

Review Article

Progress and Limitations in Ethiopian Irrigated Wheat (*Triticum aestivum* L.) Production: A Review

Getachew Shiferaw Mekonen* 

Ethiopian Institute of Agricultural Research (EIAR), Tepi Agricultural Research Center, Tepi, Ethiopia

Abstract

Wheat is one of the most significant staple crops in the world, serving as a primary source of nutrition for billions of people. It is a vital crop in Ethiopia, ranking second in Africa's production and fourth in area and production of total cereal crops. However, traditional rain-fed farming methods have led to inconsistent yields due to variable rainfall patterns. To really boost wheat production, the governments in Ethiopia plus folks who care about farming are really giving it a whirl aiming for irrigation farming. This means we're really betting on flooding fields that have water access, particularly in spots where that's real and good water. While Ethiopia has momentum in irrigated wheat production, the reality is that there are still hurdles and challenges in that sector that can't be overlooked though. This review aims to synthesize the current state of irrigated wheat production in Ethiopia, highlighting the progress made and the constraints hindering its full potential. The review will examine the factors influencing irrigated wheat production, including water availability, soil quality, and management practices, as well as the impact of climate change and pests on yields. By identifying the key constraints and opportunities, this study aims to inform policymakers, researchers, and farmers on strategies to improve irrigated wheat production and ensure food security in Ethiopia.

Keywords

Wheat, Irrigation, Opportunities

1. Introduction

Wheat (*Triticum aestivum* L.) is the most widely grown cereal crop in the world and it is the second major food crop next to rice [1, 17]. Wheat has been cultivated in Ethiopia for centuries, primarily in the highland regions where the climate is conducive to its growth. Ethiopia is the second largest wheat producer in Africa [10] and it is ranked 4th in area and production of total cereal crops [3]. However, traditional rain-fed farming methods have often led to inconsistent yields due to variable rainfall patterns. Recognizing the need for more reliable agricultural practices, the Ethiopian gov-

ernment and various stakeholders have increasingly turned to irrigation as a means to enhance wheat production.

In recent years, the adoption of irrigated wheat farming has gained momentum, particularly in areas with access to water resources [14]. The government has invested in irrigation infrastructure, including the construction of dams and canals, to facilitate water supply for agricultural purposes. Additionally, the introduction of improved wheat varieties and modern farming techniques has contributed to increased productivity. Farmers are now utilizing both sur-

*Corresponding author: gechnoble@gmail.com (Getachew Shiferaw Mekonen)

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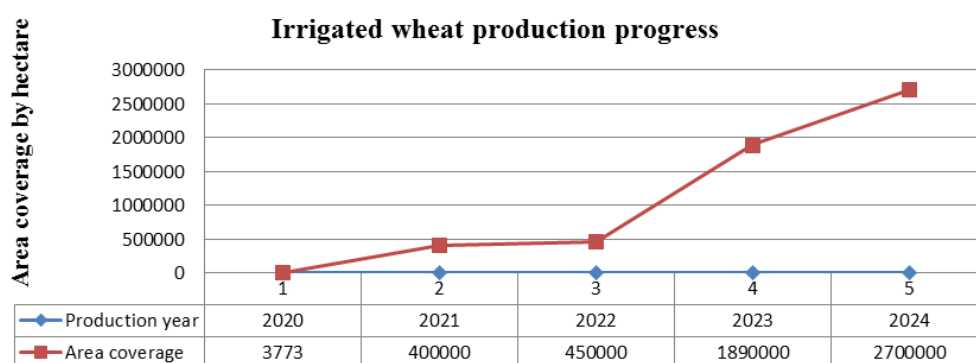
face and drip irrigation methods, which allow for more efficient water use and better crop management. Training programs and extension services have also been implemented to educate farmers on best practices in irrigated wheat cultivation.

Despite the progress made in irrigated wheat production, several challenges persist. Limited access to water resources, particularly in arid and semi-arid regions, remains a significant barrier [12]. Furthermore, issues such as land tenure insecurity, inadequate infrastructure, and access to improved seed are hindering the full potential of irrigated wheat farming.

This document provides a comprehensive review of the benefits and constraints associated with irrigated wheat production in Ethiopia. As the regions faces challenges related to food security and climate variability, understanding the dynamics of irrigated agriculture becomes crucial. This review highlights the advantages of irrigated wheat cultivation, such as increased yields and improved food security, while also addressing the constraints that farmers encounter, including water scarcity, infrastructure limitations, and socio-economic factors.

2. Irrigated Wheat Production Progress from 2019 to 2024 in Ethiopia

The Ethiopian government developed irrigation growth as one of the foundations for wheat self-sufficiency and to increase the income of small-scale farmers, as seen by the history of irrigated wheat up until 2020, which covered 3773 hectares and less. Consequently, the irrigated wheat has shown dramatic jump. In 2021/2022 season following government's nationwide wheat planting campaign more than 400,000 ha of wheat area was cultivated by irrigation with the expected production of 1.6 million tones [2]. During the 2022 winter season, Ethiopia has covered more than 450,000 ha of land with irrigated wheat [5]. The government policy of agricultural input supply and rural extension services has also been adjusted to meet the requirements of irrigated agriculture, and to support the initiative the government provided free inputs such as seed, fertilizer and pesticides. A significant factor in protecting the nation from the worst food crisis that may have resulted from the Russian-Ukrainian War's value chain constraints was the growth in wheat produced by irrigation in recent years, which reached 1.89 million hectares in the 2023 cropping year and 2.7 million hectares in 2024. [16].



Source MoANR, 2024

Figure 1. Production progress from 2020 to 2024.

2.1. Development of Improved Wheat Varieties

The research achievements in irrigated wheat cultivation in Ethiopia represent a significant step towards enhancing agricultural productivity and ensuring food security [13]. The development of improved wheat varieties and the adoption of efficient irrigation practices have empowered farmers and contributed to the overall economic growth of the agricultural sector [4]. Continued investment in research and development will be crucial for sustaining these gains and addressing future challenges in wheat production. One of the most notable achievements in irrigated wheat research in Ethiopia is the development of high-yielding and disease-resistant wheat varieties [6]. The Ethiopian Institute of Agricultural Re-

search (EIAR) has played a pivotal role in breeding programs that have resulted in varieties [8] such as:

1. Hidase: A high-yielding variety that is resistant to common wheat diseases.
2. Danda'a: Known for its drought tolerance and adaptability to various agro-ecological zones.
3. Kakaba: A variety that has shown excellent performance under irrigated conditions.

These varieties have been tested and validated in various regions, leading to increased adoption by farmers.

2.2. Enhanced Irrigation Practices

Research has also focused on optimizing irrigation practices to maximize wheat yields. Studies have explored vari-

ous irrigation methods, including:

1. **Furrow Irrigation:** Compared to other irrigation methods, furrow irrigation requires fewer infrastructures and can be implemented with minimal investment.
2. **Drip Irrigation:** This method has been shown to conserve water while providing adequate moisture to the wheat plants, resulting in higher yields.
3. **Sprinkler Irrigation:** Effective in areas with limited water resources, sprinkler systems have improved the efficiency of water use in wheat production.



Image 2. Irrigation canal image taken from Oromia region wheat production field.

The implementation of these irrigation techniques has been supported by training programs for farmers, ensuring they are equipped with the knowledge to manage water resources effectively [9].

2.3. Impact on Food Security

The advancements in irrigated wheat research have had a profound impact on food security in Ethiopia. Increased wheat production has contributed to:

1. **Higher Incomes for Farmers:** With improved yields, farmers have been able to sell surplus wheat, enhancing their livelihoods.
2. **Reduced Dependence on Imports:** The growth in domestic wheat production has decreased reliance on imported wheat, contributing to national food sovereignty.
3. **Improved Nutritional Status:** Wheat is a staple food in Ethiopia, and increased availability has led to better nutrition for the population.

3. Benefits of Irrigated Wheat Production

Irrigated wheat production in Ethiopia presents a significant opportunity for enhancing food security, improving livelihoods, and boosting the economy. This document explores the various benefits associated with the adoption of irrigated wheat farming practices in the country, highlighting its potential to transform agricultural productivity and contribute

to sustainable development [11, 7].

1. **Increased Crop Yields:** Irrigation allows for more consistent water supply, which is essential for optimal wheat growth. Studies have shown that irrigated wheat can yield significantly higher outputs compared to rain-fed systems, leading to improved food security for local communities.
2. **Extended Growing Seasons:** With irrigation, farmers can cultivate wheat during both the main and off-seasons, diversifying their production and income sources. This flexibility helps mitigate the risks associated with climate variability and ensures a more stable food supply throughout the year.
3. **Improved Soil Fertility:** Irrigation practices can enhance soil moisture retention and nutrient availability, leading to healthier crops. Additionally, the application of fertilizers in irrigated systems can be more effective, further boosting wheat productivity.
4. **Economic Benefits:** Higher yields from irrigated wheat can lead to increased income for farmers, contributing to local economic development. This can also stimulate job creation in related sectors, such as transportation and processing.

4. Constraints of Irrigated Wheat Production

Even though irrigation has the ability to boost yields and provide food security, a number of obstacles prevent wheat from being grown effectively. These limitations, which affect the overall productivity and sustainability of irrigated wheat farming in the area, range from socioeconomic problems to environmental variables [15].

1. **Water Scarcity:** Despite the availability of water resources, competition for water among different agricultural and non-agricultural users can lead to scarcity. Inefficient water management practices can exacerbate this issue, limiting the effectiveness of irrigation systems.
2. **Infrastructure Limitations:** Many regions in Southwest Ethiopia lack the necessary infrastructure for effective irrigation, such as canals, pumps, and storage facilities. Poor infrastructure can hinder access to water and reduce the overall efficiency of irrigation practices.
3. **Socio-Economic Challenges:** Farmers often face socioeconomic barriers, including limited access to credit, markets, and agricultural extension services. These challenges can restrict their ability to invest in irrigation technologies and adopt best practices for wheat production.
4. **Climate Change Impacts:** Climate change poses a significant threat to agricultural production, including irrigated wheat. Changes in precipitation patterns and increased temperatures can affect water availability and

crop yields, making it essential for farmers to adapt their practices.

5. Conclusion

Ethiopia's research, and currently production, of irrigated wheat, has tremendous promise for a radical change in agriculture in the country. Increased yields, longer growing seasons, and improved economic prospects are just a few of the benefits of investing in cutting-edge research and sustainable agriculture practices in Ethiopia. To fully exploit the potential of this agricultural approach, infrastructure restrictions, socioeconomic concerns, climate change, and water scarcity must be addressed. Cooperation among researchers, policy-makers, and farmers will be critical in realizing these prospects and promoting a vibrant agriculture sector.

Abbreviations

EIAR Ethiopian Institute of Agricultural Research
MOANR Ministry of Agriculture and Natural Resource

Author Contributions

Getachew Shiferaw Mekonen is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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