Review Article

The importance of Legumes in the Ethiopian Farming system and Overall Economy: Overview

Abstract

Ethiopia has diverse agro-ecological environment that permits different farming systems. Crops, livestock and trees are the major components of the farming system in the country. Agriculture is the back bone of the country´s economy, provides direct livelihood for about 83% of the population, and prime source of food for the population. Crops production is the dominant component in Ethiopian agriculture as well as in the farming system. Out of the total arable land of 50.5 million hectares, close to 16.4 million hectares are suitable for producing annual and perennial crops. Legumes are among the various crops produced in all the regions of the country in different volumes after cereals.Twelve legume species are grown in the country. Legumes have multiple uses. Grain legumes provide food and feed and facilitate soil nutrient management. Herbaceous and tree legumes can restore soil fertility and prevent land degradation while improving crop and livestock productivity sustainably. The pulse industry in the country has developed significantly with little intervention, and great potential exists to increase the production and impact of pulses through proactive and targeted support. The role that Ethiopia now plays in the international pulse market can be attributed to significant growth rates in pulse production over the last 15 years. However, Sets of constraints and considerable gaps span the legumes along the value-chain from production to marketing and utilization. The country needs to target the constraints and gaps to optimize the importance of legumes in the farming system and economy of the country.

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Key words: Ethiopia, Farming system, Legumes, sustainability, and agriculture

1. Background

Ethiopia is a country located in the horn of Africa with a total land size of 1.14 million sq. km. of which 99.3 percent is a land area and the remaining 0.7 percent is covered with water bodies of lakes (MOWR 2002), and estimated population close to 90 million (2007 census registered 72.4 million). The country's economy is highly dependent on the Agricultural sector which provides direct livelihood for about 83% of the population, contributing 43 – 45% of the country's Gross Domestic Product (GDP), 87% of its export earnings and around 73% of the raw material requirement of agro-based domestic industries. Above all, the agricultural sector is the prime source of food for the ever growing population of the country. Population concentration is highest in the highlands (above 1500 meters above sea level), which accounts for about 45 percent of the country's total landmass but home for nearly 90 percent of the population. The country has diverse agro-ecological environment that permits different farming systems. Crops, livestock and trees are the major components of the farming system in the country. Around 55 percent of the total land area constitutes moisture-stressed arid, semi-arid and sub-moist areas with less than 120 days of crop growing period. These drier areas are commonly low in soil fertility and high in rainfall variability and drought risk. Areas with a longer and dependable period with minimum of 120 crop growing days are found in the remaining 45 percent of the total land area, particularly in the highlands (ADBG, 2008). On the other hand, the country has 12 river basins with an annual runoff volume of 122 billion m^3 of water and an estimated 2.6 - 6.5 billion m^3 of ground water potential, which makes an average of 1575 m^3 of physically available water per person per year, a relatively large volume. However, due to lack of water storage infrastructure and large spatial and temporal variations in rainfall, there is not enough water for most farmers to produce more than one crop per year.

The existence of diverse farming systems, socio-economics, cultures and agro-ecologies as endowed Ethiopia with a diverse biological wealth of plants, animals, and microbial species, especially crop diversity. Crop plants such as coffee (*Coffea arabica),* safflower (*Carthamus tinctorius*), tef (*Eragrostis tef*), noug (*Guizotia abyssinica),* anchote (*Coccinia abyssinica)*and enset *(Ensete ventricosum)* originated in Ethiopia.

High genetic diversity is found in major food crops (wheat, barley, sorghum and peas); industrial crops (linseed, castor and cotton); cash crop (coffee); food crops of regional and local importance (teff, noug, Ethiopian mustard, enset, finger millet, cowpea, lentil) and in a number of forage species of world importance such as clovers, medics, oats (IBC 2007).

Though the diverse agro-ecological setting permits diverse farming and livelihood systems, crop production is by far the largest component of the agricultural economy. Out of the total arable land of 50.5 million hectares, close to 16.4 million hectares are suitable for producing annual and perennial crops. Of this estimated land area about 8 million hectares (nearly 50%) are used annually for rain-fed small holders crops (Tadesse et al 2009).

The food crops can be grouped in to eight groups for simplicity of description and comparison purposes. The groups are cereals, pulses, oilseeds, vegetables, root crops, fruit crops, stimulant crops and sugar cane. Stimulant crops consist of Chat, coffee and hops.

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According to CSA (2010/11), Out of the total grain crop area, 81.97% (9.69 million hectares) is covered under cereals. Teff, maize, wheat, sorghum and barley took up the lion share of cereals area coverage and volume of grain production.

Pulses are among the various crops produced in all the regions in different volumes across the country after cereals. Twelve pulse species are grown in the country. Of these, faba bean (Vicia *faba* L.), field pea (*Pisum sativum* L.), chickpea (*Cicer arietinum* L.), lentil (*Lens cultinaris* Medik.), grass pea (*Lathyrus sativus* L.), fenugreek (*Trigonella foenum-graecum* L.) and lupin (*Lupinus albus L.*) are categorized as highland pulses and grown in the cooler highlands. Conversely, haricot bean (*Phaseolus vulgaris* L.), soya bean (*Glycine max* L.), cowpea (*Vigna unguiculata* L.), pigeon pea (Cajanus cajan L.) and mung beans (*vigna unguiculata)* are predominantly grown in the warmer and low land parts of the country. Pulses grown in 2009 /10 covered 12.95% (1.49 million

hectares) of the grain crop area and 10.5% (more than 18.98 million quintals) of the grain production was drawn from the same crops. Faba beans, haricot beans, and field peas were planted to 4.45% (more than 512 thousand hectares), 2.12% (more than 244 thousand hectares) and 1.97% (about 226 thousand hectares) of the grain crop area, respectively. The production obtained from faba beans, chick-peas, and haricot beans was 3.38% (about 6.11 million), 1.57% (about 2.85 million) and 2.01% (3.63 million) quintals of the grain production, in that order. Other pulses like lentil (105,956 hectares and 1,237,772 quintals), grass pea (135,658 hectares and 2,040,196 quintals) soybeans (5,679hectares and 72,050 quintals), fenugreek (21,183 hectares and 271,220 quintals), and lupins (25,033 hectares and 416,759 quintals) have important share in terms of area coverage and volume of production.

Table: Estimate of Area coverage and volume of production of different legumes, 2009/2010 and 2010/11 Meher season.

Pulses	Area in hectare		Production in Quintal	
	2010/11	2009/10	2010/11	2009/10
Faba beans	459,183.51	512,067	6,977,983.87	6,108,453
Field peas	203,990.64	226,533	2,570,314.09	2,358,721
Haricot beans	237,366.39	244,013	3,402,795.18	3,628,903
Chick peas	208,388.62	213,187	3,228,388.27	2,846,398
Lentils	77,334.22	105,956	809,517.33	1,237,772
Grass peas	131,043.99	135,658	2,009,485.58	2,040,196
Soya beans	11,261.12	5,679	158,244.22	72050
Fenugreek	14,670.04	21,183	179,052.29	271220
Lupin (Gibto)	14,284.15	25,033	196,154.18	416759

Source: CSA, 2009/10 and 2010/11

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2. Importance of legumes

Legumes are known to perform multiple functions. Grain legumes provide food and feed and facilitate soil nutrient management. Herbaceous and tree legumes can restore soil

fertility and prevent land degradation while improving crop and livestock productivity on a more sustainable basis. Thus the adoption of such dual-purpose legumes, which enhance agricultural productivity while conserving the natural resource base, may be instrumental for achieving income and food security, and for reversing land degradation (Minale, 2011).

The Ethiopian farmers' produces different legume crops mainly for food and feed, to fetch cash, and more importantly to restore the fertility of the crop land. It contributes to smallholder income, as a higher-value crop than cereals, and to diet, as a cost- effective source of protein that accounts for approximately 15 percent of protein intake. Moreover, pulses offer natural soil maintenance benefits through nitrogen-fixing, which improves yields of cereals through crop rotation, and can also result in savings for smallholder farmers from less fertilizer use of the following crop. It also contribute significantly to Ethiopia's balance of payments.

2.1. Contribution of legumes to small holder livelihood

Pulses contribute to smallholder livelihoods in multiple ways. Firstly, pulses can play a significant role in improving smallholders' food security, as an affordable source of protein (pulses make up approximately 15 percent of the average Ethiopian diet) and other essential nutrients. As a protein source, pulses are more affordable for smallholders than meat, fish, and dairy products, and for the 40 percent of Ethiopians who practice orthodox Christianity, pulses become the single largest source of protein during the fasting period. Secondly, pulses can have an income benefit for smallholders, both in terms of diversification and because they yield a higher gross margin than cereals. The income benefits of diversifying from cereals to pulses for one smallholder farmer are exemplified in a case study considering the net profit of wheat, barley and teff, compared to faba beans and chickpeas in Ethiopia. The results demonstrate that pulses are generally more profitable than cereals, giving smallholders an economic incentive to increase pulse production. Faba beans provide the highest net return among the crops considered, while chickpeas provide higher returns than barley and teff, but comparable returns to wheat (Rashid et al 2010).

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2.2. Farming system importance of legumes

Another very important offer of legumes is that it improves soil health. It has nitrogen fixing properties that can reduce fertilizer usage for cereals in the next season by up to 60 percent (if the recommended fertilizer dosage is otherwise adhered to). For example, lupin can potentially fix and accumulate a total of 150 to 400 kg/ha per year nitrogen (Takunov and Yagovenko 1999; Reeves et al 1990; Jansen 2006) and Faba bean up to 200 kg/hectare per year. Given that cereal production causes higher soil nutrient depletion, rotating between pulses and cereal will not only contribute towards maintaining soil health but can also reduce the country's fertilizer usage (Rashid et al 2010).

2.3. Importance of legumes to livestock feed

Moreover, legumes have been shown to improve both the quantity and quality of fodder, and thus sustain feed production during the dry season and increase livestock productivity. Experiments in Ethiopian highlands showed that forage legumes did not reduce the barley grain and straw yield, but significantly increased the total fodder yield – barley straw plus forage (Zewdu 2004); similar results were found for maize (Zewdu 2003). Average fodder yields of 14.2 and 3.4 tons per hectare of maize-vetch and barley-clover, respectively, were reported compared to 9.3 and 2.3 tons per hectare of sole maize and barley, respectively (Zewdu et al. 2000). The average crude protein content of crop residues is about 3.8% of dry matter, whereas legumes crude protein content on average varies between 14-24% of dry matter (Mpairwe et al. 2003). In Ethiopia, Crossbred cows given an oats-vetch diet produced on average 1.40kg/day more milk than those given hay diet (5.54 vs. 4.14 kg milk/day) (Khalili et al. 1992). Legumes mixed with crop residues also increase other livestock production parameters like weaning rate, manure and lactation yield (Minale 2011).

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2.4. Importance of legumes to human health

From health perspective, some pulses have got tremendous uses. Scientists in Australia regard lupin seed as a valuable human health food to help reduce blood pressure and cardiovascular disease. Food enriched with lupin seed makes people feel

full for longer and reduces their hunger. Research has shown that diets supplemented with lupin grain may also play an important role in treating type 2 diabetes, particularly in overweight and obese people.

2.5. Economic importance

Economically, pulses are the third largest crop export product in terms of total value (USD 90 million), and have a positive impact on the trade balance, and contribute to the country's foreign exchange reserves.

3. Potentials and opportunities

The pulse industry has developed significantly with little intervention, and great potential exists to increase the production and impact of pulses through proactive and targeted support. Rough calculations suggest that Ethiopia could expand its foreign market presence by at least doubling its current exports through increased production levels (Rashid et al 2010). Smallholder income could also be increased by at least 40-70 percent per hectare of pulses planted through greater pulse productivity (with better inputs and sound agronomic practices). There is an opportunity to stabilize and increase supply by improving production up to the full potential which would meet domestic demands, helping to ensure food security.

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Ethiopia is now one of the top ten producers of total pulses in the world, the second-largest producer of faba beans after China, and the fifth or sixth largest producer of chickpeas. Within Ethiopia, pulses are the third-largest crop export behind coffee and oil seed, and represent a USD 90 million export industry.

The role that Ethiopia now plays in the international pulse market can be attributed to significant growth rates in pulse production over the last 15 years. For instance, in 1994/5 the country produced only 742 thousand tons of pulses, compared to 1.8 million tons in 2007/08 and 1.95 million tons in 2010/11.This growth of 263 percent between 1994/95 and 2010/11 implies an annual growth rate of 16.4 percent. Growth rates for individual pulses are even higher. The total production of haricot beans, a key export,

was only about 34 thousand tons in 1994/95 and increased by tenfold to 340, 279 thousand tons in 2010/11.

Through productivity and market improvements, the critical role of pulses in smallholder livelihood and food security can be expanded. The current productivity of pulses falls significantly below the demonstrated potential. For example, current average chickpea yields are 1.2 metric tons per hectare, but the demonstrated potential in Ethiopia is 2.9 tons per hectare if accompanied by the appropriate inputs. Estimates suggest that productivity gains from improvements in planting techniques could double overall pulse production to two million tons over a period of five years. This gain in productivity would not only increase smallholder income by 40 to 70 percent per hectare, but would also ensure greater food security through meeting domestic pulse demand. In addition, Ethiopia could expand its foreign market presence through increased production levels, which will lead to at least doubling of its current annual exports. Even under conservative assumption of proportionate increase in domestic consumption and export, doubling production will result in at least doubling of export earnings from US$90 million to US$180. If the domestic production remains at the current level, export earnings will be far greater (Rashid et al 2010).

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4. Gaps and Challenges

Sets of constraints and considerable gaps span the legumes along the value-chain from production to utilization. Generally, legumes have got less attention in terms of crop management, and input utilization by different development actors' especially small scale farmers compared to cereals. This gap is mainly attributed to the perception of the farmers. The low grain productivity per unit area of legumes compared to cereals is a real challenge that legume scientists should always look into. Assessments in Ethiopia show, productivity is below potential due to: low input usage, especially chemical fertilizers capable of increasing yields in field trials by 10 to 80 percent; limited availability of seed and limited familiarity with the variety of existing pulse types, and; limited usage of modern agronomic practices; poor extension services.

Although the research system managed the release of different improved varieties for the major pulses in the country, there are neglected potential pulses like lupin, mung bean and fenugreek where no improved variety has been released and reached to the farmers.

As to marketing and export of legumes, numbers of constrains have been identified in assessments made in the country. Due to the large number of ineffective intermediaries operating in the value chain, the link between the producers and the export markets is weak, the intermediaries have failed to acquire scale and operate in limited geographic areas. The fragmentation of intermediaries between the producer and consumer markets creates a lack of transparency in markets. While there has been substantial growth in recent years, the current export market is underdeveloped. The less developed, fragmented exporters operating at smaller scale in the market results in inconsistent export flows and thus, inconsistent demand for exports. The major causes of limited export development are (i) inadequate market intelligence (ii) inability to leverage scale efficiencies due to smaller size and (iii) non-conducive business environment due to missing credit and insurance; and (iv)inconsistent policy interventions (Rashid et al 2010).

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5. Conclusion

Legumes could offer multiple uses. It could be used as human food, animal feed, source of nitrogen fertilizer for the soil, and as a medicine for human health. Moreover, it is good and cheap source of dietary protein and fetch reasonable cash for the Ethiopian poor farmers. The country has huge potential to produce different legumes and make use of them. However, the country needs to give sufficient attention to the sector in terms of changing the perception of the farmers to produce up to the potential by using all the production packages. In line with this the research system should deliver productive technologies for the different legume crops that potentially be produced in the country. To make the country competitive in the different potential markets, the technologies should be market oriented and quality driven.

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