Trends in Global and National Grain Legume Production and Trade: Implications on Local Chickpea and Lentil production Dynamics: The Case of Gimbichu and Minjar-Shenkora Districts of Ethiopia

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1. RATIONALE AND BACKGROUND

Despite significant economic growth that has been achieved in the past decade, poverty and food insecurity still remain the major development challenges of Ethiopia. Current evidences showed that the incidence of poverty is estimated at about 29.6% (MoFED, 2012). Furthermore, some nutrition and health indicators showed the prevalence of high level of food insecurity in the country (FAOSTAT, 2014). In recent years, there is a growing consensus that economic growth and poverty alleviation cannot be achieved unless the agricultural sector is transformed from subsistence farming to market oriented production system through trade and investment. Also, this notion has been well articulated in the agricultural development strategy of Ethiopia that gives a due emphasis on the commercialization of smallholder farmers by promoting production of high value crops competitive in local and export markets through intensification and diversification strategies.

Consequent to the current agricultural commercialization strategy, grain legumes have recently emerged as the third strategic agricultural export commodity next to coffee and sesame in generating foreign exchange earnings for economic growth in Ethiopia. Especially, the contribution of chickpea and lentil are more pronounced than the traditional export commodities such as common bean and faba bean. Currently, chickpea has become the second export commodity next to common been while lentil ranks 6th in generating pulse foreign exchange revenues. Yet, lentil has a major role for smallholders' income in local markets by fetching the highest food grain price.

Beyond other enabling factors, much of the successes of the pulse sub-sector (chickpea and lentil) could be attributed to the development and wide use of market preferred improved production technologies that have made significant improvement in production and productivity. The national chickpea and lentil research program coordinated by EIAR-DZARC in collaboration with partners such as ICARDA and ICRISAT has developed and disseminated a number of market preferred and high yielding improved technologies that are widely adopted by smallholder farmers. ICARDA has made significant contributions through the provision of breeding lines of Kabuli chickpeas except three varieties (Chefe, Shasho & Acos) as well as to all improved lentil verities except those three (EL-142, Derash, and Dembi) with high yield, disease resistant and good market classes. To note a few, cultivar Alemaya from lentil and cultivar Arerti from

Kabuli chickpea have been the most widely adopted improved varieties that have made significant impact on the productivity and income of smallholder farmers[1].

Besides success stories, the pulse subsector is also constrained by a number of challenges. Evidences showed that the integration of smallholder farmers to the market economy still remains very limited; for instance, 23% and 37% of the total chickpea and lentil production destined to the market for cash income, respectively (CSA, 2013b). In addition, the pulse export is not competitive in terms of price, quality and volume so that the local market accounts for the largest share (80%) of the pulse trade volume (Shiferaw et al, 2007). Currently, there are a number of emerging issues challenging the sustainability of previous achievements in the improvement of the productivity and income of lentil and chickpea growing smallholder farmers. For instance, there is a general observation that, in recent years, lentil production has been showing a declining trend in Gimichu District which was once known to be the lentil belt and often cited as the most successful impact oriented project areas in the production of improved lentil varieties[2].On the other hand,other major achievements have been obtained since recent years in improving the productivity and production of ICARDA bred Kabuli chickpea varieties in some other areas such as Minjar-Shenkora District. Based on this premise, ICARDA has initiated this study to investigate the major drivers of change shaping the current chickpea and lentil cropping dynamics and further identify researchable and feasible intervention areas that could sustain the productivity of the subsector.

2. OBJECTIVES

The purpose of this study was to examine the major drivers of change shaping the current lentil and chickpea production dynamics and identify and prioritize researchable areas for further in-depth study in the future.

The specific objectives are to:

- Examine trends in lentil and chickpea productionand trade and its significance from global perspectives;
- characterize and describe the dynamics of lentil and chickpea production system;
- identify key drivers of change impacting the current lentil and chickpea production dynamics; and

[1] The National Chickpea and Lentil Research Program (DZARC) has been awarded a gold medal by Ministry ofScience and Technology in 2014 for its outstanding achievement in pulse (chickpea and lentil) research and development in Ethiopia.

[2] The late Premier MelesZenawi and the former World Bank President, Jim Wolfensohn,had visited this area in October 2004 as the most successful case.

- identify the major opportunities for and constraints to the production and marketing of lentil and chickpea

3. METHODOLOGY

3.1 Profile of the Study Areas

3.1.1. GIMBICHU DISTRICT

Gimbichu district is located in East Shewa Zone, OromiyaNationalRegional State. It is situated at 82 km East of Addis Ababa. According to the information from the district agricultural office, the total area of the district is estimated to be 75,071 ha (Table 1).

Table 1. Land use pattern, Gimbichu District, 2013/2014

Land use	Area (ha)	Percent
Cultivated land	48,916	65
Grazing land	3,753	5
Forest area	2,740	4
Bush land	8,258	11
Degraded land	8,348	11
Settlement and Institutional	2,268	3
Others	788	1%
Total area	**75,071**	**100**

Source: District Agricultural Office, Gimbichu, 2014

The total population of the district in 2014 was estimated at about 93 thousand where 53% were male while the remaining were female. About 95% of the population depends on agriculture for their livelihood. The total number of households in the district are also estimated at 15 thousand consisting of 84% male-headed and 16% female-headed households.

The district is situated in a highland area with mainly a flat topographic feature (85%) but with a few ragged and gorge areas (15%). Its altitude ranges from 900 to 2,700 meters above sea level. The average temperature ranges from 16 to 23ºC. The annual rainfall ranges between 800 and 1000 mm. The rainfall pattern is bimodal. The main rainy season (***Kiremt***) occurs in the period between June to September while the short rainy season (***Belg***) prevails from February to May.

The dominant spoil type of the district is Vertisol covering 75% of the area causing waterlogging problem during the main rainy seasons. Farmers traditionally practice late planting and ridge and furrow seedbed preparation methods to overcome the waterlogging problem. In the past, the broad bed and furrow technology had been disseminated in the district by the Debre Zeit Agricultural Research Center in collaboration with International Livestock Research Institute (ILRI) through the vertisol project. The oxen drawn broad bed maker (BBM) was designed to overcome the waterlogging problem and enable farmers to plant early in the season. But, due to some technical problems, the adoption of the BBM technology could not move as it had been expected.

The farming system of the district is typically a mixed crop-livestock production system. Agriculture is virtually rainfed and oxen are the source of draught power for land preparation, planting and threshing. The major crops in order of importance include wheat (bread and durum), lentil, chickpea, Tef, faba bean, and grass pea. It is estimated that wheat accounts for 52%; lentil (19%), chickpea (17%), tef (6%), faba bean (2%) and other crops cover less than 2% of the total cultivated land (Figure 1). In terms of production, wheat (57%), lentil (16%) and chickpea (18%) alone constitute 91% of the total grain production in the district. In general, the cropping pattern in the district is dominated by cereals while pulse crops are planted for cash and crop rotation purposes.

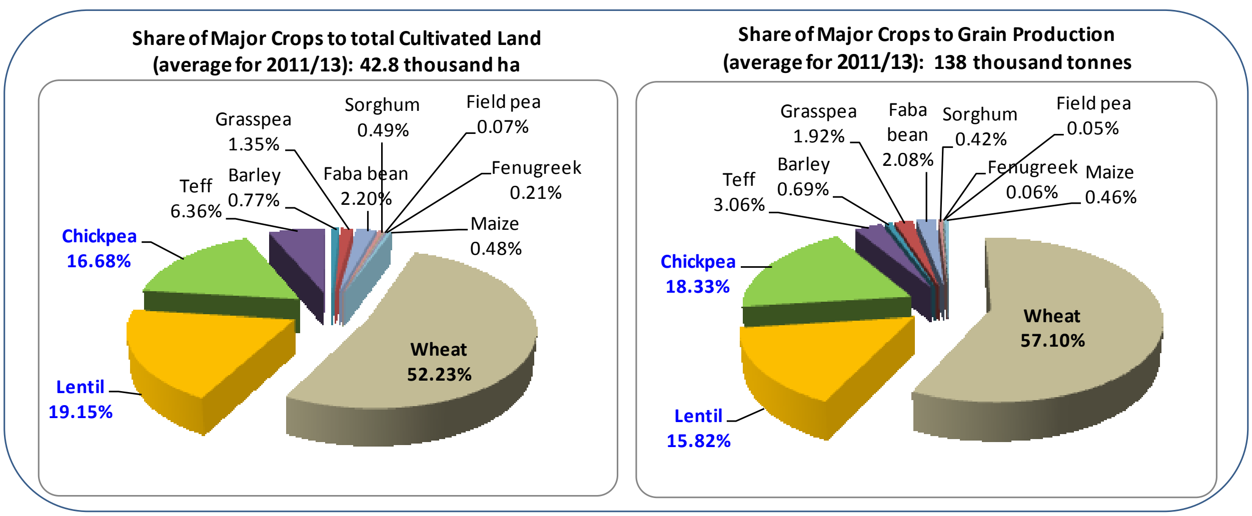
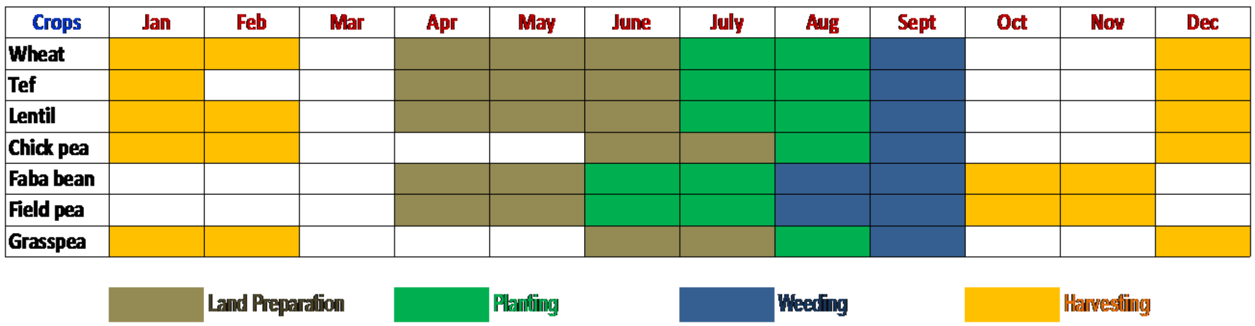


Figure 1. Cropping Pattern in Gimbichu District, 2011/13 ,

Source: Computed using Data from Office of Agriculture, Gimbichu District, 2014

The cropping calendar of the district is shown in Table 2. Wheat is planted in July and August while tef planting takes place during the period between mid-July and Mid-August. Planting of pulse crops such as chickpea, lentil and grasspea, is taking place in July and August. Farmers sometimes use late planting method to overcome the apparent waterlogging problem due to the dominant vertisol in the area. Faba bean is planted during the period between late June and early July. Faba bean is commonly planted on well drained light soils. Harvesting of faba bean begins in October. Tef harvesting is done during the period between mid-November and December. Harvesting of other crops begins in December and extends to the month of February due to the high altitude of the district and the late planting practice.

Table 2. Cropping calendar, Gimbichu District



Source: Field survey, 2014.

Similar to other highland areas of the country, livestock are the most important component of the farming system in the district. The livestock population include 137.3 thousand cattle, 61.8 thousand sheep and goats, and 36.4 thousand equines. Livestock provide sources of draught power, transport, cash income, food, and fuel.

In terms of infrastructure, the district has one all-weather gravel road which connects the main town of the district, Chefe Donsa, to Debre Zeit and Sendafa towns where the former is located to the highway connecting Addis Abeba to the Eastern, Southern, and South-eastern part of the country and the latter is located on a highway connecting Addis Abeba to Dessie. However, Intra-district road networks are very limited and often seasonal and in poor conditions.

3.1.2. MINJAR-SHENKORA DISTRICT:

Minjar-Shenkora district is situated in North Shewa Zone, Amhara National Regional State. It is located at 129 km East from Addis Ababa. Based on current information from the district agricultural office, the total area coverage of the district is estimated at 229.5 thousand ha (Table 3).

Table 3. Land use pattern, Minjar-Shenkora District, 2013/2014

Land use	Area (ha)	Percent
Cultivated land	48,803	21
Grazing land	3,359.5	1
Forest area	17,647.09	8
Settlement and Construction	27,717.7	12
Degraded land and others	131,935.71	57
Total area	**229,463**	**100**

Source: District Agricultural Office, Minjar-Shenkora, 2014

Data from the district agricultural office unveiled that the total population of Minjar-Shenkora District is currently152,430consisting of 52% male and 48% female. The majority of the population (80%)lives in rural areas where agriculture provides the sources of livelihood. In 2014, the total number of rural households are estimated to be 21,730 where 93% are male-headed while 7% are female-headed households.

The topography of the district is mainly characterized by flat landscape (84%) with a few ragged and mountain areas (16%). Its altitude ranges from 1040 to 2,380 meters above sea level. The average temperature ranges from 14 ºC to 27 ºC while the annual rainfall ranges between 780 and 900 mm. The rainfall pattern is bimodal. The main rainy season (***Kiremt***) occurs in the period between June to September while the short rainy season (***Belg***) prevails from February to May. In contrast to Gimbichu, the soil type in Minjar-Shenkora district is mainly light soil but vertisol covers 19% of the total area.

Similar to other highland areas, the farming system of the district is typically a mixed crop-livestock production system. Crop production is entirely based on rainfed farming. The major crops include tef, wheat (bread and Durum), chickpea, lentil, barley, maize, faba bean, field pea, and grass pea. Tef stands first by covering 41% of the total cultivated land in the district followed bywheat (25%), chickpea (10%), lentil (6%), barley (5%) and maize (3%) (Figure 2). In terms of production, the first three major crops are tef (22.5%), wheat (35%), and Chickpea (10%) which account for nearly 68% of the total grain production while lentil constitutes only 3% of the total grain production (Figure 2). Similar to Gimbichu, the cropping pattern in Minjar-Shenkora district is dominated by cereals while pulse crops are planted for cash and crop rotation purposes.

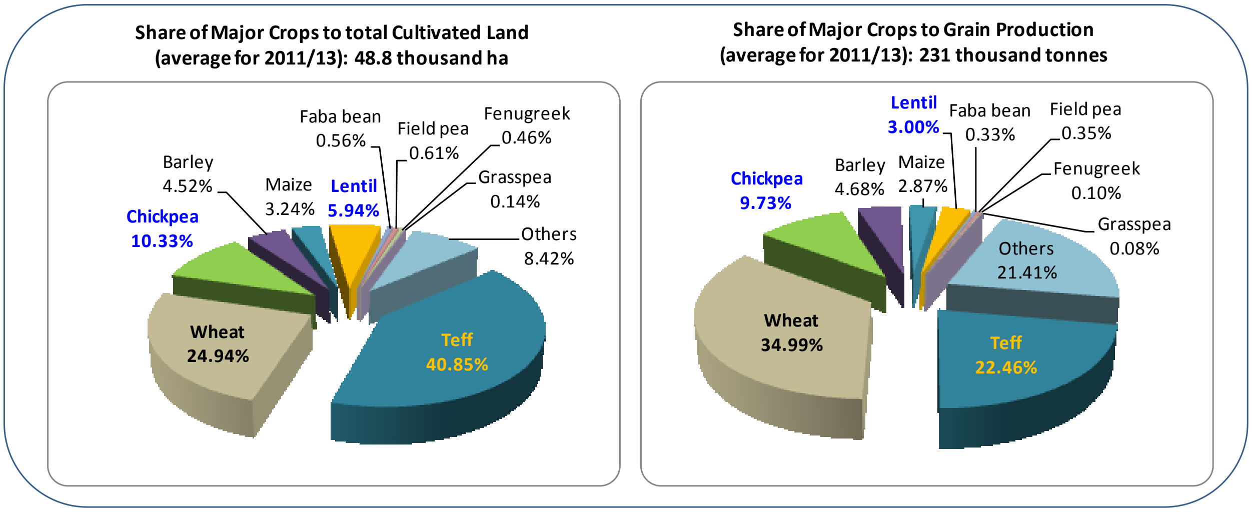


Figure 2. Cropping Pattern in Minjar-Shenkora District: 2011/13
Source: Computed using Data from Office of Agriculture, Minjar-Shenkora District, 2014

The cropping calendar depicting the major farm operationsin the districtis presented in Table 4. Tef is commonly planted in July while there are also some tef planting activities in late June. Wheat planting takes place during the period between June and July. Planting of lentil and chickpea is taking place in June and July. Here, it is important to note that farmers in Minjar-Shenkora district plant their crops a bit earlier than farmers in Gimbichu due mainly to the dominant light soil type and level of rainfall. Harvesting of tef, lentil, barley, faba bean and field pea is commonly underway during the months of October and November. Tef harvesting is done during the period between mid-November and December. In general, all harvesting activities are commonly completed by early January.

Table 4. Cropping calendar, Minjar-Shenkora District

Crops	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Tef			Land Preparation	Land Preparation	Land Preparation	Land Preparation	Planting	Weeding		Harvesting	Harvesting	
Wheat			Land Preparation	Land Preparation	Land Preparation	Planting	Planting	Weeding			Harvesting	Harvesting
Chick pea			Land Preparation	Land Preparation	Land Preparation	Land Preparation	Planting	Weeding			Harvesting	Harvesting
Lentil				Land Preparation	Land Preparation	Planting	Weeding	Weeding		Harvesting	Harvesting	
Barley				Land Preparation	Land Preparation	Planting	Weeding			Harvesting	Harvesting	
Maize		Land Preparation	Land Preparation	Planting	Weeding	Weeding					Harvesting	Harvesting
Faba bean			Land Preparation	Land Preparation	Land Preparation	Planting	Weeding			Harvesting	Harvesting	
Field pea			Land Preparation	Land Preparation	Land Preparation	Planting	Weeding			Harvesting	Harvesting	

Land Preparation Planting Weeding Harvesting

Source: Field Survey, 2014.

As noted earlier, being a mixed farming system, livestock are the most important components providing sources of draught power, transport, cash income, food, and fuel. According to the current data from the office of agriculture in the district,the livestock population include 104.5 thousand cattle, 52 thousand sheep,68 thousand goats, 33 thousand equines, and nearly 4.6 thousand camels.

In terms of infrastructure, the district has one all-weather asphalt road which connects the main town of the district, Arerti, to Modjotown which is located on the main highway connecting Addis Abeba tothe Eastern, Southern, and South-eastern part of the country; this main highway is also the sole route connecting Ethiopia to the port of Djibouti.

3.2 Survey Design and Methods

The results of this study are based on both primary and secondary data. Primary data were generated using rapid survey techniques involving focus group discussion (FGD), key informant survey, and field observations. The field survey work was conducted during the months of November and December 2013. Here, the survey design involved two stages to conduct interviews with farmers. First, since lentil and chickpea may differ in some specific issues, the survey work was designed to select one district for each crop. In this case, being a major lentil growing area, Gimbich District was taken for lentil survey while Minjar-Shenkora was covered asthe major chickpea growing district. Within each district, Peasant Associations (PAs) were also selected in order of their importance in the production of each crop. In Gimbichu district, a total of six PAs were selected for lentil survey involving FDG with lentil growing farmers covering different issues of the lentil production dynamics. Moreover, two PAs from neighboring Ada'a district , were also covered in the survey. Key informant survey was also conducted with experts from the office of agriculture and Yerer Farmers' Cooperative Union. In addition, a semi-structured survey was conducted with traders and lentil processors in Beki areas. For the chickpea survey in Minjar-Shenkora district, five major chickpea growing PAs were selected to conduct focus group discussion with farmers. Similarly, primary data was generated through interviews with farmers, experts, traders and other key informants.

In addition to the field survey work in the two districts, one large food processing company was visited in Debre Zeit town. The company, Export Trading Group (ETG), is a FDI company engaged in processing and export of pulse crops. Oromiya Agricultural Output Market Enterprise (OAOME) located in Burayu, suburb to Addis Ababa, was also visited to make a survey on the marketing of processed lentil. OAOME is just another version of Ethiopian Commodity Exchange (ECX) but actively engaged in the exchange of most food grain crops as opposed to ECX accommodating targeting export commodities. It was found that OAOME is the terminal market for the lentil supply from Beki processing areas.

Finally, most of the secondary data were collected from local sources such as CSA, National Bank of Ethiopia while some were also obtained from external web-based data sources such as FAO, The World Bank, etc.

3.3 Data Analyses

Since the study is based on a rapid appraisal techniques, the data analysis is mainly based on descriptive statistics and trend analysis. The nature of this research is more of exploratory and characterization as opposed to rigorous quantitative modeling approach. And yet, this approach is much better than other options to achieve the objectives of the study.

4. GLOBAL PULSE PRODUCTION AND TRADE

4.1 Global Pulse Production

Pulses do have multiple functions in the farming systems of many developing countries ranging from human nutrition, animal feed; export commodities and provide environmental services. They provide an important alternative source of protein for millions of low income people in the developing world (Yadav et al., 2007). It is estimated that, on average, pulse crops contribute to 7.5 and 3% of the total protein and calorie consumption in developing countries, respectively (Akibode&Maredia, 2011). Most legume crops are widely considered as healthy foods and constitute an important component of the vegetarian dietary system(Yadav et al., 2007).Moreover, legumes also serve as important sources of animal feed and rotation crops in different cropping systems for maintaining soil fertility through fixing atmospheric nitrogen into the soil. Grain legumes are also important sources of cash income for many smallholder farmers in developing countries.

Despite some of their intrinsic traits in terms of nutrition and environmental benefits, the production of most pulse crops is mainly concentrated in South Asia, West Africa, East Africa, Central America and parts of South America. It is estimated that, on average, the annual global pulse production was nearly 66 million metric tonnes from 76 million ha of land during 2006-2012. As indicated in Figure 3, India is the largest producer of pulse crops accounting for 24% of the global pulse production, followed by Myanmar, Canada, and China contributing 7% each during 2006-2012.The first 5-leading pulse producing countries (India, Myanmar, Canada, China, and Brazil) alone accounted for 50% of the world pulse production. Still, in terms of area, India stands first by holding 32% of the world pulse harvested land. The current data also showed that Ethiopia belongs to the major pulse producing areas with marginal contribution in term of pulse production (3%) and area (2) which is of course below its actual potential.

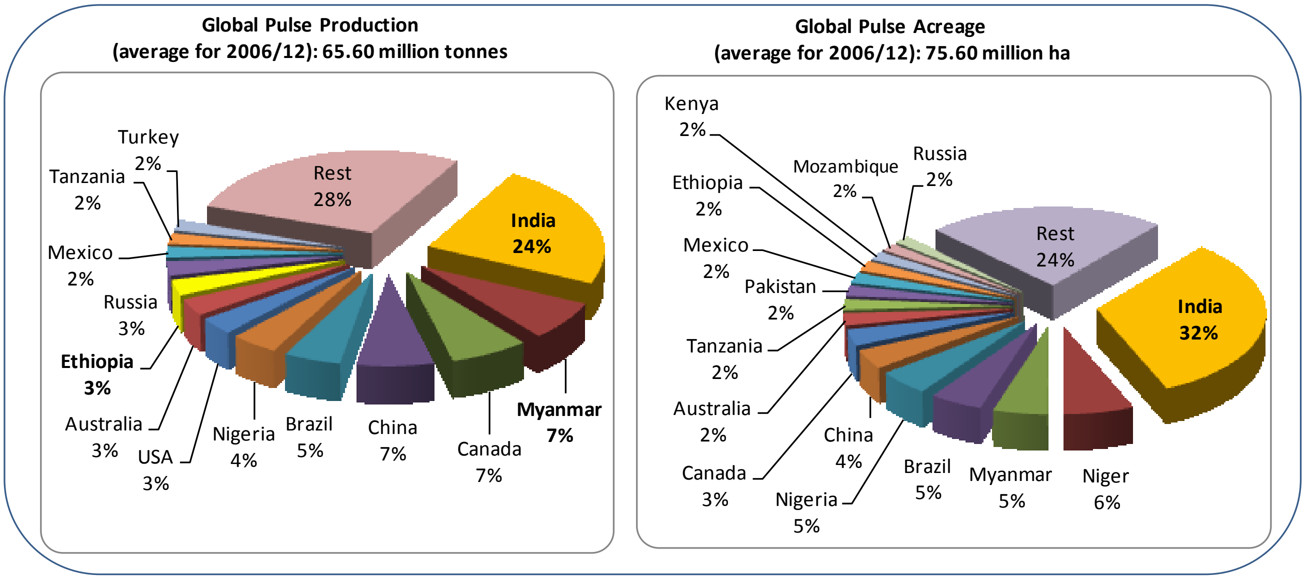


Figure 3. Share of Major Pulse Producing Countries to Global Pulse Production
Source: Computed from FAOSTAT online Database, 2014

Available evidences showed that global pulse production and area coverage have remained stable with a modest growth since the last decade or so (Figure 4). This poor performance is closely associated with a marginal growth in global pulse productivity that could be resulted from a number of biophysical, socioeconomic, policy and other constraints in the major pulse producing countries.

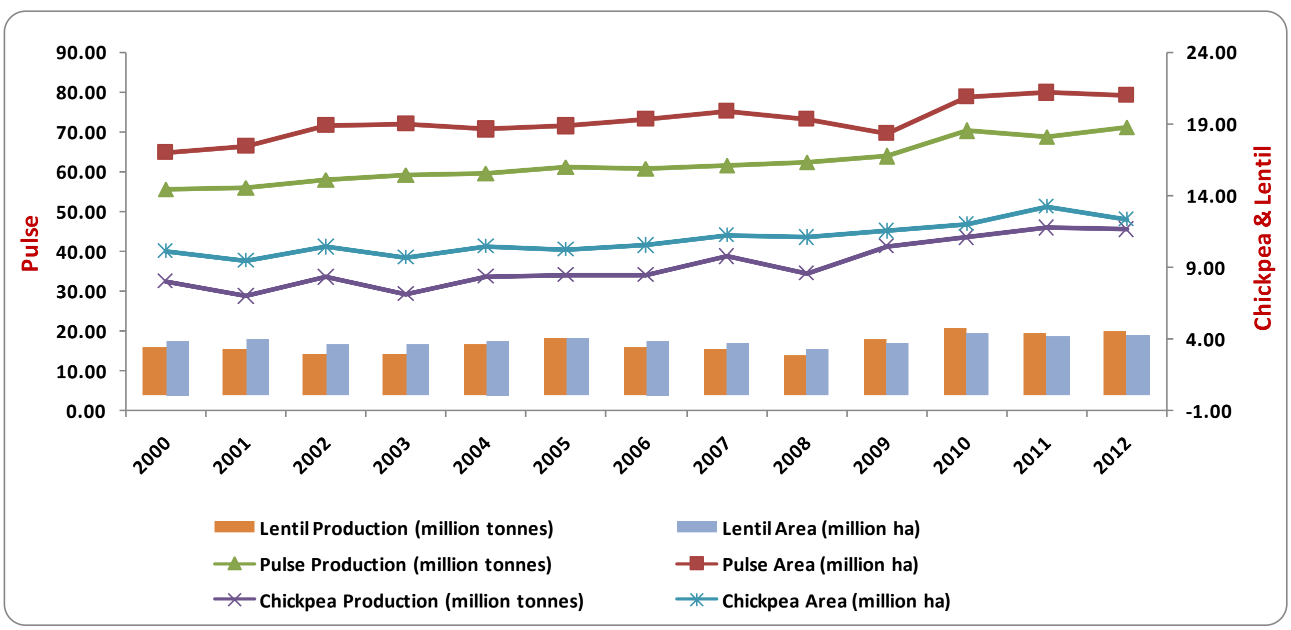


Figure 4. Trends in Global Pulse Production (ton) and Harvested Area (ha)
Source: Computed from FAOSTAT online Database, 2014

While different pulse crops are produced globally, only a few have a major share in terms of production and area (Figure 5). Dry beans are the largest pulse crops accounting for 33% of the world pulse production from 38% of pulse harvested areas. Chickpea stands second followed by dry peas contributing 16% and 15% of global pulse production, respectively. Lentil also belongs to the major pulse crops by accounting for 6% and 5% of the world pulse production and area, respectively. The contribution of all other pulse crops to global pulse production remains below 10%.

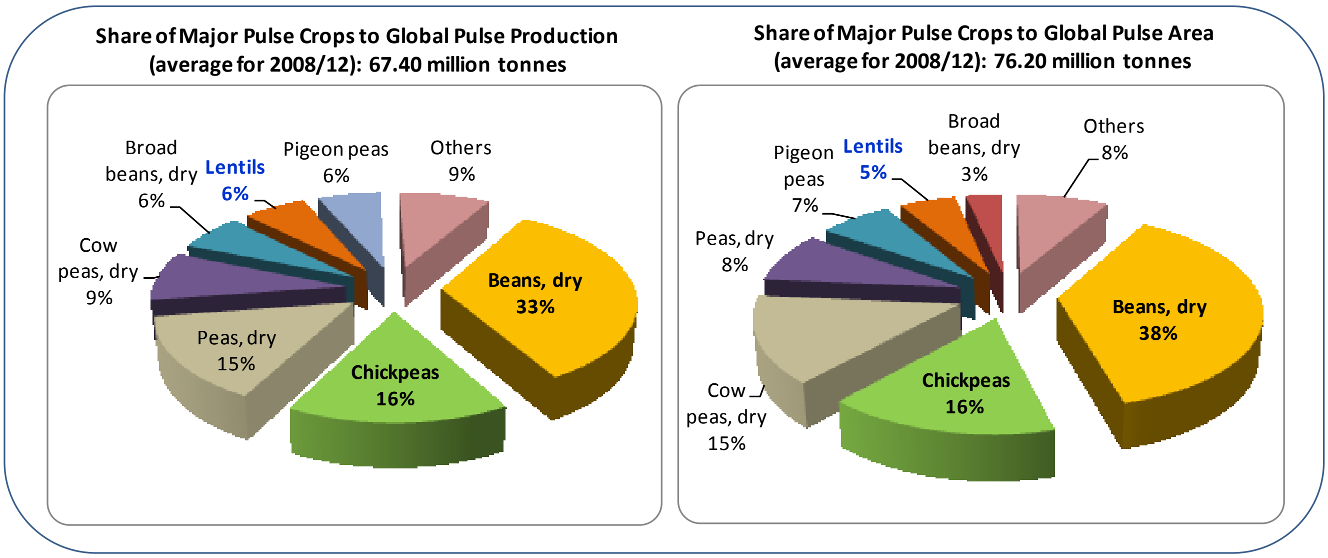


Figure 5. Share of Major Pulse Crops to Global Pulse Production
Source: Computed from FAOSTAT online Database, 2014

World Chickpea Production

Chickpea is the second major pulse crop in the world with a total production of 10.24 million tonnes from 11.71 million ha of land (Figure 5). Globally, chickpea is commonly identified as desi and Kabuli types. The desi types are mostly brown seeded and traditionally grown in warmer climates of Asia and Africa, mostly in India, Pakistan, Bangladesh, Myanmar and Ethiopia; and the kabuli types are white- and large-seeded varieties more suited to the temperate climates of Turkey, Mexico, the USA, Afghanistan and Iran. Although there are no precise data showing global chickpea production disaggregated into desi and kabuli types, some estimates showed that Kabuli chickpea contributes to 15- 30% of global chickpea production while the desi type accounts for the remaining proportion (Knights et al., 2007; Reddy et al., 2007;).

India is the leading chickpea producer in the world accounting 67% of global chickpea production followed by Pakistan and Turkey each producing 5% of the world chickpea production (Table 5). India, Pakistan and Turkey together accounted for 78% of the world chickpea production. Other major chickpea producing countries have a share of less than 5%. Furthermore, the top-10 producing countries all together covered 95% of the world chickpea production. Ethiopia as a major chickpea producer countries stands sixth in the world by covering 3% and nearly 2% of global chickpea production and harvested area, respectively.

The Indian subcontinent is the leading chickpea producer in the world, its performance in terms of productivity is found to be very poor with an average yield below 1 ton per ha. The North American Countries such Mexico, USA, and Canada have attained better productivity ranging 1.5 -1.7 ton per ha as compared to other major chickpea producer countries in the world. The current chickpea productivity of Ethiopia estimated at 1.4 ton per ha can be considered as better performance relative to the world average yield which is 0.87 ton per ha.

Table 5. Major Chickpea Producing Countries in the World, (average for 2006/12)

Top 10 Countries	Production (Mt)	Share (%)	Area (ha)	Share (%)	Yield (Mt/ha)
India	6,873,957.14	67.12	7,929,114.29	67.71	0.87
Pakistan	554,442.86	5.41	1,063,428.57	9.08	0.52
Turkey	527,259.00	5.15	468,291.57	4.00	1.13
Australia	460,178.86	4.49	408,633.57	3.49	1.13
Myanmar	393,777.43	3.84	295,376.14	2.52	1.33
Ethiopia	309,813.71	3.03	217,178.14	1.85	1.43
Iran	264,130.14	2.58	545,774.14	4.66	0.48
Mexico	154,982.29	1.51	91,862.43	0.78	1.69
Canada	129,554.29	1.26	84,214.29	0.72	1.54
USA	84,744.14	0.83	52,904.14	0.45	1.60
Sub Total (Top 10)	**9752839.86**	**95.23**	**11,156,777.28**	**95.28**	**0.87**
World	**10,241,723.71**		**11,709,644.00**		**0.87**

Source: Computed from FAOSTAT online Database, 2014

World Lentil Production

Lentil is among the major pulse crops in the world with an average production of 3.9 million tonnes per annum from nearly 4 million ha of land (Table 6). Lentil is commonly categorized into red, green and brown types that are targeting different market segments. Estimates unveiled that the red type accounts for 70% of global lentil production while the green and brown types contribute to 25% and 5% of world lentil production (Agri-Food Canada, 2010). Canada and the US are large producers of the green type whereas the rest of the world produces mainly the red type. For instance, Canada accounts for 75% of the world green type lentil production (Agri-Food Canada, 2010).

Canada is the largest lentil producer in the world by producing 1.3 million tonnes or 33% of global lentil production, followed by India and Turkey which account for 24% and nearly 11% of the world lentil production during 2006-12 (Table 6). Other major producers include USA (5.7%), Australia (5%), Nepal (4.4%), China (3.5%), Syria (2.7%) and Ethiopia and Iran each accounting for 2.4% of global lentil production. In general, the top-10 countries contribute to 94% of the world lentil production.

In contrast to chickpea, developed countries such as Canada, USA, and Australia play a major role in global lentil production. These three countries alone cover nearly 44% and 30% of the total world lentil production and area harvested during 2006-12. The trend of global lentil production has not showed a significant change in growth, lentil production in these countries has been trending upwards during the past 12 years (Figure 4).

The performance of global lentil production in terms of productivity is also limited to few major producing countries. China ranks first with an average yield of 2.1 ton/ha followed by Turkey (1.5 ton/ha), USA and Canada each with an average of 1.3 ton/ha during 2006-12 (Table 6). However, despite India is the second largest lentil producer in the world, its productivity remains at 0.63 ton/ha which is much lower than the world average (1 ton/ha). Here, Ethiopia has managed to attain the world average yield.

Table 6. Major Lentil Producing Countries in the World, (average for 2006/12)

Top 10 Countries	Production (Mt)	Share (%)	Area (ha)	Share (%)	Yield (Mt/ha)
Canada	1,278,960.00	33.05	874,042.86	22.39	1.46
India	934,985.71	24.16	1,477,528.57	37.85	0.63
Turkey	411,798.00	10.64	272,382.14	6.98	1.51
USA	219,162.14	5.66	165,575.71	4.24	1.32
Australia	193,841.86	5.01	153,108.57	3.92	1.27
Nepal	171,193.71	4.42	192,614.86	4.93	0.89
China	135,857.14	3.51	64,714.29	1.66	2.10
Syria	104,444.57	2.70	135,942.29	3.48	0.77
Ethiopia	94,330.14	2.44	96,794.86	2.48	0.97
Iran	92,039.29	2.38	182,600.71	4.68	0.50
Sub Total (Top 10)	**3,636,612.56**	**93.96**	3,615,304.86	**92.62**	1.01
World	**3,870,226.71**		**3,903,454.86**		**0.99**

Source: Computed from FAOSTAT online Database, 2014

4.2 Global Pulse Trade

On average, the annual global pulse export trade is estimated at 6.7 billion USD from the export of 11.74 million tonnes per annum during 2006-2011 (Figure 6). This is equivalent to 18% of the total pulse crops produced globally. Canada is the leading pulse exporter in the global market by accounting 25% of the world pulse export value followed by Myanmar (13%). The other major pulse exporting countries with significant market share include China (11%), USA (9%), Australia (7%), Argentina (4), France (3), and Turkey (3%). Despite its potential in pulse production, Ethiopia's market share in world pulse export is about 2%. While developing countries are more important in global pulse production, developed countries have increasingly found to be more competitive in pulse export market by having the largest export market share. For instance, Canada, USA, Australia and France alone accounted for 44% and 54% of the world pulse export market in terms of value and volume, respectively.

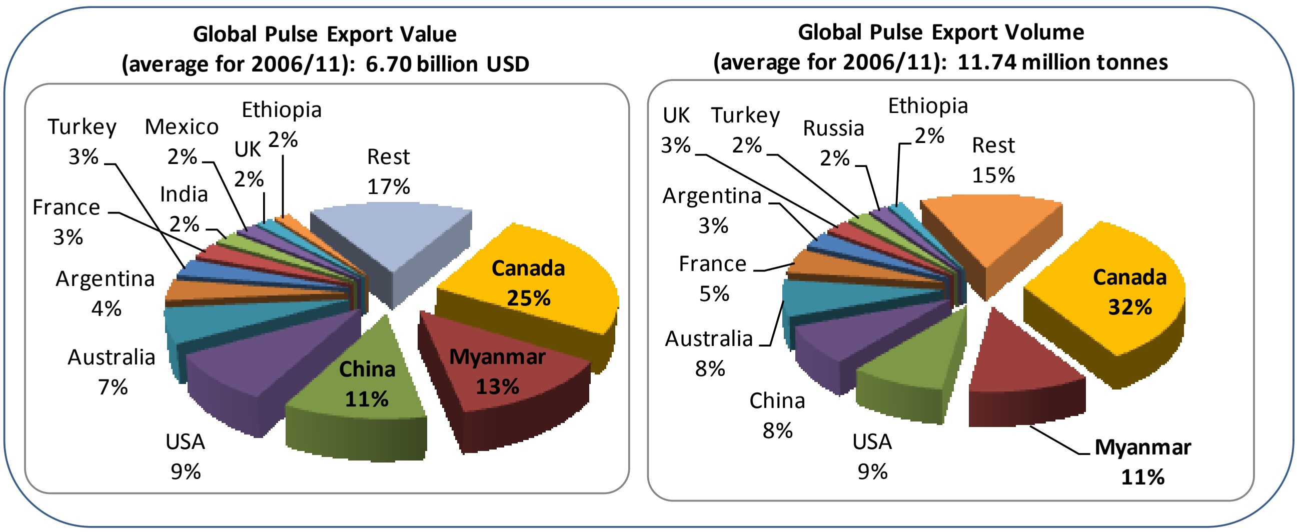


Figure 6. Major Pulse Exporting Countries in the World
Source: Computed from FAOSTAT online Database, 2014

Among the major pulse crops, dry beans are the dominant pulses in global export market by covering 43% of the total world pulse export value during 2008-2011 while dry peas rank second by having 20% of the market share (Figure 7). Although the share of lentil to global pulse production is much lower (ranks 6th) than chickpea (ranks 2nd), it has greater market share than the later in global pulse export market. Lentil stands 3rd among major pulse crops in terms of global pulse export value (20%) and volume (15%). However, chickpea ranks fourth among the pulses by having 11% and 9% of the world pulse export market share in terms of value and volume, respectively.

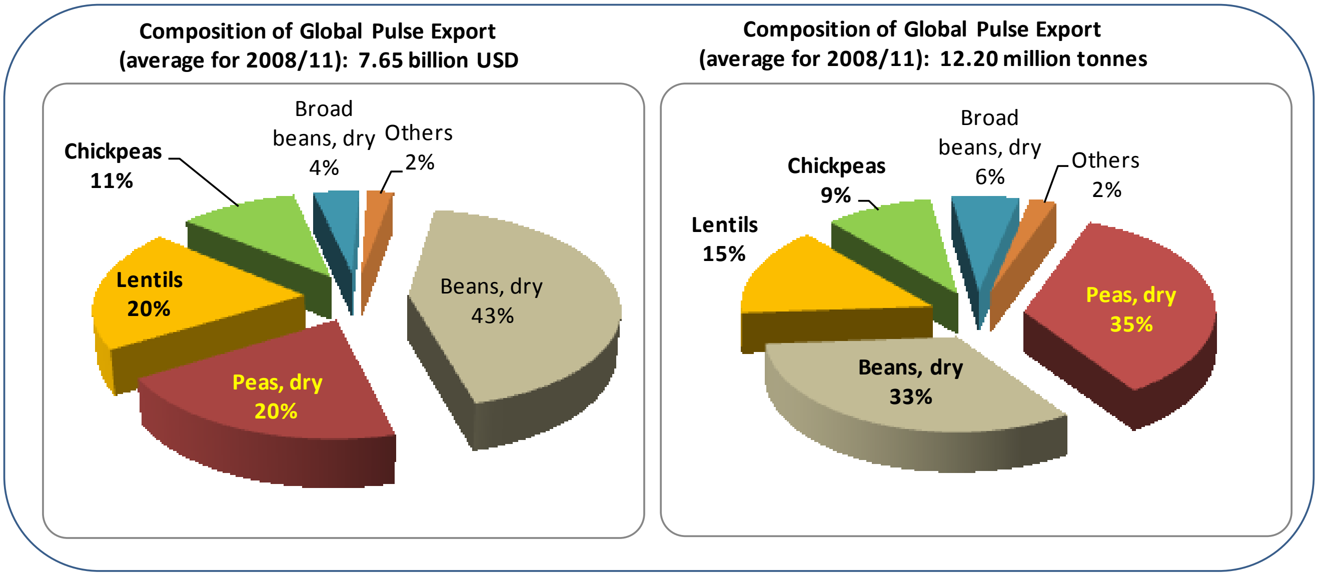


Figure 7. Share of major pulse crops to global pulse export
Source: Computed from FAOSTAT online Database, 2014

It is estimated that, on average, a total of 11.14 million tonnes of pulses valued at 7 billion USD per annum was globally imported by different countries around the world during 2006-2011 (Figure 8). The Indian sub-continent consisting of India, Pakistan, Bangladesh and Sri Lanka is the largest destination market for global pulse export. Despite being the major pulse producer in the world, the Indian subcontinent is known to be the largest consumer and importer of pulses by accounting for 28% and 35% of the global pulse import in terms of value and volume during 2006-2011. India alone is the largest global pulse export destination market in the world by importing 22% and 26% of the world pulse import value and volume, respectively (Figure 8).The major factors such as population growth and an increasing trend in cereal and oilseed production and consumption; low productivity; policy that favors more cereals and oil-crops have caused domestic pulse production in the subcontinent to be far short of domestic demand by an amount of 3-4 million tonnes per annum (Pulse Australia, 2012). In addition, the gap could be further widened by unfavorable cropping seasons. So, global pulse demand is greatly dictated by the local pulse production in the subcontinent in addition to other factors such as price and quality.

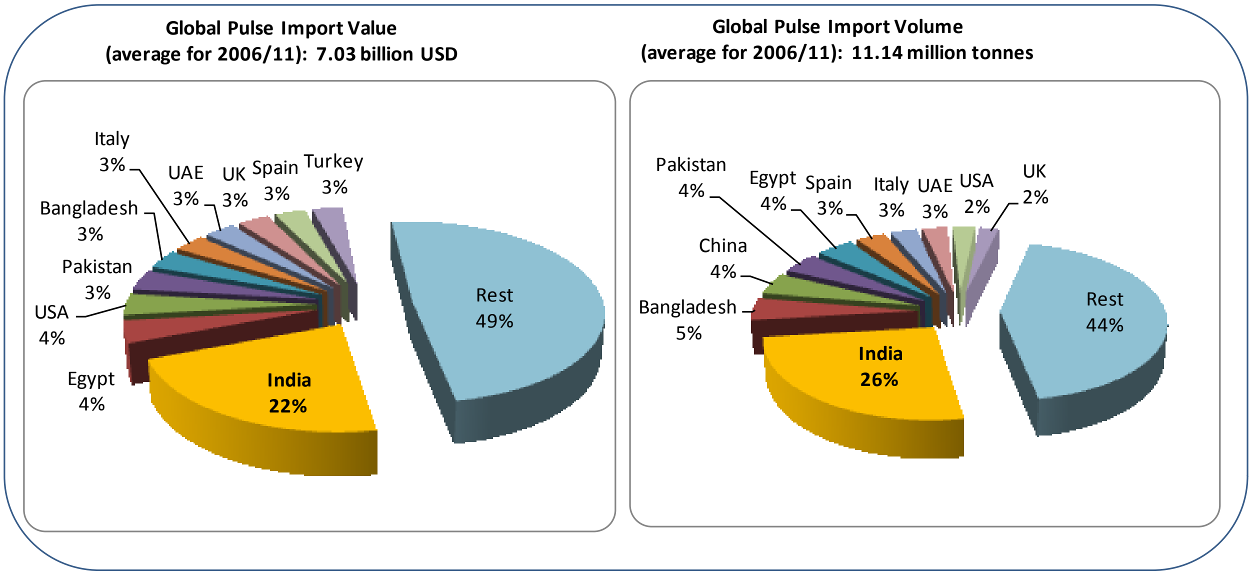


Figure 8. Major Pulse Importing Countries in the World
Source: Computed from FAOSTAT online Database, 2014

Global Chickpea Export

The average global chickpea export trade value was estimated at 721 million USD per annum from an average export of 1 million metric tonne during the period 2006-2011 (Figure 9). Australia is the leading chickpea exporter in the world by having the largest market share in terms of chickpea export value (24%) and volume (33%). The other major chickpea exporting countries include India (18%), Mexico (15%), Turkey (8%), Canada (8%), Myanmar (4%) and Ethiopia (4%). The top 10 chickpea exporting countries alone accounted for 90% of the world chickpea export market share. Here, it is important to note that although Ethiopia's chickpea export market share is still very limited, evidences have showed that it has been improving its competitiveness and reached 4% global market share which is much better than its previous poor performance in some few years back which was often below 2%. Its market share in terms of volume has also improved and increased to 5%.

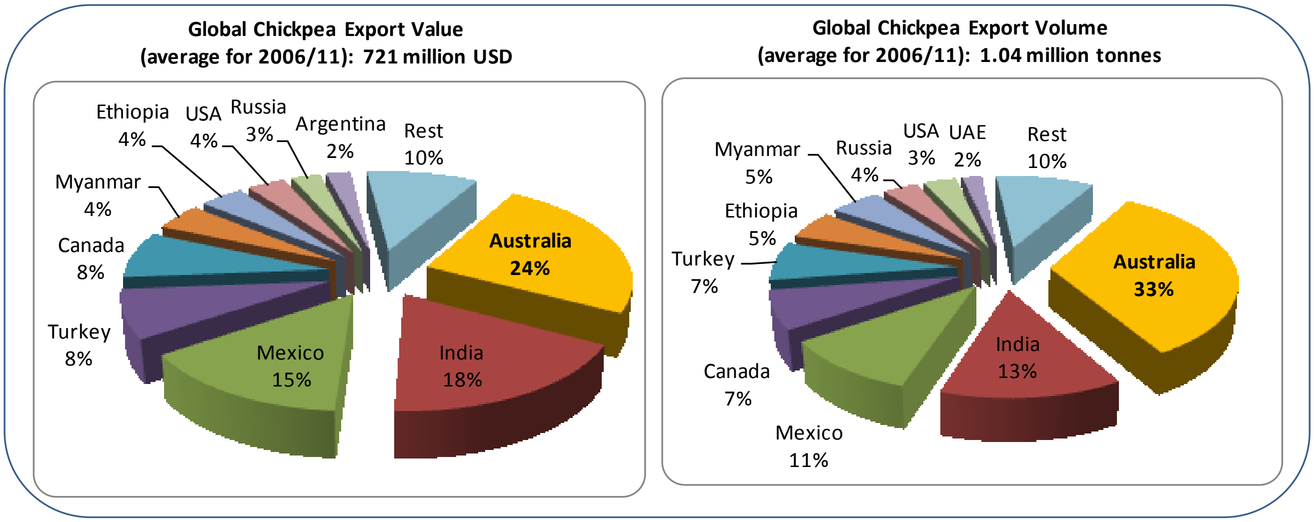


Figure 9. Major Chickpea Exporting Countries in the World
Source: Computed from FAOSTAT online Database, 2014

In general, the largest proportion of global chickpea production is locally marketed and consumed within those countries producing the crop. In this case, it is estimated that about 10% of global chickpea production was traded in export markets during 2006-11 (Table 7). In addition, there are great variability among major chickpea exporting countries in terms of the level of commercialization of their chickpea production towards export trade. There is an apparent trend that the developed nations do have more export oriented chickpea production than those developing countries. The leading chickpea exporting countries such as Australia and Mexico have exported 82% and 80% of their total domestic chickpea production to the world market, respectively (Table 7). Other developed countries whose chickpea production mainly destined for export market include Canada (59%), USA (47%) and Russia (95%). While India is the second largest chickpea exporter in the world, its export is limited to 2% of its total local chickpea production. Ethiopia has, on average, exported 18% of its domestic chickpea production.

Table 7. Major Chickpea Exporting Countries in the World,(average for 2006-2011)

countries	Export (Mt)	Export/Domestic Production (%)	Unit Value (USD/Mt)
Australia	347,586.17	81.85	506.66
India	139,823.17	2.08	934.49
Mexico	108,745.83	80.26	973.54
Canada	74,258.17	59.44	747.52
Turkey	72,637.33	13.81	805.10
Ethiopia	53,079.67	18.11	541.42
Myanmar	52,454.50	13.95	607.85
Russia	36,174.17	94.78	520.30
USA	34,295.83	46.50	734.47
UAE	20,471.67	-	644.19
Sub Total (Top 10)	939,526.51		685.93
World	**1,043,075.83**	10.42	690.72

Source: Computed from FAOSTAT online Database, 2014

There is a significant variability in the unit values of chickpea export per tonne among major exporting countries. The average world chickpea export price was 690 USD per tonne during 2006-2011 (Table 7). The highest unit value of chickpea export was recorded by Mexico (nearly 974 USD/tonne) followed by India (934 USD/tonne), Turkey (805 USD/tonne), Canada (748 USD/tonne), and USA (734 USD/tonne). Australia, the leading chickpea exporter, was found to be competitive in price by exporting the lowest unit value (507 USD/tonne) among the major chick exporting countries. The high export prices of Mexico, Turkey and Canada are attributed to the quality of their chickpea export mainly of kabuli types in terms oflarge seed size. Australia has the largest market share in the Indian subcontinent with its desi type chickpea export in terms of price competitiveness.

Global Lentil Export

Despite its low position in global pulse production, lentil is a high value crop ranking 3rd in world pulse export market share. It is estimated that, on average, about 46% global lentil production was traded in export markets during 2006-2011 (Table 8). Canada is the largest lentil exporter in the world by having 56% and 59% of the world lentil export market share in terms of value and volume, respectively (Figure 10). Other major lentil exporting countries next to Canada include Turkey (12%), USA (8%), Australia (7%), and Syria (5%) while others including Ethiopia have a market share below 5%. The top five exporting countries accounted for 86% of the global lentil export market share.

Table 8. Major Lentil Exporting Countries in the World, average for 2006/11

Countries	Export (Mt)	Export/Domestic Production (%)	Unit Value (USD/Mt)
Canada	1,007,148.50	81.01	705.92
Turkey	182,524.83	44.80	832.71
USA	162,807.33	75.51	629.41
Australia	136,524.33	91.64	664.78
Syria	72,722.33	70.82	793.48
UAE	32,797.83	-	741.59
Nepal	24,195.83	14.66	1,229.10
India	20,398.33	2.19	592.12
China	17,866.83	13.30	674.46
Ethiopia	8,777.83	9.89	813.34
Sub Total (Top 10)			
World	**1,721,177.50**	**45.81**	**732.79**

Source: Computed from FAOSTAT online Database, 2014

Similarly to the case of chickpea, the developed countries have a more export oriented lentil production system and found to be the major lentil suppliers in export market. The leading lentil exporting countries such as Canada and Australia have exported 81% and 92% of their domestic lentil production during 2006-2011, respectively (Table 8). Among the top five countries Turkey exported about 45% of its domestic production while USA has exported the largest proportion estimated at 76%. Other major exporting countries exported relatively small proportion of their domestic production. In the case of Ethiopia, about 10% the total local lentil production was trade in export market. India, the second largest lentil producer in the world, exported only 2% of its total domestic production.

The average unit value of lentil export ranged from 592 USD/tonne to 1229 USD/tonne during 2006-2011 (Table 8). The highest unit value was recorded by Nepal followed by Turkey (833 USD/tonne), Ethiopia (813 USD/tonne), Syria (794 USD/tonne), and Canada (706 USD/tonne). Here, Australia is still competitive in price by exporting relatively at fairly low export price (below the average world price) mainly to the Indian Subcontinent.

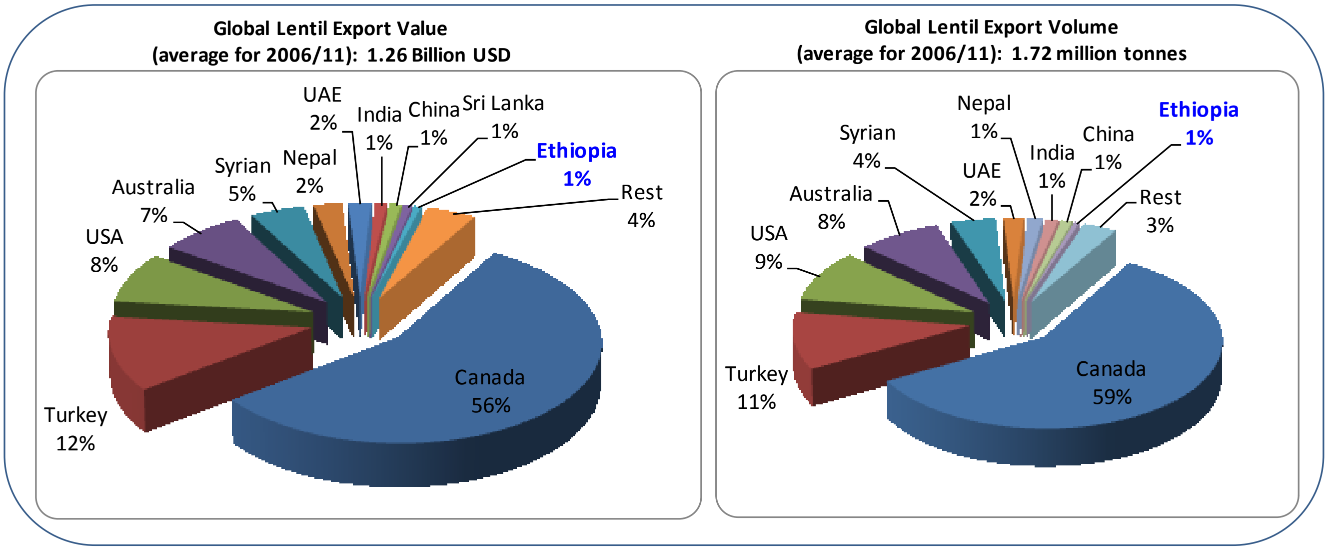


Figure 10. Major Lentil Exporting Countries in the World
Source: Computed from FAOSTAT online Database, 2014

Global Chickpea Import

Globally, major chickpea destination markets have imported a total of 993 thousand metric tonne per annum with a trade value of 730 million USD during the period 2006-2011 (Figure 11). As the major pulse destination market, the Indian subcontinent (India, Pakistan, and Bangladesh) is the largest chickpea export destination market in the world by accounting for 34% and 44% of the global chickpea import in terms of value and volume, respectively. Other major importing countries accounted for a market share below 10% of the world chickpea import value and volume.

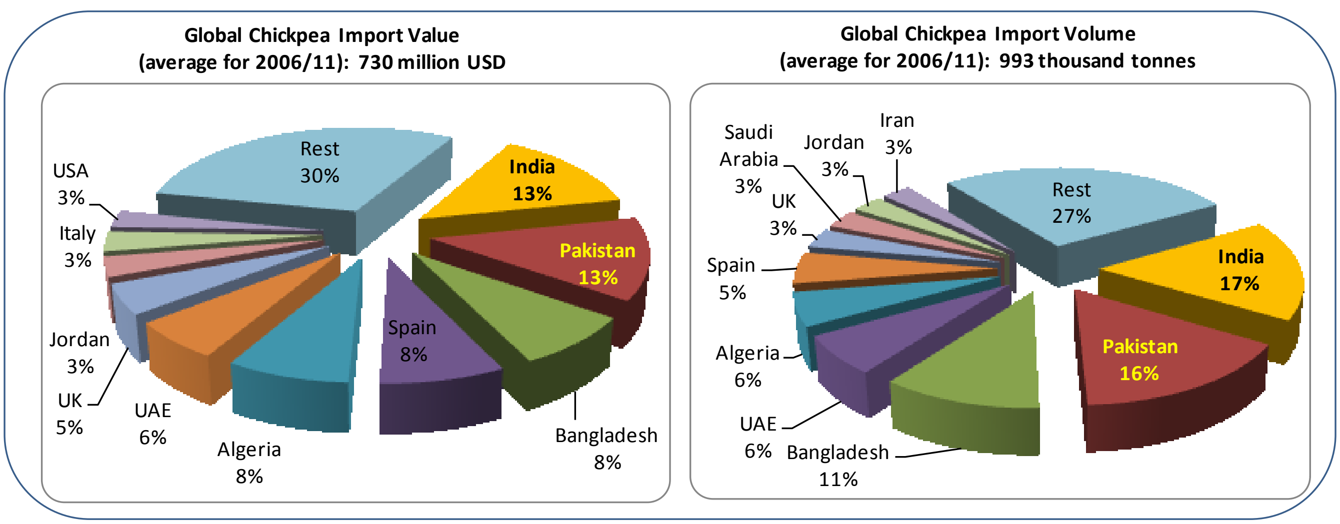


Figure 11. Major Chickpea Importing Countries in the World
Source: Computed from FAOSTAT online Database, 2014

Global chickpea markets are highly segmented based on the product end use. In general, global chickpea markets are broadly segmented into kabuli and desi types. The kabuli market is characterized by competition in quality for which high premium price is paid for extra large seeded types. These high value markets include North America, Europe, Middle East and North Africa. In these markets, the most preferred quality attributes in order of importance include seed size, color, good taste and thin seed coat (Yadav et al., 2007).The kabuli types are used for preparing a wide variety of meals including salads and vegetable mixes, snacks, soups, sweets and as condiments. Mexico, Canada, Turkey, Australia, and Iran are the major competitors in these markets.

The second market is the desi type market which is widely found in the Indian subcontinent where there is stiff competition in price and cost of production for an average grain quality. In addition, grain visual appeal is considered as important as objective measurement of grain quality (Pulse Australia, 2012). Desi chickpeas are generally used whole, shelled and split to produce dhal, or milled into fine flour for human consumption.

Global Lentil Import

It is estimated that, on average, some 1.6 million tonne of lentil with a trade value of 1.3 billion USD was globally imported per annum by different countries during the period 2006-2011 (Figure 12). Figure 14 clearly depicts that the Indian Subcontinent (India, Bangladesh, Pakistan, and Sri Lanka) is also an import destination market for global lentil export. It accounted for 26% and 28% of the world lentil import value and volume during 2006-2011, respectively. While Turkey is the major lentil exporter in the world, it was also the leading lentil importing county in the world by accounting 11% of global lentil import during the same period. Other major lentil importing countries include UAE, Egypt, Algeria, Sudan, Spain, and Colombia.

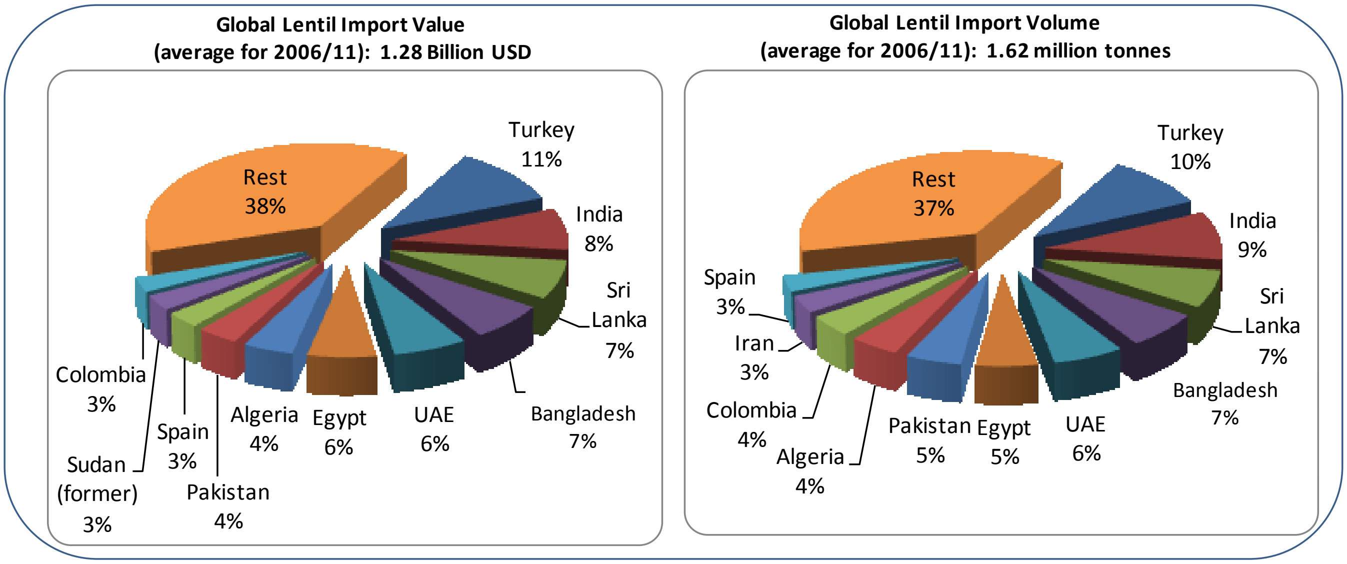


Figure 12. Major Lentil Importing Countries in the World

Source: Computed from FAOSTAT online Database, 2014

The world lentil market could be segmented into red lentil and large seeded green lentil export markets. The major red lentil export markets include the Indian Subcontinent, Turkey, Egypt, and Sudan. In this market, competition is mainly in price with average quality. Canada, Turkey, Syria, Australia, Nepal and India are the major suppliers of the red lentil export markets In most cases, split red lentil is supplied to this segment of the market. While lentil processors use different technologies to dehull and split red lentil for export markets, most millers prefer to use those lentil varieties that maximize milling efficiency with their specific technology (McVicar et al., 2010).

The high value large seeded green lentil markets include Europe and Latin America where competition is mainly based on quality parameters. In this case, Canada has been highly competitive by having the largest market share of the green lentil export market.

5. ETHIOPIA'S AGRICULTURAL TRADE PROFILE: Synopsis

The Ethiopian development strategy envisages the ultimate goal of achieving poverty reduction and broad based economic growth by transforming the current predominantly subsistence agriculture into a more commercial oriented production system. Hence, a due emphasis has been given to the promotion of export trade by producing high value commodities that are competitive in export markets. However, despite the high priority[3],

[3]The Ethiopian government has introduced export trade incentive schemes to enhance the competitiveness of the export sector and increase and diversify its export earnings. These incentive schemes include the export trade duty incentives (*Duty Drawback scheme, Voucher scheme and Manufacturing under Bonded warehouses scheme)* and

current evidences unveiled that the overall performance of the Ethiopian export has still remained below expectations. For instance, the export sector, on average, accounted for 7% of GDP and 25% of the import bill during the period 2005/2012 (Table 9). Hence, the export sector should grow substantially to make a meaningful contribution to the economy.

The structure and performance of Ethiopian export is closely associated with the agricultural sector. Current socioeconomic indicators show that Ethiopian economy is more of an agrarian where agriculture accounts for 44% of GDP while the share of industry is limited to 11% of the economy (NBE, 2012). Therefore, Ethiopian export is currently dominated by agricultural commodities that account for, on average, 75% of the total export earning of the country (Figure13).It is also important to note that the share of export earnings generated by the agricultural sector was used to be more than 90% for many years prior to the early 2000s (Berhanu, 2003; Ashenafi and Getaneh, 2014).This export structure is expected to persist until a major structural change has been made in the economy that reduces the share of agriculture. The recent structure and performance of Ethiopian export for the period 2005-2012 is presented in Table 9.

Table 9. Values of Major Export Commodities of Ethiopia (Millions of USD)

COMMODITIES	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	Average
Coffee	354.3	424.2	524.5	375.9	528.3	841.8	833.1	**554.6**
Oilseeds	211.4	187.4	218.8	356.1	358.5	326.6	472.3	**304.4**
Leather & Leather Products	75	89.6	99.2	75.3	56.4	103.8	109.9	**87.0**
Pulses	37	70.3	143.6	90.7	130.1	137.9	159.7	**109.9**
Meat & Meet Products	18.5	15.5	20.9	26.6	34	63.3	78.8	**36.8**
Fruits & Vegetables	13.2	16.2	12.8	12.1	31.5	31.5	44.9	**23.2**
Live Animals	27.6	36.8	40.9	52.7	90.7	147.9	207.1	**86.2**
Chat	89.1	92.8	108.3	138.7	209.5	238.3	240.3	**159.6**
Gold	64.7	97	78.8	97.8	281.4	461.7	602.4	**240.5**
Flower	21.8	63.6	111.8	130.7	170.2	175.3	197	**124.3**
Others	87.8	91.8	106.3	91.3	112.5	219.1	207.1	**130.8**
TOTAL EXPORT EARNINGS	**1,000.30**	**1,185.10**	**1,465.70**	**1,447.90**	**2,003.10**	**2,747.10**	**3,152.70**	**1,857.41**
EXPORT/GDP RATIO (%)	**7.70**	**6.10**	**5.50**	**4.60**	**6.70**	**8.70**	**9.50**	**7.0**
Export/Import Ratio (%)	**21.80**	**23.10**	**21.50**	**18.70**	**24.20**	**33.30**	**28.50**	**25.10**

Source: Compiled from NBE.

Recent data revealed that the total export earnings of Ethiopia has increased from 1 billion USD in 2005/06 to 3.15 billion USD in 2011/12 (Table 9).This is equivalent to an

export financing incentives (*Export Credit Guarantee scheme, Foreign Credit Scheme, and Retention of Export proceed Earnings scheme*).

increment of export earnings by 2.2 billion USD during the reference period. While the current foreign exchange earnings is very minimal by any standard, it could be considered as a significant improvement for Ethiopia whose export revenue had not been exceeding 1 billion USD for many years. The improvement recorded in the total foreign exchange earnings could be attributed to both increase in volume and unit values of major export commodities. Of the total increment in export earnings (2.2 billion USD), the largest share has attributed to the improvement in export revenues from Gold (25%) and coffee (22%) while other commodities such as oilseeds (12%), live animals (8%), flower (8%), chat (7%) and pulses (6%) had also significant contributions to the total export growth. The export revenues of major export commodities are presented in Table 7.

Evidences also showed that the performance of Ethiopian export in terms of volume has been significantly improved since recent years (Table 10). While there is a variability in the performance of commodities, all export commodities except leather and leather products have increased substantially resulting in the growth of total export earnings.

Table 10. Volume of Major Export Commodities of Ethiopia ('000 Mt)

COMMODITIES	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Coffee	147.7	176.4	170.7	134	172.2	196.1	169.4
Oilseeds	265.6	235	152.1	287	299	254.2	367.4
Leather & Leather Products	15.4	15.8	14.9	7.3	2.9	5.2	4.4
Pulses	**110.4**	**158.8**	**233**	**138**	**225.7**	**224.5**	**226.2**
Meat & Meet Products	8	5.8	6.5	7.5	10.2	16.9	17.7
Fruits & Vegetables	34.8	40.9	39.9	38.5	66.3	91.6	123.5
Live Animals	33.3	43.7	40	36.7	67.9	112.8	144.9
Chat	22.3	22.7	22.4	25.4	36.1	41	41.1
Flower	6.3	14.4	22.4	29.2	36	41.6	46.8

Source: Compiled from NBE Reports.

Despite the issue of export diversification has always been a priority in the development plan, Ethiopian export structure is still limited to a few primary commodities such as coffee, oilseeds, pulses, and live animals (Figure 13). These primary commodities, on average, accounted for 57% of the total foreign exchange earnings during the period 2005-2012. And yet, this is somehow a significant improvement in the composition of export commodities when it is compared to previous experience. For instance, the traditional export commodities (coffee, oilseeds, pulses, hides and skins) accounted for 83% and 70% in 1970/71 and 1999/2000, respectively (Berhanu, 2003).

As shown in Figure 15,coffee has been the major export commodity in Ethiopia accounting for 30% of the total foreign exchange earnings followed by oilseeds (16%), Gold (13%), chat (8%), flower (7%), and pulses (6%). Historically, coffee was the single most important Ethiopian export commodity generating more than 60% of the total export revenue over the last five decades. However, since recent years, the share of coffee has been shrinking while a marginal expansion has been observed in other non-coffee export commodities such as gold, oilseeds, pulses, flowers, fruits and vegetables, and chat.

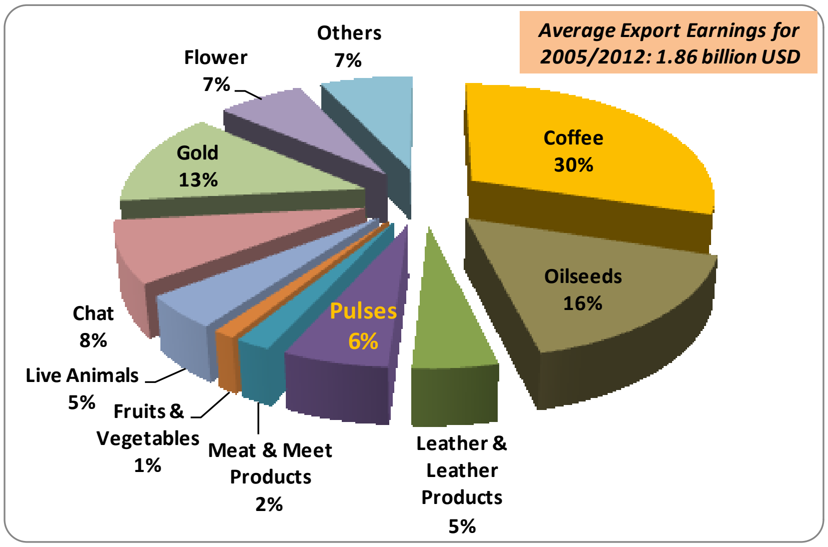


Figure 13. Share of Major Export Commodities to Total Ethiopian Export Earnings
Source: Computed from NBE Reports.

With regard to pulses, there has been a major improvement in export performance in terms of value, volume and composition. The export revenue from pulses has increased from just 35 million USD in 2005/06 to 160 million USD in 2011/12 with a corresponding growth in volume from 110 metric tons to 226 metric tons (Tables 9 & 10). Furthermore, there is a changing trend in the composition of pulses export where the non-traditional pulse export commodities such as chickpea, faba bean, and lentil have emerged to take a significant position in export trade. Figure 14 clearly depicts the trend in the share of pulses export to total export earnings in relation to that of coffee and oilseeds.

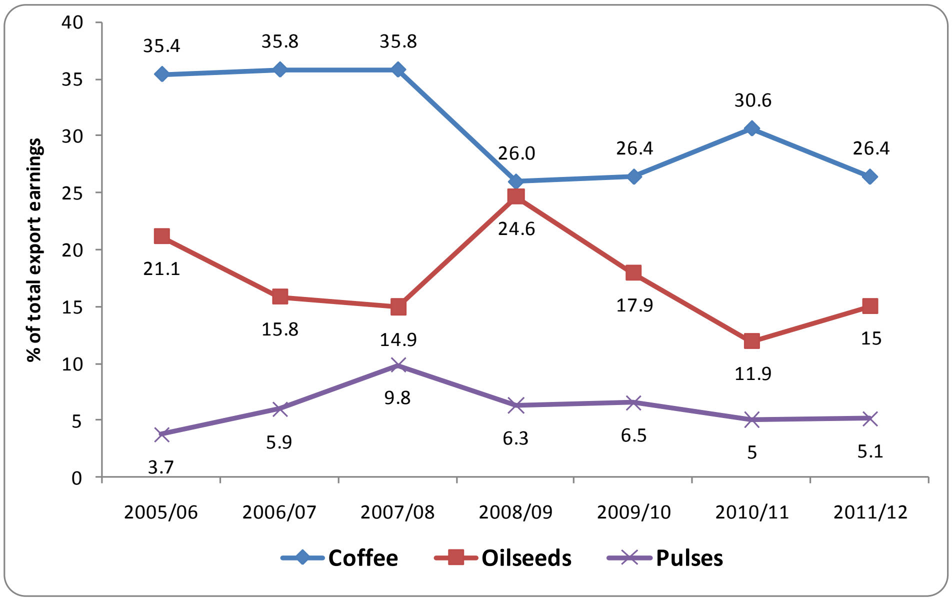


Figure 14. Trends in the Share of Selected Commodities to Total Export Earnings
Source: Computed from NBE Reports.

The major export destination markets for Ethiopia include Europe where 47% of the country's merchandise export is supplied and other export markets in order of importance are Asia (30%), Africa (19%), America (3.4%) and Oceania (0.6%) (NBE, 2012). Coffee, flowers, leather and leather products, gold and textile are the main export commodities destined to Europe. While oilseeds, pulses, leather and leather products, live animals, and coffee are the main export commodities delivered to the Asian markets. Ethiopia is also engaged in different bilateral and multilateral trade pacts to expand the market opportunities for its export commodities. In this case, it is the member of Common Market for Eastern and Southern Africa(COMESA), and has also preferential market access with USA under African Growth Opportunity Act (AGOA) and the European Union.

6. OVERVIEW OF THE PULSE SUB-SECTOR IN ETHIOPIA

6.1 Significance of Pulses

Pulses are the most important crops in Ethiopian agriculture next to cereals in terms of food production and area coverage. It was estimated that, on average, a total of some 20 million metric tons of food grains per annum were produced in Ethiopia during the period 2008-2012 on 11.8 million ha of land (CSA, 2012a). of these, pulses accounted for 10% and 13% of the total food grain production and cultivated land, respectively. While the prevalence of diverse and suitable agro-ecologies in the country enables the production of a variety of pulse crops, the major ones include highland pulses such as faba bean (Viciafaba L.), field pea (Pisumsativum L.), chickpea (Cicerarietinum L.), lentil

(Lens cultinarisMedik.), grass pea (LathyrussativusL.), fenugreek (Trigonellafoenum-graecum L.),lupine (Lupinusalbus L.)[4]and lowland pulses consisting of haricot bean (Phaseolus vulgaris L.), and soya bean (Glycine max L.). Among the major pulse crops, faba bean, accounting for 33% of the total pulse production, ranks first and followed by haricot bean (17%), chickpea (16%), field pea (12%), grasspea (11%), lentil (5%) while others do have marginal contributions (Figure 15).

Pulses do hold a vital significance in Ethiopia with diverse roles at different levels ranging from the farm household to the national economy at large. Some 8.5 million smallholder farmers are engaged in pulse production to generate their livelihood (CSA, 2013a). Furthermore, pulses contribute to food and nutrition security by providing alternative protein source and important dietary supplement to the national diet. It is estimated that pulses provide about 8% and 20% of the total calorie and protein intake of Ethiopian population (CSA, 2012b; FAOSTAT, 2013). Especially, in terms of cost, pulses provide affordable protein source for those low income consumers who do not have access to animal products.

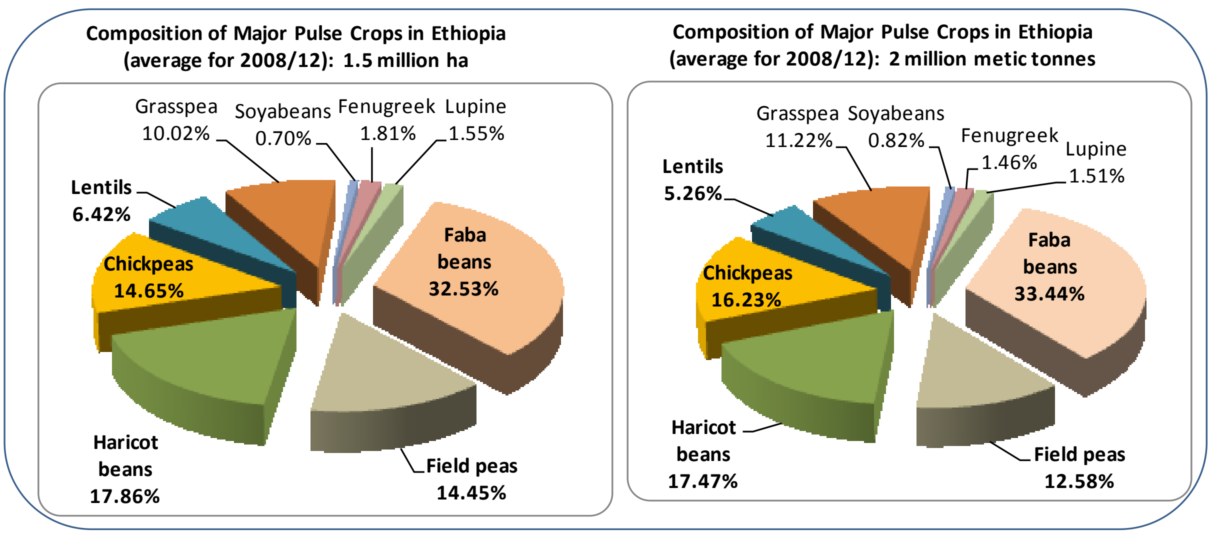


Figure 15. Composition of Major Pulse Crops in Ethiopia (2008/2012)
Source: Computed from CSA Statistical Reports.

Pulses are important sources of cash income for smallholder farmers as they are highly demanded in local and export markets. However, this advantage has remained very minimal due to the apparent low level of commercialization where only 22% of the total pulse production is destined to the market (CSA, 2013b). Moreover, evidences showed that, given the current market prices, pulses are generally more profitable than other major cereals that create an economic incentive for smallholders to keep pulse production (Rashid et al., 2010).

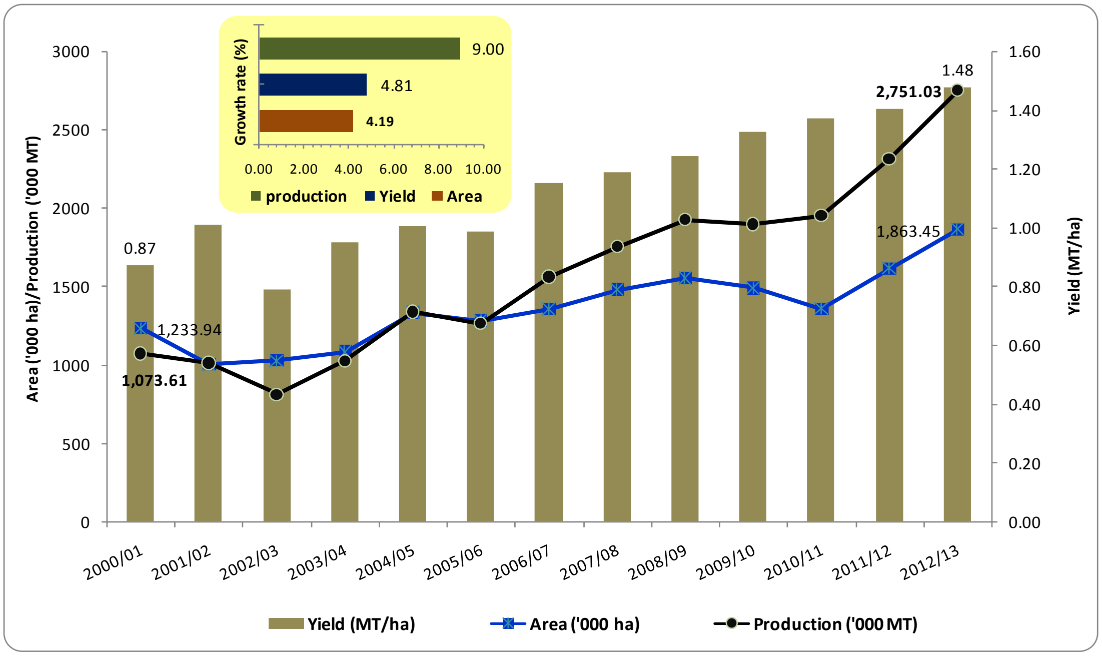
[4] In Ethiopia, it is locally called ***Gibto***.

Furthermore, pulses have been used for many years by Ethiopian farmers in crop rotation to maintain soil fertility due to the ability of the crops to fix atmospheric nitrogen into the soil. This feature reduces fertilizer cost and improves productivity in subsequent cereal crops. Available evidences showed that pulse crops can reduce the amount of fertilizer application on the subsequent cereal crop by up to 60% (Rashid et al., 2010). In addition, pulse crop residues provide an important sources of animal feed especially in the mixed farming systems of Ethiopian highlands.

Finally, pulses have recently gained the momentum to become strategic export commodities in diversifying and generating the sources of Ethiopian foreign exchange earnings. As clearly indicated in the preceding section (section 5), pulse export earnings have showed a remarkable increment from 37 million USD in 2005/06 to 160 million USD in 2011/12.

6.2 Performance of the Pulse Sub-Sector

Evidences showed that the performance of the pulse subsector in Ethiopia has improved significantly during the implementation of the last subsequent development plans where the production of market oriented agricultural commodities such pulses have become a priority. Especially, pulse production has been showing an upward trend during the past 13 years, ranging from 1.10 million tons in 2000/01 to 2.75 million tons in 2012/13 (Figure 16). Yield has improved from 0.87 ton/ha to 1.5 ton/ha while pulse coverage had been expanded from 1.2 million ha to 1.9 million ha. In terms of growth rates, pulse production was growing 9% per annum during the reference period (Figure 16).This production growth is attributed to both growth in yield and area harvested at 4.8% and 4.2% per annum, respectively. This implies that the contribution of productivity growth (yield) is limited to 53% of the total pulse production growth and the remaining has resulted from area expansion. So, it is important to note that area expansion still remains to have a great role in the growth pulse production.



Note:Growth rates are calculated using *semi-log function*($lnX_t = a + bt$).

Figure 16. Trends of Pulse production in Ethiopia (2000-2013)

Source: Computed from various CSA Statistical Reports.

TRENDS IN CHICKPEA PRODUCTION

Chickpea (Cicerarietinum L.) is one of the most important food legumes in Ethiopia widely cultivated by smallholder farmers under rain-fed conditions. It is estimated that about 1.1 million smallholder farmers in Ethiopia are chickpea growers on an average land of about 0.20 ha. Chickpea accounts for 16% and 15% of the total pulse production and pulse cultivated area in the country, respectively (Figure 17). In 2012/13 cropping season, 410 thousand metric tons of chickpea was produced from a total area of 240 thousand ha of land (CSA, 2013a).

Chickpea production is highly integrated in the farming systems of the Ethiopian highlands and serves as a multi-purpose crop. It is commonly used as a rotation crop with cereals to restore and maintain soil fertility. Because of its unique adaptation to low moisture stress, smallholder farmers grow chickpea after the rainy season using residual soil moisture(Geletu et al., 1996a).This enables smallholder farmers to practice double cropping and hence improve farm productivity. Chickpea also provides an alternative source of dietary protein for the population who cannot afford animal products. In addition, it provides an important source of cash income for farmers and generates foreign exchange earnings to the economy. The crop residue from chickpea is an important source of animal feed in the highland areas where there is a growing feed shortage problem.

Chickpea is widely grown across the vertisol-dominated highlands of Ethiopia with altitude ranging from 1400-2300 meters above sea level and mean annual rainfall of 700-2000 mm(Geletu et al., 1996a).However, the major chickpea growing regions include Amhara (Gondar, Gojam, Wello, and North Shewa) and Oromia (East, West, and Northwest Shewa, Arsi) which account for 54% and 40% of the total chickpea production in Ethiopia, respectively, and followed by Tigray (4%), SNNP (2%), and Benishangul-Gumuz (0.12%) (Figure 17).There is also productivity difference among regions ranging from 0.6 ton/ha in Benishangul-Gumuz to 1.7 ton/ha in Oromia region which is above the average national yield of 1.6 ton/ha (Figure 18). Other regions in order of their productivity include Amhara (1.6 ton/ha), Tigray (1.3 ton/ha) and SNNP (1 ton/ha).

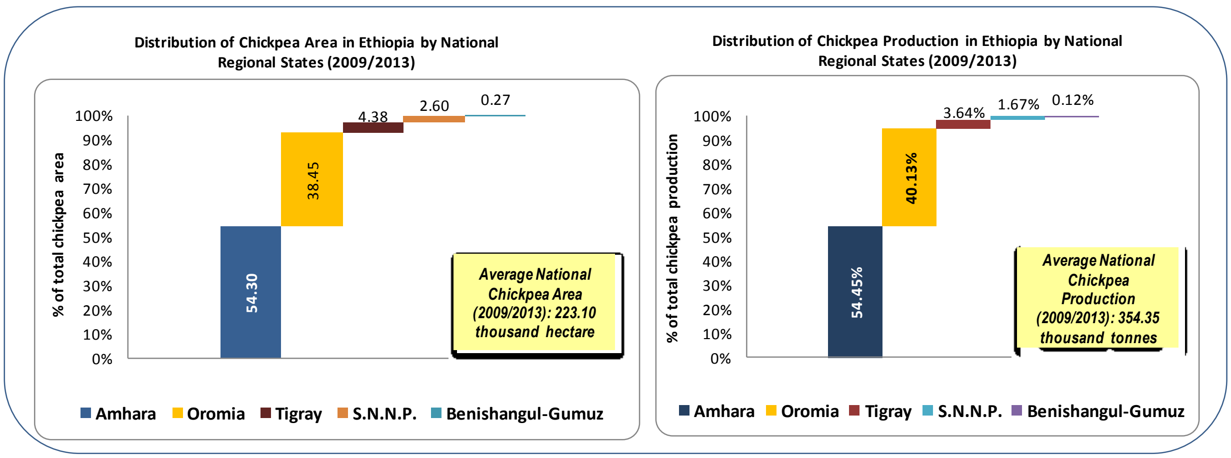


Figure 17. Distribution of Chickpea Production by National Regional States (2009/2013)
Source: Computed from various CSA Statistical Reports.

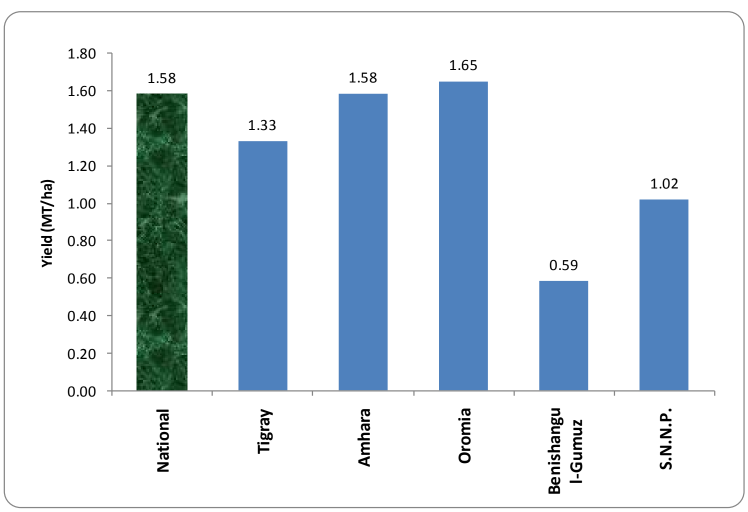
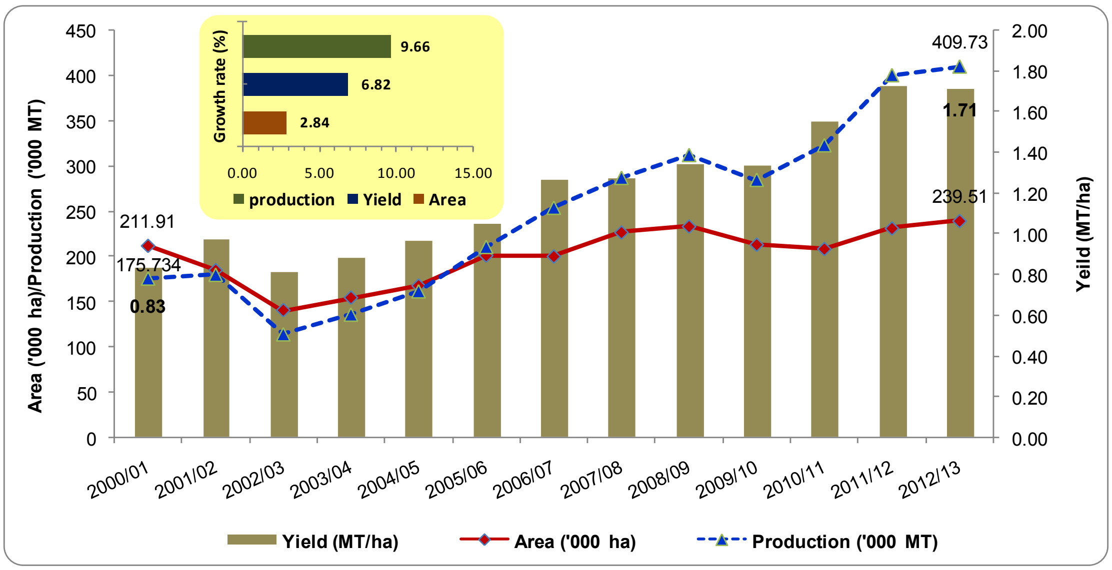


Figure 18. Average Chickpea Yield (MT/ha) by Regional States (2009/2013)
Source: Computed from various CSA Statistical Reports.

While the performance of the chickpea sector still remains below its potential, there has been an upward trend in chickpea production since the past 10 years. Ethiopian chickpea production increased from 176 thousand metric tons in 2000/01 to 410 thousand metric tons in 2012/13 which was growing by 10% per annum during the period 2000-2013 (Figure 19). More importantly, the growth rate of chickpea yield was found to be 7% per annum where yield had been raised from 0.8 ton/ha to 1.7 ton/ha during the reference period. On the contrary, the rate of area expansion in chickpea production was estimated at 3% per annum. Therefore, about 70% the total chickpea production growth during the period 2000-2013 has been achieved by productivity improvement which is contrast to the average pulses scenario.



Note: Growth rates are calculated using ***semi-log function*** ($lnX_t = a + bt$).

Figure 19. Trend of chickpea production in Ethiopia (2000-2013)

Source: Computed from various CSA Statistical Reports.

TRENDS IN LENTIL PRODUCTION

Lentil is a high-value pulse crop in Ethiopia predominantly produced by smallholder farmers under rainfed conditions. It accounts for 5% and 6% of the total pulse production and pulse harvested area in the country (Figure 15). Current evidences showed that a total of 953 thousand smallholder farmers are engaged in lentil production with an average land of 0.13 ha of land. The total lentil production in Ethiopia is estimated at 152 thousand metric tons produced from 124 thousand ha of land (CSA, 2013a).

The production of lentil is mainly limited to the highlands of Ethiopia with altitudes ranging from 1800 to 3000 meters above sea level with a mean annual rainfall of 650-1500 mm (Geletu et al., 1996b).Similarly, like the case of chickpea, lentil production ismainly concentrated in Amhara (Gojam, Gonder, Wello, and North Shewa) and Oromia (East, West and Southwest Shewa) where each accounts for 55% and 37% of the total lentil production in the country, respectively (Figure 20). Therefore, these two regions alone cover 92% of the total lentil production in Ethiopia. Other minor lentil growing regions include Tigray (7%) and SNNP produces less than 1% of the total lentil production in Ethiopia.

Furthermore, there is a variability in lentil productivity among the different regions in Ethiopia (Figure 21). The highest average lentil yield, 1.33 ton/ha, is found in Oromia region while other regions in order of their lentil productivity include Tigray (1.21 ton/ha), Amhara (1.10 ton/ha) and SNNP (0.81 ton/ha). Here, evidences showed that while more than half of Ethiopia's lentil production is concentrated in Amhara region, its average yield is found to be below the average national yield, 1.15 ton/ha.

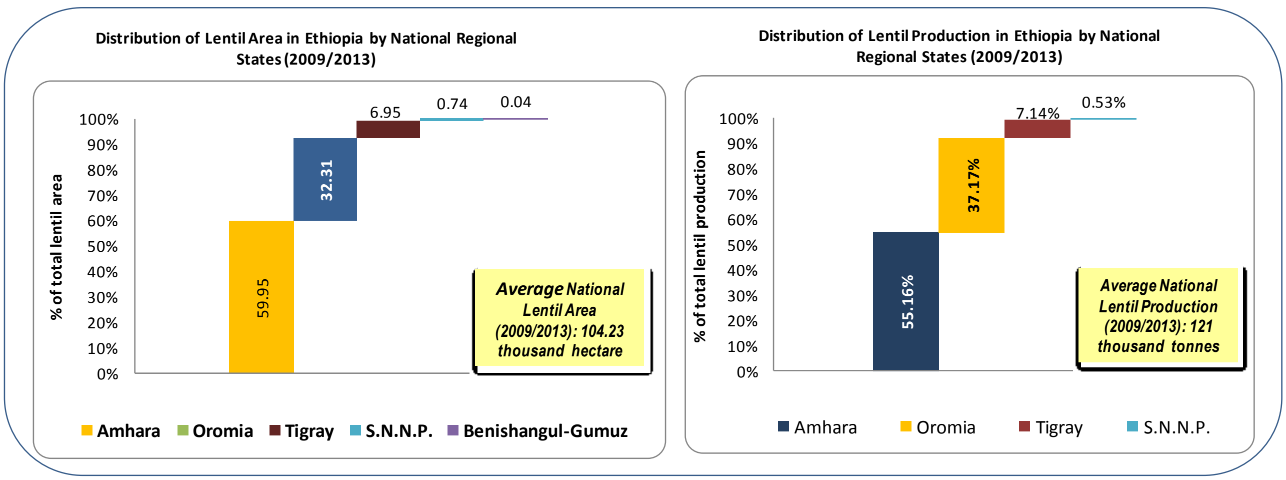


Figure 20. Distribution of Lentil Production by National Regional States (2009/2013)
Source: Computed from various CSA Statistical Reports.

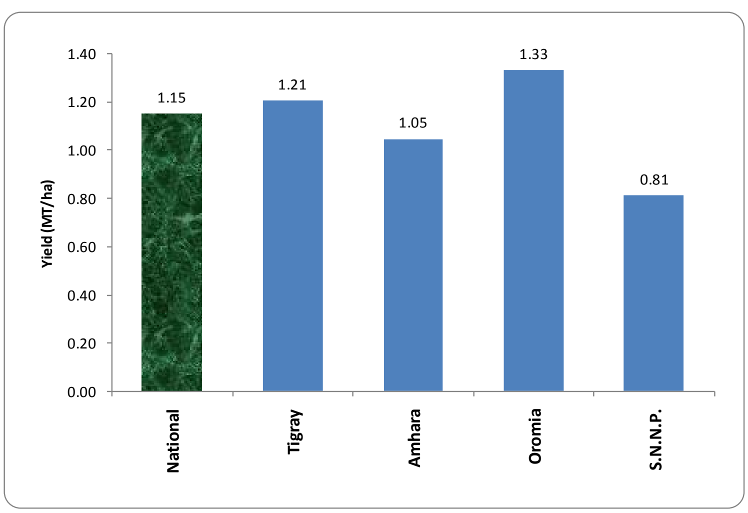
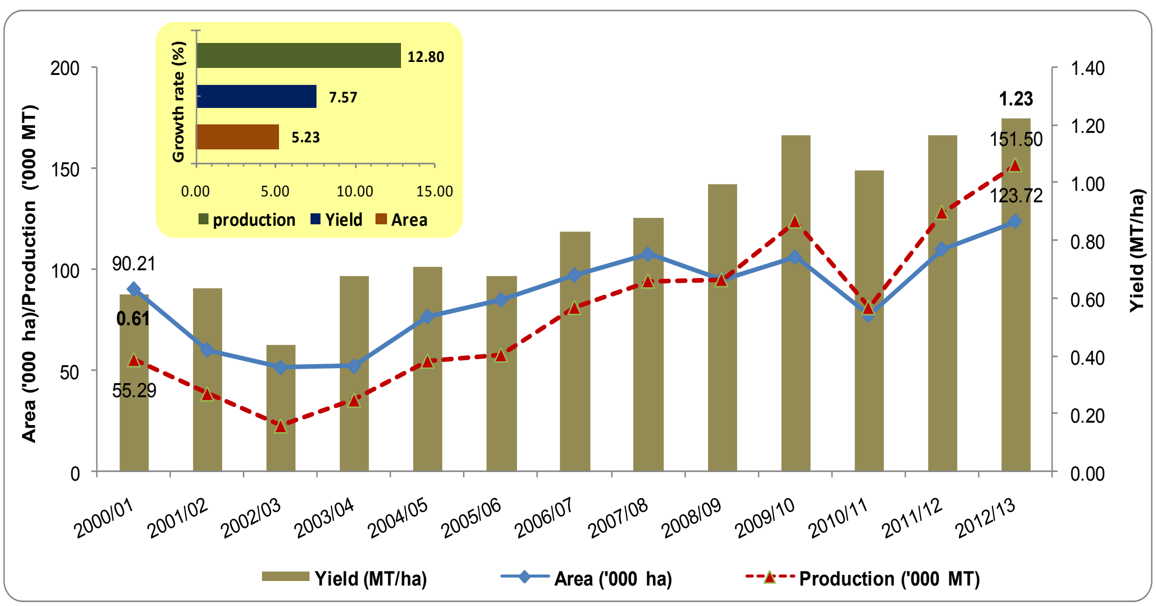


Figure 21. Distribution of Average Lentil Yield (MT/ha) by Regional States (2009/2013)
Source: Computed from various CSA Statistical Reports.

Lentil has major economic and ecological roles in Ethiopian smallholder agriculture. Fetching the highest price in local markets as compared to other food grains, lentil is primarily produced as a cash crop by smallholder farmers in Ethiopia. Moreover, at the macro level, lentil is one of the major pulse export crops generating foreign exchange earnings. Lentil provides an alternative source of protein in the daily diets of the population. Because of its ability in nitrogen fixation, lentil improves soil fertility in the cereals dominated faming systems in the highlands of Ethiopia. In addition, its crop residue provides an important source of feed for livestock production.

Similar to chickpea, there has been a significant improvement in the performance of lentil production in Ethiopia since the last 10 years as evidenced by the upward trend depicted in Figure 22. The total lentil production increased from 55 thousand metric tons in 2000/01 to 152 thousand metric tons in 2012/13 which is nearly a triple increment. Moreover, lentil yield has been improved from 0.61 ton/ha to 1.23 ton/ha. In this case, lentil production has registered an average growth rate of nearly 13% per annum during the period 2000-2013 (Figure 22). In addition, yield growth rate has been about 8% per annum while the rate of lentil area expansion is estimated at 5% per annum. Hence, about 67% of the total lentil production growth has been attributed to yield growth during the reference period.



Note: Growth rates are calculated using ***semi-log function*** ($lnX_t = a + bt$).
Figure 22. Trend of lentil production in Ethiopia (2000-2013)
Source: Computed from various CSA Statistical Reports.

6.3 Structure of Pulse Markets

Subsequent to the implementation of the market liberalization policy in 1991, there had been wider private sector participation in grain marketing that led to an improvement in the efficiency of the grain marketing system in Ethiopia (Negassa and Jayne, 1997). Yet, the prevailing structure of Ethiopian grain marketing system remains traditional and inefficient which is characterized by very long and poorly coordinated chain from farm production to consumption. Furthermore, the structure of the grain marketing involves very limited value addition as the grain moves along the marketing chain. The bulk of the grain is transacted in unprocessed form. This indicates that the market structure is unsophisticated involving few market services that are often limited to transportation and storage (Gabre-Madhin, 2001). The same holds for pulse marketing. The pulse marketing system is very complex and has a very long chain involving a number of marketing actors as the grain moves from the point of production to consumption (Shiferaw et al, 2007; Bekele & Hailemariam, 2007).

While the overall structure of the pulse marketing system is quite complex, few major marketing channels linking smallholder farmers with different end-users have been identified. In local markets, the pulse supply chains reach the final consumers in rural areas through rural retailers and farmers and in urban areas through urban retailers. In the export market, the limited pulse supply is exported by grain traders mainly processors and exporters. In general, three major types of pulse spot markets have commonly been identified in Ethiopia based on location, infrastructure and size of marketing actors (Shiferaw et al, 2007; Bekele & Hailemariam, 2007). These markets along with major marketing actors and channels are briefly outlined below (Figure 23).

a) Primary markets

They are rural village markets in major production areas which are commonly held on a weekly basis. Most smallholder farmers sell their produce in rural spot markets in small quantities, usually in donkey loads. In the primary markets, farmers have the option of selling their grain to several buyers, i.e. rural assemblers, brokers, *Woreda* (district) wholesalers and retailers, primary cooperatives and rural consumers.

b) Secondary markets

The secondary markets are located in major towns at *Woreda* level and have better infrastructure as compared to the primary markets. The most important marketing actors include wholesalers, retailers, consumers, processors and farmers cooperatives/unions. Here, the most important channels are the links between assemblers and wholesalers as well as brokers and wholesalers.

c) Tertiary markets

They are terminal markets often located in major cities such as Addis Ababa and Adama. The main marketing actors in the tertiary markets include urban wholesalers, exporters, processors, small retailers and supermarkets.

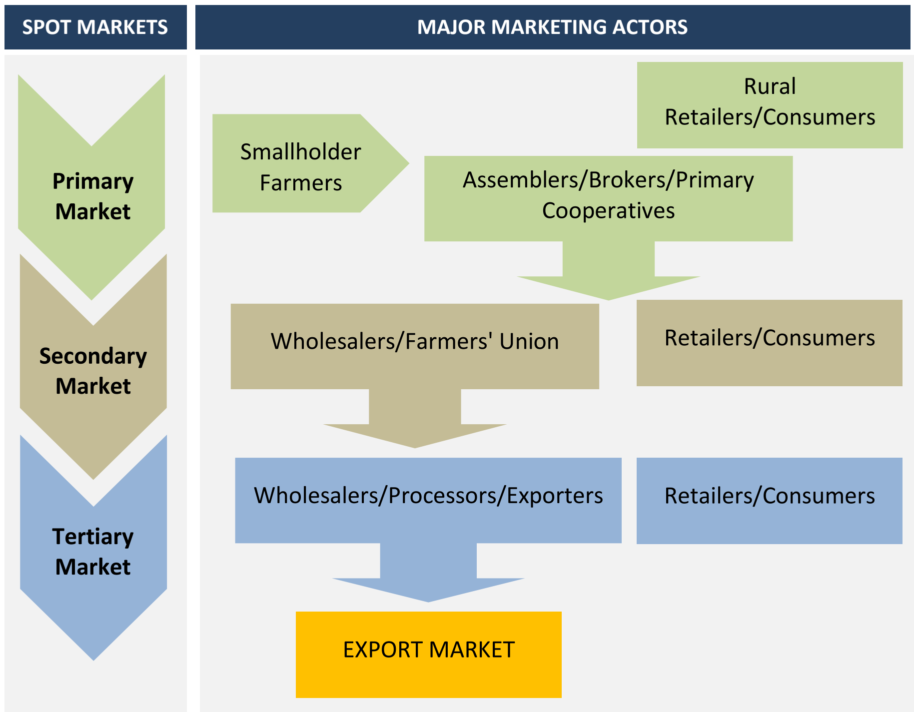


Figure 23. Structure of Major Pulse Markets and Marketing Channels in Ethiopia
Source: Author's Illustration from the literature.

Here, it is important to note that, among the pulse crops, the marketing of common bean (canning Beans) has ceased to operate within the general framework of the above marketing system when it became one of the major ECX-mandated commodities with a new trade regulation in 2010[5]. According to the new trade regulation (Sesame and White Pea Beans Transaction Regulation No. 178/2010), white pea beans trading in Ethiopia shall be conducted only at primary transaction centers and the Ethiopian Commodity Exchange (ECX), i.e.

a) **Primary Transaction Centers** are marketplaces where white pea beans transaction takes place only between producers and suppliers. These markets are located in major white pea beans production areas of the country.

[5]The Ethiopia Commodity Exchange (ECX) was established by Ethiopian Government with Proclamation No. 550/2007 in 2007 and became operational in April 2008. ECX is a marketplace, where buyers and sellers come together to trade, assured of quality, delivery, and payment. Currently, the ECX-mandated commodities include coffee, sesame, and haricot bean.

b) **Ethiopian Commodity Exchange (ECX)** where transactions take place only between white pea beans suppliers/producers and exporters/processors following the exchange rules.

Therefore, within the current ECX framework, haricot bean (white pea beans) marketing is limited to a single channel targeting the export market in contrary to other pulse crops which have a number of alternative outlets. A similar scenario would have been occurred with chickpea if it was included in the list of ECX commodities. In 2011, though it has not yet implemented, there was a plan to include chickpea as an ECX-mandated commodity for the crop has become a major source of pulse export earnings next to haricot beans over the past few years.

6.4 Grades and Standards

One of the major limitations of Ethiopian agricultural marketing system is lack of market information and absence of grades and standards. Virtually all transactions in grain marketing are based on informal grades that lack consistency and uniformity. The quality parameters are actually based on visual observation and fall short of reflecting some hedonic traits of commodities (Gabre-Madhin, 2001). So, in most cases, visual inspection of a product is needed to determine the quality standards at the point of transactions.

A recent market study showed that traders at all levels classify chickpea into three informal grades based on major quality traits in terms of seed color, seed size, presence of foreign matter and broken and shriveled seeds (Bekele & Hailemariam, 2007). It was found that grade 1 Kabuli chickpea needs to have at least 98% white seed color, 96% large seed size and less than 4% foreign matter and shriveled and broken grain each while grade 2 kabuli should have 96% white seed color, 91% large seed size, and less than 5% foreign matter and shriveled and broken grains each. In contrast, grade 1 desi chickpea requires 94% red seed color, 96% large grain size, and foreign matter and shriveled grains not exceeding 6%. Grade 2 desi chickpea should have 80% red seed color, 90% large grain size, and foreign matter and shriveled and broken grains not exceeding 8%. Therefore, white seed color and large seed size are important quality parameters for kabuli chickpeas while red seed color and large seed size are critical quality parameters for desi chickpeas. Similarly, the lentil marketing system lacks the use of grades and standards rather transactions are based on informal grades using visual quality parameters. Lentil with large seed size and red color when split are considered as premium quality and preferred for export market.

While most transactions in the chickpea and lentil marketing systems are primarily based on the informal grading system, the Quality and Standards Authority of Ethiopia

(QSAE) has developed grades and standards for these commodities to help facilitate transactions (Table 11 &12). However, the formal standards have failed to address the market preferred traits of these commodities; rather they give more emphasis on Sanitary and Phytosanitary Standards (SPS). Therefore, to improve the competitiveness of Ethiopian chickpea and lentil in global markets, it is important to meet the requirements of standards for food safety, SPS, and other non-tariff trade barriers. To overcome these limitations, chickpea and lentil grains for export markets are required to have grading and certification for color, seed size, moisture content, pesticide residue, weeds, pests, and diseases.

Table 11. Ethiopian grades and standards for chickpeas regardless of chickpea types

Quality traits	Maximum allowable limit (%)		
	Grade 1	Grade 2	Grade 3
Totally damaged seeds	0.3 - 1.0	1.0 - 1.5	1.5 - 2.0
Broken grains	0.5	1.0	1.5
Shriveled grains	2.0	4.0	8.0
Cracked coat	3.0	5.0	7.0
Foreign matter	0.2	03	0.5

Source: Quality and Standards Authority of Ethiopia (QSAE)

Table 12. Ethiopian grades and standards for lentil

Quality traits	Maximum allowable limit (%)		
	Grade 1	Grade 2	Grade 3
Weevil damage	0.3	0.8	1.0
Totally damage	2.0	3.0	4.0
Foreign matter stone	0.1	0.2	0.5
Foreign matter total	0.5	1.0	1.5

Source: Quality and Standards Authority of Ethiopia (QSAE)

6.5 Price trends of Pulses in Ethiopia

Although the local prices for most food grains have generally increased since 2006, there has been a significant upswing in the trends of local pulse prices in Ethiopia after late 2009. This trend could be observed from Figure 24 depicting price trends of major pulse crops based on a weekly price data collected by DZARC from Bishoftu (Debre Zeit) market. In general, pulse prices have increased significantly during the period from September 2010 to September 2012. Especially, pulses hit a historical high price level during the year 2011. As clearly seen (Figure 24), all pulses were traded at prices exceeding the price of white tef which is normally a high value crop in Ethiopian markets. For instance, chickpea (both Kabuli &Desi types) prices have reached unprecedented price levels exceeding Birr 2000/quintal during July-August 2011. This price increment is equivalent to 189% and 431% rise in the prices of Kabuli and Desi chickpeas which was in December 2009. A similar scenario has been occurred for lentil prices. It was also found that, on average, chickpea and lentil prices in 2011 have surpassed that of white tef price by 36% and 55%, respectively. However, this scenario has reversed and white tef price has remained stable and started to exceed all pulse prices since November 2013.

Furthermore, price data showed that the desi and kabuli chickpea types do differ in prices. The price of Kabuli types is found to be, on average, 15% higher than that of the Desi types. Other market studies have also found that Kabuli types were traded at prices 36% above the price of the Desi types (Bekele & Hailemariam, 2007). Similarly, the red lentils tend to fetch the highest price as compared to that of the white lentil while evidences showed that the price differential is not as such significant.

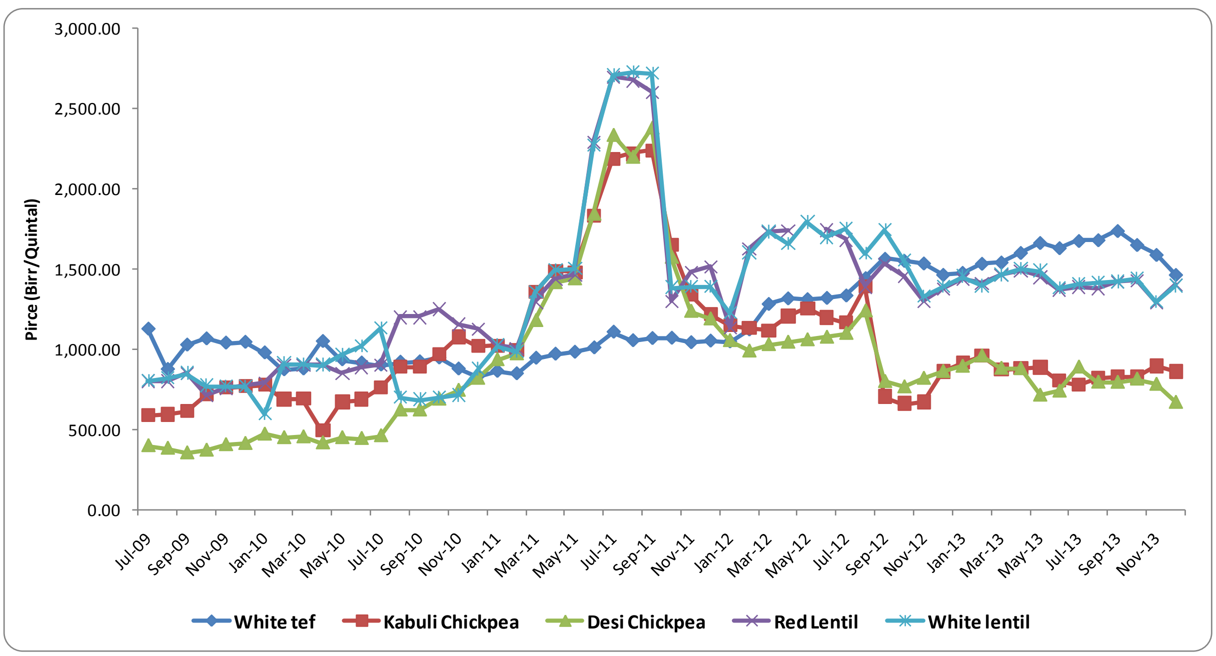
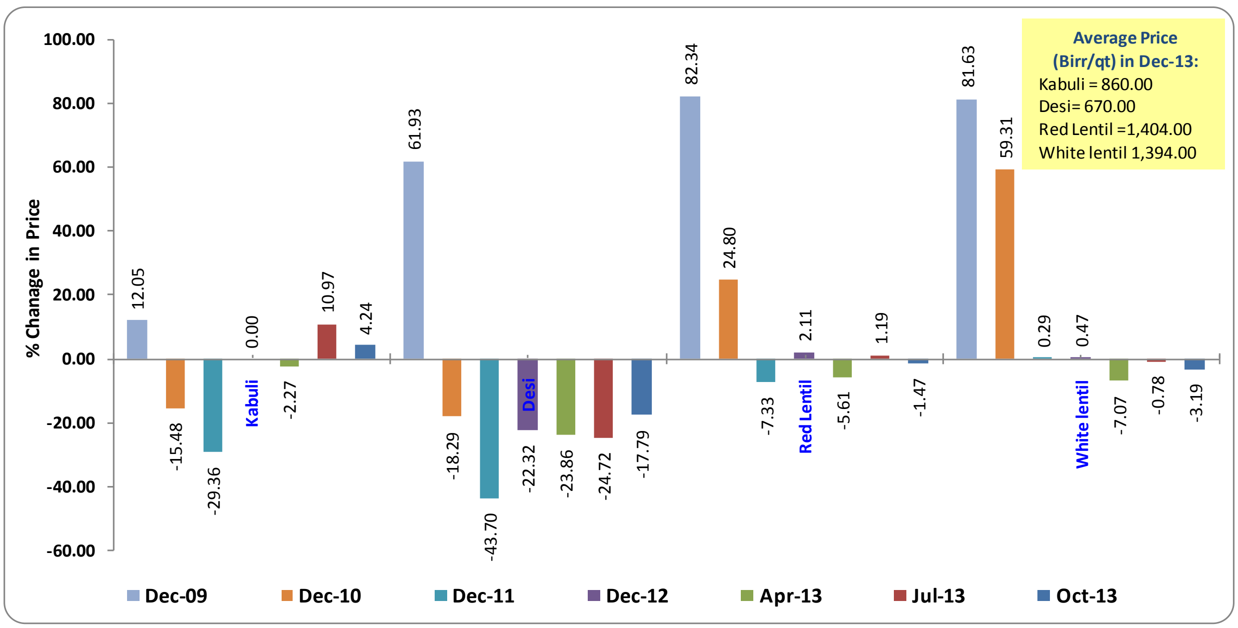


Figure 24. Average Monthly Pulse Prices (Nominal) at Bishoftu (DebreZeit) Market (July 2009 – December 2013).

Source: Socioeconomics, DZARC.

As clearly indicated in Figure 24, while pulse prices have started to decline since the last quarter of 2012, the fall in chickpea prices are quite significantly as compared to lentil prices. This declining trend in pulse prices has been further elaborated in Figure 15 using retrospective analysis in price percentage change based on the average prices of chickpea and lentil in December 2013 as a benchmark. Despite the declining trend in chickpea and lentil prices, the current pulse prices are above the average prices reported in December 2009 (Figure 25). For instance, the local prices for Desi and Kabuli chickpeas in December 2013 have increased by 62% and 12% from their values in the same month in 2009, respectively. The price percentage change showed that the average chickpea prices in December 2013 have been much lower than their values in the same month since 2010 and even less than their average values in the first month of the last quarter in the same year (Figure 25). For instance, the average prices of Kabuli and Desi chickpeas in December 2013 are 29% and 44% lower than their values in the same month in 2011. The declining trend is much worse for Desi than Kabuli types. On the contrary, lentil prices have remained stable without major increment.



NB: Percentage change in prices is computed using average prices for December 2013.

Figure 25. Percentage Change in Pulse Prices (Nominal) at Bishoftu (DebreZeit) Market (December 2009 – December 2013).

Source: Socioeconomics, DZARC.

Current evidences showed that Ethiopia still remains to have very limited market share in global pulse export markets and lacks reputation for having a track of records for its product quality. Consequently, Ethiopia is a price taker vulnerable to over supply from major competitors in world pulse markets. Studies have showed that the dramatic rise in local pulse prices since the past few years have been largely driven by persistent growth in export demand, mainly to Sudan, Pakistan, United Arab Emirates, India and Turkey (Bekele & Hailemariam, 2007; Shiferaw et al, 2007 FAO/WFP, 2012; USAID, 2013). The current global pulse price trend is depicted in Figure 26.

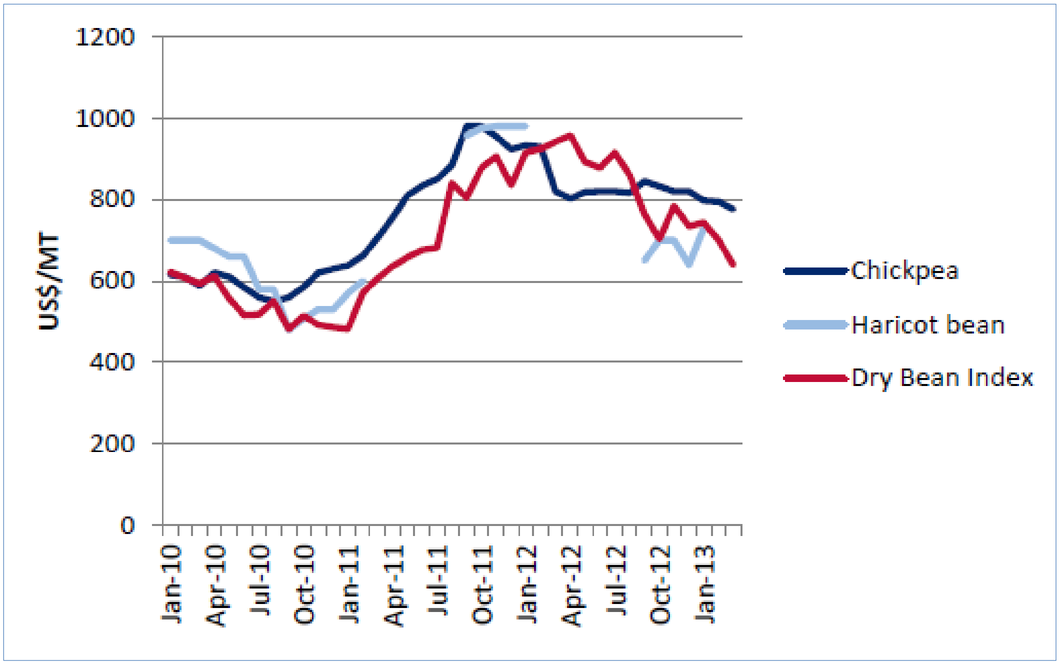


Figure 26. International Pulse Prices (US$/MT), January 2010-January 2013
Source: USAID, 2013, Page 23.

The current local pulse price trends in Ethiopia during 2010-2012 are closely associated with the global price trends in both nominal and real terms (Figure 27). Chickpea prices, which were increasing during early 2010 and early 2012, have been affected by surplus production in India, while lentil prices also reflect the ongoing decline on global markets (USAID, 2013). The same report indicated that Ethiopia is somehow losing its comparative advantage in the production of some pulse crops where the local pulse prices surpass the import parity to make commercial imports profitable. For instance, lentil local prices were found to be 70% higher than their import parity prices while chickpea was found to be more competitive for having its local prices 33% lower than the import parity price.

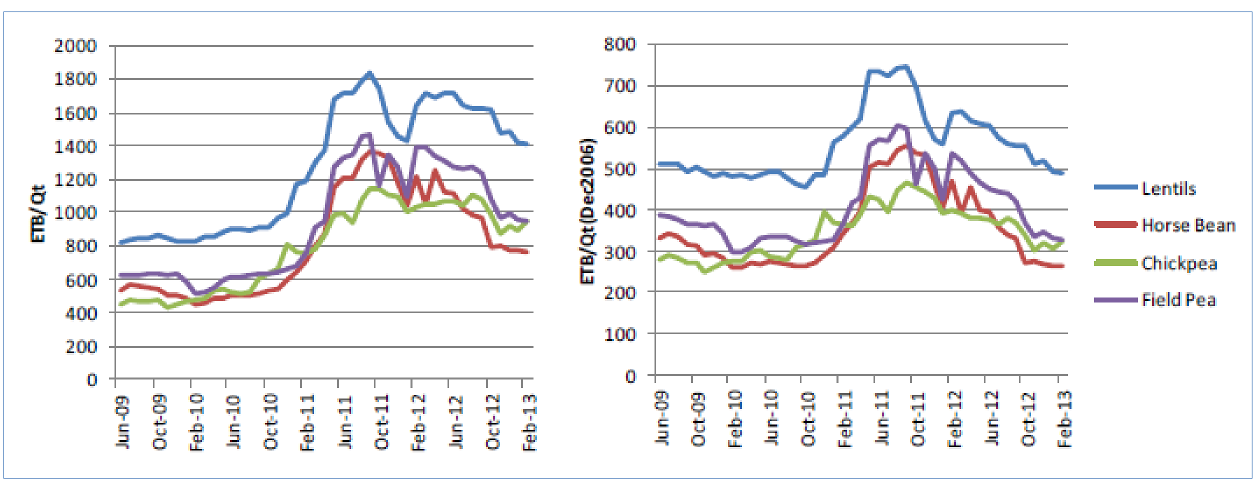


Figure 27. Nominal (left) and Real (right) Domestic Pulse Prices, June 2009-Feburary 2013
Source: USAID, 2013, Page 23.

Similar to other food grains, pulse markets are also characterized by high seasonal price variations due to the very nature of Ethiopian rainfed farming system. Current evidences showed that pulse prices are getting high during the rainy season (June-August) when grain supply is at its lowest level while prices reach at their low level during the harvesting season (December-May) when there is high inflow of grain supply in the market (Figure 28). Hence, there is an increasing price trend as the season switches from the harvesting to the rainy season. It is found that the prices of Kabuli and Desi chickpeas increased by 16% and 21% during the low supply rainy season, respectively. Similarly, the price differentials for red lentil and white lentil vary from 20% to 22% during the low supply season, respectively. So, this indicates that the market actors could have the potential to benefit from price rise at least by managing their supply through proper storage facilities.

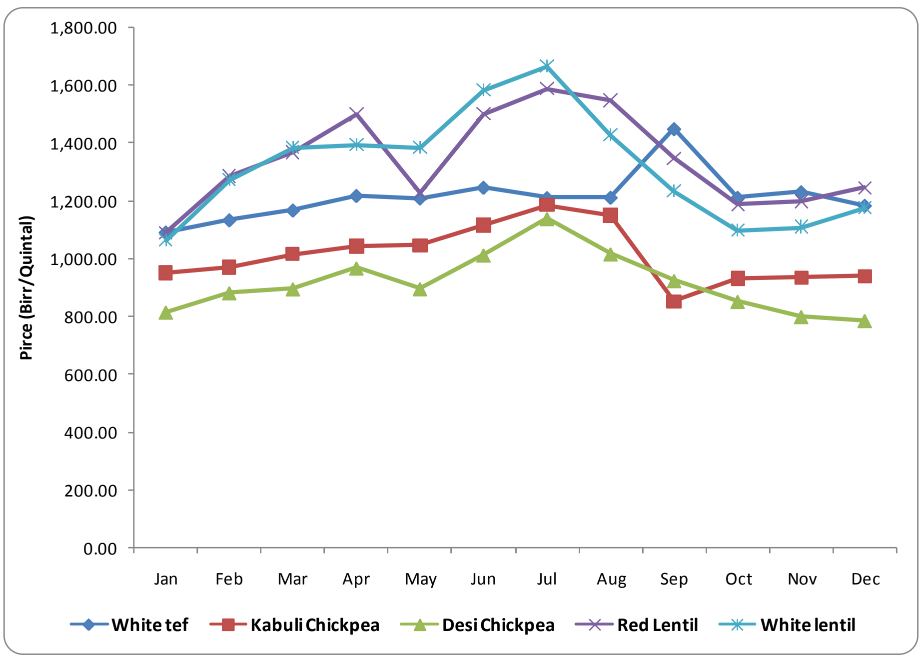


Figure 28. Seasonal pulse price patterns (average, 2009–2013), Bishoftu (DebreZeit) Market.
Source: Socioeconomics, DZARC.

6.6 Pulses Export Trade

As clearly indicated in the preceding section, pulses are the third major agricultural export commodities next to coffee and oil seeds (mainly sesame) in generating Ethiopia's foreign exchange revenues. However, while a number of pulse crops are produced in Ethiopia, the structure of its pulse export is concentrated to a few commodities often between three and four items (Figure 29). For instance, 9 billion Birr per annum was earned from an average annual export of 891 thousand tons of pulses to the world market during the period 2009-2012. In terms of composition of pulses export, haricot bean stands first by contributing 45% and 43% of the total pulse export volume and value, respectively, followed by chickpea (24%), faba bean (20%), and mung bean (6%). Lentil is the fifth major pulse export commodity by accounting for nearly 4% of the total pulse export volume and value each while others contributions are limited barley at 2% of the total pulse export earnings.

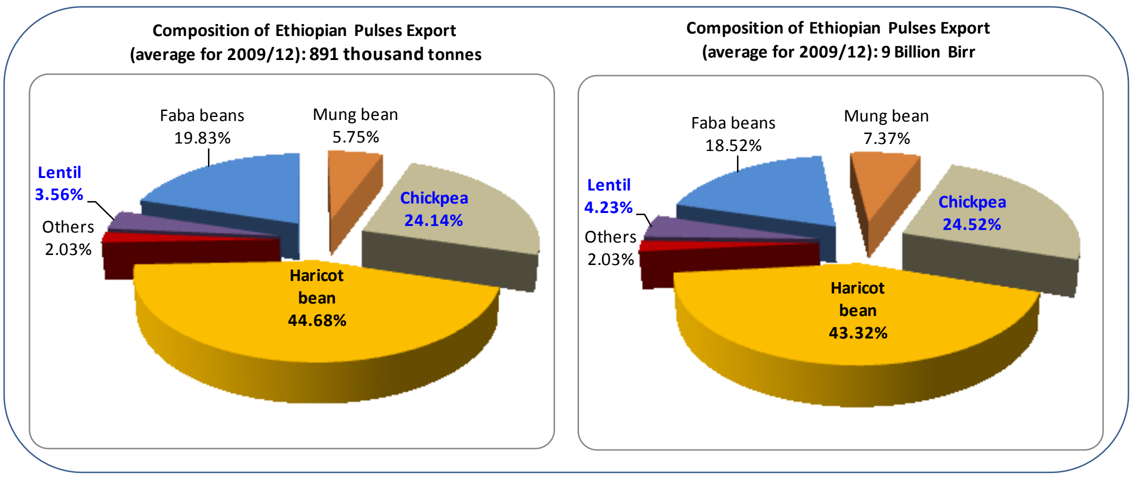
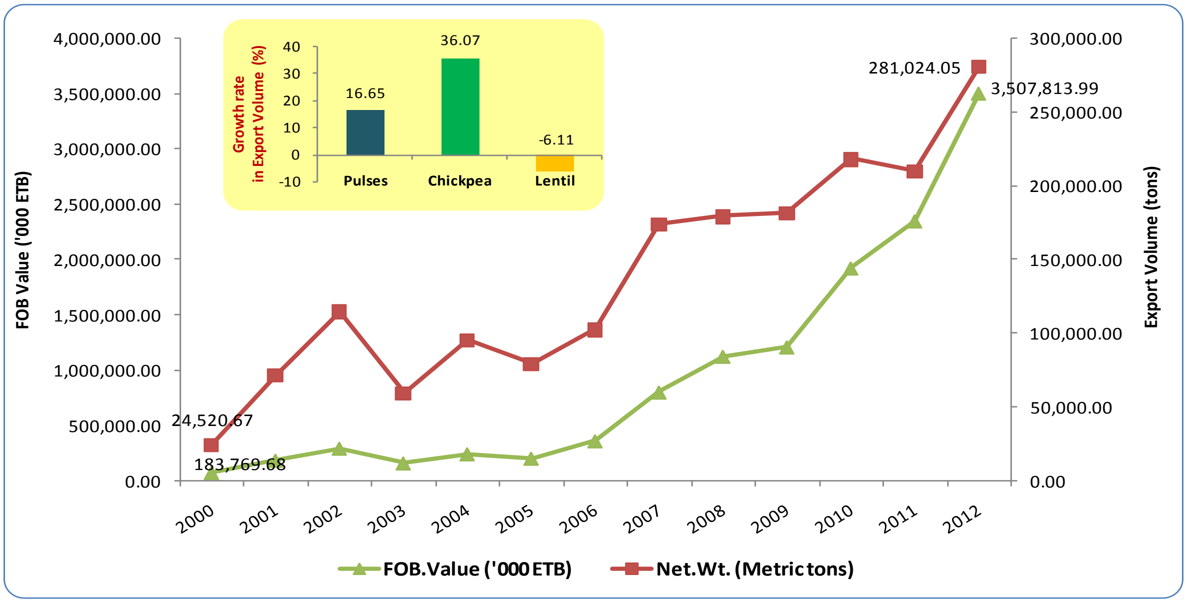


Figure 29. Composition of Ethiopian Pulses Export (2009/12)
Source: Computed from Ethiopian Revenue and Customs Authority Data.

Despite the strong demand from local markets, Ethiopian pulse export has been increasing significantly over the last decade due mainly among others to the ongoing promotion of commercialization of smallholder farmers as well as better incentives from global pulse markets. The trend in the total volume and value of pulses export has showed consistent growth during the period 2000-2012 (Figure 30).The total volume of pulse export has increased from 25 thousand tons in 2000 to 281 thousand tons in 2012 which is more than a tenfold increment during the reference period. In this case, the volume of pulse export had been growing by 17% per annum during the last 12 years (Figure 30). Similarly, the trend of pulse export value has showed a remarkable growth where the total pulse export revenue has increased from 184 million birr in 2000 to 3.5 billion birr in 2012.



Note:Growth rates are calculated using ***semi-log function***$(lnX_t = a + bt)$.

Figure 30. Trend of Ethiopian Pulses Export (2000-2012)

Source: Computed from Ethiopian Revenue and Customs Authority Data.

Although Ethiopia is one of the major pulse producing countries in the world, its export market share has been very limited so that it is essentially a price taker on global pulse export market. There is also subsequently considerable variability of importing countries over years. Current evidences showed that the principal destination markets for Ethiopian pulses export are situated in the Middle East and the Indian Subcontinent. The top-5 Ethiopian pulse importing countries alone accounted for 62% of the total pulse export volume during the period 2009-2012; these are in order of importance Sudan (25.8%), Pakistan (1.2%), United Arab Emirates (8.7%), Kenya (6.2%), and India (5.8%) (Figure 31). Other major Ethiopian pulse export destination markets include Yemen (4.6%), United Kingdom (3.6%), and Turkey (3.2%).

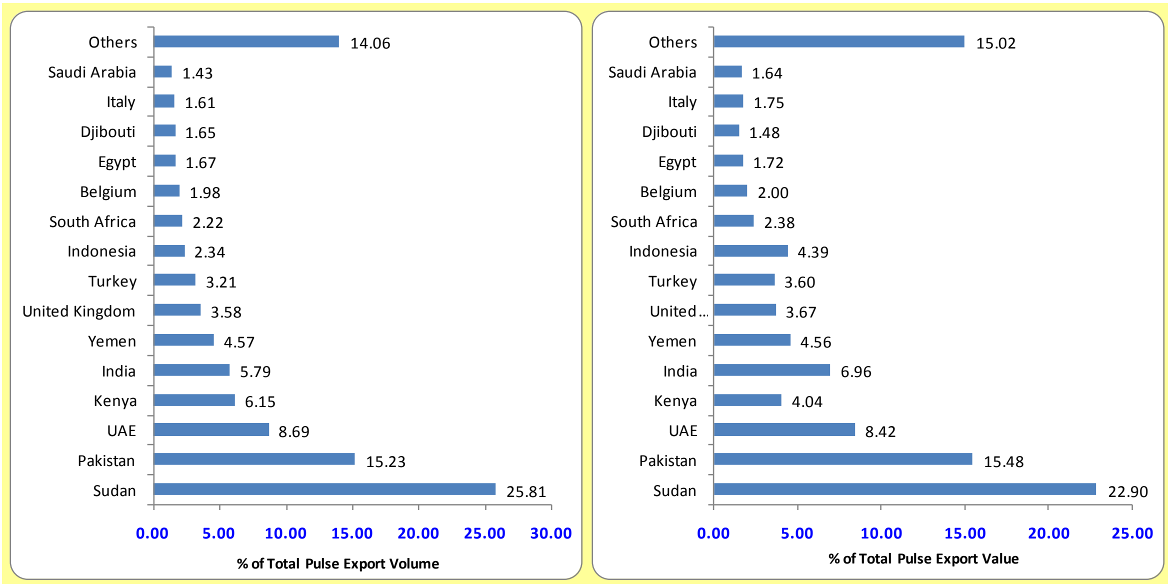
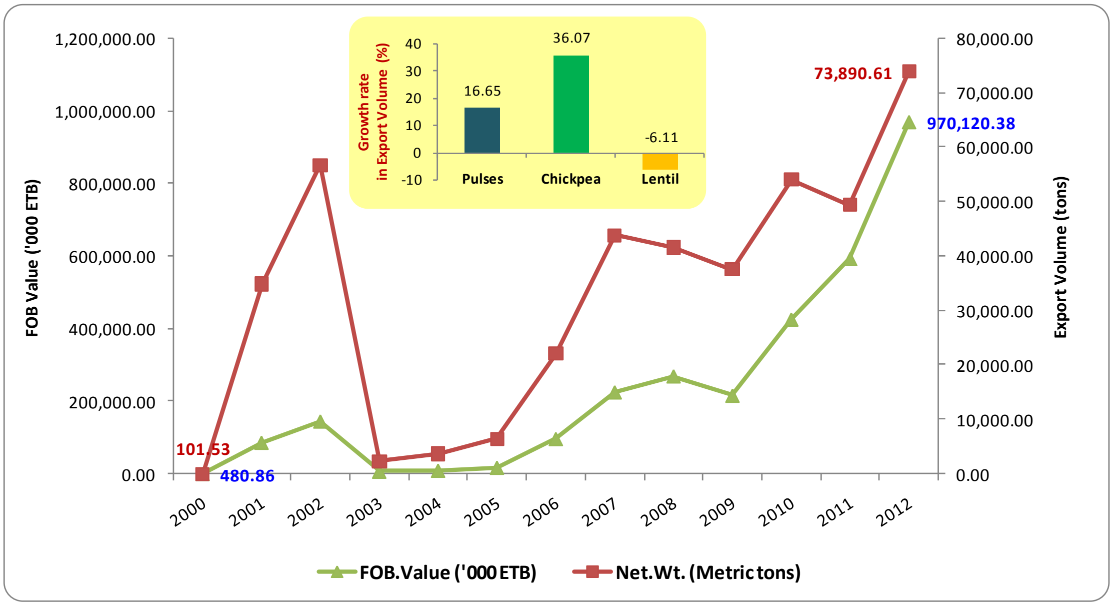


Figure 31. Major Destinations of Ethiopian Pulses Export: 2009-2012
Source: Computed from Ethiopian Revenue and Customs Authority Data.

CHICKPEA EXPORT TRADE

Chickpea is the second major export commodity among pulse crops by generating nearly 25% of the total Ethiopian pulse export earnings. Though Ethiopia holds a significant position among major chickpea producing countries in the world, the largest proportion of its chickpea production is destined for local markets. As clearly shown in section 4, currently, Ethiopia's chickpea export accounts for only 18% of its domestic production; this figure is very low as compared to that of the major global competitors such as Australia that exports 82% of its domestic chickpea production. Moreover, yearly fluctuation has been an apparent feature of Ethiopian chickpea export for many years. However, the performance of chickpea export has showed major improvements since the last ten years. The volume of chickpea export, for instance, increased from 102 tons in 2000 to 74 thousand tons in 2012 which was increasing, on average, by 36% per annum during the reference period (Figure 32). Similarly, the level of chickpea export earnings has showed a remarkable increment from 184 million Birr in 2000 to 3.5 billion birr in 2012. In addition to the growth in chickpea production and productivity, it is believed that the recent better performance in Ethiopian chickpea export was encouraged by external factors from major export markets such as bad weather in South Asia and Australia and increasing demand in South Asian markets (Shiferaw et al., 2007).



Note: Growth rates are calculated using ***semi-log function*** *($lnX_t = a + bt$)*.

Figure 32. Trend of Ethiopian Chickpea Export: 2000-2012

Source: Computed from Ethiopian Revenue and Customs Authority Data.

Ethiopian chickpea export is also somehow characterized by variability of destination markets from year to year. Following the recent increasing trend in the volume of chickpea export, the export markets are diversified to include the Indian Subcontinent (India, Pakistan, and Bangladesh), Middle East and North Africa (UAE, Israel, Saudi Arabia, Morocco, Egypt, etc.), North America (USA, Canada), Europe (UK and Greece), and Southeast Asia (Singapore, China, Japan, Indonesia). Current evidences showed that about 55% of the total chickpea export during 2009-2012 was destined to the Indian Subcontinent namely Pakistan (46%), India (5%), Bangladesh (3.4%) while other major Ethiopian chickpea export destination markets include United Arab Emirates (23%), Sudan (10%), and Saudi Arabia (3%) (Figure 33).

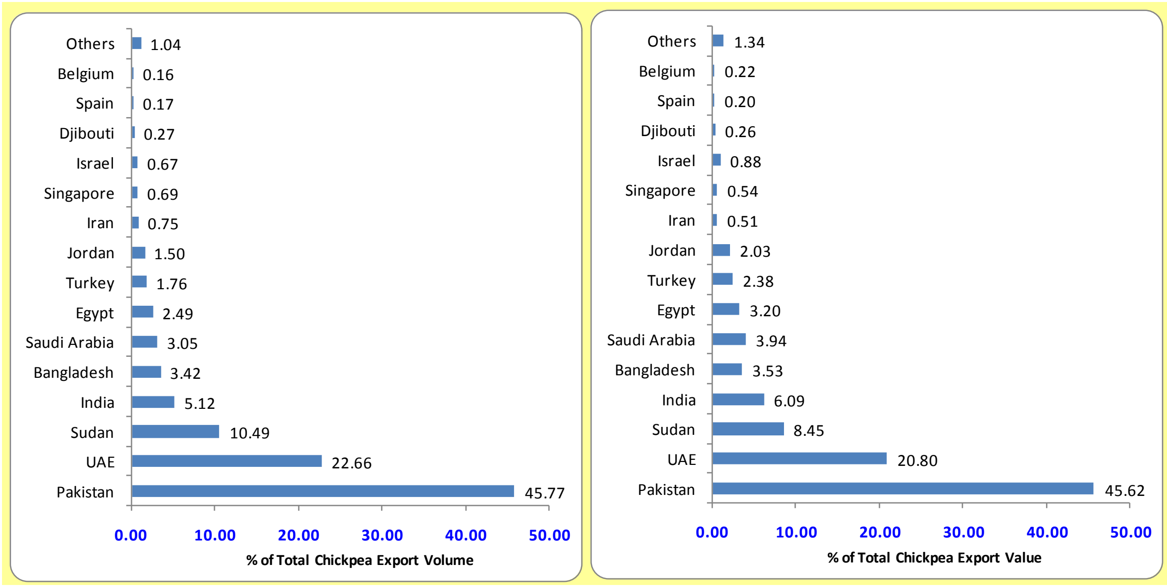
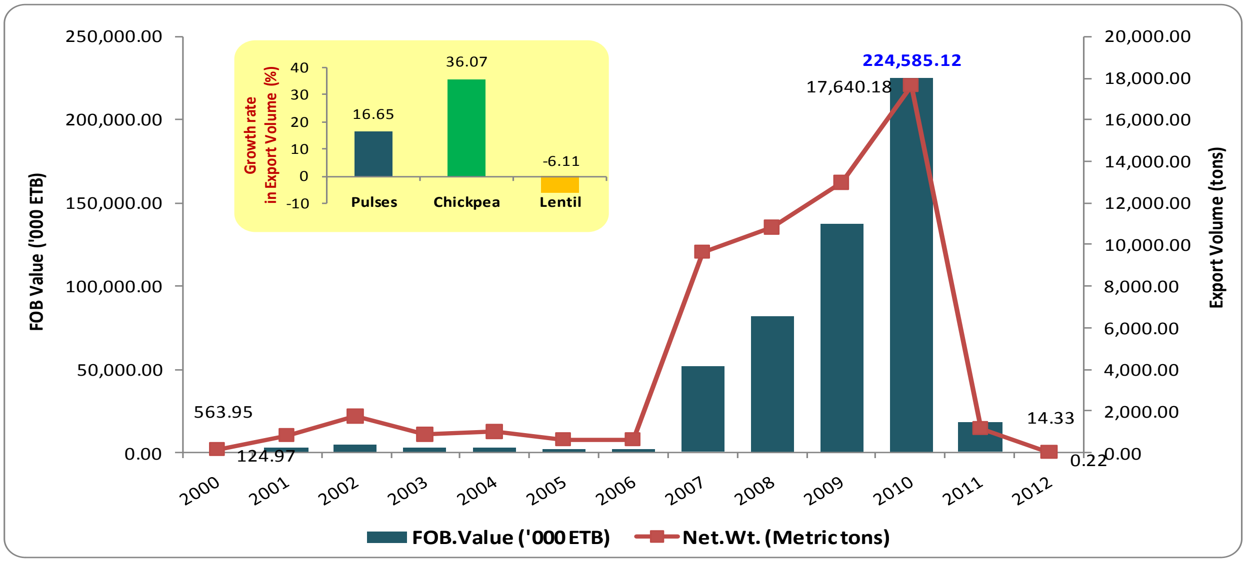


Figure 33. Major Destinations of Ethiopian Chickpea Export: 2009-2012
Source: Computed from Ethiopian Revenue and Customs Authority Data.

LENTIL EXPORT TRADE

Lentil is widely used as an important ingredient of the daily diets of most Ethiopian households so that its local consumption is very high as compared to other pulse crops. It is often argued that the strong demand and high price in the local market has made Ethiopian lentil export less competitive so that its export share is very low among other pulses. Currently, lentil is the fifth export commodity in the pulse category by contributing only 4% of the total pulses export income. It is estimated that Ethiopia's lentil export is limited to 10% of its domestic production. Despite its potential as a strategic export commodity, the performance of Ethiopian lentil export has been very much below expectations and characterized by high fluctuations in export volume and value. This is clearly depicted in Figure 36 based export data for the period 2000-2012. Lentil export has achieved better performance during the period 2007-2010 due to an improvement in export volume and value. The maximum lentil export was recorded in 2010 by generating an income of 225 million birr from the export of 17.6 thousand tons of lentil to the world market (Figure 34). The better export performance during 2007-2010 could mainly be attributed to the global food grain crisis where there was a price hike in export markets. In general, Ethiopian lentil export has been characterized by very poor performance during the past twelve years where the country's lentil export was declining 6% per annum (Figure 34).



Note:Growth rates are calculated using ***semi-log function***$(\ln X_t = a + bt)$.

Figure 34. Trend of Ethiopian Lentil Export: 2000-2012

Source: Computed from Ethiopian Revenue and Customs Authority Data.

The major destination markets for Ethiopian lentil export are also similar to that of its chickpea export. Turkey and Sudan were the major destination markets where 23% and 22% of the total lentil export volume was sold during 2009-2012, respectively (Figure 35). In terms of value, Sudan was the leading destination market by accounting for 27% of the total lentil export earnings followed by Turkey (22%), United Arab Emirates (13%), Pakistan (7%), Egypt (6%), Singapore (5%), Bangladesh (4%)while other markets are covering the lentil export earnings below 4%.

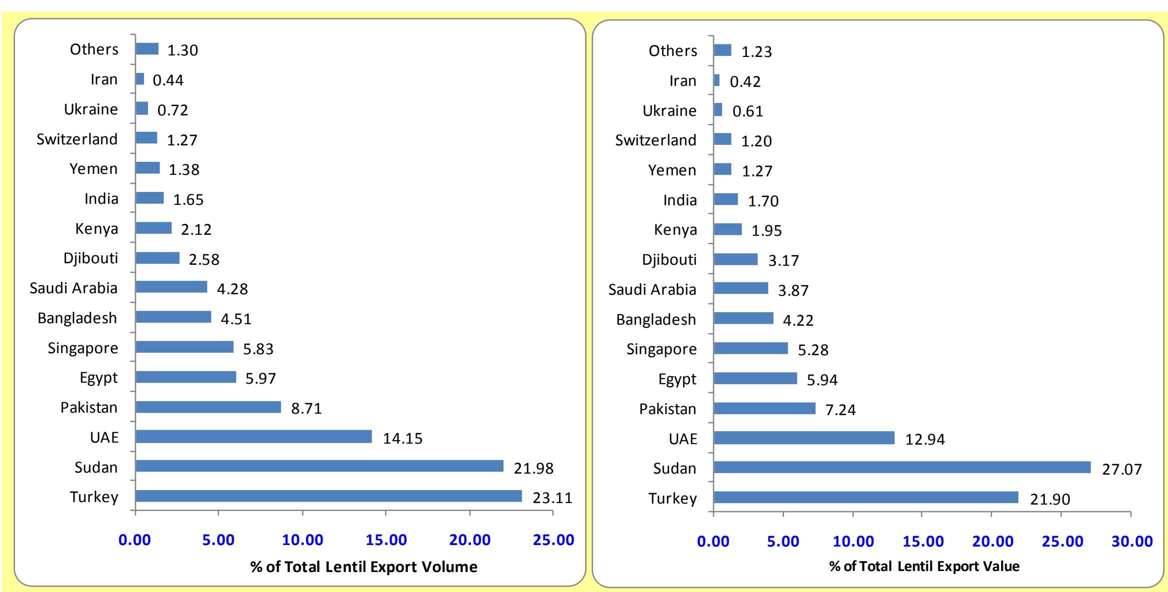


Figure 35. Major Destinations of Ethiopian Lentil Export: 2009-2012

Source: Computed from Ethiopian Revenue and Customs Authority Data.

7. PULSE TECHNOLOGIES, CROPPING DYNAMICS AND MARKETING IN THE STUDY AREAS

7.1 Research and Technology Development

LENTIL RESEARCH AND TECHNOLOGY DEVELOPMENT

Despite its economic significance, the productivity and production of lentil has still remained very low due to a number of production constraints including disease and insect pests, poor management practices, and other socioeconomic factors. Various research and development efforts were made in the past to overcome these production constraints and improve the productivity and production of lentil. In this case, the history of lentil improvement program in Ethiopia dates back to the early 1970s when it was initially started at Debre Zeit Agricultural center. In 1976, Debre Zeit Agricultural Research Center was given the mandate to coordinate the lentil research program at national level. Since then, the center has been coordinating the national lentil research program in collaboration with other federal and regional agricultural research centers. Initially, the objective of the lentil research program was increasing productivity so as to ensure the sustainability of lentil production and thereby improving the welfare of smallholder farmers and consumers. Currently, the research program still maintains its initial objective with the exception that it is focusing on generating market preferred lentil technologies in line with the current market oriented agricultural development strategies.

The lentil research program has undertaken various genetic improvement and associated crop management studies to generate improved lentil production technologies. Experience showed that the success of the lentil research program is closely associated with the collaboration and partnership especially with International Center for Agricultural Research in the Dry Areas (ICARDA) in terms of germplasm exchange and other capacity building activities. This collaboration with ICARDA has been in existence since the 1970s when the lentil research program was at its early stage. So far the lentil research program has developed and released 11 improved lentil varieties for production along with their recommended agronomic management practices (Table 13). With the exception of the four varieties, the remaining were developed from materials obtained from ICARDA, i.e. Chalew, Chekol, Gudo, Ada'a, Alemaya, Alem Tena, and Teshale. The lentil variety, Alemya, was used to be the most successful and widely adopted improved variety which had a major impact on the welfare of smallholder farmers in project intervention areas such as Gimbichu district.

when the speed of variety development is considered during the past four decades, the lentil research program has managed to develop, on average, one improved lentil variety for every 3-year period. Moreover, the average age of the improved lentil varieties is found to be 18 years while it becomes 14 years when those obsolete varieties (EL-142 & R-186) are not considered6. Taking the year 2000 as a bench mark, the program has developed and released one variety for every three and half year period with an average age of 6 years showing the speed of variety development is even much slower. Currently, there is a growing demand from policy makers that the lentil research program to focus more on introduction of advanced materials or finished technologies elsewhere and make an adaptation to speed up the technology development process. This approach has been believed to be low cost and fastest way of developing improved production technologies. However, the success of this approach depends on the nature of the introduced material where introduction from similar agro-ecology is more likely to be successful.

[6] Obsolete varieties are those that have ceased to exist in the current production system.

Table 13. List of improved lentil varieties released in Ethiopia with their adaptation areas

#	Variety	Year of release	Days to maturity	Seed rate (kg/ha)	Adaptation Areas		Grain Yield (t/ha)		Source	Status
					Altitude (masl)	Rain Fall (mm)	On-Station	On-Farm		
1	EL-142	1980	80-109	50-65	1650-2000	400-600	1.4-2.0	0.9-1.2	Ethiopia	Obsolete
2	R-186	1980	122-143	65-80	1800-2400	500-1200	1.7-2.5	1.4-1.6	Mexico	Obsolete
3	Chalew (NEL158)	1985	111-128	50-65	1850-2450	500-1200	1.9-2.6	1.4-1.8	ICARDA	In production
4	Chekol (NEL2704)	1994	84-91	50-65	1600-2200	500-1200	1.5-2.2	1.4-1.8	ICARDA	In production
5	Gudo (FLIP 84-78L)	1995	86-151	80-120	1850-2450	500-1100	1.8-2.5	1.6-2.4	ICARDA	In production
6	Ada'a (FLIP 86-41L)	1995	86-157	80-120	1850-2450	500-1100	1.9-2.6	1.56	ICARDA	In production
7	Alemaya (FLIP 89-63L)	1997	81-136	65-80	1800-2600	500-1200	2.0-3.0	1.8-2.4	ICARDA	In production
8	Alem Tena (FLIP 96-49L)	2004	94-126	85-90	1600-2000	400-600	1.7-2.3	1.5-2.0	ICARDA	In production
9	Teshale (FLIP 96-46L)	2004	97-129	85-100	1800-2400	400-800	1.8-3.7	1.6-2.6	ICARDA	In production
10	Derash	2010	109-117	85-100	1600-2400	400-800	2.3-3.7	2.0-3.0	Local	In production
11	Denbi	2013	95-105	60-65	1800-2400	600-700	2.0-2.5	1.7-2.0	Local	In production

CHICKPEA RESEARCH AND TECHNOLOGY DEVELOPMENT

Despite some recent improvements in the productivity of chickpea which is currently estimated at 1.7 ton/ha7, the production and productivity of chickpea in Ethiopia still remain below expectations due to several production constraints including major diseases, insect pests, poor management practices and other socioeconomic constraints. The national chickpea research program has been working on those major production constraints to increase the productivity and production of chickpea since the last three to four decades. Here, it is important to note that the history of chickpea research program in Ethiopia is closely related to that of lentil research. The program was first started in 1972 at Debre Zeit Agricultural Research Center with the major objective of increasing the productivity and production of chickpea and thereby improving the livelihoods of smallholder farmers. Similarly, DZARC has been mandated to coordinate the national chickpea research program being undertaken at federal and regional agricultural research centers.

The chickpea research program has a long-established partnership and collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the International Center for Agricultural Research in the Dry Areas (ICARDA) in capacity building and acquisition of germplasm. This collaboration was established in 1978. Breeding and crop management research activities are conducted to develop improved chickpea production technologies for both desi and kabuli types. Since the inception of chickpea research in Ethiopia, the program has developed and released seventeen improved chickpea varieties of both chickpea types (Table 14). Among these varieties, three (DZ-10-4, DZ-10-11 and Dubie) were developed by selection from local breeding materials while six desi and two kabuli varieties were developed from breeding materials obtained from ICRISAT. All other improved kabuli varieties (five) were developed from ICARDA materials. Evidences showed that ICRISAT collaboration has concentrated on the desi types with limited contribution to the development of kabuli types (only two kabuli types , i.e. Chefe and Shasho) while all kabuli types except those two varieties have been developed from breeding materials acquired from ICARDA.

The performance the chickpea research program showed that, on average, one improved chickpea variety was developed for each two and half years period during the last four decades. It was also found that the average age of the improved chickpea varieties is 16 years while it is 13 years when those obsolete varieties (DZ 10-4 & DZ 10-11) are excluded. However, the program has showed better performance when considering the period after 2000. In this case, it has managed to deliver, on average,

[7] CSA, 2013.

one variety per annum while the average age of the released varieties becomes 6 years.

Currently, the chickpea research program is expected to be responsive to both the local and export markets with the major objective of increasing the income of smallholder farmers and foreign exchange earnings of the country. For instance, more emphasis is given to the large seeded market preferred kabuli types targeting the export markets while technology introduction and adaptation is a guiding strategy. The large seeded improved kabuli variety, Acos Dubie, can be considered as an example of an adapted technology. This variety was introduced from Mexico and released by EIAR in collaboration with a private company called ACOS Plc in 2009 primarily targeting the export market in Europe. While this variety has been technically viable, its success is seriously hampered by market linkage problems.

Table 14. List of improved chickpea varieties released in Ethiopia with their adaptation areas

#	Variety	Year of release	Days to maturity	Seed rate (kg/ha)	Adaptation Areas		Grain Yield (t/ha)		Source	Remark
					Altitude (m.a.s.l)	Rain Fall (mm)	On-Station	On-Farm		
1	DZ 10-4	1974	111–135	65–75	1800–2300	700–1100	1.6-2.2	1.0-1.4	Ethiopia	Obsolete
2	DZ 10-11	1974	106–123	70–80	1600–2000	700–1100	1.5-2.8	1.1-1.9	Ethiopia	Obsolete
3	Dubie	1978	110–115	80–90	1800–2300	700–1100	1.7-2.8	1.6-1.7	Ethiopia	In production
4	Mariye	1985	106–120	120–140	1500–2300	700–1300	1.8-3.0	1.4-2.3	ICRISAT	In production
5	Wroku (DZ 10-16-2)	1994	100–149	100–120	1900–2600	700–1200	1.9-4.0	1.9-2.9	ICRISAT	In production
6	Akaki (DZ 10-9-2)	1995	97–147	90–120	1900–2600	700–1200	1.8-4.0	1.9-2.6	ICRISAT	In production
7	Arerti (FLIP 89-84C)	1999	105–155	100–115	1800–2600	700–1200	1.6-5.2	1.8-4.7	ICARDA	In production
8	Shasho (ICCV 93512)	1999	90–155	100–125	1800–2600	700–1200	1.6-4.6	2.0-4.2	ICRISAT	In production
9	Chefe (ICCV 92318)	2004	95–150	110–140	1800–2600	700–1200	1.2-4.8	1.8-3.6	ICRISAT	In production
10	Habru (FLIP 88-42c)	2004	91–140	110–140	1800–2600	700–1200	1.4-5.0	2.0-4.0	ICARDA	In production
11	Ejere	2005	118-129	120-140	1800-2600	700-1200	1.5-3.5	1.2-2.8	ICARDA	In production
12	Teji	2005	122-130	120-140	1800-2700	700-1200	2.0-3.5	1.6-2.9	ICARDA	In production
13	Natoli	2009	136	120-130	1800-2700	700-1200	2.2-2.6	2.0-2.5	ICARDA	In production
14	ACOS Dubie	2009	136	140-150	1600-2400	600-1200	1.1-2.4	1.0-1.3	Mexico	In production
15	Minjar	2010	86-143	120-140	1800-2600	700-1200	2.2-5.0	2.0-4.0	ICRISAT	In production
16	Teketay	2013	85-150	120-160	1800-2600	700-1200	2.5-2.8	2.0-2.3	ICRISAT	In production
17	Dalota	2013	90-145	130-135	1800-2600	700-1200	2.0-2.7	1.6-2.2	ICRISAT	In production

7.2 Profitability and Adoption of Improved Technologies

The adoption of improved agricultural technologies is influenced by a wide array of technical, economic, social, and institutional factors. However, two major factors have been identified in the literature as the main drivers of adoption of agricultural technologies in developing countries: (a) the availability and affordability of technologies; and (b) farmers' expectations that the use of those technologies remain profitable—in turn influenced by factors such as access to land, labor, prices, and profitability of agricultural enterprises (Jack, 2013; Foster and Rosenzweig, 2010;). The sustainability of technology adoption is driven by the profitability of agricultural enterprises closely associated with the changing prices of agricultural products. For instance, once attracted by higher product prices, farmers can abandon the technologies if the expected returns from adoption are lower than the prevailing costs. Furthermore, profitability is also greatly influenced by the response rate and the costs associated with the application of the new technology (Mulat, 1999). The response rate of a technology depends on the quality of the technology, the type of agro-ecology, crop management factors, availability and access to complementary inputs. Superior technologies are less risky and generate large economic benefit. Proper land preparation, appropriate planting time, and effective pest control are some of the management factors that influence the productivity of a technology.

The most widely used indicators for measuring the performance of agricultural enterprises include marginal rate of return (MRR), net returns to land and labor, and cost-benefit ratios. Here, for the purpose of this report, the gross margin approach has been adopted for assessing the relative profitability and competiveness of lentil and chickpea production with other major cereals in the study areas specifically tef and wheat. Gross income is measured by the total production each crops valued by their respective market price while the variable costs include the values of seeds, fertilizers, chemicals, labor and draft power. Gross margins are computed as returns to land and management. Table 15 shows the gross margin analysis for major crops selected in the study areas. Results showed that, under the current market scenario, lentil and chickpea are found to be more profitable as compared to the major cereals, i.e. tef and wheat. With a gross margin of Birr 16,189 per ha, lentil is found to be the most profitable crop followed by chickpea (Birr 13,504/ha), tef (Birr 13,258/ha) and wheat (Birr 10,868/ha). As indicated in Table 15, wheat turns out to be the crop with lowest gross margin indicating that it is less competitive as compared to other crops. While results showed that pulses (lentil and chickpea) are generally more profitable than cereals, creating an economic incentive to increase pulse production, actual decision is greatly influenced by other important factors such as consumption, risk and other technical factors.

Table 15. Gross Margin Analysis for Major Crops (Birr/ha), 2014

SN	Description	Wheat	Teff	Lentil	Chickpea
1	**VARIABLE COSTS**				
1.1	Inputs (Seeds, fertilizer, chemicals) (Birr)	6902	6612	4211	2505.50
1.2	Total Labor (Person days)	45	64	48	39
1.3	Labor cost (Birr)	3190	4330	3160	2890
1.4	Oxen labor (oxen-pair day)	12	14	10	12
1.5	Oxen labor cost (Birr)	2400	2800	2000	2600
1.6	Total Variable Cost (Birr)	*12492*	*13742*	*9371*	*7996*
2	**RETURNS**				
2.1	Yield (kg)	3200	1800	1800	2500
2.2	Gross Return (Birr)	*23,360*	*27,000*	*25,560*	*21,500*
2.3	Gross Margin (Birr)	*10,868*	*13,258*	*16,189*	*13,504*

Source: Field Survey, 2014; supplemented by baseline survey data (2008).

Here, other than economic factors, the adoption of agricultural technologies are also constrained by lack of information and awareness. To this gap, different participatory research approaches had been developed with the major objective of involving farmers early in the technology development process to ensure that technologies generated are accepted and wider adoption achieved. As part of its research-extension program, DZARC has adopted and implemented participatory research approaches in Gimbichu and Minjar-Sherkora districts to demonstrate and promote improved lentil and chickpea production technologies. For instance, different Farmers' Research Groups (FRGs) were established to enable farmers actively participate starting early in varietal development process to technology promotion.

Despite quite a significant number of improved lentil and chickpea production technologies have been developed and released for production, the use of those technologies has still remained negligible and limited to those areas with better access to the technologies. Current evidences showed that only 1% of the total lentil and chickpea area each in Ethiopia were planted with improved seeds during 2012/13 cropping season (CSA, 2013c). It was also estimated that about 4 and 3% of the total lentil and chickpea area were covered by the extension package program during the same cropping season, respectively. Yet, current experience and field observations especially across major chickpea growing areas of the country showed that the improved varieties have been making progress in reaching much larger areas as evidenced by the improvement in national average chickpea yield recorded at 1.7 ton per ha which was used to be below 1 ton per ha. According to some expert opinions, some 10 to 15% of the total chickpea area could be covered by improved varieties mainly through the informal seed system and the regular extension program.

Results of our rapid assessment survey in Gimbichu district showed that Alemaya is the most widely used lentil variety followed by Ada'a and Derash varieties. Furthermore, the survey results showed that farmers commonly plow their lentil plots at least 4 times using oxen plow and apply seed rate at 140 kg per ha using broadcast method. Fertilizer application is commonly used on lentil plots but limited to DAP which is applied at an average rate of 120 kg per ha. Weed control methods involve both hand weeding for broad leaves and herbicide application for grass weeds. Here, Topic is commonly applied to control Phalaris paradox which is the most problematic weed to lentil production. An adoption study conducted by DZARC in 2004 revealed that 30% of the total lentil growing farmers in Gimbichu district planted improved lentil varieties; and Alemaya was found to be the most widely adopted improved variety followed by Ada'a.

The results of the rapid assessment survey on chickpea adoption showed that Arerti is the most widely adopted variety in Minjar-Shenkora district followed by Shasho and Habru varieties. Discussion with key informants from the district office of agriculture indicated that the improved variety, Arerti, covered about 93% of the total chickpea area in Minjar-Shenkora district while Shasho and Habru accounted for 3 and 2% of the total chickpea cultivated area, respectively. The local chickpea varieties were believed to cover about 2% of the total chickpea area in the district. Farmers' chickpea management practices include land preparation with at least 3 plowing frequency using ox plow. Farmers commonly plant their chickpea using broadcast method applying on average 160 kg of seed per ha. Since recent years, there are also some farmers adopted row planting method using the seed rate of 80 kg per ha. Generally, farmers do not apply fertilizer on their chickpea plot while there are very few cases where DAP is applied at a rate of 100 kg per ha. It was also found that farmers use both hand weeding and chemical methods to control weeds. The most widely used herbicide was Topic to control Phalaris paradox which is the most problematic weed in chickpea production. Farmers' chickpea management practices in Minjar-Shekora district have often been cited as best practices as compared to other chickpea growing areas of the country.

A baseline survey conducted in 2008 showed that the improved variety, Arerti, was adopted by 30% of the total chickpea growing farmers during 2007/08 cropping season and followed by Chefe (5%) and Ejere (5%); the adoption rate for Shasho was limited to 1% (Solomon et al, 2010). Similar adoption pattern was also found in Gimbichu district. The adoption rate of Arerti in Gimibchu district was 27% followed by Shasho which was adopted by 19% of the total chickpea growers during 2007/08 cropping season. The adoption rate of Chefe and Ejere was limited to 1% each.

7.3 Pulse Cropping Dynamics and its Key Drivers

LENTIL CROPPING DYNAMICS

Our rapid assessment survey has identified roughly two distinct phases on lentil cropping dynamics in Gimbichu district: The first phase occurred during 1998-2008 which was characterized by the expansion and intensification of lentil production where the productivity of the crop had showed a remarkable growth. The second phase which has become apparent since 2009 is featured by the declining of lentil productivity and production due to the emergence of different production constraints. A brief sketch of the lentil cropping dynamics in Gimbichu district is depicted in Figure 36.

Available evidences showed that the development and promotion of improved lentil production technologies during 1998-2008 was achieving greater momentum that had brought about outstanding improvement in the productivity and production of lentil in Gimbichu district. In this case, the following research and development interventions especially during the mid-1990s could be considered as the major driving factors that were enhancing the adoption of improved lentil production technologies and improving the productivity and livelihood of smallholder farmers:

1) Nile Valley Project: collaboration of EIAR/DZARC and ICARDA

Gimbichu areas were once characterized by local lentil production which had been constrained by diseases and waterlogging problems related to the dominant vertisols. Consequently, farmers were practicing late planting which had been closely associated with low lentil productivity. So, to overcome these production constraints, the national lentil research program in collaboration with ICARDA had developed and promoted improved lentil production technologies consisting of improved varieties and management practices especially early planting using improved drainage methods. The Nile Valley Project which was implemented during the mid- and late-1990s is perhaps the most successful collaborative research for development project of EIAR/DZARC and ICARDA to date. Especially, this project has made a success story in transforming the lentil production system and improving the livelihood of lentil producing farmers in Gimbichu district. For instance, four improved lentil varieties including the most popular variety, Alemaya, were developed during the period 1994-1997. Productivity was, on average, raised to 2.5 ton per ha.

2) Joint Vertisol Project (JVP)/DZARC

The Joint Vertisol Project (JVP) was also an active intervention in Gimbichu areas in the 1990s with the main objective of demonstrating and promoting proper vertisol management technologies to harness the potential of the highly productive vertisols.

Due to the apparent waterlogging problems associated with the vertisol, farmers were traditionally used to plant local varieties using late planting method which had been resulting in poor productivity. The vertisols technologies were including oxen-drawn Broad Bed and Furrow (BBF) to facilitate surface drainage and the use of improved varieties, fertilizer, and early planting that were intended to increase productivity and reduce soil erosion. This project has made a great contribution to improving lentil productivity and production in Gimbichu areas through wider dissemination of the above improved lentil varies such Alemya and changing the perception of farmers on early planting.

3) New Extension Program/ SG200

Another important milestone in improving the productivity of crop production in Ethiopia was the introduction and implementation of the new extension approach in 1994/1995 cropping season. This extension approach is referred to as Participatory Demonstration and Training Extension System (PADETES) which was adapted from the successful Sasakaw Global 2000 (SG 2000) extension project initiated in 1993. It is a package approach involving the active participation of smallholder farmers in the development process. The extension program involves the dissemination of improved technology packages for cereals, pulses, livestock, soil and water etc. Consequently, this extension program has also significantly contributed to the expansion and intensification of lentil production in the study area.

consequent to the preceding interventions, the use of improved lentil production technologies and productivity had showed significant improvement. Farmers reported that lentil production was more competitive so that more areas from other major crops such as wheat, tef, local lentil, and faba bean were allocated to lentil production. Yet, it is very important to note that even if lentil is more competitive, it cannot replace all other crops due to the fact that crop choice is influenced by many other factors including consumption. In general, improved access to technology, productivity improvement, high market prices, low input cost and soil fertility maintenance were found to be the major factors driving the expansion of lentil production during the intervention period. A similar scenario has also occurred in spillover areas within Gimbichu district. The spillover areas include those areas where no intervention was actually made rather diffusion of improved lentil production technologies has occurred from project intervention areas through different channels. These areas have witnessed an improvement and expansion of lentil production and productivity quite lately during 2005-2011.

Survey results showed that despite all those success stories, the sustainability of lentil productivity improvement has started to dissipate since 2009 due to a number of emerging production constraints (Figure 36). These production constraints in order of their importance include rust, root rot, aphids and bollworm. Of all, rust was reported to be the most critical constraint causing a major challenge on the sustainability of lentil production in Gimbichu district. The following challenges were identified to control the current rust problem:

- lack of effective chemical control methods, i.e. currently available chemicals were found to be ineffective;
- lack of tolerant improved varieties: the problem has been increasingly observed on those popular improved varieties such as Alemaya; and
- planting time (both early and late) was found to be ineffective to control the rust problem.

Consequently, the following outcomes have occurred due to the current rust problem;

- the productivity of lentil has declined. It is estimated that, on average, lentil yield has been reduced by 66% with the current scenario; it could also be a crop failure in the worst scenario
- grain quality has been deteriorating so that the demand is very low;
- the cost of lentil production has been increasing since recent years due to the increasing demand for chemical inputs;
- it was reported that there has been a shift in cropping pattern where lentil is increasingly replaced by tef, wheat, and chickpea. This scenario is being further driven by the following factors:
    - tef fetches high price in the current market so that it serves as a cash crop;
    - tef and wheat straw fetches better price in the feed market;
    - relatively low input cost for chickpea production;
    - increasing chickpea price since recent years due to growing export demand; and
    - the availability of effective herbicides to control grass weeds encourages tef production.

Finally, an attempt was made to triangulate the results of the rapid assessment survey with that of the trend analysis based on data obtained from office of agriculture in Gimbichu district for a 10-year period (2004/05-2012/2013). At it has been indicated in Figure 37, the trend analysis in the area of major crops before and after 2009 conforms somehow with the survey results. For instance, prior to 2009, lentil area was expanding sharply while that of wheat was decreasing; the area of tef and chickpea was relatively stable at lower level. Chickpea and tef areas have been exhibiting an increasing trend since 2009. However, the overall performance of lentil production during the period

2004-13 showed that the crop still remains very productive and competitive despite all the challenges which were identified by the rapid assessment survey. Here, it is the researcher's strong conviction that the survey results are much more dependable than the official data as the former was verified by field observations and primary sources. So, in any case where the survey results do not conform to the official data, then the implication of the former overrides that of the official data.

With this remark, the trend analysis showed that lentil production was increasing, on average, 13.3% per annum resulting from 4.6 and 8.7% area expansion and yield growth per annum, respectively (Figure 38). The performance of chickpea has also showed similar performance with an average production growth rate of nearly 13% per annum. The chickpea yield growth was estimated at 9% per annum while area expansion was nearly 4% per annum. Yet, the performance of wheat in Gimbichu district was very poor indeed as indicated by the fact that wheat production was declining by nearly 5% per annum during the reference period. Wheat acreage was shrinking by 3% per annum while productivity was falling by 2% per annum during the same period.

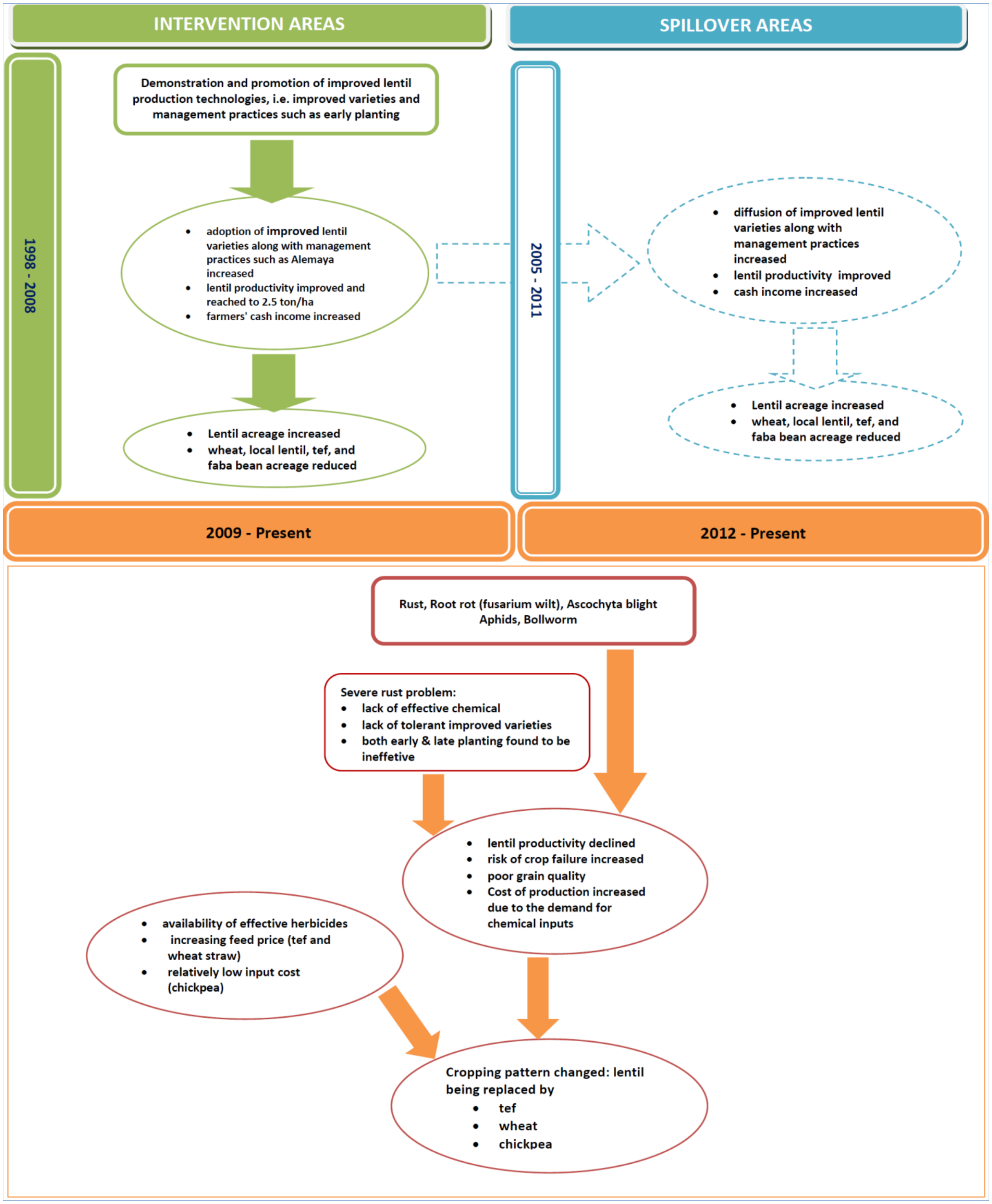


Figure 36. Lentil Cropping Dynamics in Gimbichu District
Source: Field Survey, 2014.

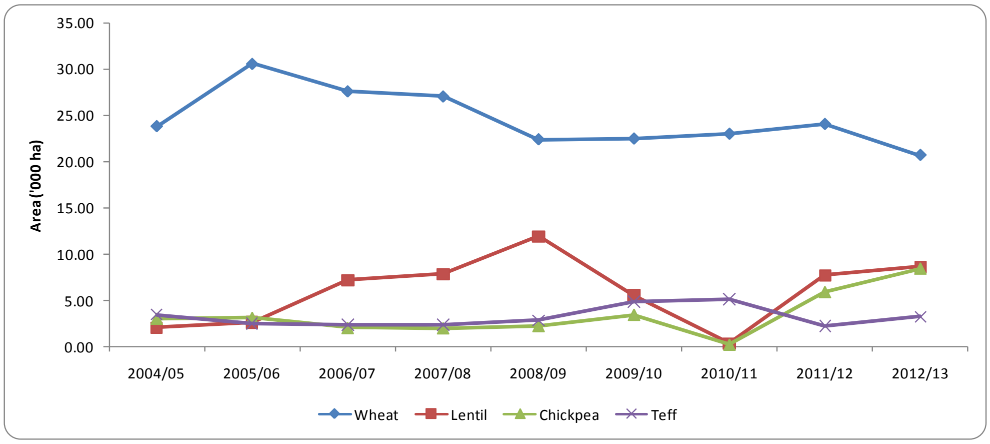


Figure 37. Trend in Area of Major Crops in Gimbichu District ('000 ha) (2004-2013)
Source: Office of Agriculture, Gimbichu District, 2014

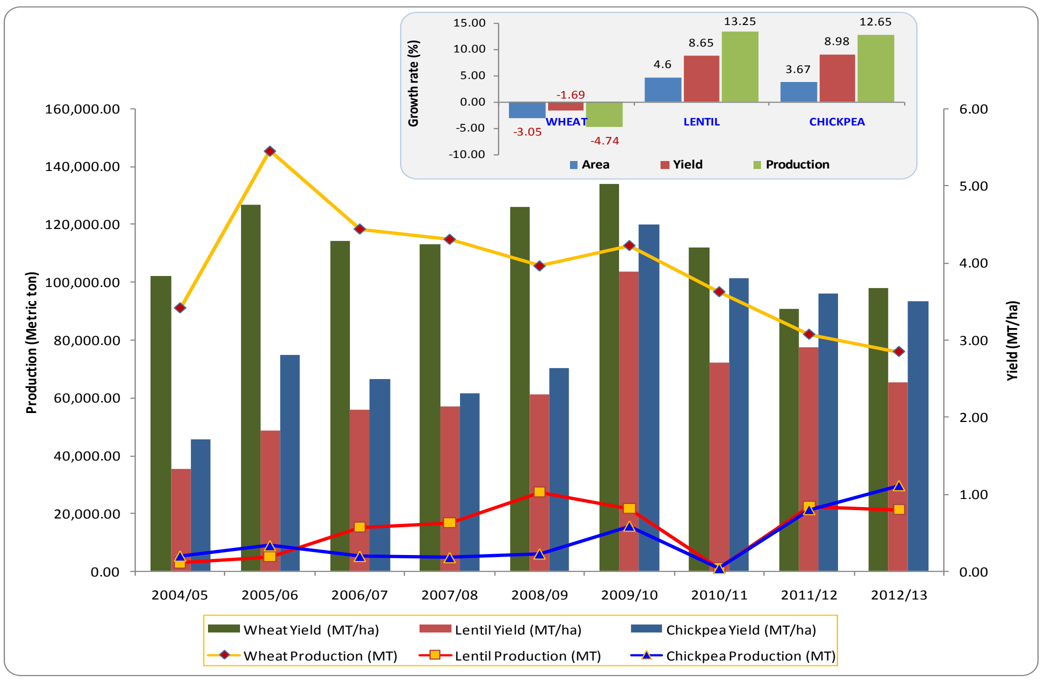


Figure 38. Trend in Production and Yield of Major Crops in Gimbichu District (2004-2013)
Source: Office of Agriculture, Gimbichu District, 2014

CHICKPEA CROPPING DYNAMICS

Similarly, survey results showed that the chickpea cropping dynamics in Minjar-Shenkora district has witnessed two contrasting phases since the past 10 years. The first phase which was characterized by the expansion and intensification of chickpea production lasted from 2005 to 2011. However, the second phase has been exhibiting a descending trend in chickpea productivity due to the emergence of different production constraints quite recently, i.e. since 2012. A brief sketch of the chickpea cropping dynamics in Minjar-Shenkora district is depicted in Figure 39.

Minjar-Shenkora district is one of the high potential chickpea growing areas where research and development efforts have achieved a major milestone in lifting chickpea production and productivity to best performance level. Especially, the development and promotion of market preferred kabuli chickpea varieties since the mid-2000s has increased the productivity and commercialization of chickpea production in Minjar-Shenkora areas. The wider use of improved chickpea production technologies and the associated productivity improvement could be attributed to the following research and development interventions:

1) EIAR/DZARC and ICARDA COLLABORATION

As it has been the case for lentil, ICARDAS's persistent collaboration with the national chickpea research program (EIAR/DZARC) has contributed a lot to the recent success of the chickpea sector. Traditionally, Ethiopian chickpea production was predominantly desi types which are small seeded with low export price. However, in recent years, the national chickpea research program has developed and released different high yielding market preferred kabuli chickpea varieties along with their management package in collaboration with ICRADA. For instance, five improved kabuli chickpea varies have been developed from breeding materials obtained from ICARDA. Here, the most popular and widely adopted improved chickpea variety, Arerti has been developed from ICARDA materials. It is important to note that this improved chickpea variety, Arerti, was named after the main town of Minjar-Shenkora district, "***Arerti***".

2) Tropical Legumes-II (TL-II) Project: collaboration of EIAR/DZARC and ICRISAT

As earlier noted, ICRISAT has also a long-established partnership with the national chickpea research program in the planning and implementation of different research for development projects. In terms of variety development, all improved desi varieties except those released from local materials and the two kabul varieties (Chefe and Shasho) were developed from ICRISAT materials. Furthermore, since recent years, ICRISAT has been extensively engaging in the development and promotion of high yielding and market preferred chickpea varieties in major chickpea growing areas of

Ethiopia. For instance, the Tropical Legumes-II (TL-II) Project which is being implemented in Ethiopia since 2007 can be cited as a case for its active engagement in chickpea development. Here, Minjar-Shenkora district is one of the three pilot project areas of TL-II project where many successes have been recorded. The project implementation has adopted different strategies including fast track testing and adoption of existing varieties (including ICARDA materials) and advanced breeding materials for use by farmers; develop market preferred chickpea varieties and community based seed production and delivery systems. One can safely make a conclusion that much of the success stories in the chickpea sector since the mid-2000s has been attributed to TL-II project. Especially the wider diffusion and adoption of all ICARDA kabuli varieties (e.g. Arerti) in most chickpea growing areas as well as the establishment of smallholder farmers seed producers associations could be considered as some of the major achievements of the project.

The above interventions along with other regular development programs have brought about wider use of improved technologies and high chickpea productivity and production growth in Minjar-Shenkora district. Survey results showed that more than 90% of the total chickpea area in Minjar-Shenkora, which was once used to be a local desi chickpea growing area, is now planted with improved kabuli chickpea varieties. It is also estimated that the average chickpea yield ranges between 3 and 3.5 ton per ha. Chickpea has become more completive since the last 7 years. Consequently, farmers reported that chickpea production have taken more areas from other major crops such as tef, wheat, local chickpea and sorghum. The following have been identified as the major factors driving the expansion of chickpea production during the intervention period:

- improved access to technology, i.e. decentralized farmers-based seed production and delivery system;
- productivity improvement;
- high chickpea price due to growing export demand. The price has reached as high as 1600 birr per quintal until recent years;
- low labor input for chickpea production;
- high fertilizer cost for cereals; and
- crop rotation or soil fertility management.

Similar to the lentil case, it was found that despite all the success stories recorded in the district, there has been a growing concern since the last two years (2012) on the sustainability of the current chickpea productivity due to several emerging production constraints (Figure 39). These production constraints in order of their importance include root rot, Ascochyta blight, bollworm, and cutworm. Furthermore, the effects of these production constraints are further compounded by the following challenges:

- price risk which is closely associated with frequent chickpea price fluctuation. For instance, chickpea price was reached its lowest level around Birr 800 per quintal in early 2014.
- lack of new varieties or heavy reliance on old varieties. The improved variety, Arerti, was released as resistant to fusarium wilt and ascochyta blight. However, farmers reported that since the last two years, this very has been severely affected these diseases. The perception that there is no new variety is perhaps closely related to lack of information and the big task ahead in the promotion of recently released chickpea varieties such as Minjar (2010), Teketay (2013), and Dalota (2013). In addition to these desi types, there are also kabu varieties such as Natoli and ACOS dubie which were all released in 2009;
- lack of effective chemicals to control pest problems; and
- poor seed management system.

Consequent to the above challenges, the following outcomes were identified:

- chickpea productivity declined. It is estimated that chickpea yield has reduced, on average, by 30-40% under the current pest problem scenario;
- poor grain quality or deteriorating seed size resulting in low demand;
- cost of production has been increasing due to the growing demand for chemicals to control pests;
- farmers reported that there has been a growing tendency toward allocating more areas from chickpea to other major crops such as tef and wheat. This scenario is being further driven by the following factors:
    - tef fetches high price in the current market so that it serves as a cash crop;
    - tef and wheat straw fetches better price in the feed market;
    - the availability of effective herbicides to control grass weeds encourages tef production.

With a similar remark that has been made for the case of lentil, a 10-year trend analysis on the production of chickpea and other major crops in Minjar-Shenkora was done to triangulate with the results of the rapid assessment survey. Accordingly, it was found that the trend analysis somehow conforms with the survey results which indicate the cropping dynamics since 2005. While all the major crops have showed an increasing trend in area expansion during the period 2004-2013, the trends of chickpea and lentil area have been steadily increasing from their minimum level in 2004/05 to the highest level in 2012/13 (Figure 40).

The overall performance of chickpea and lentil is much stronger than that of tef and wheat. For instance, it is estimated that chickpea production was growing, on average, 42% per annum resulting from 26 and 16% area expansion and yield growth per annum, respectively (Figure 41). Lentil production has also showed a strong performance as evidenced from an average growth rate of 35% per annum consisting of 23% area expansion and 12% productivity growth. While tef and wheat have showed moderate performance as compared to pulses, much of their production growth was generated from productivity improvement. The average tef production growth was estimated at 10.5% per annum generated from 3.7 and 6.8% area expansion and yield growth. Wheat which is another important crop grew on average 13% per annum with 4% area expansion and 9% yield growth. So, much of the total cereal production growth came from productivity growth.

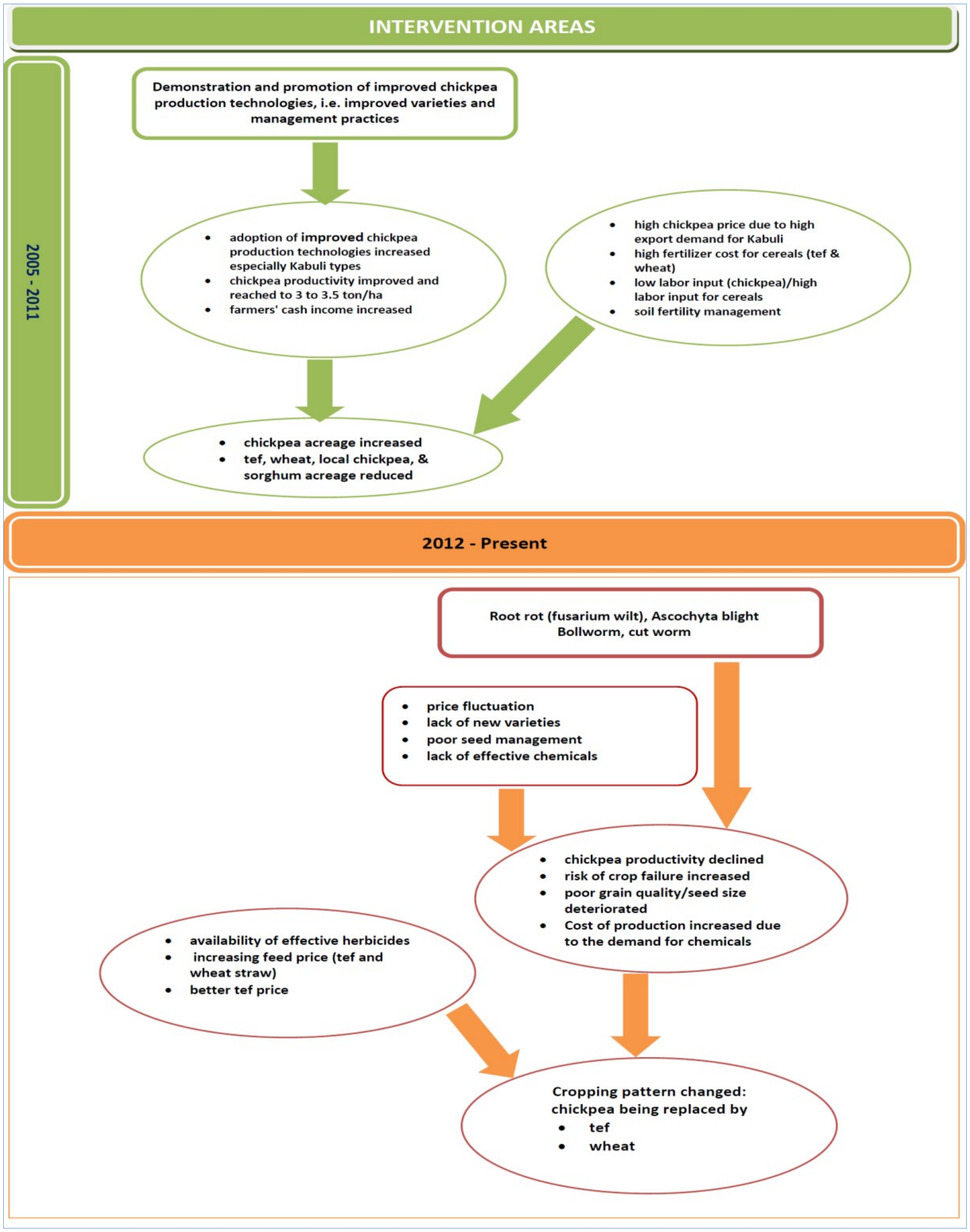


Figure 39. Chickpea Cropping Dynamics in Minjar-Shenkora District
Source: Field Survey, 2014.

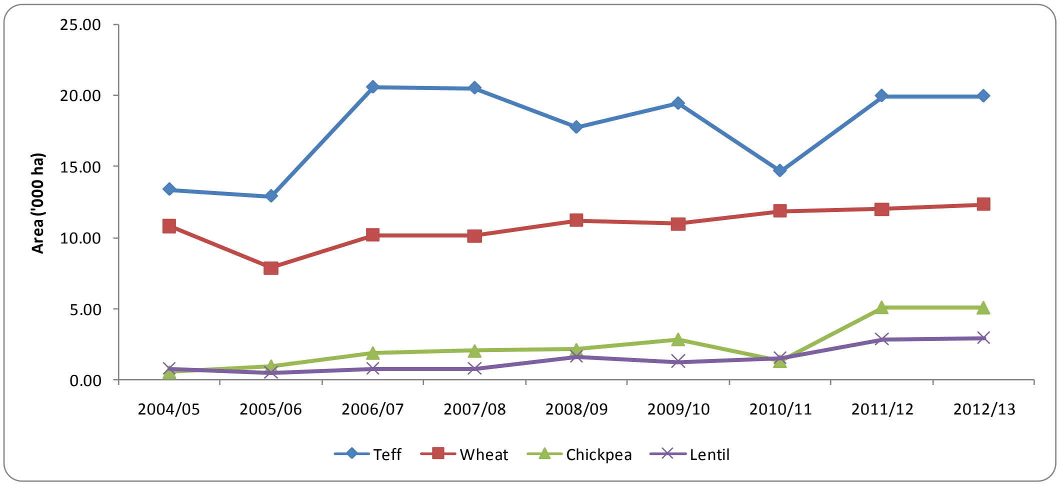


Figure 40. Trend in Area of Major Crops in Minjar-Shenkora District ('000 ha) (2004-2013)

Source: Office of Agriculture, Minar-Shenkora District, 2014

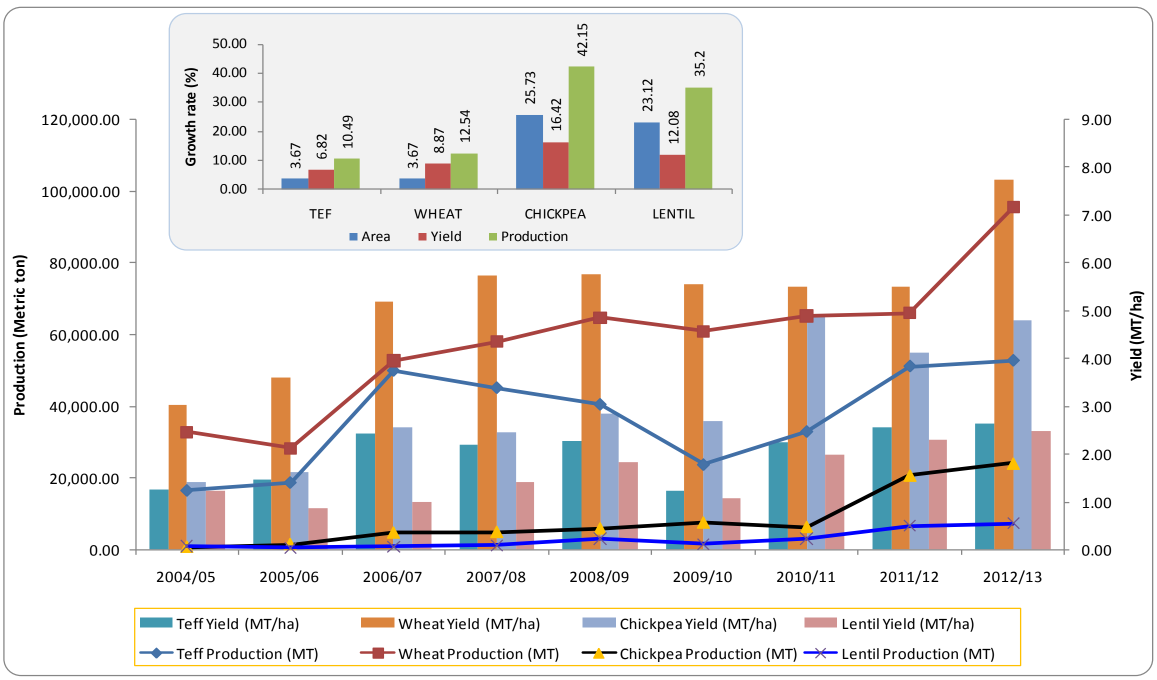


Figure 41. Trend in Production and Yield of Major Crops in Minar-Shenkora (2004-2013)

Source: Office of Agriculture, Minar-Shenkora District, 2014

7.4 Market Participation and Consumption

The current agricultural development strategy in Ethiopia primarily focuses on the commercialization of smallholder agriculture to achieve the development objective of alleviating poverty and food insecurity. Evidences have showed that pulses have now become strategic commodities that promote the commercialization process as they do have a high demand both in local and export markets. In this context, an attempt was made to assess the level of commercialization of lentil and chickpea production in the study areas. The rapid assessment survey showed that lentil and chickpea are indeed the most important sources of cash income for smallholder famers. It was found that, on average, 80 and 85% of the total lentil and chickpea production is destined for marketing purposes to generate cash income, respectively.

These results are exceeding by far the average values at national and zonal levels (Figure 42). For instance, it was estimated that nearly 37 and 24% of the total lentil and chickpea production in Ethiopia is channeled into the market for cash income, respectively indicating that the bulk of the total pulse production remains at farm level. Furthermore, estimates unveiled that farm household consumption accounted for 41 and 57% of the total lentil and chickpea production, respectively. In contrast, evidences revealed that pulse growing farmers in East Shewa Zone, which includes the study areas, do have better market integration as compared to the average farmers in Ethiopia. The proportion of total pulse production sold in the market ranges from 53 to 58% for both crops (Figure 42). This shows that more than half of the total lentil and chickpea production is destined for marketing purposes. It is also found that lentil and chickpea are the most market oriented pulse crops with the highest proportion sold in the market. Here, it is important to note that pulse growing farmers in East Shewa Zone are relatively well integrated to the pulse markets for mainly having better market access in terms of infrastructure and location to major terminal markets.

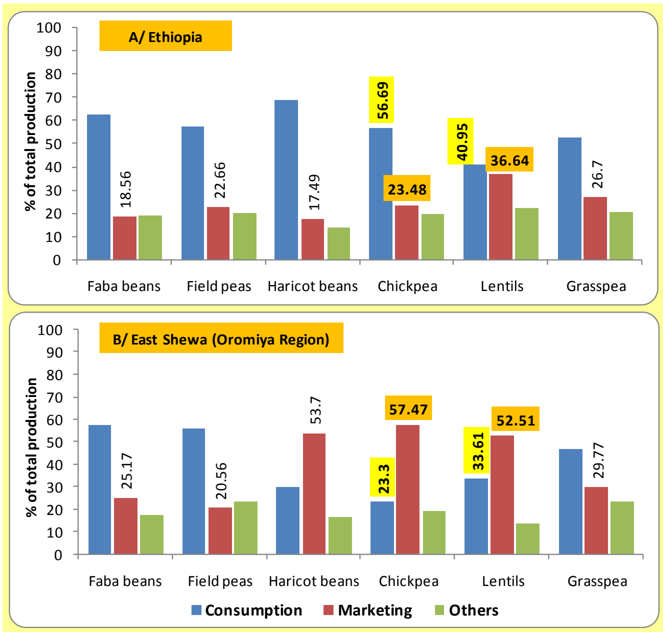


Figure 42. Utilization of Major Pulse Crops in Ethiopia (2012/2013 Cropping Season)
Source: CSA, 2013b

In Ethiopia, there is a high and growing demand for lentil and chickpea in local markets which is closely associated with the deep-rooted values of these crops in the diets of the population. They are major staple food legume crops used for the preparation of various traditional foods in Ethiopia. The methods of utilization of these food legume crops show somehow a sort of variability. Lentil is a highly demanded and widely consumed food legume crop because of its high protein content and fast cooking quality traits. Of all, ***Wot*** (lentil stews) is the most widely served traditional dish in Ethiopia prepared from whole or dehusked and split lentil. It is also eaten deep-fried as snacks, soups mixed with vegetables; its flour is also mixed with other food grains to prepare different traditional food items such as ***Shiro*** and bread.

Similarly, chickpea is widely consumed in Ethiopia in the form of different traditional foods. It is commonly consumed as green pod, roasted, boiled and fried. Here, ***Wot*** (Sauce) is the most widely consumed Ethiopian traditional dish prepared from dehusked and split or finely/coarsely ground chickpea. Chickpea is also used for the preparation of unleavened bread. Finally, it is important to note that the demand for and consumption of lentil and chickpea is getting high during the main fasting periods especially with Ethiopian Orthodox Christians.

7.5 Processing and Marketing

Lentil Processing and Marketing

The economic significance of lentil is not limited to serving as a cash crop for smallholder farmers rather it generates further more employment along its value chain. Lentil is the most widely processed agricultural commodity (split form) among food legumes being supplied for local and export markets. Our survey work with lentil processors and traders showed that some 80% of the total lentil supply in the market is commonly sold in a processed form while the grain accounts for only 20%. The lentil processing industry in Ethiopia is mainly characterized by small scale operators using small mills and more of manual labors. It is also concentrated in the vicinity of the capital such as Beki and Sendafa areas which are located at a very close distance from Gimichu district, the major lentil growing area. Especially, Beki areas are known to be the lentil processing belt where lentil is processed, graded, packed and sold mainly in the local markets as well as to a limited extent supplied to the export market.

It was found that all processors in Beki areas convert lentil into splits using small scale mills which are also used for flour mills in other parts of the country (Figure 43). In general, four key stages were identified in the local lentil processing to come up with the end product, split lentil, as briefly outlined as follows (Figure 44):

1) **Soaking:** at this stage, one metric ton lentil grain is soaked in a concrete lined pit filled with water (about 400 liters) for 24 hrs. Here, spade is commonly used to mix the grain with water and the grain should be submerged in the water. The purpose of soaking is just to remove some soil materials and make the grain suitable for dehulling (dehusking).
2) **Drying:** when the soaked grain absorbs almost all water in the pit after 24 hrs, it will be taken out from the pit and piled on the ground and then covered with sacks for one day to drain the soaked water. And then, the drained lentil will be further subject to sun drying for 1 day by spreading the grain over the ground.
3) **Seed cleaning:** After the grain is optimally dried, it will further be cleaned from foreign materials using sieves of different sizes. Seed cleaning will take a total of 2 days. Here, it was found that there are 5 sieve levels of different sizes which are used for grain cleaning:

    Sieve level 1: separates lentil grain from small stone particles
    Sieve level 2: separates large seed size
    Sieve level 3: separates small seed size
    Sieve level 4: separates soil and sand
    Sieve level 5: separates shriveled grain

4) **Dehusking/splitting, winnowing and cleaning**: Immediately following seed cleaning, the grain is split using small scale mills driven mostly by electric engines while there are also few cases of machines operating with diesel engine (Figure 43). After finishing the splitting operation, the split lentil will be subject to winnowing in an open air and further cleaning using sieves of 3 different size.

Sieve level 1: separates lentil grain that is not dehulled and needs redulling
Sieve level 2: separates sand particles
Sieve level 3: separates broken and ground grains as well as soil particles

All activities at this stage take a total of 2 days. In general, it was found that the complete processing of one metric ton of lentil takes a total of 7 day using two persons. Moreover, the postharvest loss was estimated to be 20 to 25% of which moisture and foreign matters account for 4%. Furthermore, one metric ton lentil costs 150 Birr with diesel mill while it cost 120 Birr with mill operated by electric engines.

The lentil processing produces two products consisting of the main product, split lentil, and the byproduct. It was found that processors do have three major informal grades for split lentil when they sell their product. The premium grade is called Magna and fetches the highest price (2500 birr/quintal) in the market while others are Grade 2 and 3 with an average price of 1800 and 1600 birr/quintal, respectively. The processors also noted that the premium quality is produced from the local lentil varieties while at the moment the improved lentil variety, Alemaya, was reported to have Grade 2 product.

The lentil processing has also two important byproducts. The first byproduct consists of unevenly split and ground grain mixed with the husk which is locally called ***Shena***. This byproduct is highly demanded for livestock feed and fetch a good price with 600 birr/quintal. The second byproduct is entirely husk generated mainly from winnowing and also sold for animal feed at a price of 60 Birr/quintal.

It was observed that the local lentil processing involves highly labor intensive activities such soaking, drying, cleaning, splitting, winnowing and cleaning. In this case, one important aspect of the local lentil processing industry is its labor management approach. It was found that lentil processors do not use labor on a daily wage basis rather there is an income sharing arrangement between the mill owner and the labor. In this labor arrangement, the capitalist gives, for instance, one tone of lentil for two individuals to undertake all the processing operations using his machines and other processing facilities. Then, after the completion of the processing operations, the laborers will share 50% of the total profit while the remaining goes to the owner of the processing facilities. In this case, the two laborers further share 25% each from their total income share. It is also important to note that all marketing issues including supply procurement is managed by the capitalist. Consequently, all risks including any loss will be borne by the processing owner.

Perhaps one of the major challenges of a processing business is that supply should be all year round and dependable. In this regard, the lentil processors collect their supply from different major lentil growing area of the country such as East Shewa (Gimbichu, Ejere, Ada), Wollo, Tigray, Jiru, Becho, etc. The processors reported that most improved varieties such as Alemya are mostly obtained in East Shewa zone. More supplies are purchased during harvesting time, November-January when there is enough supply in the market and price is fair.

The survey result unveiled that there is price variation for lentil supply based on variety types. The processors reported that, currently, the local lentil varieties fetch premium price of 180 to 200 birr per quintal over that of improved varieties such as Alemaya. However, this scenario was completely in contrast to the market situation in some 3 or 4 years ago when improved varieties were bought with 100 to 200 birr difference over the local varieties. The processors have related this market scenario with the apparent disease and pest problems on the improved variety where grain quality has been deteriorating and become below the standard as compared to the local varieties. Currently, it was found that high quality product is produced from local varieties which have a black seed coat.

Figure 43. Local mill used for lentil splitting in Beki Areas
Source: Field Survey, 2014

Figure 44. Local Lentil Processing Activities in Beki Areas
Source: Field Survey, 2014

Profitability of Lentil Processing

A brief assessment of the profitability of the local lentil processing was done using gross margin analysis. It showed that the business is profitable as indicated by the gross margin of Birr 5,154 per ton (Table 16). The high gross margin is closely associated with the following factors: First of all, the lentil processing adds value by converting the grain into split lentil and then grading using informal standards. Secondly, there is always a high demand for split lent in the local market. Thirdly, it seems logical to make a conclusion that there is no as such a strong competition in the sector as the processing has been traditionally concentrated in this part of the country.

Table 16. Gross Margin Analysis for Lentil Processing per metric ton, 2014

SN	Description	Value (Birr)
	COST	1,400.00
1	Cost of lentil grain purchase	14,000.00
2	*Unload & store*	40.00
3	Labor for processing	1,120.00
4	Cost of dehulling	150.00
5	*Weighing & loading*	60.00
6	Transport	220.00
	Total cost	15,590.00
	REVENUE	
7	Gross income from split lentil	20,000.00
8	Income from byproducts	
8.1	Husk	24.00
8.2	Mix of broken lentil with husk (*Shenna*)	720.00
	Gross Return (Birr)	20,744.00
	Gross Margin (Birr) per ton	**5,154.00**

Source: Field Survey, 2014

Despite the profitability of lentil processing as evidenced from the gross margin analysis, there were also major marketing problems reported by the local processors. From economic point of view, competitive markets are desirable and most economic policies are targeting towards this end. However, the lentil processors reported that the current growing competition in the market is a major threat and constraint to their business. It was indicated that currently the number of processors has been increasing significantly even in some other parts of the country where processing was not a common feature. For instance, it was noted that there has been an emerging and growing lentil processing activities in Bahir Dar and Debre Birhan areas where there had never been any lentil processing. Moreover, there is also a growing number of new large scale modern lentil processing plants that have been established in recent years with great capacity to compete in local and export markets. For instance, the Export Trading Group (ETG) company located in Debre Zeit can be cited as the case for the growing competition in the market. This processing plant was established in 2009 by foreign investment and engaged in the processing of pulse and oil crops for local and export markets. This processing unit has the capacity to manage 50 metric tons of lentil per day while it is currently operating at around 60% of its capacity.

Chickpea processing and marketing

In contrast to lentil, the bulk of chickpea is usually sold unprocessed. Processing in the case of chickpea export is limited to cleaning, sorting, grading and packaging levels. However, in recent years, there has been a growing trend in the processing and marketing of chickpea in local markets by medium and small scale processors which are locally called ***Baltina*.** They are engaged in the processing and marketing of chickpea in the form of dusked and split chickpea (***Kik***) or dhal, chickpea floor for sauce (***Shiro***), and roasted (***kollo***). The desi types are highly preferred for ***Kik*** and ***Shiro*** while the Kabulis are for roasted chickpea (***Kollo***). The small scale processors are often operating in and around large urban centers through their different selling outlets.

8. Major Challenges in the Pulse Subsector

9. Summary and Conclusions

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