

Pesticide Science and Pest Control

Research Article

Agronomic Research Activities in Ari, Konso, South Omo, and Basketo Zones of Southern Ethiopia: An Overview

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Abstract

Agriculture plays a central role in the livelihoods of communities in Southern Ethiopia, particularly in Ari, Konso, South Omo, and Basketo zones, where farming systems are closely tied to local environmental conditions and traditional practices. This overview brings together existing agronomic research conducted in these areas to provide a clear and accessible understanding of what has been studied, what has been achieved, and what still needs attention. The review draws on a range of sources, including journal articles, research reports, theses, and institutional publications, and synthesizes them using a narrative approach. The findings show that most agronomic research in the region has focused on improving crop production through the use of improved crop varieties, better soil fertility management practices, and moisture conservation techniques. Crops such as maize, sorghum, common bean, and root and tuber crops have received considerable attention, with many studies reporting yield improvements when appropriate technologies are applied. At the same time, the review reveals several important gaps. Research efforts are uneven across the zones, and in many cases, recommendations are not sufficiently tailored to local conditions. In addition, the role of indigenous knowledge and farmers' experiences is often underrepresented, and there is limited integration of climate-resilient and sustainable farming practices. Overall, this overview highlights the need for more inclusive, location-specific, and practical research that connects scientific findings with farmers' realities. Strengthening collaboration among researchers, extension services, and local communities will be essential to ensure that agronomic innovations are both effective and widely adopted. The insights from this review can help guide future research priorities and support efforts to improve agricultural productivity and sustainability in Southern Ethiopia.

Keywords: Agronomic research, Crop production, Soil fertility, Farming systems, Southern Ethiopia, Ari, Konso, South Omo, Basketed.

Introduction

The zones of Ari, Konso, South Omo, and Basketo in Southern Ethiopia represent a diverse agricultural landscape characterized by contrasting agroecological conditions, ranging from the semi-arid lowlands of Konso to the relatively moisture-reliable mid-altitude areas of Ari and Basketo [1-3]. In these areas, agriculture is predominantly rain-fed and small-holder-based, forming the backbone of rural livelihoods. De-

spite its importance, agricultural production in these zones continues to face persistent challenges, including climate variability, declining soil fertility, limited access to improved technologies, and increasing biotic pressures [4-6].

Among these constraints, biotic stresses such as crop diseases, insect pests, and parasitic weeds play a major role in reducing agricultural productivity and threatening food secu-

riety. A comprehensive review by [7], highlights that these biotic constraints are among the most critical limiting factors in Southern Ethiopia, particularly in Ari, South Omo, and Konso zones, where farmers frequently experience yield losses due to disease outbreaks, pest infestations, and aggressive weed species such as *Striga*. Similar concerns have also been widely reported in earlier agronomic studies across the region [8-10].

These challenges are further intensified by weak pest management systems and limited access to effective control technologies at the farm level.

In Konso zone, farmers have developed remarkable indigenous soil and water conservation practices, particularly stone terrace systems that have gained international recognition for their sustainability [4,11]. However, despite these efforts, agricultural production remains highly vulnerable to recurrent drought and severe biotic pressures, including *Striga* infestation, which can lead to complete crop failure in sorghum-based systems (Tesso & Ejeta, 2011; Ejeta, 2007). Post-harvest losses are also significant, with traditional storage systems often failing to protect grains from insect damage [6].

South Omo zone is dominated by agro-pastoral systems where crop production is closely integrated with livestock keeping. Although this system provides livelihood resilience, it is frequently affected by recurrent drought, rangeland degradation, and limited agricultural infrastructure [12-13]. Research efforts in this zone have mainly focused on technology demonstrations and the introduction of improved crop and forage varieties [14-15]. However, detailed agronomic information such as soil fertility status, fertilizer response, and crop productivity under local conditions remains limited [16, 5].

The Ari zone represents a more diverse agroecological setting, where enset, maize, and sorghum are the dominant crops [1,7]. Although some studies have explored crop diversification and production constraints, systematic agronomic experimentation is still limited. Biotic stresses, including maize leaf blight and *Fusarium*-related diseases, have been reported as major yield-reducing factors in the zone [7]. These challenges further emphasize the need for location-specific agronomic research to improve productivity and resilience.

Compared to the other zones, Basketo remains significantly under-researched. Existing literature is very limited and mainly focuses on woody species diversity and a few recent studies on fertilizer response in selected crops [3,17]. There is a clear absence of systematic agronomic data, including cropping systems, soil fertility status, and pest management practices. This lack of evidence makes it difficult to design appropriate agricultural development interventions for the zone.

In general, the agricultural systems of these four zones are

under increasing pressure from both abiotic and biotic factors. As emphasized by [7], biotic constraints such as pests, diseases, and weeds remain major bottlenecks to sustainable crop production and food security in Southern Ethiopia. At the same time, broader policy and development strategies in Ethiopia stress the importance of generating location-specific and evidence-based agricultural recommendations rather than generalized approaches [18, 16]. Climate change, particularly in semi-arid areas like Konso and South Omo, further increases vulnerability and necessitates adaptive agronomic solutions [19, 13]. Therefore, this review aims to: synthesize existing agronomic research conducted in Ari, Konso, South Omo, and Basketo zones; identify major findings related to crop production, soil fertility, pest and disease management, and technology adoption; highlight key research gaps and limitations; suggest future research priorities to support sustainable agricultural development in these under-studied regions

Methodology

This study used a narrative review approach to bring together and summarize agronomic research activities carried out in Ari, Konso, South Omo, and Basketo zones of Southern Ethiopia. The purpose was to understand what has been studied so far, identify key findings, and highlight existing gaps in research.

Relevant literature was gathered from different sources, including journal articles, MSc theses, institutional reports, and online databases such as Google Scholar and university repositories. The search focused on key terms such as agronomic research, crop production, soil fertility, pest and disease management, farming systems, and the names of the study zones.

After collecting the literature, studies were carefully screened based on their relevance to crop production systems, soil management, pest and disease constraints, climate adaptation, and technology use. Repeated and unrelated studies were removed. The remaining studies were then organized into main themes and summarized in a clear and descriptive way.

Results

Agronomic Research

The review indicates that agronomic research in Ari, Konso, South Omo, and Basketo zones has mainly focused on improving crop production, enhancing soil fertility, managing pests and diseases, and introducing improved agricultural technologies (Table 1). These research efforts are generally aimed at increasing agricultural productivity and supporting the dominant smallholder farming systems in the study areas.

However, the extent and intensity of agronomic research are not uniform across the four zones. Ari and South Omo zones have received relatively greater research attention, particularly in crop production practices and technology demonstration activities. In contrast, Konso and especially Basketo zones are less studied, with limited experimental research and weak documentation of agronomic practices.

This imbalance in research coverage has resulted in a lack of consistent, location-specific agronomic information across the zones. While some studies provide useful findings on crop performance and soil management, many of the re-

sults remain general and are not fully tailored to the diverse agroecological conditions of each area. Consequently, many farmers still rely largely on traditional practices and have limited access to improved and well-adapted technologies.

Overall, the findings show that although agronomic research has contributed to improving understanding of farming systems in Southern Ethiopia, significant disparities remain among the zones. This highlights the need for more balanced, context-specific, and participatory research to support sustainable and equitable agricultural development

Zone	Main Research Focus	Major Crops	Key Challenges
Ari	Crop production, disease control	Maize, sorghum, Enset	Leaf blight, Fusarium diseases
Konso	Soil conservation, Striga management	Sorghum, maize	Drought, Striga infestation
South Omo	Technology promotion, mixed farming	Maize, sorghum, forage crops	Drought, soil fertility decline
Basketo	Very limited research, fertilizer use	Potato, minor crops	Lack of data and studies

Table 1: Main Agronomic Research Focus in the Study Zones

Crop Production Situation

Across all four zones, the review shows that the use of improved crop varieties combined with better agronomic practices has a strong potential to increase crop yields. In Ari and South Omo zones, for example, studies reported noticeable improvements in maize and sorghum productivity when farmers used improved seeds together with appropriate soil fertility management practices [7, 5].

In Konso zone, traditional farming systems particularly the well-known stone terrace structures continue to play a vital role in sustaining crop production under harsh environmental conditions [4]. Despite this resilience, overall agricultural productivity remains low due to erratic rainfall patterns, declining soil fertility, and limited access to improved agricultural inputs and technologies [19].

Soil Fertility Challenges

Soil fertility decline is one of the most serious and widespread constraints affecting crop production in all four zones. Farmers often apply limited amounts of fertilizer, and in many cases, the existing fertilizer recommendations do not match local soil conditions.

[16] emphasized that fertilizer recommendations in Ethiopia are generally broad and fail to capture important site-specific differences. This challenge is particularly evident in South Omo and Basketo zones, where soil fertility data and detailed soil characterization studies are very limited. As a result, many farmers continue to experience low yields even when improved crop varieties are used.

Pests, Diseases, and Weeds

The review clearly indicates that pests, diseases, and weeds are major biotic constraints affecting agricultural production

in the study areas. According to [7], these challenges significantly contribute to low crop productivity in Ari, Konso, and South Omo zones.

One of the most severe problems is Striga (witchweed), which heavily affects sorghum and maize production, particularly in Konso and South Omo zones [8-9]. In Ari zone, farmers frequently face crop diseases such as maize leaf blight and Fusarium infections, both of which have substantial negative impacts on yield levels [7].

Technology Use and Farming Systems

The adoption of improved agricultural technologies remains generally low across most of the study zones. This situation is mainly attributed to weak extension services, limited financial capacity of farmers, and low awareness of improved farming practices.

Among the four zones, South Omo has relatively better exposure to demonstration-based technology dissemination activities. In contrast, Basketo zone remains largely under-researched and has received very limited attention from formal agricultural research and extension systems [15, 3]. Despite these limitations, indigenous knowledge systems continue to play an important role, particularly in Konso zone, where farmers have long practiced effective soil and water conservation techniques. These traditional practices demonstrate that local knowledge is valuable and can complement modern agronomic innovations when properly integrated [4].

Key Research Gaps

Table 2 highlights several critical gaps in agronomic research across Ari, Konso, South Omo, and Basketo zones. These include a persistent lack of location-specific agronomic recommendations tailored to the diverse agroecological condi-

tions of the areas. In addition, field-based experimental studies are very limited, particularly in the Basketo zone, where research evidence is almost nonexistent. Another major gap is the weak integration of farmers’ indigenous knowledge with formal scientific research, which limits the relevance and applicability of findings at the local level. Furthermore,

there is insufficient attention given to climate-resilient farming systems, despite increasing climate variability in the region. Overall, agronomic research efforts remain unevenly distributed, with some zones receiving considerably more attention than others, leading to imbalanced knowledge generation across the study areas

Area	Main Gap	Effect
Soil fertility	No site-specific data	Low fertilizer efficiency
Crop production	Few field experiments	Slow productivity improvement
Pest management	Weak control strategies	High crop losses
Basketo zone	Almost no research	Poor agricultural planning
Climate adaptation	Limited studies	High vulnerability

Table 2: Major Research Gaps Identified

Discussion

Overall, this review shows that agronomic research in Ari, Konso, South Omo, and Basketo is still developing and unevenly distributed. While some progress has been made in crop production and soil management, many challenges remain unsolved.

One of the most important findings is the strong impact of pests, diseases, and weeds on crop production. As highlighted by [7], these biotic stresses are a major barrier to achieving food security in Southern Ethiopia. Similar concerns have been reported by earlier studies, especially regarding Striga infestation in cereal crops [8, 9].

Soil fertility decline is another major issue limiting productivity. The findings agree with [16], who emphasized that fertilizer use must be better adapted to local conditions. Without this, farmers will continue to experience low yields even when improved technologies are introduced.

The review also shows that local farming knowledge, especially in Konso, remains very important. This suggests that future agricultural development should not ignore traditional practices but rather combine them with modern scientific approaches.

In general, the study highlights the need for stronger, more practical, and location-specific research. Improving collaboration between researchers, extension workers, and farmers will be key to making agricultural technologies more effective and widely used.

Recommendations

Based on the findings of this review, several key recommendations are proposed to improve agronomic research and agricultural development in Ari, Konso, South Omo, and Basketo zones of Southern Ethiopia.

First, future agronomic research should prioritize the devel-

opment of location-specific recommendations that reflect the unique agroecological conditions of each zone. This is essential to improve the effectiveness and adoption of agricultural technologies by farmers.

Second, there is a strong need to strengthen field-based experimental research, particularly in under-studied areas such as Basketo zone. Generating primary agronomic data in these areas will help fill existing knowledge gaps and support evidence-based decision-making.

Third, researchers and development actors should work to integrate farmers’ indigenous knowledge with modern scientific approaches. Local farming experience, especially in soil and water conservation, can play a valuable role in improving the relevance and sustainability of agronomic innovations.

Fourth, greater emphasis should be placed on climate-resilient agriculture, including drought-tolerant crop varieties, moisture conservation techniques, and sustainable soil management practices to address increasing climate variability in the region.

Finally, stronger collaboration between research institutions, extension services, and local farmers is necessary to improve technology dissemination, enhance adoption rates, and ensure that research outputs translate into practical benefits for farming communities

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