Cowpea Conference III held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, 4–8 September 2000. IITA

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). 2015. Ethiopian Dryland Climate Characterization a Draft Ethiopia Country Strategy Paper. Addis Ababa, Ethiopia.

International Institute Tropical Agriculture (IITA). 1984. Annual Report 1983. IITA. Ibadan, Nigeria.

IITA. 1997. Grain Legume Improvement Program, 1997 Report. International Institute Tropical Agriculture, Ibadan, Nigeria.

International Board for Plant Genetic Resources Cowpea Descriptors IBPGR Secretariat. 1983. AGPG: IBPGR/82/80. Rome.

Kidane Georgis 2003. Land degradation adoption, low soil fertility and water stress: the major issues for improving crop production and food security in the dryland areas of Ethiopia, *In:* The proceedings of the food security conference. Challenges and prospects food security in Ethiopia, UNCC, Addis Ababa August 3-15,2003. pp 201-216.

Langyintuo AS, J Lowenberg-DeBoer, M Faye, D Lambert, G Ibro, B Moussa, B Kergna, A

Kushwaha, S Musa, and G Ntoukam. 2003. Cowpea Supply and Demand in West and Central Africa. *Journal of Field Crops Research*, 82:215-231

Mahalakshmi V, Q Ng, M Lawson, and R Ortiz. 2007. Cowpea [*Vigna unguiculata* (L.)

Walp.] core collection defined by geographical, agronomical and botanical descriptors. Plant Genetic Resources: Characterization and Utilization 5(3); 113–119. doi: 10.1017/S1479262107837166.

Ministry of Agriculture (MoA). 2012. *Crop Variety Register Issues* No. 15, June2013. Animal and Plant Health Regulatory Directorate. Addis Ababa, Ethiopia.

Singh BB. 2002. Recent Genetic Studies in Cowpea. *In:* Fatokun CA, SA Tarawali, BB Singh, PM Kormawa, M Tamo (eds)). *In*: Challenges and Opportunities for Enhancing Sustainable Cowpea Production International Institute of Tropical Agriculture, Ibadan, Nigeria: p. 3–13.

Singh BB, HA Ajeigbe, SA Tarawali, S Fernandez-Rivera, and M Abubakar. 2003. Improving the production and utilization of cowpea as food and fodder. *Field Crops Res* 84:169-177.

Reddy MS and Kidane Georgis. 1993. Dryland farming and research in Ethiopia. Ethiopian Agricultural Research Organization, Addis Ababa.

Tiroesele B, K Thomas, and S Seket. 2015. Control of Cowpea Weevil, *Callosobruchus*

Maculatus (F.) (Coleoptera: Bruchidae), Using Natural Plant Products. *Insects*, 6: 77-84; doi:10.3390/insects6010077.

Vavilov NI. 1956. Studies on the origin of cultivated plants. Bulletin of Applied Botany and Plant Breeding 16: 1–248.

Swella George B and MK Deus Mushobozy. 2007. Evaluation of the Efficacy of Protectants against Cowpea Bruchids (*Callosobruchus maculatus* (F.)) on Cowpea Seeds (*Vigna unguiculata* (L.) Walp). *Plant Protect. Sc.* 43:(2): 68–72

Westphal E. 1974. Pulses in Ethiopia, their taxonomy and agricultural significance. Center for Agricultural publishing and documentation, Wageningen Pp.213-132.