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## Review Article

# A Review of Research Progress, Challenges, and Opportunities for Major Crops

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## Abstract

Cereal, pulse, root, oilseed, and horticultural crops are key to food security and livelihoods in Southern Ethiopia, especially in the Ari, South Omo, and Konso zones. For the past thirty years, research has focused on improving the productivity, adaptability, and resilience of major crops like maize, sorghum, teff, barley, chickpea, pigeon pea, common bean, and several root and horticultural crops. Important achievements include developing and sharing improved varieties, region-specific farming practices, managing soil fertility, and controlling pests and diseases. However, issues like recurring drought, declining soil fertility, limited access to quality seeds, pest and disease challenges, and low use of improved technologies continue to restrict crop production. Socio-economic factors, such as insufficient extension services, poor market access, and labor shortages, also hinder productivity. Future research should focus on climate-smart agriculture, community-involved breeding, integrated pest and disease management, reliable seed systems, and stronger connections between research institutions and local communities. This review summarizes past research successes, points out ongoing challenges, and identifies chances to boost major crop production in the Ari, South Omo, and Konso zones. The insights here aim to help policymakers, researchers, and stakeholders devise strategies to improve productivity, resilience, and food security in these areas.

**Keywords:** Cereal crops, Pulse crops, Root crops, Horticultural crops, Southern Ethiopia

## Introduction

Agriculture is essential to the economy in Southern Ethiopia, especially in the Ari, South Omo, and Konso zones. It supports over 80% of rural livelihoods and contributes significantly to food production [1,2]. The region has various agro-ecological zones, from lowland pastoral areas below 500 meters above sea level to midland and highland farming systems above 1500 meters, which influence cropping patterns and productivity [3,4]. Cereal crops like maize (*Zea mays L.*), sorghum (*Sorghum bicolor L.*), teff (*Eragrostis tef*), and barley (*Hordeum vulgare L.*) are the mainstay of these cropping systems. Pulses such as chickpea (*Cicer arietinum L.*), pigeon pea (*Cajanus cajan L.*), and common bean (*Phaseolus vulgaris L.*) are vital for household nutrition and

improving soil fertility through nitrogen fixation [5,6]. Root crops, including sweet potatoes and cassava, oilseeds like groundnuts and sesame, and horticultural crops such as tomatoes, onions, and cabbage support food security and income, although their cultivation suffers from limited research and support [7,8].

In the past thirty years, Ethiopia has seen significant agricultural research and development aimed at key crops. Research centers like Jinka Agricultural Research Center (JARC) and Konso Agricultural Research Center have introduced high-yielding, drought-resistant, and disease-resistant varieties of maize, sorghum, and pulses suited to local conditions [9,10]. To improve productivity and maintain soil health,

they have promoted integrated soil fertility management and conservation agriculture practices [11,12]. Involving farmers in selecting varieties and conducting agronomic trials has led to greater acceptance of new technologies in some regions [13,14].

The agro-ecology of the area is divided into three main zones: lowland (hot and dry), midland (with moderate rainfall and temperature), and highland (cool and moist). Maize and sorghum grow well in midland and lowland areas due to favorable rainfall and soil conditions [3,15]. Teff and barley are mostly found in the highlands, where the altitude and cooler temperatures suit their growth [4]. Pulses like chickpea and pigeon pea are common in midland and lowland areas, while root and horticultural crops are primarily grown in home-steads and irrigated plots [5,7]. These patterns are affected by soil type, rainfall, and local farming practices.

There has been notable progress in developing high-yielding and stress-resistant crop varieties. For example, maize varieties such as BH-661 and BH-546 have shown great adaptability in midland regions. Drought-resistant sorghum varieties like Meko-1 and ESH-1 are popular in lowland areas [9,10]. Improved pulse varieties, including Kabuli chickpea and Red Wolayta common bean, have increased yield and market appeal [5]. ISFM strategies, which include using organic and mineral fertilizers, practicing crop rotation, and intercropping with legumes, have enhanced soil quality and crop yields [11,12].

Despite the progress, cereal and pulse crop production faces many challenges. Recurrent drought and unpredictable rainfall lower yields and lead to crop failures [16,17]. Soil fertility decline, erosion, and continuous monocropping without nutrient replenishment worsen production losses [10,13]. Limited access to quality seeds, insufficient pest and disease management, and low adoption of improved technologies also create major obstacles [5,6]. Socio-economic issues, such as weak extension services, poor market access, and labor shortages, further limit productivity [14,15].

Future research and development efforts should concentrate on climate-smart agriculture to build resilience to drought and heat [7,9]. Programs that involve local farmers in breeding, along with better pest and disease management and stronger seed systems, are essential for increasing adoption and productivity. Improving collaboration among research institutions, government bodies, and local communities will help spread effective technologies and promote sustainable agricultural growth [8,10].

Objective of the review to summarize research progress on cereal, pulse, root, oilseed, and horticultural crops in the Ari, South Omo, and Konso zones. It will identify ongoing production challenges and suggest future research and development priorities to boost productivity, resilience, and food security in these areas. The goal is to assist policymakers, researchers, and stakeholders in creating targeted solutions for sustainable agricultural development.

## **Material and Methods**

### **Literature Search and Data Sources**

A review of cereal, pulse, root, oilseed, and horticultural crops in Ari, South Omo, and Konso zones was carried out by searching peer-reviewed journals, conference proceedings, theses, and reports published from 1990 to 2025. The databases and sources used included Scopus, Web of Science, Google Scholar, Science Direct, AJAR (African Journal of Agricultural Research), Ethiopian Journal of Agricultural Sciences, and publications from the Ethiopian Institute of Agricultural Research (EIAR). Reports from government and regional agricultural offices were also considered to gather production statistics, agro-ecological information, and data on technology adoption [1,8].

### **Inclusion and Exclusion Criteria**

Studies were selected based on these criteria:- relevance to cereal, pulse, root, oilseed, and horticultural crop production in Ari, South Omo, or Konso zones, research focused on agronomic practices, crop productivity, breeding, soil fertility, pest and disease management, and climate adaptation, peer-reviewed articles, official reports, theses, and conference proceedings published from 1990 to 2025.

Articles that did not relate to the geographic area or crop type were excluded. Duplicate publications were removed. The remaining studies were checked for quality and reliability [18,19].

### **Data Extraction and Synthesis**

From each selected study, data on the following variables were extracted:

- Crop type (cereal, pulse, root, horticultural, oilseed)
- Production systems and agro-ecological zones
- Varietal improvement and breeding outcomes
- Agronomic practices (fertilization, intercropping, soil management)
- Yield performance and productivity trends
- Pest and disease incidence
- Adoption rates of improved technologies

The extracted data were combined to identify trends, gaps, and challenges in crop production. Quantitative data on crop yields, adoption rates, and area coverage were summarized in tables and graphs when available. Qualitative information on socio-economic and institutional factors was summarized in narrative form [19,20].

### **Analytical Approach**

A narrative synthesis method was used to combine findings from different study designs and data types. Where applicable, a comparative analysis of crop yield trends and technology adoption rates across zones was done. The study also used descriptive statistics to summarize production data and identify key challenges and opportunities for future research [21].

## Results and Discussion

### Production Trends of Major Crops

Cereal and pulse crops are essential to agriculture in Ari, South Omo, and Konso zones. Over the last thirty years, the area dedicated to cereals has gradually increased, especially for maize and sorghum. This rise is due to the introduction of high-yielding, drought-tolerant varieties [5,9]. Pulse crops like chickpea, pigeon pea, and common bean have also expanded, driven by their nutritional value and market demand [6]. Root crops, oilseeds, and horticultural crops are still mostly underused. They have limited area coverage because of a lack of research focus and extension support [7,8].

**Table 1:** Area Coverage and Production of Major Crops in Ari, South Omo, and Konso Zones (2020–2023)

Crop Type	Crop	Area (ha)	Average Yield (t/ha)	Reference
Cereal	Maize	45,000	3.2	[22]
Cereal	Sorghum	38,500	2.8	[22]
Cereal	Teff	12,000	1.5	[22]
Cereal	Barley	6,500	1.9	[22]
Pulse	Chickpea	8,000	1.3	[5]
Pulse	Pigeon pea	5,200	1.1	[6]
Pulse	Common bean	9,000	1.4	[6]
Root	Sweet potato	3,500	8.0	[7]
Oilseed	Groundnut	2,000	1.2	[8]
Horticultural	Tomato	1,500	12.0	[8]

**Note:** Data compiled from CSA reports, regional agricultural offices, and published studies (1990–2025).

### Yield Trends and Agronomic Improvements

The introduction of better crop varieties and farming practices has led to a moderate rise in crop yields across all three zones. Maize yields grew from 1.8 t/ha in the 1990s to 3.2 t/ha from 2020 to 2023. Sorghum yields increased from 1.5 t/ha to 2.8 t/ha, thanks to the use of drought-tolerant varieties and integrated soil fertility management [9,10]. Pulse crops also showed positive trends. Chickpea and common bean yields rose by 15 to 25% after improved varieties were introduced [5,6]. However, average yields for all crops are still below potential. This is due to biotic and abiotic challenges, limited use of inputs, and poor adoption of suggested farming practices [16,17].

### Constraints to Crop Production

Crop production in Ari, South Omo, and Konso faces multiple

constraints, which can be grouped as follows

**Table 2:** Major Constraints Affecting Crop Production

Constraint Type	Specific Issue	Impact on Production	Reference
Abiotic	Recurrent drought	Reduced yields, crop failure	[16]
Abiotic	Soil fertility depletion	Low productivity	[10]
Biotic	Pests and diseases (striga, aphids, rust)	Crop loss, reduced yield	[5]
Socio-economic	Limited access to quality seed	Low adoption of improved varieties	[6]
Socio-economic	Weak extension services	Poor farmer knowledge	[14]
Socio-economic	Poor market access	Low incentive to invest in inputs	[15]

### Adoption of Improved Technologies

Adoption of improved technologies differs among crops and regions. Maize and sorghum have the highest adoption rates, about 45 to 60%. This is because of strong links between research and extension services and farmers' preference for high-yield varieties [9,10]. Pulse crops have lower adoption rates, around 25 to 35%. This is due to limited seed availability and market issues [5,6]. Root and horticultural crops show very low adoption rates, under 15%. This is mainly a result of insufficient research focus and extension support [7,8].

**Table 3:** Adoption Rates of Improved Crop Varieties in Ari, South Omo, and Konso Zones

Crop	Improved Variety Adoption (%)	Reference
Maize	55	[9]
Sorghum	48	[10]
Teff	32	[22]
Barley	28	[22]
Chickpea	30	[5]
Pigeon pea	25	[6]
Common bean	33	[6]
Sweet potato	12	[7]
Tomato	10	[8]

## Discussion

The results show that while research and development efforts have increased crop productivity in Ari, South Omo, and Konso, significant gaps still exist. The adoption of better varieties and farming practices varies among crops. Cereals have seen higher adoption due to strong extension support and market demand. In contrast, pulses, roots, oilseeds, and horticultural crops are behind because of limited seed systems, low research focus, and socio-economic challenges [5,7]. Ongoing abiotic stresses like drought and soil fertility loss continue to be major obstacles. Integrated soil fertility management, conservation agriculture, and climate-smart practices are crucial for tackling these issues [9,10]. Likewise, participatory breeding, pest and disease management, and better access to quality seeds are needed to boost productivity and resilience [6]. Strengthening the links between farmers, extension services, and research can help speed up the adoption of better technologies and support regional food security.

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## Reference

1. FAO. (2019). *The State of Food and Agriculture: Climate Change, Agriculture, and Food Security*. Rome: Food and Agriculture Organization.
2. Tadesse, B., et al. (2020). Maize and sorghum production in Ari zone. *Ethiopian J. Crop Sci.*, 12(1): 14–29.
3. Mengistu, T., et al. (2015). Agro-ecological diversity in Southern Ethiopia. *J. Ethiopian Agri. Sci.*, 9(2): 1–18.
4. Desta, B., et al. (2018). Agro-ecological zoning of South Omo. *Ethiopian J. Nat. Res.*, 10(4): 23–37.
5. Feyisa, B., & Tadesse, M. (2023). Pulse production systems in Ari and Konso zones. *Afr. Crop Sci. J.*, 31(2): 145–160.
6. Njeru, J., & Mugo, F. (2023). Adoption of improved pulse varieties in South Omo. *Agri. Res. J.*, 15(4): 33–49.
7. Moullick, P., & Tadesse, M. (2024). Horticultural crops in Konso and Ari zones. *J. Trop. Agri.*, 42(1): 77–90.
8. Alemayehu, T., et al. (2017). Root and horticultural crops production in Southern Ethiopia. *J. Agri. Sci.*, 12(3): 45–58.
9. Abebe, D., et al. (2016). Drought-tolerant maize varieties in Southern Ethiopia. Addis Ababa: EIAR.
10. Tesfaye, K., et al. (2021). Climate-smart agriculture in Southern Ethiopia. *Climatic Change J.*, 17: 245–262.
11. Alemu, M., et al. (2010). Integrated soil fertility management in Ethiopia. *Soil Sci. & Agri. J.*, 8(2): 12–28.
12. Bekele, H., et al. (2012). Adoption of improved cereal varieties in Southern Ethiopia. *J. Dev. Agri.*, 14(1): 33–49.
13. Hailu, A., et al. (2019). Participatory varietal selection for maize and sorghum. *J. Agri. Ext. Dev.*, 11(3): 22–35.
14. Gebre, H., et al. (2021). Socio-economic constraints in Southern Ethiopia agriculture. *Ethiopian J. Econ. Dev.*, 29(1): 55–71.
15. Tsegaye, D., et al. (2017). Extension services and agricultural productivity in South Omo. *Dev. Pract.*, 27(5): 625–639.
16. Worku, T., et al. (2020). Soil fertility challenges in Southern Ethiopia. *Soil Fertility J.*, 18(2): 45–59.
17. Gebremedhin, B., & Haile, A. (2018). Drought and crop yields in South Omo. *J. Arid Environ.*, 152: 1–10.
18. Moher, D., Liberati, A., Tetzlaff, J., & Altman, D.G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med.*, 6(7): e1000097.
19. Grant, Maria J., and Andrew Booth. "A typology of reviews: an analysis of 14 review types and associated methodologies." *Health information & libraries journal* 26, no. 2 (2009): 91-108.
20. Lefebvre, C., Manheimer, E., & Glanville, J. (2017). Searching for studies: A guide to systematic review methods. *Cochrane Handbook*.
21. Haddaway, N.R., Collins, A.M., Coughlin, D., & Kirk, S. (2015). The role of systematic reviews in evidence-based conservation. *Conserv. Biol.*, 29(3): 659–66
22. CSA. (2021). *Agricultural Sample Survey 2020/21*. Addis Ababa: Central Statistical Agency.