

# Advances in Chickpea Crop Improvement for Improved Productivity and Resilient Cropping Systems in Ethiopia

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## I. Introduction

- Chickpea (*Cicer arietinum* L.) is an important food legume (Figure 1) in Ethiopia with wide potential (Figure 2)
- In 2016, over one million household farmers produced 0.47 million tons of chickpea on 258,486.29 ha
- Chickpea is a cheap protein source, especially for those who cannot afford animal protein
- Ethiopia leads chickpea production in Africa and was ranked fifth in the world in the year 2013
- It is becoming an important export commodity for the nation
- The major challenges are low productivity, poor farming practices, biotic and abiotic stresses and lack of improved varieties that meet the quality requirements of the international market
- Considerable efforts were made by the national chickpea improvement program (NCIP) to overcome the problems and brought significant change
- The paper discusses research and development efforts made and highlights future directions.

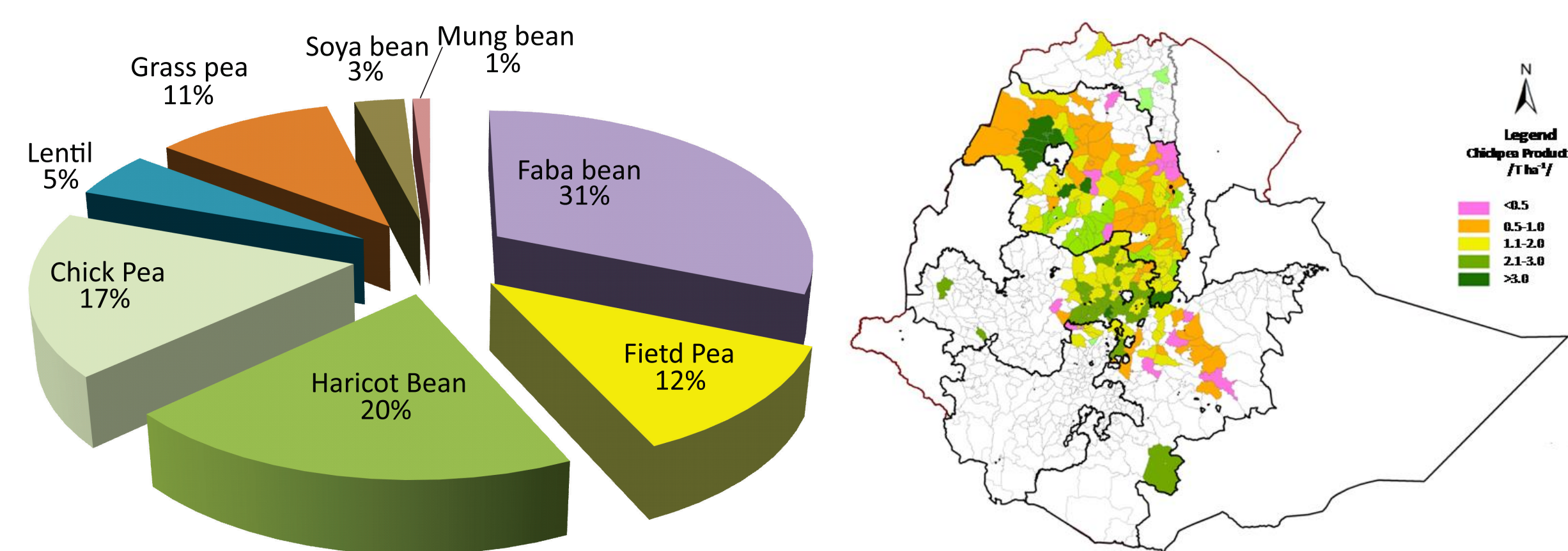


Figure 1. Share of major pulse crops to total pulse production in Ethiopia, 2015. Figure 2. Productivity potential of chickpea in Ethiopia.

(Source: Compiled from CSA, 2016)

## II. Methodology

- Chickpea improvement started with collection, characterization and evaluation of the local diversity
- Chickpea lines and segregating populations introduced (from ICRISAT and ICARDA) and evaluated
  - lines either released as new varieties or
  - used to improve local landraces through parental crossing
- Molecular breeding streamlined into the national breeding program in close collaboration with ICRISAT
- Production management options evaluated
- The informal seed system was strengthened through establishment and technical backstopping of farmers' seed producer associations
- Different platforms were used at different times to enhance research-extension-farmer linkage
- Farmers Participatory Variety Selection (FPVS) approach has been launched by the Tropical Legumes (TL) project to improve uptake efficiency
- The selected varieties are demonstrated and visited by large number of farmers.

## III. Results

### Crop Improvement

- Released 27 improved varieties with respective management packages
- The TL project made significant contributions to the development of the recently released varieties
- Tremendous achievements in seed size, resistance to major diseases, pest management and agronomic practices were made
- The national average yield advantage was more than double when compared to what it was a decade ago
- Under best production conditions the packages for chickpea can yield more than 4t ha<sup>-1</sup>
- There is untapped 'gene X environment X management' potential to be exploited.

### Seed System

- Demand for seed of improved varieties by the farmers had increased
- However, there was huge gap between the demand and supply of seed
- TL II project worked on the establishment of 18 farmers' seed producer associations
- There is considerable increase in the availability of seed over years (Table 1), but it is still far below the demand
- Seed roadmap target: 86.6t breeder, 1216.7t foundation and 16,691.5t QDS/certified seed in 2018.

Table 1. Seed production of improved chickpea varieties by the informal and formal seed system (2008-2015).

Seed class	Production year								Total
	2008	2009	2010	2011	2012	2013	2014	2015	
Breeder	3.8	4.5	5.3	6.0	6.8	7.4	8.1	8.1	50.0
Basic	39.5	76.5	89.1	100.7	107.8	165.7	136.5	72.1	787.9
Certified/QDS	632.7	1,064.8	1,386.8	1,607.6	2,125.9	2,347.1	3,289.8	2,040.7	14,495.4
Total	632.7	1,145.8	1,481.2	1,714.3	2,240.5	2,520.2	3,434.4	2,120.9	15,333.3
% increment		69.5	29.3	15.3	30.7	12.5	36.3	-38.3	

### Technology Transfer

- Different platforms were used at different times to enhance research-extension-farmer linkage
- FPVS approach (Figure 3) built farmers' confidence on new varieties
- Demonstration (Figure 4) of selected varieties and farmers' field day visits enhanced technology uptake.
- Salient research highlights in 2016

- 14 improved varieties evaluated in 81 FPVS in 22 target intervention districts
- 582 farmers participated in variety selection, of which 138 were women (23.7%)
- 949 demonstrations conducted with 11 selected varieties in 30 target districts
- 1,136 farmers participated in the field days, of which 207 (18.2%) were female
- 1,499 farmers, agriculturalists and administrative staff (19.1% female) were trained.
- Success in introduction of chickpea technologies in nontraditional production areas.



Figure 3. Participatory variety selection by farmers.



Figure 4. Chickpea technology demonstrated to farmers participating in a field day.

### Impact of R&D on National Chickpea Production and Productivity

- Chickpea national production in the recent decade increased drastically (Figure 5)
- This could largely be attributed to the significant improvement in the productivity of the crop
- The national productivity of chickpea doubled (1.9 ton ha<sup>-1</sup>) compared to what it was a decade ago
- Currently Ethiopia is the top chickpea producer in Africa (Figure 6) and fifth in the world in 2014.

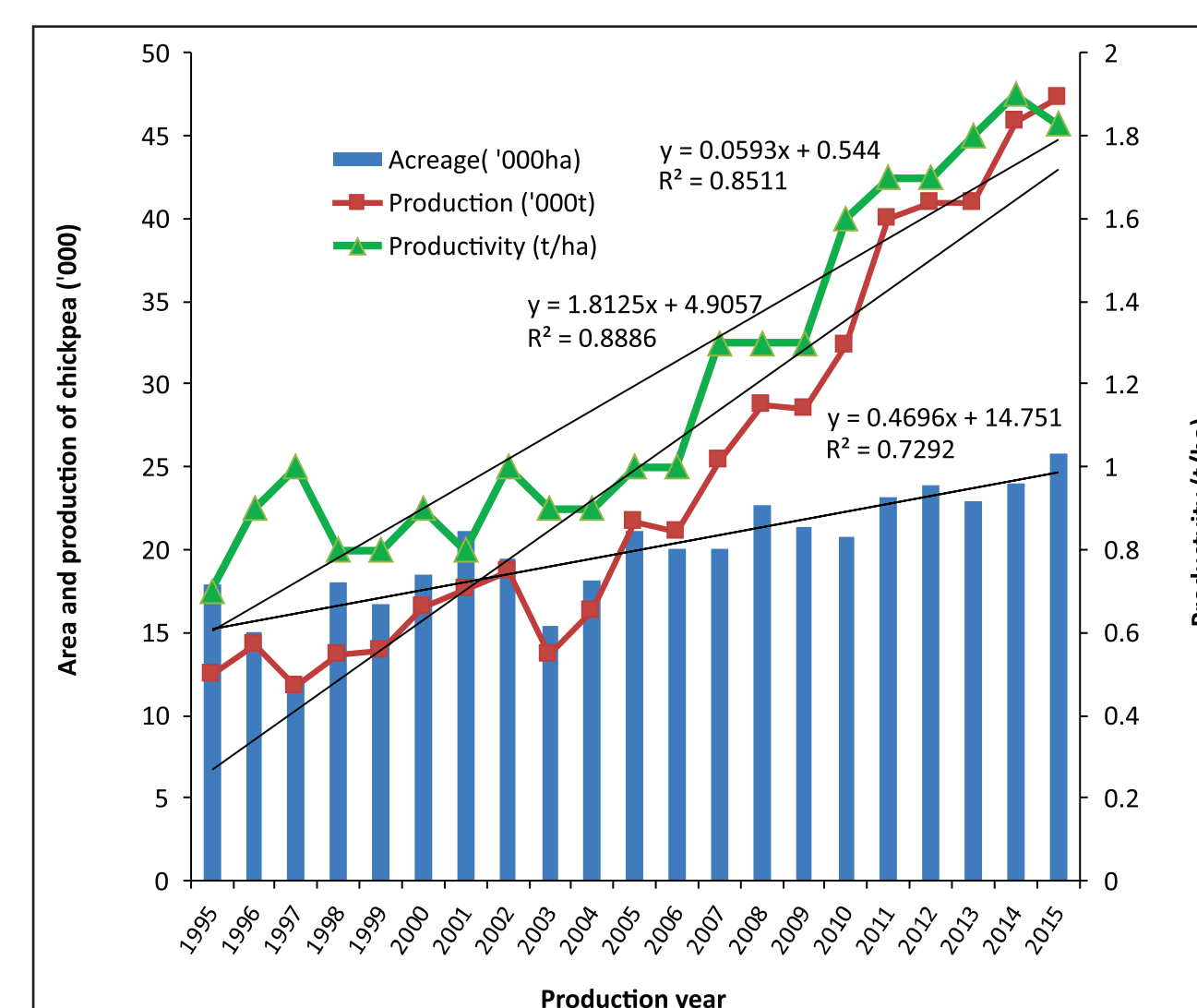


Figure 5. Chickpea production area, productivity and production in Ethiopia. (Source: FAOSTAT and CSA data, 1995-2015)

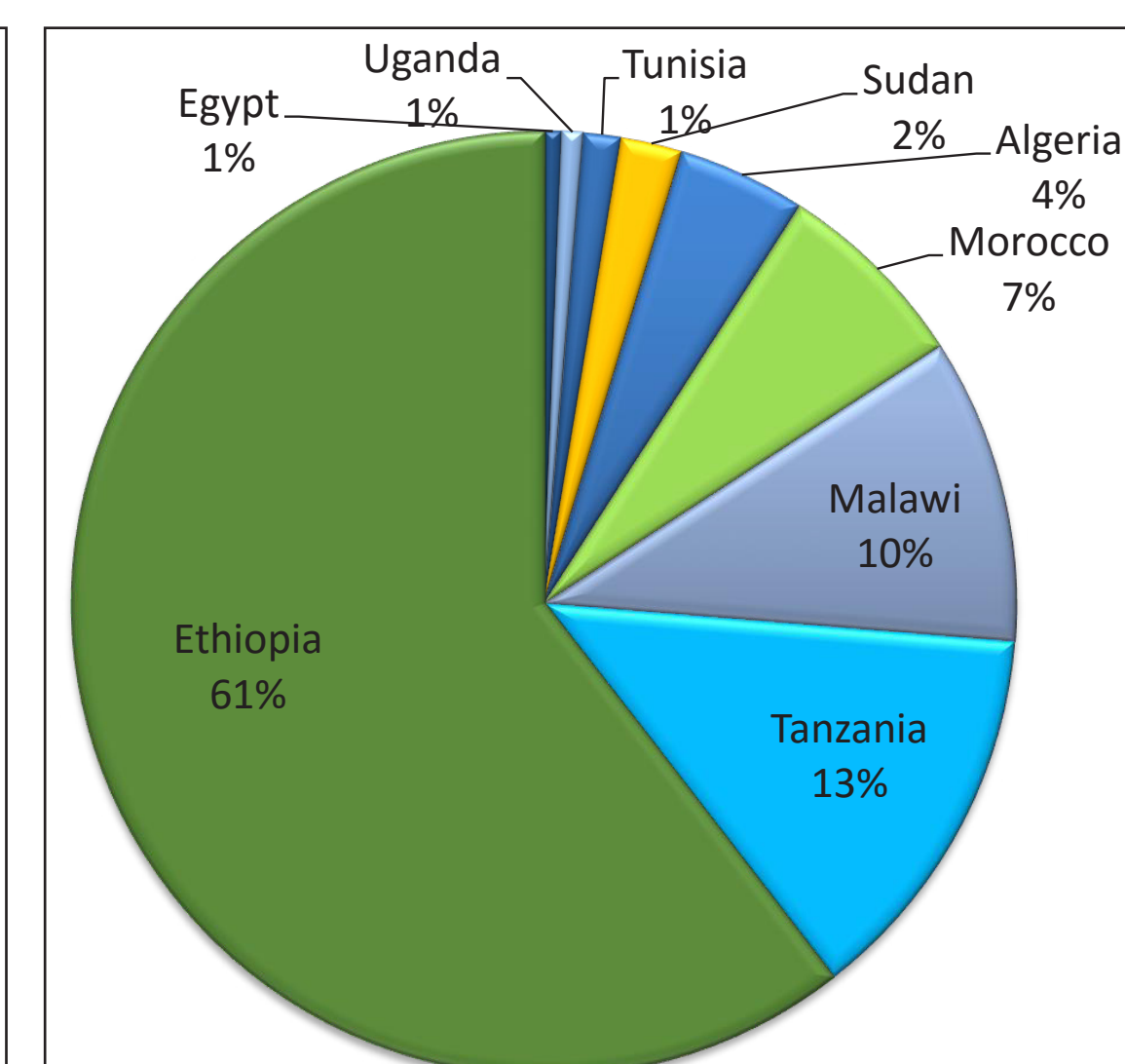


Figure 6. Ethiopia's position in Africa's chickpea production. (Source: FAOSTAT, 2014)

### Impact of R&D on Chickpea Export

- Chickpea is becoming an important export commodity for Ethiopia
- The nation's export volume and earning showed moderate increase (Figure 7)
- However, the country's share in the global chickpea export market is only about 4%
- The country is the sixth top chickpea exporter in the world and leads Africa (Figure 8)
- Further improvement of the crop and its management is critical to meet export market requirements
- This has to be coupled with enhancement of the marketing supply chain.

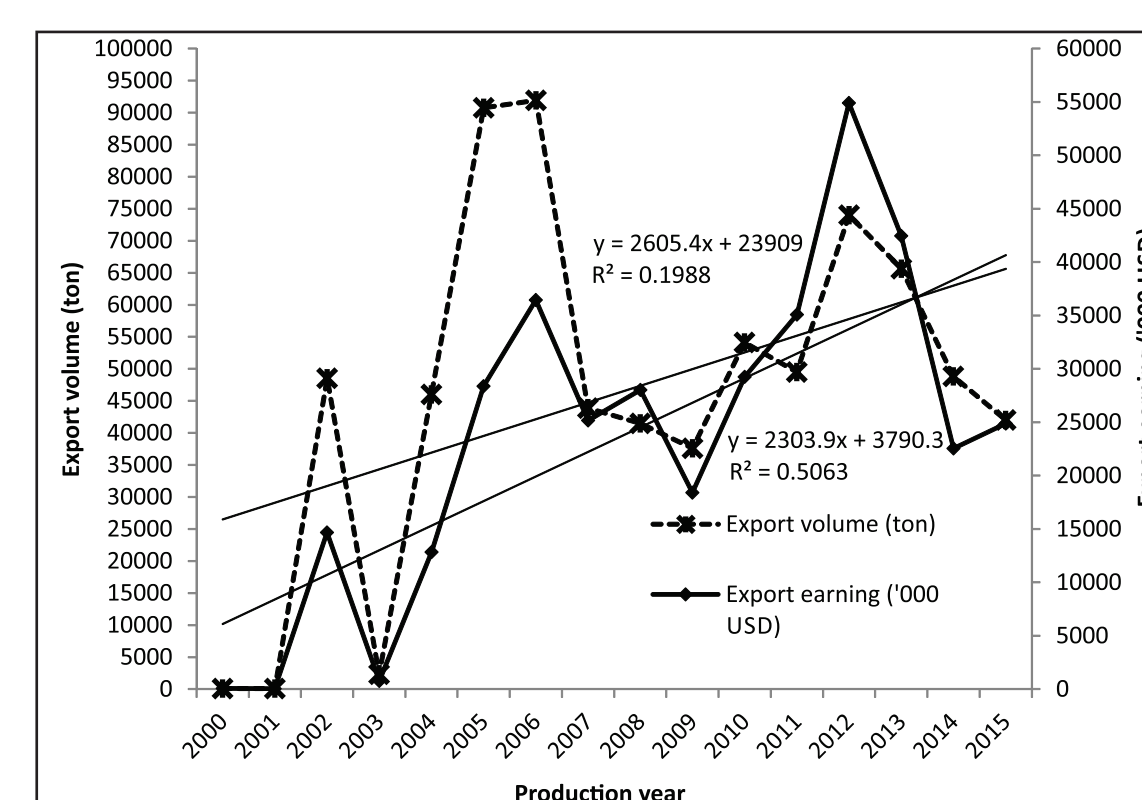


Figure 7. Chickpea export volume and earnings in Ethiopia. (Source: FAOSTAT, 2000-2015)

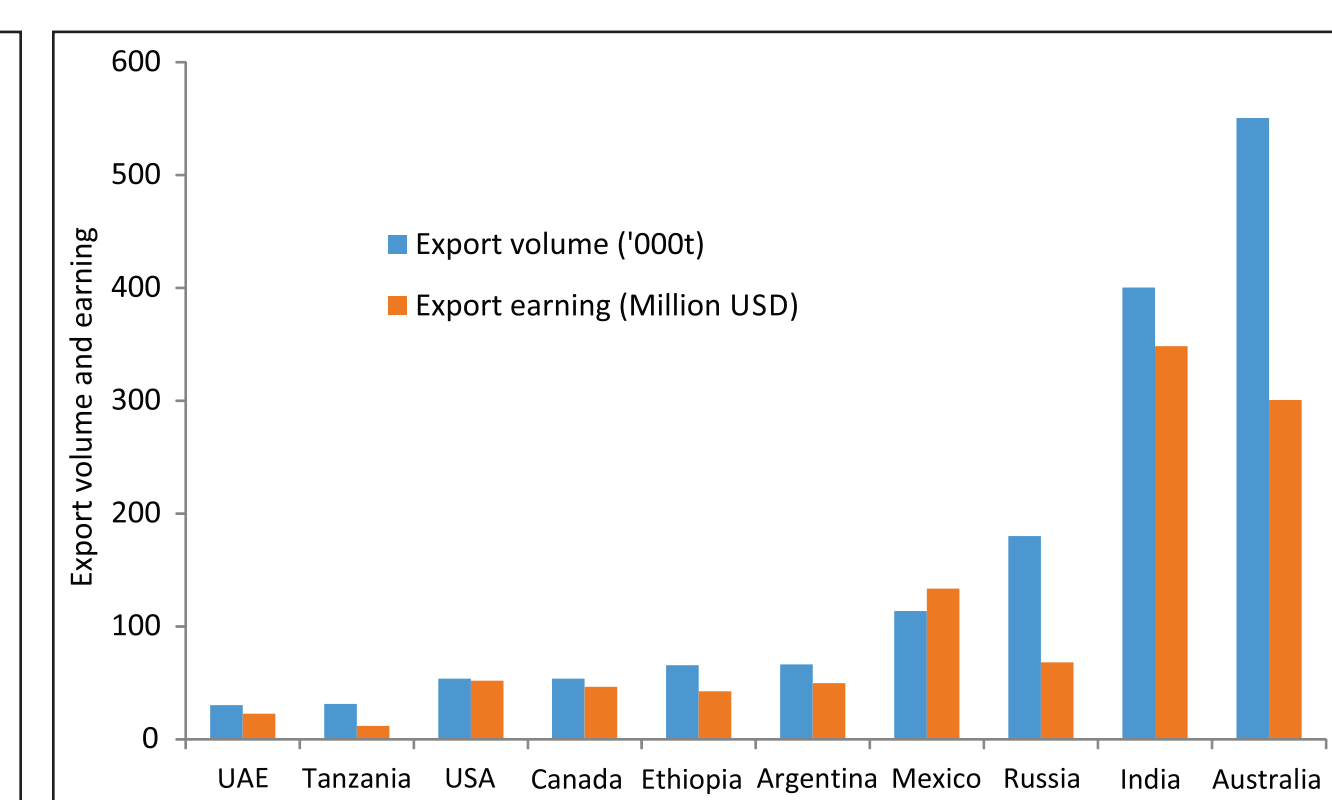


Figure 8. Chickpea export volume and earnings of top exporter countries. (Source: FAOSTAT, 2013)

## III. Conclusion

- Chickpea production in Ethiopia is challenged by low productivity, poor farming practices, biotic and abiotic stresses
- R&D resulted in drastic increment in the national productivity and production increased considerably
- There is untapped potential to be exploited extrapolating gene X environment X management combinations

## IV. Future Direction

- Further improving the crop to meet national and international quality requirements
- Focus on breeding traits such as drought and heat stresses in view of changing global climate
- Develop technologies for mechanized farming
- Strengthen the seed system to satisfy the ever-increasing demand
- Enhance technology dissemination and market linkage
- Strengthen small-pack approach
- Push chickpea to nontraditional potential areas.

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